Advancing Female Athlete Performance:

The Art of Applying Science in the Field

Trent Stellingwerff, PhD, FACSM

@TStellingwerff

Canadian Sport Institute Pacific

Victoria, Canada

Monday Sept. 15th, 2025: 16:00 to 16:20 UK time.

My Background: Part Sport Scientist and Part Coach

Chief Performance Officer / Director or R&D at the Canadian Sport Institute Pacific

Programme national de certification des entraîneurs

National Coaching Certification Program

International Middle-to Long Distance Running Chartered Professional Coach (ChPC)

Applying Sport Science:

Evidence based vs. "Scienciness"

RUGBY SCIENCE NETWORK

WORLD RUGBY

“Scienciness” is not a new term, and where do coaches develop new knowledge?

Dr. Dave Collins

Table II. Participants' perceived source of last th

Raw data theme	No. (%)
Coaching course	48 (13.45)
University/college course	40 (11.2)
Workshop/clinic	14 (3.92
Conference	9 (2.52)
Another coach	98 (27.45)
Watching others	22 (6.16)
Mentor	10 (2.80)
Sport scientist	8 (2.24)
Online social networks	16 (4.48)
Internet unspecified	13 (3.65)
Specific website	7 (1.96)
YouTube	7 (1.96)
Coaching experience	23 (6.44)
Reflection	7 (1.96)
Use of coaching aids	6 (1.68)
Books/magazines	23 (6.44)
Academic journals	6 (1.68)

Note: Numbers and percentages relate to stand-
[a]See Nelson et al. (2006) for conceptualisation o

Stoszkowski & Collins 2015 J. Sports Sci.

‘Scienciness’ and the allure of second-hand strategy in talent identification and development

Dave Collins[a,b] and Richard Bailey[c,*]

[a]*Institute of Coaching and Performance, University of Central Lancashire, Lancashire, UK;* [b]*Grey Matters Performance, Stratford upon Avon, Warwickshire, UK;* [c]*RBES Ltd, Sheerness ME12 3LL, UK*

Sports Med (2015) 45:1–7
DOI 10.1007/s40279-014-0251-1

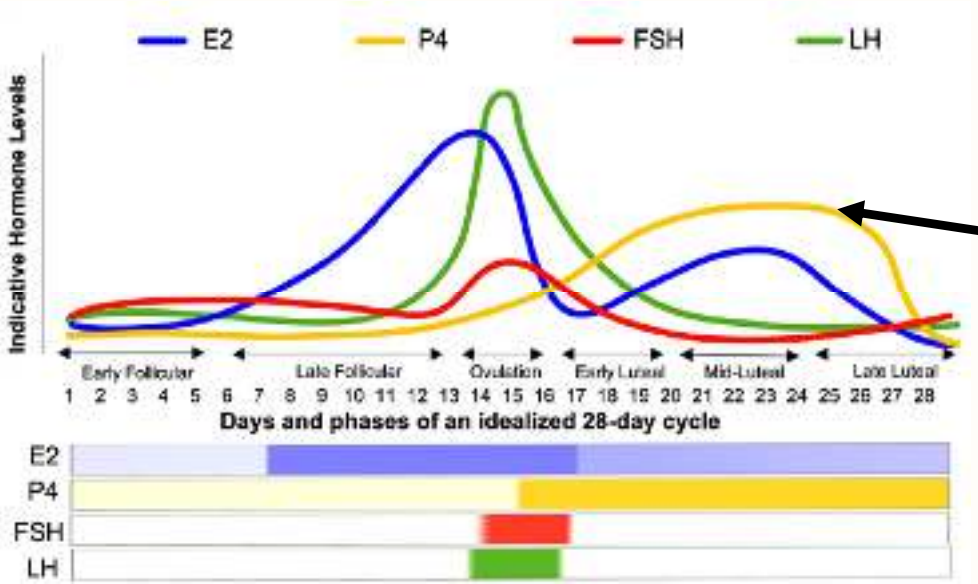
CURRENT OPINION

The Illusion of Competency Versus the Desirability of Expertise: Seeking a Common Standard for Support Professions in Sport

Dave Collins · Veronica Burke · Amanda Martindale · Andrew Cruickshank

And measuring the “typical” text book menstraul cycle is nearly impossible

”Textbook”

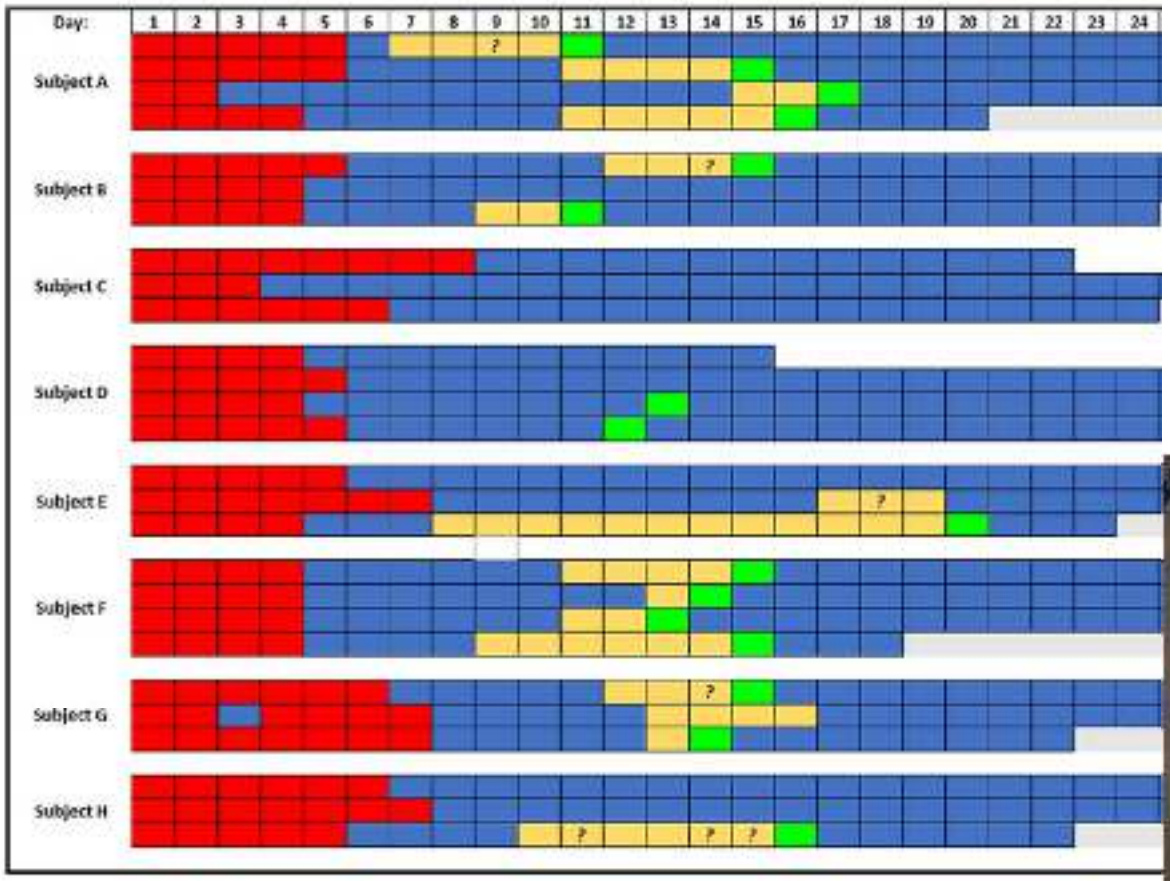


“Use of low luteal phase serum progesterone as a diagnostic tool for LPD is plagued by the pulsatile release of progesterone. Serum progesterone levels can fluctuate 8-fold in a 90-minute period during the midluteal phase and range from 2.3 to 40.1 pg/mL during a 24-hour period in the same healthy subject. Because this rapid fluctuation traverses almost the entire range of luteal values, there can be no standard for appropriate luteal phase progesterone in fertile women”

D’Souza, A. C., et al. (2023). Menstrual cycle hormones and oral contraceptives: A multi-method systems physiology-based review of their impact on key aspects of female physiology. Journal of Applied Physiology

Mesen, T. B., & Young, S. L. (2015). Progesterone and the luteal phase: a requisite to reproduction. Obstet Gynecol Clin North Am, 42(1), 135-151.

What does cycle to cycle variability in 8 naturally menstruating athletes across 27 cycles actually look like?



100 % menstruated

- One athlete had a cycle length that ranged 23 to 44 days
- Yellow boxes represent urinary estrogen surge (only 59% of cycles)
- Only 59% ovulated (thus 41% of cycle were anovulatory)
- Handful of previous studies have found anovulation rates ranging from ~10 to 40%+ of recreational populations (Prior et al, PLOSOne 2015)
- **What is the anovulatory rate in elite female athletes across different sports, with different training loads across their training careers?????!!!!!!!**

McKay AKA, Minahan C, Harris R, McCormick R, Skinner J, Ackerman KE, and Burl
for Conducting Research in High-Performance Female Athletes. Med Sci Sports Ex

Yet we get coaches on the internet (who have PhD's) saying stuff like this?.....

[redacted]
Yesterday at 1:20 PM ·

MENSTRUAL CYCLE-BASED TRAINING

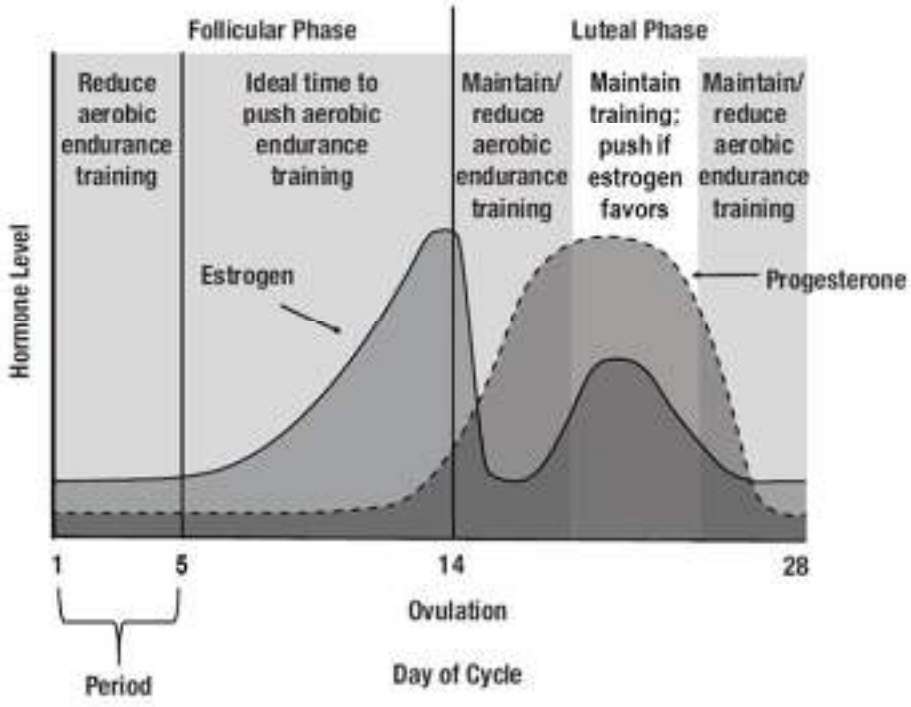
In general, endurance exercise performance is stronger during the estrogen-dominant follicular phase and weaker during the progesterone-dominant luteal phase. The follicular phase is even associated with better pain tolerance. However, if the secondary peak in estrogen in the middle of the luteal phase is high enough that it counteracts the negative consequences of progesterone, endurance performance can also be strong during the mid-luteal phase.

With this simple, general system—follicular phase stronger and luteal phase weaker—you can optimally plan your training, always remembering to balance inductive reasoning (feeling) with deductive reasoning (science).

Increase your endurance training volume during the follicular phase (especially week 2), when estrogen is high. Refrain from increasing (or slightly reduce) weekly volume during your period a at times of the month when estrogen is low—early- and late-luteal phase (early in week 3 and la in week 4). Avoid challenging workouts during your period, especially if you don't feel well or if have menstrual cramps (dysmenorrhea).

For more info and female-specific training programs, get my book, [redacted]

PACIFIC | CALGARY | SASKATCHEWAN | MANITOBA



No influence of MC in Rugby Players either…

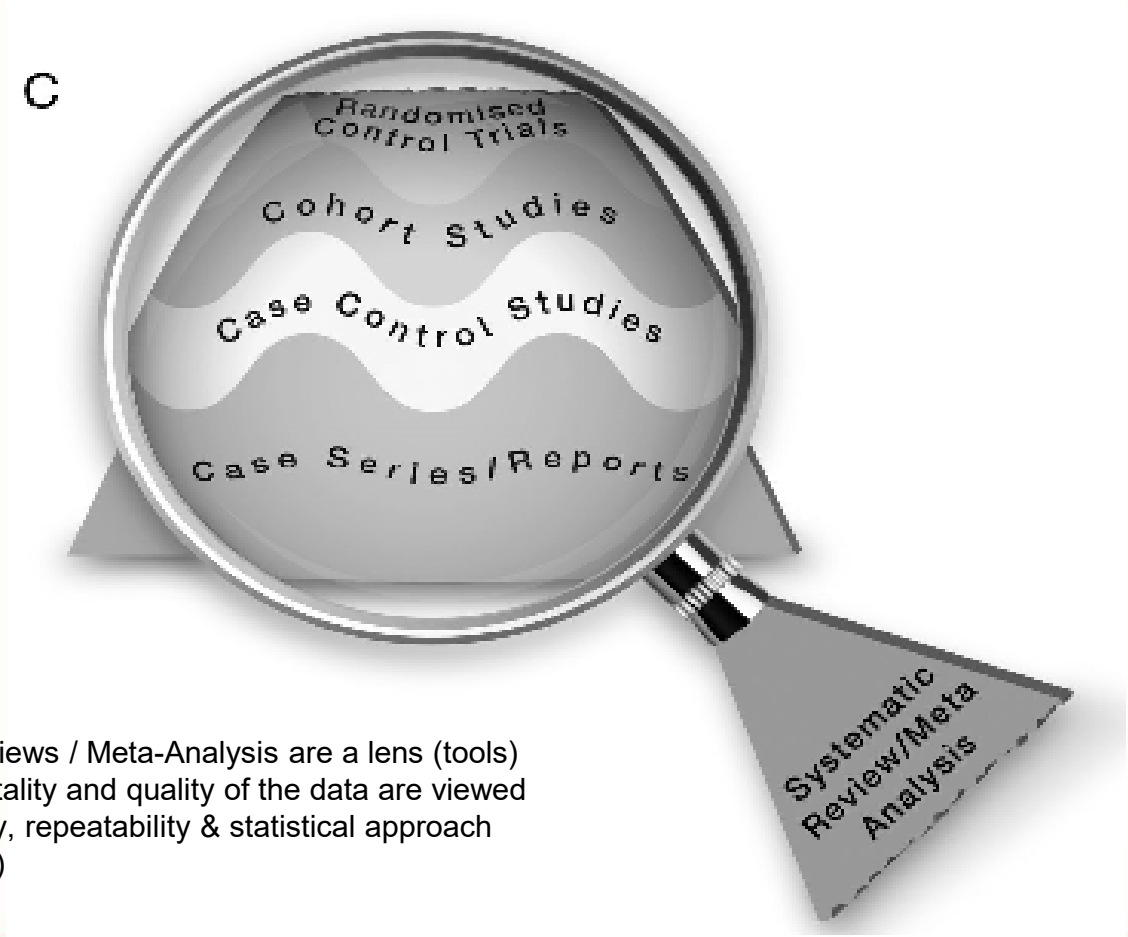
Minimal influence of the menstrual cycle or hormonal contraceptives on performance in female rugby league athletes

Ella S. Smith[1] | Jonathon Weakley[2,3] | Alannah K. A. McKay[1] | Rachel McCormick[1] | Nicolin Tee[1] | Megan A. Kuikman[1] | Rachel Harris[4,5] | Clare Minahan[6] | Simon Buxton[7] | Jessica Skinner[7] | Kathryn E. Ackerman[8] | Kirsty J. Elliott-Sale[9] | Trent Stellingwerff[10,11] | Louise M. Burke[1]

"Evidence of changes in testing performance across a MC, or during active HC use, is insufficient to justify "phase-based testing"

Smith, E. S., Weakley, J., McKay, A. K. A., McCormick, R., Tee, N., Kuikman, M. A., . . . Burke, L. M. (2024). Minimal influence of the menstrual cycle or hormonal contraceptives on performance in female rugby league athletes. Eur J Sport Sci, 24(8), 1067-1078. doi:10.1002/ejsc.12151

Assessing the evidence….



Systematic reviews / Meta-Analysis are a lens (tools) in which the totality and quality of the data are viewed (quality, validity, repeatability & statistical approach considerations)

Murad, M. H., Asi, N., Alsawas, M., & Alahdab, F. (2016). New evidence pyramid. *Evid Based Med, 21*(4), 125-127. doi:10.1136/ebmed-2016-110401

Generating Sport Science Evidence “In the Field”

RUGBY SCIENCE NETWORK

WORLD RUGBY

Athletes / Coaches ahead of sport scientists?

2002
(30 yrs)

CONTROL	CAFFEINE
[illegible]	[illegible]
Extra CHO	[illegible]
[illegible]	29.15* ± 0.13 g/d

Effect of caffeine: 2.2%* [0.5 - 3.8%]

Effect of additional CHO: 1.0% [-0.7 – 2.7%]

Cox, G. R., Desbrow, B., Montgomery, P. G., Anderson, M. E., Bruce, C. R., Macrides, T. A., . . . Burke, L. M. (2002). Effect of different protocols of caffeine intake on metabolism and endurance performance. Journal of Applied Physiology, 93(3), 990-999.

Sports Medicine
https://doi.org/10.1007/s40279-025-02227-0

OPEN ACCESS

REVIEW ARTICLE

Integrative Field-Based Health and Performance Research: A Narrative Review on Experimental Methods and Logistics to Conduct Competition and Training Camp Studies in Athletes

Trent Stellingwerff[1,2,3] · Louise M. Burke[4] · Hannah G. Caldwell[5,6] · Robert J. Gathercole[7] · Chris J. McNeil[5] · Christopher Napier[8] · Sarah A. Purcell[5,9] · Susan Boegman[1] · Elizabeth Johnson[1] · Sharleen D. Hoar[1] · Alexandra M. Coates[8] · Erica V. Bennett[3] · Alannah K. A. McKay[4] · Ida. A. Heikura[1,2] · Michael J. Joyner[10] · Jamie F. Burr[11]

Stellingwerff, T., Burke, L. M., Caldwell, H. G., Gathercole, R. J., McNeil, C. J., Napier, C., . . . Burr, J. F. (2025). Integrative Field-Based Health and Performance Research: A Narrative Review on Experimental Methods and Logistics to Conduct Competition and Training Camp Studies in Athletes. Sports medicine, 55(6), 1377-1403.

KEY DEFINITIONS

Field-based sport research

Any study designed and data generated from research participant(s) undertaking competition (including competition results) and/or any training and/or medical/therapy interventions in their typical sporting training environments; for most athletes/sports this is outdoors in the practice field or competition venue.

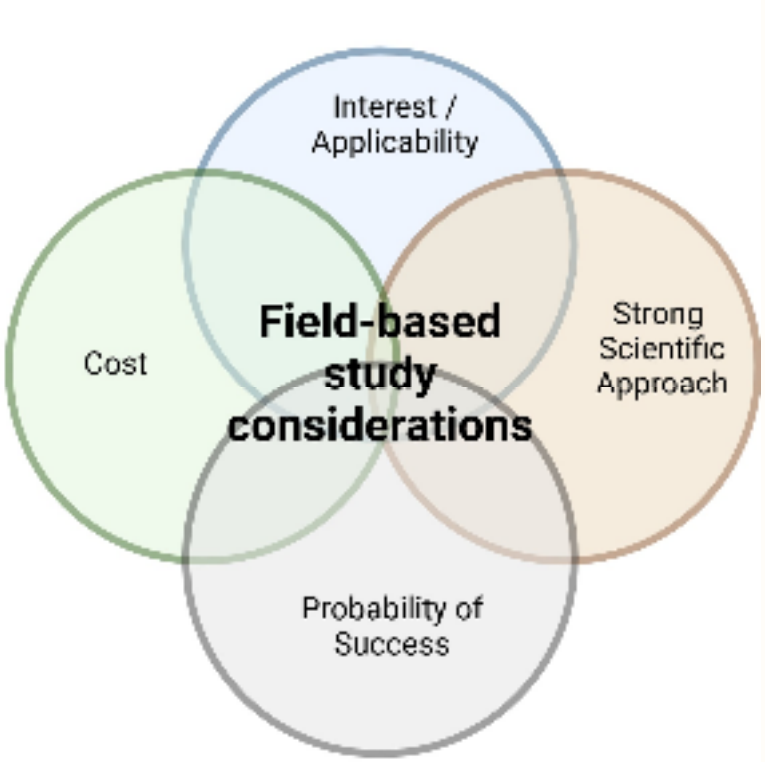
Sport ecological validity

A study design and study outcomes that are easily applicable and suitable to their unique athlete populations within a given specific sport or event. Cross-sectional descriptive field-based studies are often the only feasible research design for elite and world-class athletes.

Stellingwerff, T., Burke, L. M., Caldwell, H. G., Gathercole, R. J., McNeil, C. J., Napier, C., . . . Burr, J. F. (2025). Integrative Field-Based Health and Performance Research: A Narrative Review on Experimental Methods and Logistics to Conduct Competition and Training Camp Studies in Athletes. Sports medicine, 55(6), 1377-1403.

SPORT INSTITUTE NETWORK
RÉSEAU DES INSTITUTS DU SPORT

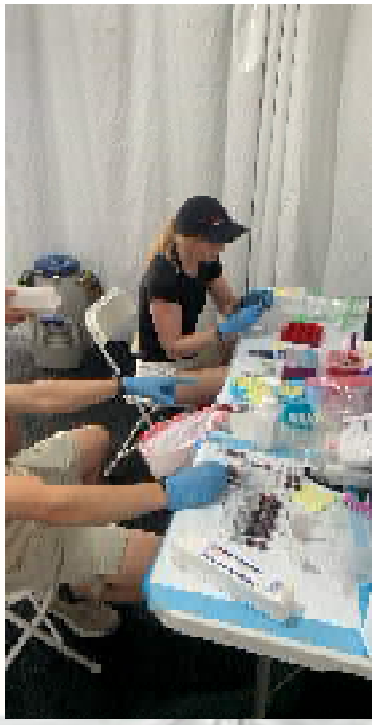
FIELD-BASED STUDY CONSIDERATIONS



Parameter	Considerations
Interest / Applicability	Sport / Athlete / Coach / Sport Institute - Will the research potentially improve health and/or performance outcomes in the sport in the near future (within the lifespan of a coaching job or sport career)? Industry Partner - Will the research potentially create a return on investment? Funding Agency - Do the research questions satisfy the criteria and ethos of the funding agency / grant?
Strong Scientific Approach	Is the study design novel? (e.g., innovative application of existing information / technology or in unique population?) Is the research going to be done at a quality / level that supports graduate students, publishing and ethics criteria? Are the right equipment / methods available to execute the study?
Probability of Success	Is the right expertise available for study success? Is the ideal / target subject pool available? (elite athletes have very specific and constrained schedules) Does the study design have enough pilot data to ensure success? When considering scientific underpinnings and feasibility does this research project have an appropriate probability of success (given the cost)? Has the study proposal / protocol undergone a SWOT analysis? (Strength, Weaknesses, Opportunities, Threats)
Cost	Is the budget appropriate and feasible for all stakeholders? What is the athlete / coach / sport burden? (or time cost)? Is the opportunity cost for all involved in the project appropriate? (or a distraction from other work?)

Stellingwerff, T., Burke, L. M., Caldwell, H. G., Gathercole, R. J., McNeil, C. J., Napier, C., . . . Burr, J. F. (2025). Integrative Field-Based Health and Performance Research: A Narrative Review on Experimental Methods and Logistics to Conduct Competition and Training Camp Studies in Athletes. Sports medicine, 55(6), 1377-1403.

Setting up mobile lab



Field Based Methods / Protocol Considerations

1) Environmental conditions (equipement and testing considerations)
2) Shipping vs. sourcing locally (e.g., calibration gases, blood supplies etc).
3) Power sources (voltage, amperage, adaptors, grounding, stability)
4) Biohazard (cleaning, waste disposal)
5) Local / regional laws
6) Health and safety (local/regional approaches)
7) Sound (background noise)
8) Collaboration considerations (local experts)

Stellingwerff, T., Burke, L. M., Caldwell, H. G., Gathercole, R. J., McNeil, C. J., Napier, C., . . . Burr, J. F. (2025). Integrative Field-Based Health and Performance Research: A Narrative Review on Experimental Methods and Logistics to Conduct Competition and Training Camp Studies in Athletes. Sports medicine. doi:10.1007/s40279-025-02227-0

IMMERSIVE RESEARCH CAMPS

- Years in the making –
Slowly building trust…Slowly developing methods…

IMMERSIVE RESEARCH CAMPS

Benefits for high-performance athletes, coaches, and researchers

Prof Louise Burke

Investigate applied science questions with tight control of research parameters that matter to the athletes / coaches (combining scientific testing rigour *with* high ecological validity)

Host high level training environment for HP participants

Introduce younger athletes to elite cohort/ environment

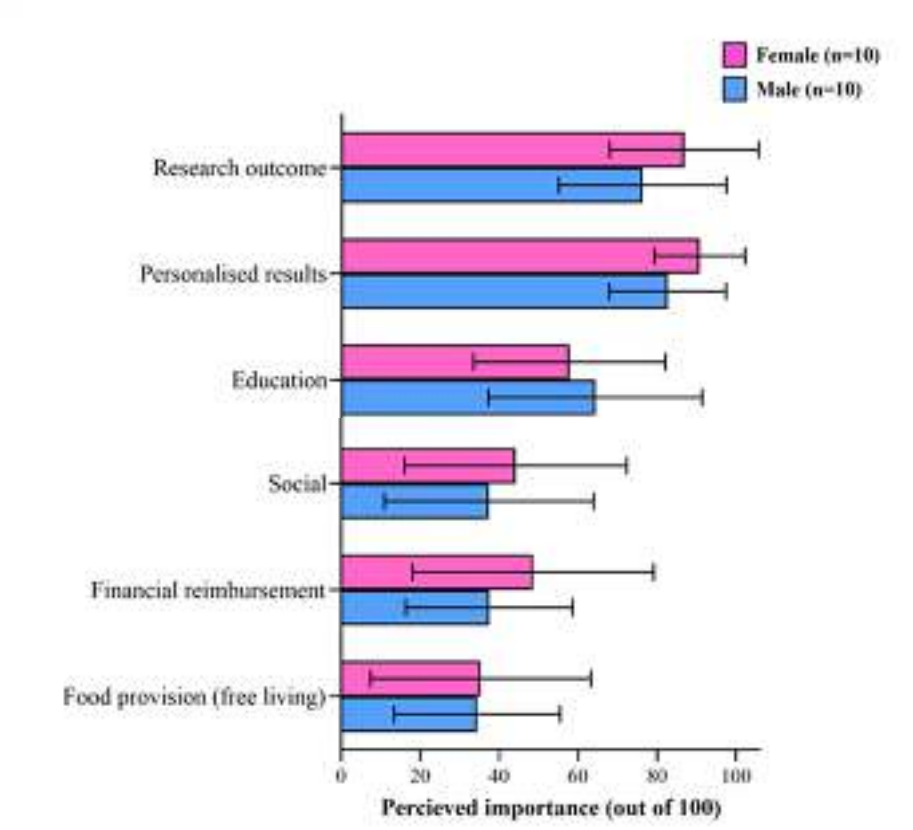
Attract external funding for the sport or organisation

Establish new resources/ techniques/ collaborations

Upskill research camp personnel

PR opportunities/ impact within lay and scientific community

FEMALE ATHLETES REPORT POSITIVE EXPERIENCES



Ella Smith, PhD

Experiences of 89 female and 10 male athletes (n = 48 cyclists/triathletes, n = 19 race walkers, n = 22 National Rugby League Indigenous Women's Academy players) who participated in 4 separate studies.

Smith, E. S., McKay, A. K. A., Ackerman, K. E., Elliott-Sale, K. J., Stellingwerff, T., Harris, R., & Burke, L. M. (2025). Female Athletes Report Positive Experiences as Research Participants. International journal of sport nutrition and exercise metabolism, 35(5), 433-443. doi:10.1123/ijsnem.2024-0182


HOW DO WE KNOW STUDIES ARE APPLICABLE?
RUGBY SCIENCE NETWORK
WORLD RUGBY

From Paper to Pod
of Performance Nu

Graeme L. Close[1] · Andreas I

OPEN ACCESS

Table 1 The Paper-2-Podium (P-2-P) Matrix: an operational framework to evaluate the translational potential of performance nutrition research

Score	− 2	− 1	0	+ 1	+ 2
Research context	Non-human cells and no exercise condition (mechanistic study)	Non-human cells but exercise condition (mechanistic study)	Human cell type in vitro study (mechanistic study)	Human participants and exercise performance measures (applied study)	Human participants, exercise performance measures and evaluation of mechanisms (applied and mechanistic study)
Research participants	Levels of participants not reported	Inappropriate age group or training status for the context required	Inappropriate training status of the participants for the context required (with defined criteria) although in required age group	Close to appropriate training status for the context required, e.g. trained level participants when wanting to translate to elite athletes (with defined criteria), and in the required age group	The same training status for the context required, e.g. elite level participants when wanting to translate to elite athletes (with defined criteria) and in required age group
Research design	No control group and no blinding of intervention. No consideration of sample size	Randomisation of participant allocation to treatment in matched pairs design, inclusion of control group but no blinding of intervention. No consideration of sample size	Randomised cross-over trial with repeated measures or matched groups design, inclusion of control group but no blinding of intervention. Sample size commensurate with previous research in the area but no sample size calculations provided	Randomised cross over trial with repeated measures or matched groups design with single blind placebo- controlled conditions. Sample size commensurate with previous research in the area but no sample size calculations provided	Randomised cross over trial with repeated measures or matched groups and double-blind placebo- controlled conditions. A priori sample size calculation provided and justified
Dietary and exercise controls	No reference to dietary or exercise controls	Methods of dietary and exercise control cited (but limited to subject self-reporting) and no objective data provided	Methods of dietary and exercise control cited (but limited to subject self-reporting) supported by relevant objective data	Dietary provision provided by researchers, exercise control cited, supported by relevant objective data but limited replication to real world context	Dietary provision provided by researchers, exercise control cited, supported by relevant objective data and representative of real world context
Validity and reliability	No inclusion of familiarisation trial or citation of reliability data and measurement tool error. Exercise protocol not representative of the relevant exercise modality nor valid to real-world context	Inclusion of familiarisation trial but no citation of reliability data or measurement tool error. Exercise protocol not representative of the relevant exercise modality nor valid to real-world context	Inclusion of familiarisation trial and citation of reliability data and measurement tool error. Exercise protocol not representative of the relevant exercise modality nor valid to real-world context	Inclusion of familiarisation trial and citation of reliability data and measurement tool error. Exercise protocol is representative of the relevant exercise modality but limited to a laboratory-based protocol that is not valid to real-world context	Inclusion of familiarisation trial and citation of reliability data and measurement tool error. Exercise protocol is representative of the relevant exercise modality and includes both laboratory- and field- based protocols that are applicable to real-world context

From Paper to Podium: Quantifying the Translational Potential of Performance Nutrition Research

Sports Medicine
https://doi.org/10.1007/s40279-018-1005-2

Graeme L. Close[1] · Andreas M. Kasper[1] · James P. Morton[1]

Score	− 2	− 1	0	+ 1	+ 2
Having assessed the relevant paper from a research design perspective, the below criteria evaluate the feasibility of application in relation to the practitioner's chosen sporting context					
Feasibility of application	Outside the budget constraints of the organisation. Complex to implement, e.g. daily long term supplementation and low chance of compliance	Could be within budget constraints but complex to implement and low chance of compliance	Within budget constraints, reasonable to implement and some chance of compliance	Cheap to implement, simple to implement and good chance of compliance	Cheap to implement, extremely simple to implement and minimal risk of non-compliance
Risk/reward	High risk in terms of anti-doping violation or safety of the intervention. No safety data available. Potential to impair performance through high risk of adverse side effects. Optimum dose not stated or unknown	Minimal risk in terms of anti-doping violation but no safety data available. Potential to impair performance through high risk of adverse side effects. Optimum dose not stated or unknown	Minimal risk in terms of anti-doping violation and safety data available. Some potential side effects, e.g. GI discomfort that may reduce performance. Optimal dose suggested but unclear	Minimal risk in terms of anti-doping violation and safety data available. Low risk of side effects that may reduce performance. Optimal dose suggested but unclear	Minimal risk in terms of anti-doping violation and safety data available. Solid evidence of no side effects and optimal dose clear
Timing of intervention	Not age-appropriate. Time available for dosing is not suitable and/or is too close to the major competition to warrant testing the new strategy	Age-appropriate for the athlete. Time available for dosing is not suitable and/or is too close to the major competition to warrant testing the new strategy	Age-appropriate for the athlete. Time available for dosing is not considered optimal but could be effective. Time from the major competition is not sufficient to warrant testing the new strategy	Age-appropriate for the athlete. Time available for dosing is not considered optimal but could be effective. Time from the major competition is sufficient to warrant testing the new strategy.	Age-appropriate for the athlete. Time available for dosing is considered optimal to be effective. Time from the major competition is also sufficient to warrant testing the new strategy
Scores	Negative score Exercise caution when applying the data in practice		0 score—low positive May be an appropriate study to guide implementation although some caution is needed	Moderate to high positive score An appropriate study to guide practice	

8 assessment factors, with scores ranging from -2 to +2 = a total score of -16 to +16

SUMMARY

RUGBY SCIENCE NETWORK

WORLD RUGBY

Moving applied sport decisions from "intuition" to evidence based outcomes

Training program decision	Source of knowledge						
	Own data and/or model	Published science	Science-based source	Expert-based source	Principles of exrx	Unsystematic observation, tacit knowledge (anecdote, experience)	Arbitrary
1							
2							
.....							

Goal: over time, reduce # of decisions supported by weak sources of knowledge towards more valid sources

#1 focus of every applied sport scientist is to integrate validated *individualized* (athlete or team) monitoring and metrics to help drive informed decision making

Dr. Dave Clarke

How difficult new idea gener
implementati

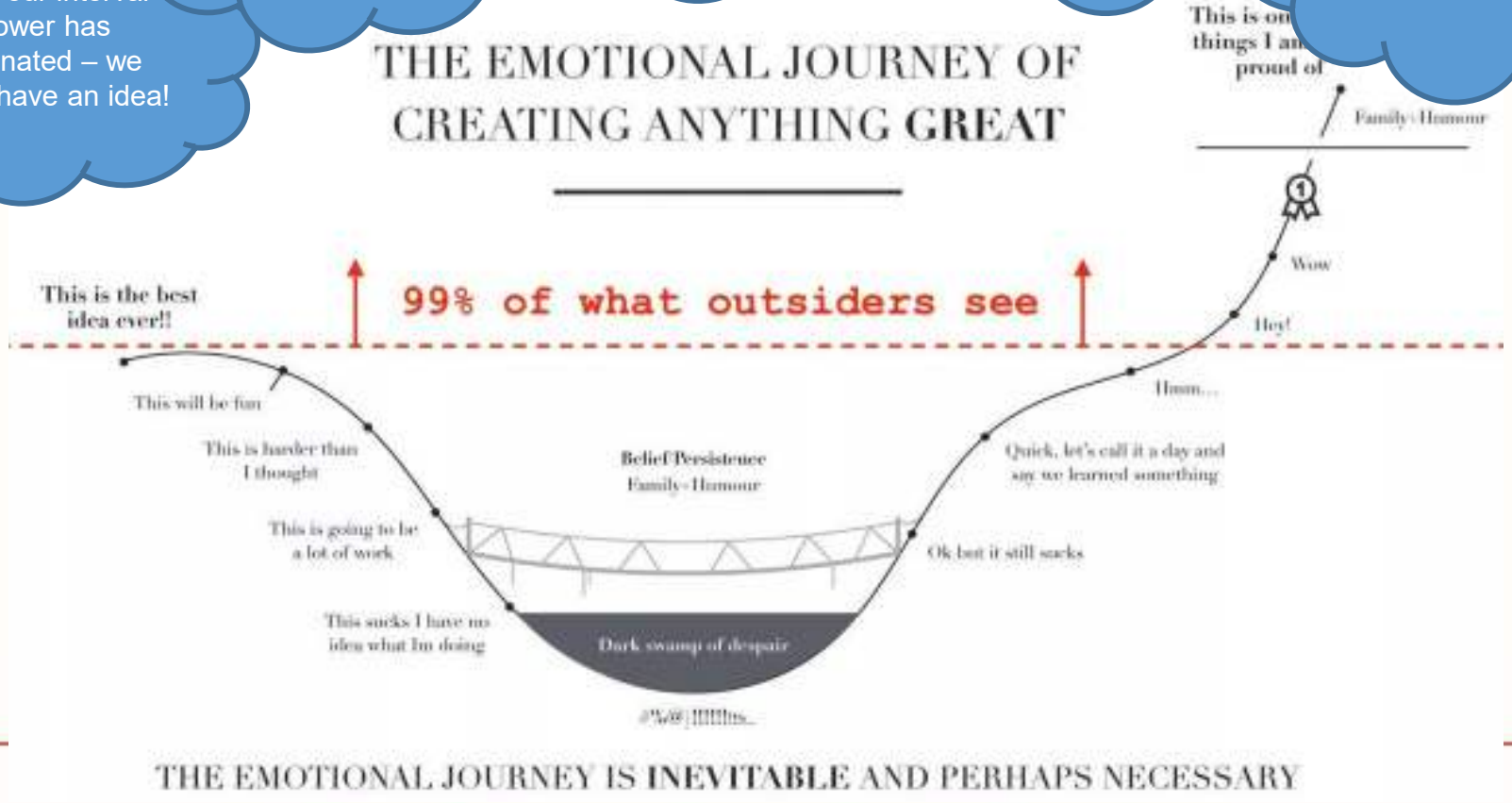
Hey, our interval power has stagnated – we might have an idea!

Hey, our interval power has stagnated – we might have an idea!
X 4 to 5 that year

Several education meetings – science of HIIT, sport/athlete historical data etc.

Programming meeting with coach, plus auditing sessions, collecting data

Evidence based data collection, debrief, success



Placebo effect minimization vs. Belief effect maximization

Research Activities

Minimize "placebo effect" via questionnaire confirmed double-blinded research designs

VS

Applied Sport Interventions

Maximize "belief effects" through carefully worded and presented implementation of validated interventions


THANK YOU!
RUGBY
SCIENCE
NETWORK
WORLD
RUGBY