

The Eighth World Congress on Science and Football in Copenhagen

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This quadrennial conference on the various football codes had several [out-standing presentations](#) and many others that made the conference a success. [Injury](#): concussion; hamstring strain; GPS variables; psychological interventions; epidemiology; team success; hip and groin; ankle; acute workload. [Match and Movement Analysis](#): time to goals; tracking systems; functional zones; playing styles; dynamical movements; fixture list and team characteristics; intensity and technical trends; coaching cues; rugby lineouts; passing and network concepts; sprints and scoring; player dispositions; ball contacts and touches; small-sided games; player-ball interactions. [Talent Development](#): over-confidence; motor performance and personality; technical skills; [Tests and Technology](#): correlations with match activities; compression socks, monitoring jump height; the yo-yo test; creativity; internal to external load; team rank. [Training](#): strength and testosterone; strength and power; workshops; periodization; video self-monitoring; futsal ball; creativity; Empowering Coaching. [Miscellaneous](#): Swiss national female team; mental fatigue; static stretching; Australian football; psychology knowledge base; Elite Player Performance Plan; female coaches; referees' mistakes. KEYWORDS: AFL, association football, elite athletes, league, match analysis, performance, rugby, soccer, tests, training.

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The venue for this special-interest conference on May 27-30 was virtually in the center of Copenhagen, only 10 min walk from the central railway station, the Tivoli Gardens amusement park, and the budget hotels. Lunches consisted of masses of giant healthy sandwiches. Coffee was always available. With ~450 registrants the atmosphere was friendly and informal, but there was plenty of good science. A big thank-you to Jens Bangsbo, Peter Krstrup and the team from Copenhagen University!

"Football is good for you" was the clear message in the opening plenum by Jiri Dvorak of the FIFA Medical Assessment and Research Centre. It's also safer for you, thanks to the various "11" programs developed to reduce the incidence of injuries, sudden cardiac death, and communicable diseases. Many presentations throughout the conference were devoted to the physical, psychological and social benefits of football. In this report I will focus only on football injury and performance, but anyone with a broader interest in football or the benefits of participation in sport in general should download and browse the abstracts, available via [this](#)

[link](#) at the [conference website](#). In what follows I have identified each abstract of interest with its code in brackets [...]. To find the abstract, open the advanced-find window (Shift-Ctrl-F) in Acrobat and insert the code.

My style of summarizing individual abstracts tends to make a fragmented report. The reviewer (Martin Buchheit) called my attention to a [practitioner's blog](#), where a more synthesized view of the conference is presented. The blogger (Neil Gibson, Heriot-Watt University, Edinburgh) noted several risk factors for injury mentioned at sessions I missed and that weren't reported in the abstracts: poor communication, and changing personnel and priorities. Check out this blogger also for his synthesis of training and testing.

As usual with a conference of any reasonable size, inevitable program clashes meant that I had to miss many potentially interesting presentations. All the more important, therefore, are informative abstracts. There were too many at this conference of the results-will-be-presented variety, especially those by experienced researchers who have something important to say.

And then there were the abstracts that looked promising but were unintelligible. I have included a selection of both kinds here, in case you want to contact the authors for more information. Their email addresses are not included in the abstracts, but if you can't track them down on-line, [email me](#). (I have a list of contact emails that was distributed at the conference.)

That said, there were more than enough outstanding presentations to make up for the deficiencies. My favorites, not all of which I was able to attend, were: increased injury risk following [concussion in rugby](#); identifying performance indicators using [time to the next goal](#); effects of [over-confidence on future success](#); effects of [strength training on testosterone and performance](#); and the psychological woes of the Swiss [national female soccer team](#).

To avoid confusing the different football codes, I have referred to *association football* as *soccer*, reserving *football* as a generic term. I have retained *football* where it is part of a proper name or is included in a verbatim quote from the abstract.

Don't miss the next WCSF, which will be hosted by Victoria University in Melbourne, Australia, in 2019. You should also consider attending the 5th World Conference on Science in Soccer in Rennes, France, in June 2017. Websites are not yet available for either of these conferences.

Injury

In a prospective cohort study of 810 professional **rugby-union** players over two years, there was a moderate increase in risk of injury (risk ratio 1.6; it should be a hazard ratio) following a **concussion** compared with following any other injury. "A more conservative [approach to] return to play following concussion should be investigated." [P07.10]

In a prospective cohort study of ~150 elite **soccer** players, the 18 players who suffered a **hamstring strain** (the most common non-contact injury in soccer) had substantially different muscle anatomy and less **eccentric strength** (a small difference) in the Nordic hamstring exercise. Hazard ratios were not reported, and I was at another session so missed any discussion of practical application. Presumably it's worth training to increase eccentric strength. [S01.2, S01.3]

"Accumulated **GPS/accelerometer-derived variables** significantly relate to injury risk in

elite youth **football** players." In other words, the more you train and play, the more likely you are to get injured. The presenter may have suggested how "these variables... should therefore be considered when monitoring workloads for optimal performance and injury avoidance." [S01.5]

Here's one suggestion: avoid spikes in workload. In **rugby league**, "very high increases in **acute workload**, relative to high chronic workload increase injury likelihoods 4-fold. Practitioners should note that high chronic workloads can be achieved without increasing the likelihood of injury, provided that acute workload is systematically increased relative to chronic workload." I think this means increase the workload gradually. [P07.02]

A literature search for **psychological interventions** aimed at reducing injuries in **soccer** turned up three studies, all of which worked, "based on different approaches, such as mindfulness and mental skills training." The effects in standardized units (presumably estimated from reduction in days lost) were moderate to large, so these interventions are definitely worth trying. [S05.2; see also S05.3]

Time-loss injuries incurred by 1462 professional **rugby-union** players at 15 English premiership clubs had a clear negative association with **team success**. The magnitude of the effect as presented is hard to evaluate, but the message is clear: reduce injury risk. [S19.4]

A program of testing and training aimed at preventing **hip and groin injuries** in **soccer** has been promulgated in Europe. Apparently only 16% of top teams are using it, possibly because they already have their own effective programs. [S22.1]

"The **epidemiology** of injuries sustained at the international level for both **Rugby-15s** and **Rugby-7s** will be presented." Sigh... [S19.1]

The FIFA 11+ program halved **ankle injuries** in a controlled trial of 417 adolescent **soccer** players. [S22.2]

Match and Movement Analysis

Analyzing the **time to each goal** in **soccer** (or **team sport** generally) as a performance measure allows actions preceding the goal to be identified as performance indicators for goals. This approach is very cool and was first presented in the [2014 performance analysis conference](#). Here the same researchers presented only a limited analysis: home teams scoring the

second goal. When home teams were one goal up, set plays and substitutions had a positive effect on the time of the second goal scored, but when one goal down, greater ball possession had a positive effect. "Therefore, the score line should be considered in performance analysis in football." [P10.09]

A new high-precision player **tracking system** that uses "deterministic image processing methods instead of the particle filter" may be an inexpensive alternative to existing costly systems in **team sports**. [S02.3]

Meanwhile, with Prozone's **tracking system** in **soccer**, "it is now possible to quantitatively measure the ability of the team in possession to transfer the ball from low to high quality situations and conversely the defending team's ability to force the ball into low quality situations." [P05.03]

Soccer coaches' ability to identify three "**functional zones**" (intervention, mutual help, cooperation), seems to be reasonably reliable, so the zones may be useful in assessing the different tactical roles of players in these zones. [P05.05]

On-the-ball event data were combined with expert opinion to derive eight **playing styles** (build-up, maintenance, counter-attack, and so on) in **soccer**. It's unclear from the abstract whether there are implications for strategy and tactics. [S02.2; see also S09.2]

In an analysis of 77 **1-vs-1 duels** of elite junior **soccer** players, "the most crucial kinematic parameter distinguishing between successful and unsuccessful confrontations was the acceleration of the attacker at the moment when he tried to pass the defender... Performing **dynamical movements** at proper moments is a key factor for success." [S03.4]

In a novel analysis of effects of **fixture list** and **team characteristics** on match outcomes in 14 years of **Australian football**, the authors expressed effects as matches won or lost for every 10 matches played. The effects of playing away (1.5 losses), travel (0.7 losses) and being older than the opponents (2.8 wins) were not unexpected, but the trivial effect of longer breaks between matches (0.1 wins) and the advantage of being a heavier team (1.7 wins) "will challenge current notions about balance of training and recovery and about team selection." [S08.3]

Analysis of seven years of Prozone data for

the English premier **soccer** league showed that the game has become more **intense** and **technical**, with a narrowing of differences among the top-ranked teams. The presenter thought that the trend in intensity will level off when it impacts the technical aspects adversely. [S09.1]

"Kick through the ball" in several **football** codes appears to be supported by biomechanics, but other unspecified **coaching cues** "seem to be inaccurate." [S10.1]

When all 2211 **lineouts** of six successful teams from the 2014 **Super Rugby** season were analyzed, "lineout success was shown to be multifactorial and not able to be predicted using simple regression models... This study has highlighted the importance of having a variety of lineout tactics to avoid predictable structures." [S19.2]

Analyzing **passing** between elite **soccer** players using **network concepts** did not seem to be particularly productive for distinguishing between teams at the top level. [S28.3]

A **sprint** by the goal scorer prior to a shot increased the chance of scoring in 16 Australian state-level youth **soccer** players observed over 17 matches. "Players should practice shooting at goal during, or immediately after performing high-intensity movements." [P06.02]

Tactical training drills in **soccer** should take into account the large changes in **disposition of players** between zones where the ball is located in games. [P06.08]

It's better to make less **ball contacts** per player-possession of the ball, in the comparison of performance of the German and Brazilian teams in the 2014 **soccer** World Cup. [P06.07] The same research group showed that teams who reached the final (Germany and Argentina) had higher numbers of **players touching the ball** per possession than teams who were eliminated in the semifinals (Netherlands and Brazil). [P10.05] There was a similar result for **passes per possession**. [P10.07]

There were numerous presentations on **intensity** and **tactics** in **small-sided soccer** games. [S09.3, S32.4, S37.4, S40.1-S40.3, P08.02, P09.04, P09.05, P09.07, P09.10, P13.02, P13.08, P14.05]

There were also several posters on the biomechanics of **player-ball interactions** in **soccer**. [P01.02-P01.06]

Talent Development

Being **too confident** is apparently a predictor

of failure generally, and here it was a strong predictor of reduced chances that youth **soccer** players would play in international matches 2 y later. I missed this presentation, so I don't know if there are implications for teaching otherwise talented youngsters to be more humble, but it surely wouldn't hurt. [S16.4]

In a prospective study of ~1800 U12 players of the German **Football** Association's talent development program, **motor performance** was a substantial predictor of selection for professional clubs' youth academies four years later, but personality characteristics (e.g., achievement motive 'hope for success', volitional skill 'self-optimization') also contributed. Magnitudes of effects were not presented in the abstract but were apparently not large, because "such characteristics should not be used for a deterministic selection of talents (in terms of fixed cut-off values)." [S12.4]

Eight technical directors and 12 state team coaches of Australian U13 **soccer** [?] considered that in talent identification, **technical skills** (e.g., first touch, the ability to strike the ball and ability in an attacking and defending 1 vs 1 situation) were more important than physical (e.g., speed, power), tactical (e.g., decision-making, anticipation, game understanding), and psychological (i.e., attitude, confidence) attributes. [S15.5]

Tests and Technology

Measures from various **performance tests** had moderate **correlations** with various activities in friendly matches between U14 to U17 **soccer** players, and the correlations were higher for activities when perceived exertion was >5. I guess this means the tests are worth doing. [S09.4, S09.5]

Wearing clinical **compression socks** produced the highest ball speeds in this crossover study of kicking by 12 "skilled and less skilled" youth **soccer** players. [S10.2]

Countermovement **jump height** showed load-dependent impairment in 18 A-league male **soccer** players in the day or two following a soccer match, whereas testosterone and cortisol were elevated only immediately after the game. So jump height is a candidate for monitoring recovery. [S11.3]

Jens Bangsbo harangued us in his unique way about the benefits of high-intensity training and of monitoring its effects with the **yo-yo tests** that he devised for **football**. [KP03]

Creativity, measured in terms of originality, flexibility, and fluency of decisions in **soccer**, may be "a key part of expert performance", but I can't see any immediate practical application. [S38.4]

Ratios of **internal to external load** might be more useful than either measure alone in tracking fatigue in **soccer**. [P03.06]

A novel way to **rank** teams in a **soccer** league looks interesting, but the abstract is incomprehensible. [P13.01]

Training

In one of the clearest presentations of the conference, high-volume **strength training** in a team of 23 elite professional **soccer** players elicited twice the increase in testosterone acutely and twice the gains in jumping and sprint performance compared with moderate-volume training in a similar team. [S26.3]

Greater increases in testosterone and growth hormone occurred when **strength training** came after rather than before endurance training in this acute crossover study of 13 English premier league **soccer** players. [S26.4]

A program of strength and **power training** improved tackling ability in 24 **rugby league** players. [P13.08]

Jesper Andersen uses the term **power training** to refer to the various forms of resistance and strength training that a **football** player needs. [S31.1]

In my notes from a **workshop** on "fitness testing and training of the top [**soccer**] player," Barry Drust was low on specifics. In his view, sport science is only the tip of the iceberg, and the real issue is the culture of the club or team. He was concerned that players do not give maximal efforts in tests and that tests are difficult to schedule during the season. He would prefer measures derived from games, but he acknowledged the low reliability of such measures. He left unanswered the questions of which tests to use, and how they can be related to training prescription and game performance. Magni Mohr was more upbeat about the value of sub-maximal tests and the yo-yo test to identify and prescribe training for players who lose fitness during the season. Tests can be scheduled for those who didn't play in a given week. [W01]

In his **workshop** on training and performance in **Australian football**, Aaron Coutts also failed to deliver what he described in his abstract as "practical recommendations for inte-

grating physical activity and player monitoring data, with specific focus on training periodization, performance analysis and athlete management." He did make the following assertions: optimal periodization is still unclear; speed in matches has a negative relationship with match outcome; winners control the ball; GPS provides measures of load, not performance; and the technical and tactical aspects need more research. The chair, Brian Dawson, said the game is all about skill, not physiology. [W04]

In contrast to the previous two presenters, Marcello Iaia appeared to be in no doubt about the value of fitness testing and training for elite **soccer** players. Unfortunately his **workshop** clashed with that of Aaron Coutts, so I can't report on his specific recommendations. [W05]

A case study of a season of training of an elite **Australian football** team accounted for the effects of injury and "provided data on complementary aspects of **periodization** (GPS measures and perceived load) that should help elite AFL teams assess the impact of its injuries and refine its strategies for training." [S08.4]

Video self-monitoring, in which you view videos of yourself doing a difficult skill well, appeared to work for the training non-preferred side kicking in 33 female **soccer** players, but the presenter didn't turn up. [S17.4]

"The quality of play can be greatly enhanced by using a **futsal ball** instead of a leather or felt football when playing or teaching **football** indoors with young people." [S20.2]

Promoting **creativity** in training sessions by adapting new teaching principles (The Creative Platform) appeared to work well in a male youth **soccer** team. [S20.4]

"**Empowering Coaching** is an education program (including a tutor-led workshop) informed by contemporary theories of motivation and behavior change strategies... Young **footballers** were less likely to drop out of football when their coach had attended the workshop compared to footballers whose coach had not attended the workshop." [S35.5]

Miscellaneous

The Swiss national **female soccer** team showed a higher level of anxiety, less dominance, less confidence, and used less goal setting than their male counterparts, and during games the female players had more distracting thoughts and reported less action orientation

after failure. These findings might apply to your national female team. [S43.1]

Thirty minutes of a **mentally fatiguing task** impaired performance of a subsequent yo-yo test by 16% in a crossover study with 12 "**football** players", although there was apparently little effect on repeated sprints with 16 professional players (not shown in the abstract). Presumably a certain level of mental stimulation would provide beneficial arousal. [S41.5]

With only seven semi-professional **soccer** players, this crossover study was definitely a pilot, but it looks like **static stretching** is beneficial rather than harmful for performance if you follow it with dynamic stretching. [S42.3]

Owing to a program clash, I opted to miss the session on **Australian football** [S08]. Brian Dawson reviewed the recent research on **altitude training, recovery, match analysis, and injury**, but unfortunately his abstract contained no results. [S08.1]

I also regret missing a presentation in which "an attempt [was] made to demonstrate how sport psychology practitioners effectively can develop a **psychology knowledge base**, and then structure and market their services, to effectively penetrate into the often conservative, protectionist and closed world of professional **football**." The abstract is otherwise uninformative. [S12.1]

With the implementation of the **Elite Player Performance Plan** (EPPP) across all professional English **soccer** academies, academy coaches are expected to measure the outcomes of their practice to evidence 'value for money'. You had to be there to hear how 10 coaches were coping, because results weren't presented in the abstract. [S15.2]

Two more classic results-will-be-presented abstracts concerned the role of **female coaches** in **soccer**. [S15.3, S15.4]

"We propose a simple change of [**soccer**] **rules** that decreases the influence of referee mistakes, and hence increases the credibility of the sport." The rule change wasn't stated in the abstract, and I was attending another session. Maybe I've got the wrong idea about abstracts being informative. [S48.3]

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