# WORLD CONFERENCE ON SCIENCE AND SOCCER 4.0

# ABSTRACT BOOK

PORTLAND, OREGON • USA • JUNE 5-7, 2014

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# Thursday, June 5, 2014

## Invited Speaker Sessions, 3:35 – 4:55pm

### Session I: Performance and Match Analysis

**TIME-MOTION ANALYSES OF PHYSICAL PERFORMANCE IN PROFESSIONAL SOCCER MATCH-PLAY: TIME TO BE MORE PRAGMATIC?**

**Christopher Carling**, Institute of Coaching and Performance, University of Central Lancashire, Preston, UK. 2LOSC Lille Métropole Football Club, LOSC Lab, Domain de Luchin, Camphin-en-Pévèle, 59780,France

Interest in the physical performance of male professional soccer players in the competition setting determined via time-motion analyses has grown substantially over the last few decades. A substantial body of published research has forcibly shaped contemporary opinions and practices in the sport. Indeed, researchers and practitioners alike frequently highlight the importance of physical performance as a key contributor to how teams perform in match-play.  In addition, the Information derived from time-motion analyses is seen to enable a more systematic evidence-based framework for physical conditioning notably in tailoring regimens according to the individual playing position. Over the course of this presentation, the author suggests that a more pragmatic approach to interpreting the current body of time-motion analysis data and its application in the practical setting is required.

**THE EVOLUTION OF PHYSICAL AND TECHNICAL PERFORMANCE PARAMETERS IN THE ENGLISH PREMIER LEAGUE**

**Paul Bradley**, University of Sunderland

This study examined the evolution of physical and technical soccer performance across a 7-season period in the EPL. Match performance observations (n=14700), collected using a multiple-camera computerised tracking system and controlled for season, phase of season, position and standard were analysed for emergent trends. Total distance covered during a match was ~2% lower in 2006-07 compared to 2012-13. Across seven seasons, high-intensity running distance increased by ~30% (890±299 vs 1151 ± 337 m, p<0.001; ES: 0.82) and high-intensity running actions by ~50% (118±36 vs 176±46, p<0.001; ES: 1.41). Sprint distance increased by ~35% across the timeframe (232±114 vs 350±139 m, p<0.001; ES: 0.93) with a concomitant increase in the number of sprints (31±14 vs 57±20, p<0.001; ES: 1.46). Mean sprint distance was shorter in 2012-13 compared to 2006-07 (5.9±0.8 vs 6.9±1.3 m, p<0.001; ES: 0.91), with the proportion of explosive sprints increasing (34±11 vs 47±9%, p<0.001; ES: 1.31). Players performed ~40% more passes (35±17 vs 25±13, p<0.001; ES: 0.66), with a greater percentage of successful passes in 2012-13 compared to 2006-07 (83±10% vs 76±13%, p<0.001; ES: 0.60). The increased number of short and medium passes followed a similar pattern to total passes (p<0.001; ES>0.6), whereas the number of long passes varied little between seasons (p<0.001; ES: 0.11). This data demonstrates evolution of physical and technical parameters in the EPL, and could be used to aid talent identification, training preparation and injury prevention.

**Session II: Youth and Talent Identification**

**TALENT DEVELOPMENT OF YOUNG SOCCER PLAYERS: GROWTH AND MATURATIONAL-RELATED QUESTIONS**

**António Figueiredo**, University of Coimbra, Portugal

There is a strong link between maturational development and growth and performance. Organizing age-groups using the criteria of chronological age leads to a big difference in size, composition and performance, and adolescence is the period when these differences are more visible and the ages between 13 and 15 years old seems to be the most heterogeneous period. In the same age group, the subjects maturationally more advanced are in general heavier and taller than their peers of the same chronological age since childhood until the end of adolescence. However, adults don't usually show the same differences when the same comparison is made. This situation can be explained by the catch up phenomenon in the late maturers individuals.

The initial process to identify promising athletes is multidimensional and the literature in the area show that growth and maturation are two important concepts to better understand the identification, selection, and development processes of young athletes. Usually young players tend to be above the mean for height and mass and tend to be advanced in biological maturity status with increasing age during adolescence and in elite development programs. Worst results is been reported for body size and functional performance in young soccer players who were not selected to play in more demanding competitions or who dropped out from sport. The same trend was visible in academy players to whom were not proposed a professional contract. Despite of the lack of evidence that the anthropometrical, maturational and physical characteristics in the beginning of the process are not direct associated with the exceptional performance in the adulthood it is of interest to understand that these indicators may open the doors of academies and others training centers of excellence promoting better conditions and better coaching to the selected players. Recently were not found decennial differences in the entrance profile of soccer players in a club academy. This finding suggests that the sport (soccer) promoting strategies are being maintained despite of the increased demandings in the anthropometric characteristics of professional players and demands of the actual professional soccer competitions.

## WHAT CLUBS HAVE THE STRONGEST YOUTH ACADEMICS? AN OBJECTIVE ANSWER TO THE MILLION-DOLLAR QUESTION

**Albert Folch**, University of Washington

### Introduction
At present there is no objective method to measure the "strength" of a youth academy (Y.A.). Clubs often use partial statistics (e.g. the number of players placed in 1st division teams) to publicize their programs and, when rankings appear based on these metrics, they create confusion. For example, a recent study placed Spanish club Osasuna as the 4th Y.A. in Europe based on the number of its players that were playing in a 1st division club, yet only 2 of its players had been called to the National Team in the last 30 years[1]. Clearly, the quality of the players (not just the number) must be taken into account to measure the strength of Y.A.s.

### Methods
All data was obtained from Wikipedia. For each country considered, I obtained the rosters of the men's National Team every two years (every EuroCup and every World Cup) from 1982 until 2012. Clicking on the name of a given player takes you to his Wikipedia page, which most often lists the Y.A. of origin; when the Y.A. could not be known, the credit went to the first professional club.

### Results & Discussion
Here I propose to rank Y.A.s within each country by counting the number of players that each Y.A. has contributed to the National Team (over a given period). The rationale for choosing the National Team is that a) the selection criteria was performed in the past by a professional coach that is not affiliated by the clubs and is independent of this study (so it is free of bias); and b) a player that belongs to the National Team meets a "minimum quality" standard that is the same for every club in a given country, so it becomes possible to compare Y.A.s by the number of players that they contribute to the National Team.

### Conclusion
I considered the top-5 European Leagues (Spain, Germany, Italy, Holland, and France). Over the 30 years considered, the National Teams had the opportunity to compete in 8 World Cups and 8 *EuroCups*. In my oral presentation I will show the graphs of the evolution of the number of players contributed by the strongest Y.A.s in each country, along with pie charts that summarize the 30-year period.

### References
1. Folch, A. (2014) "For the Love of the Ball", 190 pp. (Amazon.com)

## Session III: Physiotherapy and Injury Prevention

**CONNECTING INJURY PREVENTION TO PERFORMANCE; BUILDING A BETTER ATHLETE FROM THE BOTTOM UP**

**David McHenry**, Therapeutic Associates Inc.

As physical therapists, athletic trainers, sports physicians and strength coaches we balance our practices on that back of science, which is always being tested and honed through the filters of research.  Where we find holes in research we must fill those with assumptions based on clinical reasoning and professional experience.  One assumption that I fell victim to early in my career, and I see other colleagues also falling victim, is making the assumption that world class athletes are world class movers with impeccable symmetry, strength and balance.  In reality what we eventually come to realize is that world class athletes are world class compensators and simply have the kinesthetic awareness and physiological adaptability to create highly complex movement compensations to hide weaknesses, inflexibilities, joint dysfunctions, proprioceptive faults and other biomechanical and physiological imbalances and deficiencies.  Bodies respond to stress, and adapt based on the loads imposed on tissues and challenges given to neuromuscular systems.  Challenging a body that is in balance and exposing it to various training and strength development stimuli can facilitate positive adaptation, making the athlete more durable and more proficient at their sport.   Challenging a body that is out of balance often times strengthens those imbalances and the adaptation sends the athlete deeper in to movement compensations and more significant strength and movement imbalance until an overly challenged tissue hits a failure point.  Too often we allow pain (tendonitis, muscle strains, joint pain, etc) to be our first indicator of the body being out of balance.  Unfortunately by the time a tissue starts to complain the imbalance, movement or strength deficiency is likely progressed to the point that you then need to take drastic measures to radically rebuild the body by only then going through the evaluative and testing process to identify where the imbalances and deficiencies are hiding.  Through comprehensive clinical evaluation and modern testing procedures we have an opportunity to identify and address subtle imbalances and deficiencies before they manifest as injury or performance degradations.  This discussion will help outline how we might better identify and address these imbalances throughout the developmental growth process of our athletes.

**FIELD-BASED TESTING FOR PERFORMANCE ASSESSMENT AND QUANTIFYING RETURN TO PLAY**

**John Cone**, Ph.D., CSCS, fitfor90.com

Focus is on how to develop and implement a comprehensive testing system for the assessment of player fitness & athleticism. The progression and selection of tests focuses on the following:

- Assess relevant aspects of soccer-specific fitness & athleticism

- Analyze dominant versus non-dominant limb asymmetry

- Assess recovery progress from injury during rehabilitation

- Quantify return to play following injury

This more detailed approach to player assessment allows for effective exercise prescription, identification of potential deficiencies, and limits the potential for re-injury of athletes during rehabilitation and following return to training and competition.

## Invited Speaker Sessions, 5:00 – 6:20pm

### Session I: Youth Development I

**ASSESSMENT OF YOUNG FOOTBALL PLAYERS: IMPLICATIONS FOR TRAINING AND MONITORING**

**Martin Buchheit and Jose Alberto Mendez Villanueva**, ASPIRE, Academy for Sports Excellence, Doha, Qatar

Regular assessment of players is key to optimizing developmental programs, from the individualization of training contents to training/competitive load management. While many roads can lead to Rome, the assessment of players' locomotor (maximal aerobic and sprinting speeds) and anthropometric (body dimensions and indirectly maturity status) profiles via non-soccer specific tests may be a simple but highly-efficient means to prescribe, control and monitor training contents. The value and advantages/disadvantages of this approach will be discussed, and practical training and monitoring examples from youth football teams will be provided.

## Session II: Women's Soccer

**PHYSICAL FITNESS EDUCATION AND DEVELOPMENT OF NATIONAL TEAM PLAYERS IN EUROPEAN COUNTRIES**

**Helena Andersson**, The Swedish Football Association

In top international women's football the demands of technical, tactical, psychological and physical abilities are constantly improving. Therefore it is a challenge to educate the next generation players so that they can meet the future demands. In Europe most countries have a well-organized player's developmental plan that aim to improve these qualities. When it comes to the development of physical characteristics the main focus is on injury prevention, football endurance, strength and power and nutrition. This session will provide an overview of the development of physical demands and characteristics at different age groups from various countries in Europe. Questions such as how do we prioritize the development of physical characteristics in different ages groups, what is most important areas in the fitness training and how can we progress these qualities over the years to develop top international female players will be discussed".

**THE CHALLENGING PATHWAY FOR ELITE FEMALE SOCCER PLAYERS: DESTINATION NATIONAL TEAM**

**Dawn Scott**, U.S. Soccer Association

Approximately 18million people play soccer in the US, and 40% (7million) of those are female. The current pathway for elite female soccer players from grassroots encompasses school, club, ECNL (Elite Clubs National League), college and then the NWSL (National Women's Soccer League) professional league. The US WNT aims to identify and develop players from U14 through to the Senior team, and players face challenges at each stage of development, for domestic and national team commitments, for those who make that stage. This session will focus on the challenge for programming at each stage of player development, as well as an overview of game demands for players and with that some discussion of whether there is a true physical performance indicator for players during game play.

## Session III: Sport and Technology I

**WEARABLE TECHNOLOGY IN SPORT**

**Phillip Gisoldi**, Zephyr

**MANAGING FATIGUE IN ELITE ATHLETES**

**Patrick Byrne**, Fatigue Science

# Friday, June 6, 2014

## Invited Speaker Sessions, 8:50 -10:20am

### Session I: Trends in Nutrition and Sleep

**SLEEP AND THE ELITE ATHLETE**

**Shona Halson**, Australian Institute of Sport

Although the function of sleep is not fully understood, it is generally accepted that it serves to recover from previous wakefulness and/or prepare for functioning in the subsequent wake period.  Restricting sleep to less than 6 h per night for four or more consecutive nights has been shown to impair cognitive performance and mood, disturb glucose metabolism, appetite regulation and immune function.  There is also emerging research on the effects of sleep deprivation on bone health.

Results of recent AIS research examining the importance of sleep and sleep habits in elite athletes have demonstrated poor sleep quality and quantity in some elite athletes. Athletes' sleep/wake patterns were monitored using wrist activity monitors and sleep diaries. On average, participants across all sports obtained a total sleep time of 6:8 ± 1.1 h. Findings from this research reveal that elite athletes obtain less than the recommended 8 hours of sleep for the general population.

This presentation will outline what is currently known about sleep in athletes and discuss the role that reduced sleep quality and quantity may have on athletic performance.

**CARBOHYDRATE PERIODISATION: PRACTICAL STRATEGIES TO MAXIMISE PERFORMANCE AND TRAINING ADAPTATIONS**

**James Morton**, Liverpool John Moores University/Liverpool FC

Soccer match play is characterized by an intermittent activity profile where brief periods of high-intensity activity are interspersed with prolonged periods of moderate-intensity activity. Players may cover 10-12 km per game where high-intensity and sprinting distance can range from 0.5-1.5 km and 0.3-0.6 km, respectively. As such, soccer match play relies heavily on muscle glycogen metabolism. The nutritional strategy for match play should therefore focus on ensuring appropriate carbohydrate (CHO) availability prior to and during the game as well as immediately after so as to promote recovery. However, in relation to soccer training, training loads are usually much lower (total distance < 5 km per day) and players routinely perform strength training in a concurrent training approach. In these instances, a reduced CHO and high protein diet may therefore help to promote concurrent training adaptations (on the basis of molecular biology regulating both endurance and resistance phenotypes) and promote weight management. Indeed, recent data from our laboratory and others have collectively demonstrated that deliberately restricting CHO availability before, during and after high-intensity training sessions can enhance the oxidative capacity of skeletal muscle. This enhanced training response is potentially regulated through activation of key cell signaling kinases (e.g. AMPK, p38MAPK), transcription factors (e.g. p53, PPAR) and transcriptional co-activators (e.g. PGC-1 alpha), all of which are augmented when CHO availability is reduced. This presentation will therefore translate this emerging science to practice in an attempt to convey how deliberate periodization of CHO intake can help promote match physical performance and also promote training adaptations. In addition, the author also shares some reflections and experiences from working in the English Premier League.

## Session II: Tactical and Performance Analysis

**TACTICAL ANALYSIS IN SOCCER: WHERE TO GO?**

**Keon Lemmink**, University of Groningen

Tactical performance analysis in soccer is the objective recording and examination of behavioral events of one or more players during training or competition to provide information to coaches and players about player and/or team performance in order to plan subsequent practices to improve performance or to support preparation for the next match. Tactical performance analysis is most often used to create a permanent record of actions of players within a match. However, these analyses have certain limitations, especially from a tactical point of view. For example, spatial information of the actions of players lacks accuracy if present at all, and, due to a single camera viewpoint, only on-the-ball actions of individual players are monitored systematically.

Technological innovations, such as tracking based on synchronized multiple video cameras and/or GPS-like technology, have led to new possibilities for match and training analysis in ball team sports. Positional player data (up to 1000 Hz) are typically used to calculate distance, speed and sometimes acceleration/deceleration profiles of individual players. These analyses do not capture the dynamics and complexity of a soccer match and new approaches of the game are required for tactical analyses.

Dynamical systems theory seems an interesting framework for analyzing player vs. player and team vs. team interactions and its analytical tools and methods can cope with data with high spatial and temporal resolution. For example, on individual level it allows for the analysis of symmetry breaking processes in player dyads, whereas on team level offensive and defensive spaces or other geometrical configurations confined by the players of both teams can be investigated. Several examples of recent research on geometrical configurations in real soccer matches and small-sided games will be presented. Finally, future directions and other approaches will be discussed to analyze tactical behavior in soccer.

**CHILD TO CHAMPION: A DEVELOPMENTAL PROFILE OF THE PHYSICAL DEMANDS OF WOMEN'S SOCCER**

**Jason Vescovi**, University of Toronto

Participation in women's soccer continues to grow worldwide across all standards. A comprehensive view about the physical demands for players at all levels will help improve the evolution of athlete development strategies. It is important for athletes to achieve the functional requirements at a given level then bridge the gap between age-groups to successfully tolerate match demands at the next higher standard. This session will provide a developmental profile of the physical demands for women's soccer matches from youth players up through elite international matches.

**Session III: Biomechanics**

**ENHANCING PLAYER PERFORMANCE WITH SOCCER CLEATS**

**Alison L. Sheets-Singer**, Birgit Unfried, Nike Exploration Team, Sport Research, Nike, Inc., Portland, Oregon, USA.

Most soccer players want to be faster, and to be able to control the ball with every touch. Soccer cleats can help the athlete accomplish these goals through providing appropriate traction, plate stiffness, fit, and material properties. There has been a significant amount of previous research investigating the effects of traction on performance in soccer [1,2] and other sports [3]. A cleat's stud placement, stud geometry, and stud length can affect the traction properties, and it has been shown that an athlete's performance when running through a multi-directional course can be affected by the cleats available traction [1]. While increasing traction can make an athlete faster when changing direction, beyond a threshold further increases in traction do not continue to improve performance [3]. In order to build on this research, advances in manufacturing methods to create soccer cleats have enabled the effects of traction and stiffness on cutting speed to be explored more rapidly than ever. Selective Laser Sintering is a 3D printing technology that can be used to print the plate and traction elements of a cleat. This technology has significantly reduced the time and cost of developing a new cleat, and has radically changed the stud shapes that can be manufactured. Using this new technology, the Nike Vapor Hyperagility cleat was made specifically for athletes performing a shuttle drill in the National Football League Scouting Combine. Experiments performed to develop this cleat will be discussed.

[1] Hennig, E. M. and Sterzing, T. (2010) *Footwear Science*, 2 (1), 3 -11.
[2] De Clerq, D. et al. (2014) *Footwear Science*, 6 (2), 81-87.
[3] Luo, G., and Stefanyshyn, S. (2011) *Footwear Science* 3(3), 127-138.

**SOCCER SHOES CAN MAKE YOU RUN FASTER, SLIP LESS, AND KICK MORE ACCURATELY**

**Ewald Hennig**, University Duisburg-Essen, Germany

Game analyses over the years demonstrate that soccer has become increasingly faster and is more powerful than ever. Comfortable footwear, providing high traction and good stability for fast accelerations, stops and turns are the most desirable features that soccer players want from their shoes. From questionnaires, listing desirable shoe properties, injury protection received only a low priority for both, female and male soccer players. Originating from the priority list of players several biomechanical studies were performed to study possible influences of soccer shoe design on performance. It was found that soccer shoe design can have a substantial influence on sprinting performance, improve kicking accuracy, and influences maximum kicking velocity. The challenge in future soccer shoe design will not only be a combination of these performance related properties but also to include injury protection features.

**MYTH AND FACT OF BALL IMPACT IN SOCCER**

**Hiroyuki (Hiro) Nunome**, Fukuoka University

Ball impact is the most crucial component of kicking skill. However, due to technical and methodological issues, the information regarding this important but transient phase has been very limited to date. The use of ultrahigh-speed video, a new smoothing procedure and ball modeling to calculate the centre of mass of the ball during deformation has allowed for detailed analysis of impact. It was found that differences exist between player perceptions of what is happening at impact and what actually occurs. In my session, I would like to deepen the discussion about those gaps.

Keywords: Ball impact, dynamics, kinematics, player's perception

# Short Oral Presentations 1 –10:50-12:05p.m.

## SO1 - Performance and Match Analysis I

### TACTICAL ANALYSIS OF BARCELONA (BA), INTER MILAN (IM) AND MANCHESTER UNITED (MU) COUNTERATTACK - A MIXED METHOD APPROACH

Sarmento, H.*; Anguera, M.T.**, Pereira, A.*; Campaniço, J.***; Leitão, J.***

*-School of Education, Polytecnhic Institute of Viseu, Centre for the Study of Education, Technologies and Health; **- University of Barcelona; *-School of Education, Polytecnhic Institute of Viseu, Centre for the Study of Education, Technologies and Health; ***- University of Trás-os-Montes e Alto Douro

**Introduction**
This study aimed to detect and analyze regular patterns of play in the counterattack of football teams, through the combination of the sequential analysis technique and interviews to first League Portuguese coaches.

**Methods**
A mixed method design (QUAL/QUAL) was used. In a first stage 36 games (12 per team) of the BA, IM and MU teams were encoded using the observational instrument developed by Sarmento et al. (2010), and the data analyzed trough the SDIS-GSEQ software. Based on the detected patterns, semi-structured interviews were carried out to 8 expert high-performance football coaches and data were analyzed through the content analysis technique (Nvivo9).

**Results and Discussion**
In total, 245 counterattack sequences were observed. The MU performed significantly more counterattacks ($X2(2)=36.8$; $p=0.00$). The analysis of the results concerning the start of the offensive process (OP) through ball recovery possession by the goalkeeper has allowed to verify that there is a similar tendency in the MU and BA teams, that developed these sequences through the central ($Z≥1,96$) and right side zones of the defensive midfielder, by the execution (MU) of the forward pass ($Z=2.00$), or technical actions (BA) such as dribble ($Z=2.47$) and conduction of the ball ($Z=2.71$). In BA team, the shot with goal scored is activated by the crossing ($Z=2.82$) and by the high ($Z=3.05$) diagonal pass. Contrary to what happens with the other teams, the goal tends to be activated by the zones 8 and 11. Through the performed content analysis we could observe that coaches interpret these play patterns based their opinions, mainly, in tactical-strategic and tactical-technical aspects, and in the characteristics of the players on those teams.

**Conclusion**
The potential in the combination of these types of analyses are evident because it allows detecting and analyzing regular patterns of play, which assume a practical application to coaches, but also because the content analysis, which resulted from the interviews, has allowed complementing this approach with the know-how of the experts in the field.

**References**
1. Sarmento, H. et al. (2010). Medicina, 46(6), 401-407.
**Keywords:** Soccer, Performance, Patterns of Play

**THE INFLUENCE OF OFFSIDE RULE ON SOCCER TACTICAL PERFORMANCE**

Santos, R*., Padilha, M*., Teoldo, I*.

*Centre of Research and Studies in Soccer, Federal University of Viçosa, Brazil

**Introduction**
In soccer (association football), the ability to avoid offside situations has been appointed as a factor that distinguishes players' positional roles (1) and match outcomes (2). However, research involving the study of the effect of the application of this law on players' tactical performance is apparently scarce. Thus, the aim of this study is to examine the influence of the application of the offside rule on players' tactical performance in small-sided games (SSGs).

**Methods**
The sample comprised 168 U-17 who performed 23,071 tactical actions. The instrument used was the System of Tactical Assessment in Soccer (FUT-SAT), which provides researchers with tactical performance data, through the Tactical Performance Index (TPI). Tests were conducted in a field of 36 m long by 27 m wide with the arrangement GK+3 vs. 3+GK, in two different situations. The first was designated as "Offside Rule On" and the second "Offside Rule Off". Wilcoxon's test was performed to examine differences in players' tactical performance between both situations ($P<0.05$).

**Results & Discussion**
Results showed significant differences with respect to overall ($P=0.023$) and offensive ($P=0.007$) tactical performance between "Offside Off" and "Offside On" situations. In "Offside On" situation players displayed lower overall and offensive TPIs in comparison with "Offside Off" situation, suggesting that the application of the offside rule during training sessions (especially SSGs) might be a helpful constraint to increase players' tactical performance, particularly when performing offensive actions.

**Conclusion**
It is concluded that the application of the offside rule influences tactical performance, mainly during the performance of offensive tactical principles.

**References**
1. Taylor, J. et al. (2004) Int. J. Perform. Anal. Sport 4(1), 81-97
2. Lago-Peñas, C. et al. (2012) J. Sports. Sci. Med 9(2), 288-293.

**Keywords:** soccer, tactical performance, offside rule

**Acknowledgements**

**THE INFLUENCE OF COACH TURNOVER ON TEAM PERFORMANCE WITHIN PORTUGUESE SOCCER LEAGUES**

Duarte, R. 1, Biscaia, R. 1, Silva, J. 1, Graça, P. 1, Dias, B. 1, Lago, C. 2

CIPER, Faculdade de Motricidade Humana, Universidade de Lisboa, Portugal;  Faculty of Education and Sports Sciences, University of Vigo, Pontevedra, Spain

**Introduction**
The coaching carousel, or turnover, is an extreme, but frequently occurring, phenomenon in soccer. Among the reasons for firing a coach, the most common is the existence of a shock-effect: a new coach would be able to motivate the players better and therefore to improve results (1). However, previous researchers have been reporting controversial results about coach turnover effect in different leagues worldwide (ref). The aim of this study was to examine the influence of coach turnover on the points gained in short- and long-timescales in Portuguese soccer.

**Method**
Data consisted of the total coach turnover (n=146) from 1st and 2nd Portuguese professional soccer leagues between 2004-2005 and 2011-2012. The collection was carried out at the official website of Liga Portuguesa de Futebol Profissional (www.lpfp.pt). Team performance was measured as the mean number of points gained in four different periods: i) all the matches before coach turnover; ii) the 4 matches right before coach turnover; iii) the 4 matches right after coach turnover; iv) all the matches after coach turnover. Data were analyzed with ANOVA repeated measures using SPSS 19.0.

**Results & Discussion**
Significant differences were obtained within the four periods examined, $F(3,145)=30.342$, $p<.001$, $\eta 2=.175$, $\pi=1.0$. Bonferroni's post-hoc tests revealed significant differences between all the periods, excepting between period 1 and period 3, and period 3 and period 4. These results showed that a deep decrease in the average points gained in a short timescale leads to coach turnover (2). Moreover, in contradiction with previous studies (e.g., Lago, 2011), these findings revealed that coach turnover is better in long-term than in short-term.

**Conclusion**
The present findings may be related to specific features of Portuguese soccer leagues, such as the strong prevalence of Portuguese coaches leading the teams, with high understanding of the national soccer context.

**References**
1. Lago-Peñas, C. (2011) J. Hum. Kinet. 28, 115-122.
2. Flores, R. et al. (2012) Eur. J. Oper. Res. 222, 653–662.

**Keywords:** short-term effects, long-term effects, coach turnover

## SO2 – Training and Testing I

**MAXIMIZING PENALTY SUCCESS: USING OPTIMALITY MODELS TO IDENTIFY YOUR BEST PENALTY TAKERS AND THEIR STRATEGIES**

Hunter, A.*, Angilletta, M.J.**, Wilson, R.S.*

*School of Biological Sciences, The University of Queensland, Australia; **School of Life Sciences, Arizona State University, Arizona, USA.

**Introduction**
Penalties can determine championships and world cups – across European competitions, penalties are awarded in a quarter of all games, and half of all World Cup Finals since 1990 have been decided by a penalty. Our research seeks to maximize the probability of scoring a penalty by identifying the best strategies for success that are tailored to the shooting abilities of individual players.

**Method**
We developed an optimal model for penalty taking, designed to maximize success based on an individual's kicking speed, error, target location, and the expected behavior of the goalkeeper. Based on our predictive model, we empirically tested two key parameters of the model: (i) the relationship between kicking speed and error, and (ii) goalkeeper movement time. To measure the relationship between kicking speed and error, 20 male soccer players each executed 500 kicks across a range of speeds whilst aiming at a target from a distance of 11 m (penalty distance). Goalkeeper movement time was measured by analyzing existing video footage of penalty shootouts from professional matches. Finally, we formally tested the model's validity using a large-scale penalty competition in which we measured an individual's target location and kicking speed, and also the behavior of the goalkeeper.

**Results and Discussion**
We found the best strategy for penalty success was sensitive to an individual's speed-accuracy trade-off, such that the optimal kick speed and target location varied with an individual's relationship between kick speed and error. Based on our assessment of more than 6000 kicks, variance in error (miss distance) increased exponentially as ball speed increased, but the magnitude of this increase was dependent on the individual. Goalkeepers moved on average 200ms (SD = 100ms) before the ball was kicked.

**Conclusion**
By understanding goalkeeper movement and the speed-accuracy trade-off in penalty takers, we are able to identify the strategies that maximize the probability of success for each individual. Future research should investigate how deception influences goalkeeper movement, the accuracy of kicks and how these factors affect penalty success.

**Keywords:** penalty, optimal performance

**MONITORING RECOVERY DURING THE IN-SEASON COMPETITIVE PHASE IN ELITE SOCCER PLAYERS**

R. Thorpe1, A. Strudwick1, M. Buchheit3, G. Atkinson2, B. Drust1, W. Gregson1

Football Exchange, Research Institute for Sport and Exercise Sciences, Liverpool John   Moores University, UK 2 Health and Social Care Institute, Teesside University, UK3 Sport Science Unit, Myorobie Association, France

**Introduction**
Effective, non-invasive tools for monitoring recovery status are essential in elite sports (3). Recovery markers should be sensitive to changes in training load, but research on elite soccer players is lacking (1, 2).  Therefore, we aimed to quantify the changes in various recovery indices in response to the changes in training load prescribed to elite soccer players during a standard in-season training week.

**Methods**
Twenty-nine soccer players competing in the English Premier League were repeatedly monitored on four separate days (Game +24 h, +48h, +96h, Game -24 h) across 22 standard training weeks (no mid-week match) during the in-season competitive period. Training load (RPE-TL), perceived ratings of wellness (fatigue, muscle soreness, sleep quality), post-exercise heart rate recovery (HRR%) and heart rate variability (LnrMSSD) were assessed. Mean changes in recovery indices over the training days were quantified with within-subjects linear mixed models.

**Results & Discussion**
There were significant between day differences in RPE-TL and perceived ratings of perceived wellness ($p<0.001$; Effect Size, 1.6-2.3) with the lowest and highest rating of perceived wellness reported on day Game +24 h (Fatigue, 3.4 + 0.6 AU; Sleep, 3.7 + 0.7 AU; Soreness, 3.6 + 0.7 AU) and Game -24 h (Fatigue, 4.8 + 0.6 AU; Sleep, 5.0 + 0.8 AU; Soreness, 4.9 + 0.6 AU) respectively. HRR% (Game +24 h, 72.1 + 9.3 %: Game -24 h, 71.0 + 9.2 %) and LnrMSSD (Game +24 h, 3.35 + 0.90 ms; Game -24 h, 3.32 + 0.90 ms) remained similar between days ($p>0.05$; Effect Size, <0.1-0.1).

**Conclusion**
Perceived ratings of wellness but not HR-derived indices are sensitive to the daily fluctuations in training load experienced by elite soccer players during a standard in-season training week.

**References**
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3. Meeusen R, et al., (2006). Eur J  Sports Sci, 6, 1–14.

**Keywords:** raining, recovery, elite

**FACTORS INFLUENCING PERCEPTION OF EFFORT (SESSION – RPE) DURING ELITE SOCCER TRAINING**

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**Introduction**
The individual internal response to an external training load (TL) is an important stimulus for mediating longer-term adaptation. The session rating of perceived exertion (sRPE) is widely used as an indicator of the internal training response in team sports such as soccer (3).  Markers of external TL can predict sRPE during rugby training (4). It is unknown whether this is so during soccer training (1). Therefore, we aimed to identify the external TL markers that are most influential of sRPE during elite soccer training.

**Methods**
Twenty-two soccer players (four central defenders, three wide defenders, six central midfielders, three wide midfielders and six attackers) competing in the English Premier League were monitored.  The TL data (sRPE and global positioning system @ 10Hz) were collected during 1892 individual training sessions over an entire in-season competitive period. A multivariate-adjusted within-subjects model was employed to quantify the correlations between sRPE and sRPE-TL and various measures of external training intensity and TL respectively (2).

**Results & Discussion**
Expert knowledge and a colinearity r < 0.5 were used initially to select the external training variables for the final analysis. Total high-speed running distance (HSR; >14.4 km·h1), number of impacts and accelerations >3 m•s-2 remained in the final multivariate model (p<0.001). The adjusted correlations with sRPE were r=0.14, r=0.09 and r=0.25 for HSR, impacts and accelerations respectively. For sRPE-TL, the correlations were r=0.11, r=0.45 and r=0.37 respectively.

**Conclusion**
The external load measures that were found to be predictive of sRPE in soccer training were HSR distance, and the number of impacts and accelerations.

**References**
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2. Edwards, S. (1993). In S. Edwards (Ed.). The Heart Rate Monitor Book (pp. 113-123). Sacramento, CA: Fleet Fleet Press.
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**Keywords:** Soccer, RPE, GPS

**ACUTE NEUROMUSCULAR AND PERFORMANCE RESPONSES TO NORDIC HAMSTRING EXERCISES COMPLETED BEFORE OR AFTER TRAINING**

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**Introduction**
Hamstring muscle strains account for 12-16% of all injuries sustained in professional soccer (1), and almost half (47%) of all hamstring strains occur during the last third of the 1st and 2nd halves of soccer matches (2), suggesting fatigue as a potential predisposing factor to injury. Nordic Hamstring Exercises (NHE) have been shown to increase eccentric hamstring strength and reduce the injury risk to players, but the optimal scheduling of NHE relative to soccer training sessions is unknown. We aimed to determine the acute neuromuscular and performance responses to performing NHE either pre- or post- a simulated soccer training session.

**Methods**
8 amateur players attended the laboratory on two separate occasions and performed 60 minutes of soccer-specific exercise using a standardized protocol, which mimics the intermittent and multi-directional nature of match-play (SAFT60). Players performed a program of NHE (6 sets of 5 repetitions) either before or after SAFT60, in a randomized manner. Surface electromyography signals (sEMG) of the hamstring muscles were recorded during both NHE and maximal eccentric contractions of the knee flexors, performed at $30°·s^{-1}$. Peak torque assessments were administered before and after the NHE program, and at 15-min intervals during SAFT60. 10m sprint times were recorded on 3 occasions during each 15 min SAFT60 segment.

**Results & Discussions**
EMG during NHE was not different between trials. A greater fatiguing effect was observed in eccentric hamstring strength when the NHE program was administered before SAFT60 (15.6 %; 90% confidence intervals [CI]: 11.0 to 20.3%; likely moderate effect). Performing NHE prior to SAFT60 increased sprinting performance (1.9%; 90% CI: -0.5 to 4.4%; likely small effect), but decreased eccentric hamstring peak torque (-15.3%; 90% CI: -37.6 to 3.3%; likely small effect) during soccer-specific exercise.

**Conclusion**
Performing NHE prior to soccer training reduces eccentric hamstring strength and may increase the risk of muscular injury.

**References**
1. Hawkins, R. et al. (2001) Br. J. Sports Med. 35(1), 43-47.2. Woods, C. et al. (2004). Br. J. Sports Med. 38, 36-41.

**Keywords:** Injury prevention, hamstrings, timing of training

**HOT ENVIRONMENT MEDIATED DECREMENTS IN SOCCER-SPECIFIC CAPACITY UTILISING A NON-MOTORISED TREADMILL SOCCER-SPECIFIC SIMULATION (iSPT)**

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**Introduction**
Playing soccer in the heat can result in high body temperatures, accelerated fatigue and reduced performance compared to similar activity in a temperate environment (1). Utilizing an individualized, validated and reliable non-motorized treadmill soccer simulation (intermittent soccer performance test (iSPT)) allows quantification of maximal performance capacity in temperate and hot environments, typically not expressed during soccer match-play due to environmental factors (tactics and opposition) (2). This study aims to assess the maximal performance capacity of soccer players in a hot (30oC, 30% RH; HOT) and temperate environment (18oC, 50% RH; CON).

**Method**
8 male soccer players reported to the laboratory on 5 occasions. Visit 1-3: 3 familiarization sessions. 4-5: iSPT (90 min duration; 45 min - 1st half, 15 min - half time, 45 min - 2nd half). All familiarization was conducted in line with (2). Participants completed iSPT on two occasions (visits 4-5) in CON and HOT. All physiological and perceptual measures were recorded continuously. Body mass and hydration was assessed pre and post iSPT. Blood lactate was measured every 15 min.

**Results**
Rectal Temperature (CON: 39.27±0.05oC, HOT: 39.55±0.03oC, P=0.03) was significantly greater in HOT compared to CON. Total distance (TD) covered (CON: 9172.67±253.91m, HOT: 8876.2±328.95m, P=0.004, ↓3.23%), and sprint distance (SD) (CON: 1063±19.94m, HOT: 1047.52±6.28m, P=0.04, ↓1.51%), were significantly greater in CON compared with HOT. Fatigue between halves for TD covered (CON: 64.39±55.33m, P<0.001; HOT: 83.32±35.12m, P=0.04) was significantly greater in HOT compared to CON.

**Conclusion**
A reduction in TD covered and SD in HOT compared to CON was reported. Therefore, maximal performance is decreased in HOT. This data is the first utilizing an individualized, valid and reliable soccer simulation (iSPT), quantifying decrements in maximal soccer-specific performance between CON and HOT, which is not possible during soccer match-play due to environmental factors (tactics and opposition).

**References**
1. Mohr et al, (2012) Plos. one. 7(6) 1-10
2. Aldous et al (2013) J. Str. Cond. Res. DOI: 10.1519/JSC.0000000000000310

**Keywords:** Heat-stress, NMT, iSPT

**SO3 – Medicine and Injury Prevention**

**RELATIONSHIP BETWEEN INJURIES AND MATURATION IN HIGHLY TRAINED QATARI YOUTH SOCCER PLAYERS**

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**Introduction**
The respective influence of growth and maturation on injury aetiology in young soccer players is still not well understood, particularly in emerging countries (1). It has been suggested that apophyseal injuries are a unique type of overuse injury in the young athlete and are underreported in the literature (2). The purpose of this prospective cohort study was to investigate the injury epidemiology with the association of maturation in an elite youth soccer academy.

**Methods**
Over one season, injury incidence, severity, type and lay-off period were recorded in 289 youth soccer players, representative of ten different age groups (U9 to U18). Predicted age at peak height velocity (PHV) was calculated by a non-invasive method, players were then allocated to Pre- (< –1 year from PHV), Circum- (≥ –1 year from/to PHV ≤ 1) or Post- (> 1 year to PHV).

**Results & Discussion**
426 injuries were documented. The most common were contusion (36.8%), sprain (17.7%) and growth related injuries (16.8%). Indeed, osteochondral injuries accounted for 18.3% of all lower limb injuries, with the greatest rate observed in U14 (29.8%) and U15 (21.5%). Mean lay-off remained steady for the overuse injuries (Pre-: 13.5 ± 17.8 days; Circum-: 15.4 ± 23.2 days; Post-: 12.3 ± 22.5 days), while there was a sharp increase after PHV for the non-contact traumatic injuries (Pre-: 5.8 ± 10.1 days; Circum-: 6.1 ± 8.4 days; Post-: 14.9 ± 23.4 days). Prevalence of overuse and non-contact traumatic injuries showed substantial differences during the different growth periods. Peak occurrence of osteochondral injuries (43%) occurred in the year of PHV and was higher than muscle strains (17%) and non-contact joint injuries (9%).

**Conclusion**
The results of the study suggest that PHV onset predisposes the immature skeleton as a potential injury risk factor for osteochondral injuries. Optimizing workload monitoring and considering individual differences in the timing of maturation may help to prevent growth related injuries in highly trained youth soccer players at the crucial stage of the growth spurt.

**References**
1. Faude, O. et al. (2013) Sports Med.
2. DiFiori, J. et al. (2014) Clin. J. Sport. Med.

**Keywords:** Adolescent, Epidemiology, Peak height velocity

**STRENGTH TRAINING REDUCES INJURY RATE IN ELITE YOUNG SOCCER PLAYERS DURING ONE SEASON**

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ISSEP, University of Manouba, Tunisia. 2 Biomechanics Laboratory, National Institute of Orthopedics ''M.T. Kassab'', Tunisia3 M2S Laboratory, UFR-APS, University of Rennes; ENS Rennes, France.

**Introduction**
Soccer is a physically demanding sport that requires a mixture of fitness attributes, including muscular power required for explosive actions and strength required for injury protection as well as for physical aspects of the game (1). However, the relationship between performance enhancement induced by strength training and injury rate in adolescent soccer players needs to be studied. The purpose of this study was to examine the effect of strength training on physical fitness parameters and injury occurrence in young elite soccer players.

**Methods**
Fifty-two elite young soccer players (13-14 yrs) were divided in a randomized order to two groups: Trained group (TG, n=26) and Control group (CG, n=26). For TG 2 to 3 sessions of strength training (90min) were introduced weekly into their training program for 12 weeks (4x3 weeks separated by 1 week recovery). Both TG and CG had the same training load. Sprint test (10-20-30m), T-test time, Squat Jump (SJ), Countermovement Jump (CMJ), Drop Jump (DJ) and five jumps test (5JT), were measured at the start (T0), at the middle (T1), and at the end of the experiment period (T2). The injury occurrence was recorded by the medical and fitness training staff throughout the soccer season.

**Results and Discussion**
Compared to CG, TG performed significantly better in 10m sprint running (p<0.01), 20m (p<0.05) and T-test running time at T2. Similarly, the improvement amount for 5JT between T0 and T1 was significantly greater (p<0.05) in TG (+0.99±0.58cm) compared to CG (+0.44±0.83cm) and for SJ (p<0.05) between T0 and T2 in TG (+7.27±7.58) compared to CG (+2.03±4.56cm). A total of 17 injuries were recorded over the soccer season. The rate was higher in CG (13 injuries) compared to TG (4 injuries). Most injuries were located at the lower limb and the most common injury occurred in CG concerned muscle strains (46.2%) and ankle sprain (23.1%).

**Conclusion**
This study showed that strength training accurately and efficiently scheduled in youth soccer players, induced performance improvement and reduced the rate of injuries.

**References**
1. Myer, G. et al. (2006). J. Str. Cond. Res. 20(2), 345-353.

**Keywords:** Football, Injury, Resistance training, Plyometric training

**EFFECTIVENESS OF FUNCTIONAL CORE STRENGTH PROGRAM FOR YOUNG (U15) ELITE ACADEMY SOCCER PLAYERS. ONE COMPETITIVE SEASON FOLLOW-UP**

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**Introduction**
Soccer is associated with relatively high incidences of injury (1). The ability to stabilize the core (LPHC) against repetitive accelerating and decelerating dynamic movements, and, furthermore, change directions, is a crucial role in professional soccer players' performance and prevention of injury. The AIMS of the study were to determine the soccer player's core strength, investigate movement's limitation, quantify functional asymmetry and evaluate the effect of a specific core strength program on certain aspects of the neuromuscular system.

**Methods**
Ninety-six elite academy soccer players (mean age=15,00 yrs, height=169,12+-4,52 cm, weight=70,02+-5,32 kg) performed in the program. The players completed the progressive 3-phase core program during a competitive season (2012-2013) twice a week. Functional core performances were evaluated before, during and after the program utilizing the well-established Functional Movement ScreenTM (FMS) scoring system (2). With respect to the player's positions during the game, we analyzed the position specific movement patterns adaptations and differences in core strength and quality of functional movements.

**Results & Discussion**
One of the main findings of our study was that completion of the 3-phase training program reduced the incidence of functional asymmetry by 43%. The core performance improvements significantly related to FMS exercises such as Deep Squat ($p < 0,05$), In-Line Lunge ($p < 0,05$) Trunk Stability Push-Up ($p < 0,05$) and Active Straight Leg Raises ($p < 0,05$). We have found differences between the player's anthropometric characteristics ($p < 0,01$) and functional movement patterns quality ($p < 0,01$) by their positions.

**Conclusion**
The study underlined the importance of core strength and functional movement quality in relation to injury prevention and performance enhancement. It also revealed essential physical requirements for top-class athlete's physical education in order to meet increasing demands.

**References**
1. Hawkins, RD. et al. (2001) Br J Sports Med. 35(1): 43-47.
2. Cook, G. et al. (2006) N Am J Sports Phys Ther. 1(2): 62-72.

**Keywords:** core, prevention, performance enhancement, functional movement, stabilization

## THE EFFECT OF DETRAINING AND INTERVENTION STRATEGIES ON INJURY INCIDENCE DURING PRESEASON IN ADOLESCENT SOCCER PLAYERS

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**Introduction**
The higher incidence of injuries during preseason has been attributed to a higher workload. However, the detrimental effects of detraining during the preceding offseason are overlooked. The primary aim of this study was to examine the detrimental effects of detraining during offseason on the incidence of injury during preseason training. Moreover, the effects of intervention strategies to counteract detraining were investigated.

**Method**
One hundred and twenty-six elite adolescent players were observed prospectively for 18 months (season 1: 2012–13 and season 2: 2013–14) to study the injury incidence. Prior to and during the 2013 preseason, intervention strategies were imposed to reduce the detraining effect and subsequently reduce the incidence of injuries. These intervention strategies included offseason programs and a five-week aerobic rebuilding phase during preseason.

**Results & Discussion**
A total of 212 time-loss injuries were recorded. The incidence of injury was 1.26 in season 1 (0.88 for muscle injuries) and 0.74 (0.46 for muscle injuries) in the intervention season 2 (all per 1,000 hours of training and match exposure). One-way ANOVA was used to measure the effects of detraining and intervention strategies on the incidence of injuries during preseason. No significant differences in the weekly training volume were found between preseason and in-season for seasons 1 and 2 or between season 1 and 2 for preseason and in-season. However, differences were found in the incidence of injuries and muscle injuries between the preseason and in-season for both seasons (P<0.01). Fewer injuries and muscle injuries occurred in season 2 after the intervention (P<0.01 and P=0.013). Effect size was calculated (Cohen's d) to determine the magnitude of intervention strategies on the incidence of injuries (d = 0.63).

**Conclusion**
This study demonstrates that the higher incidence of injuries during preseason cannot be solely attributed to the higher workload; it must also be due to the detrained state of players at the start of preseason. However, the detrimental effects of detraining during offseason can be countered using intervention strategies.

**Keywords:** Offseason, Injuries, Pre-season

**RELATIONSHIP BETWEEN OSTEOCHONDRAL INJURIES AND MATURATION IN HIGHLY TRAINED QATARI YOUTH SOCCER PLAYERS**

Materne, O*., Farooq, M**., Johnson, A*

*Aspire Health Centre, ASPIRE Academy, NSMP, Doha, Qatar.**ASPETAR, Doha, Qatar.

**Introduction**
The respective influence of growth and maturation on injury aetiology in young soccer players is still not well understood, particularly in emerging countries (1). It has been suggested that apophyseal injuries are a unique type of overuse injury in the young athlete, and they are currently underreported in the literature (2). The purpose of this prospective cohort study was to investigate the injury epidemiology and the association with maturation in an elite youth soccer academy.

**Methods**
Over one season, injury incidence, severity, type and lay-off period were compared in 289 youth soccer players, representative of ten different age groups (U9 to U18). Predicted age at peak height velocity (PHV) was calculated by a non-invasive method, then players were allocated to Pre- (< −1 year from PHV), Circum- (≥ −1 year from/to PHV ≤ 1) or Post- (> 1 year to PHV).

**Results & Discussion**
426 injuries were reported. The most common were contusion (36.8%), sprain (17.7%) and growth related injuries (16.8%). Indeed, osteochondral injuries accounted for 18.3% of all lower limb injuries, with the greatest rate observed in U14 (29.8%) and U15 (21.5%). Mean lay-off remained steady for the overuse injuries (Pre-: 13.5 ± 17.8 days; Circum-: 15.4 ± 23.2 days; Post-: 12.3 ± 22.5 days), while there was a sharp increase after PHV for the non-contact traumatic injuries (Pre-: 5.8 ± 10.1 days; Circum-: 6.1 ± 8.4 days; Post-: 14.9 ± 23.4 days). Incidence of overuse and non-contact traumatic injuries showed substantial differences during the different growth period. Peak incidence of osteochondral injuries (43%) occurred in the year of PHV and was higher than muscle strains (17%) and non-contact joint injuries (9%).

**Conclusion**
The results of the study suggest that PHV onset predisposes the immature skeleton as a potential injury risk factor for osteochondral injuries. Optimizing workload monitoring and considering individual differences in the timing of maturation may help to prevent growth related injuries in highly trained youth soccer players at the crucial stage of the growth spurt.

**References**
1. Faude, O. et al. (2013) Sports Med.
2. DiFiori, J. et al. (2014) Clin. J. Sport. Med

**Keywords:** Adolescent, Epidemiology, Peak height velocity

# Short Oral Presentations 2 –1:05-2:20pm

## SO 1 – Performance and Match Analysis II

**METABOLIC POWER DURING CONSTANT AND SHUTTLE RUNNING IN AMATEUR SOCCER PLAYERS**

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**Introduction**
Quantification of the soccer player's workload seems underestimated by traditional approaches, such as when running speed is used. An approach introduced by di Prampero et al. (1) allows an estimation of the instantaneous metabolic power of accelerated and decelerated running. The aim of this study was to evaluate the estimation of metabolic power by the di Prampero approach combined with Local Position Measurement (LPM) time-motion data for both constant and shuttle running.

**Methods**
Fourteen male amateur soccer players (23±2 yrs; 183±5 cm; 78±8 kg) performed aerobic constant and 10m shuttle running tasks at 6 speeds (range 7.5-10 km/h) on artificial turf. A calibrated portable gas analyzer (Cosmed K4b2, Rome, Italy) measured oxygen consumption and metabolic power. This measured metabolic power was compared to estimated metabolic power calculated with the equation provided by di Prampero et al. (1) using speed and acceleration assessed by LPM (Inmotio Object Tracking BV, Amsterdam, The Netherlands; integrated Gaussian filter set at 100%) as input. The study was approved by the local ethics committee.

**Results & Discussion**
For all runs except for some at the highest speed, RER was below 1.0. Measured metabolic power significantly ($P<0.01$) increased with speed and was 21 to 29% higher ($P<0.01$) for shuttle run (12.6-18.1 W; range 7.5-10 km/h) compared to constant run (10.3-13.9 W). The respective values for estimated metabolic power for constant (8.9-11.6 W) and shuttle run (8.9-13.2 W) were about 16 and 29% lower ($p < 0.01$) than measured metabolic power. Adding a terrain constant of 1.08 for artificial turf would decrease this underestimation of metabolic power to about 9 and 23%, respectively (2).

**Conclusion**
Shuttle running raises the player's metabolic power compared to constant running at the same average speed. For both constant and shuttle running average aerobic metabolic power, is significantly underestimated when using the original di Prampero approach with LPM data as input, even when correcting for terrain.

**References**
1. di Prampero, P. et al. (2005) J. Exp. Biol. 208, 2809-2816.
2. Sassi, A. et al. (2011) J. Strength Cond. Res. 25(3), 606-611.
**Keywords:** metabolic power, soccer, local position measurement

**SUBSTITUTION PATTERNS AND ANALYSIS IN DIVISION I MEN'S COLLEGE SOCCER**

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**Introduction**
NCAA College soccer has liberal substitution rules that permit teams remove a player in the first half and have them reenter in the second half of the game. The aim of the study was to describe the college soccer substitutions (SUBS) and re-substitution (RESUBS) considering the: game periods, players' positions, ranked (R) or unranked (U) teams, and home and away teams.

**Methods**
The number of SUBS and RESUBS were collected in 24 Division I soccer games distributed in 3 category based on ranking team position: RvsR, RvsU, UvsU. Each game was divided in 3 time periods (1-30, 31-60, and 61-90 min). Teams were classified in home (H) and away (A). Three players positions were considered: defenders (D), midfielders (M) and forwards (F).  Moreover, the number of players participating to the game were collected and the number of players that played the entire game. Chi-square analysis was applied and the level of significance was set at 0.05. Post-hoc analysis was applied using Bonferroni adjustment.

**Results & Discussion**
Statistical differences were found in the number of SUBS between: 1) period 1 (10.9%) and 2 (44.1%), and period 1 and 3 (45.0%) ($p<0.001$); 2) all players positions ($p<0.001$) (11.9%, 48.9% and 39.2% for D, M and F, respectively); 3) RvsR (30.7%) and UvsU (40.3%) ($p<0.001$), and UvsU and UvsR (29%) ($p<0.01$) games; 4) between R (45.6%) and U (54.4%) teams ($p<0.05$). RESUBS analysis showed significant difference between R and U teams (44.4% and 55.6%, $p<0.05$). Descriptive statistics showed that an average of 5.5 ± 2.0 players per team played the entire game, and 15.3 ± 2.1 players participated to the game. The mean SUBS and RESUBS per team per game were 11.3 ± 4.8 and 6.7 ± 3.5 with RESUBS ratio of 58.8%.

**Conclusion**
This study showed that SUBS and RESUBS were influenced by game periods, players' positions, and team ranking positions. Moreover, there were a higher number of SUBS in college soccer compared with those allowed by international rules. This could influence the physical demand of college soccer players during games.

**Keywords:** substitution match analysis

**COMPARISON OF LOCOMOTIVE CLASSIFICATIONS BETWEEN CENTRAL AND EXTERNAL DEFENDERS IN ELITE YOUTH SOCCER PLAYERS**

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**Introduction**
Time-motion analysis investigations are used to identify activity patterns performed by soccer players in match-play to assist training regimes for player development (1). External defenders perform different activity patterns to central defenders in match-play (1), classified by differences in locomotive velocities between the two positions. The Bloomfield Movement Classification (BMC) provides detailed movement pattern analysis as the directions of movements are differentiated (2). The AIM of this study was to identify any differences in locomotive classification between central and external defensive playing positions in elite youth soccer players in a 4-4-2 formation.

**Methods**
Full match footage was collected on 20 defensive players, central (n=10) and external (n=10) from an English Premier League U18s soccer team (age 17 ± 1 yrs). GameBreaker+ video software was used for coding locomotive classifications via the full BMC model (2).  Results were analyzed via a MANOVA test and a within subjects repeated measures ANOVA with a Bonferroni post hoc tests applied to both, significance accepted as p≤0.05.

**Results & Discussion**
Significant main effect and interaction between central and external defenders occurred within the backward movement (p=0.002), with external defenders utilizing backward movements more often than central defenders. Both central and external defenders ranked forward movements as the highest movement classification, with central defenders ranking forward diagonal, sideways, backward and backward diagonal and external defenders ranked backward, forward diagonal, sideways and backward diagonal respectively.

**Conclusion**
The main findings of this study show forward movements comprised the most amount of time for both defensive playing positions. As backward movement the only significant difference between the two groups, contrary to previous research, central and external playing positions in a 4-4-2 formation are of similar movement classifications. Future research needs to analyze movement classifications in other playing formations.

**References**
1. Di Salvo, V. et al. (2007) Int. J. Perform. Anal. Sport. 28, 222-227
2. Bloomfield, J. et al (2004) Int. J. Perform. Anal. Sport. 4, 20-31

**Keywords:** Football, high intensity running, sprinting, passing, possession, season changes

**DEVELOPMENT OF SEMI-AUTOMATIC TRACKING SYSTEM FOR SOCCER PLAYER BY USING PARTICLE FILTER**

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**Introduction**
In order to evaluate a soccer player, tracking systems based on vision-based technology (1) are used. However, the tracking systems, especially commercially available systems, are rarely used because of high cost. Therefore, inexpensive systems for the analysis of soccer players are required. The present study developed a tracking system using the movies recorded by two commercially-available cameras. In this paper, the validity of the present system is investigated.

**Methods**
The movies are matches of Japan Professional Football League Division 1 and are recorded by two commercially-available, high density cameras (SONY, HDR-CX590V, Japan). The automatic tracking processing is carried out by using particle filter (2). The players are tracked based on the uniform color of the upper body every 1/20 seconds. Background subtraction is used to extract moving target. Also, color reduction is applied to reduce the influence of the color change due to the lighting condition. If tracking errors occur, player's position is manually corrected. The player's position in the image is transformed to the actual position in the pitch by perspective projective transformation

**Results & Discussion**
70 players (7 attackers, 37 midfielders and 26 defenders) who played in 90 minutes are analyzed and measured distance covered. The mean distance covered measured in 1st half, 2nd half and total are 5406 ± 311 m, 5519 ± 392 m and 10925 ± 615 m, respectively. These results are in good agreement with the result in literature (3). Therefore, these results indicate that the present tracking is considered to be correct.

**Conclusion**
A semi-automatic tracking system by using particle filter has been developed. The accuracy of the distance covered of the present system was confirmed by comparison with the other studies. The present system is thought to be useful method to evaluate the ability of the soccer player during a match.

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**Keywords:** Image processing, Tracking, Soccer

**AN ASSESSMENT OF COMPLEXITY AND PERCEPTUAL-COGNITIVE SKILLS IN SOCCER**

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**Introduction**
The complexity of dynamical systems (spanning brain, body and environment) can yield complex adaptive behaviors from non-linear interactions of players in space and time (1). A lack of reliable instruments to assess these varying behaviors results in inferences of how changes in behavior occurred over an extended period of time rather than being based on direct scientific measures (2). The aim of this study was to develop the construction of a 3 dimension scale to assess perceptual-cognitive performance of soccer players when acting within different levels of complex "superorganismic" team synergies and provide initial evidence of structural and criterion reliability.

**Method**
A sample of 10 soccer coaches – group A (n= 5 coaches; M=24 yrs professional experience) and group B (n=5 American coaches; M= 1 year of amateur experience) were recruited to participate in the study. A total of 100 clips of 10 previously recorded soccer matches were analyzed in 2 assessment periods with 1 month between the end of the first assessment and the beginning of the second. This resulted in a combined total of 1000 measures used for this study.

**Results & discussion**
A test retest reliability supported a significantly higher correlation between professional coaches (r=.90) than in amateur coaches (r=.70). The reliability within assessments determined a greater correlation in the second assessment (r=.65) showing an acceptable reliability between groups. Internal consistency of the scale (r=.91) was also measured, providing evidence of this scale's criterion validity. These findings indicate that this scale is reliable across applications and at different times with high and low skilled coaches.

**Conclusions**
Future studies could measure the validity of this instrument across a diverse sample of coaches. The use of the scale may be useful for identifying elements of emerging complexity at the team-fractal-player level; determine a perceptual-cognitive profile in players; and to better understand complex tactical dynamics in soccer.

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**SO2 – Women's Soccer**

**EFFECT OF A REPEATED SPRINT TEST ON SUBSEQUENT SKILL PERFORMANCE IN ELITE FEMALE SOCCER PLAYERS**

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**Introduction**
Key elements of soccer include the players' ability to perform repeated, high-intensity work while maintaining efficient skills when in possession of the ball. Many studies have recently focused on the measurement of skill and the validity of field-based tests,[1] as they relate to soccer performance. Skill performance can become impaired following bouts of brief, high-intensity exercise.[2] The aim of this study was to measure the effect of short-term fatigue on subsequent skill performance in elite level female soccer players.

**Method**
30 international female soccer players (mean ± SD: age 23 ± 3.2y; height 1.61 ± 0.7m; Body mass 55.2 ± 8.7kg) were recruited to take part in the study. Following two familiarization trials using the Loughborough Soccer Passing Test (LSPT),[3] the exercise protocol consisted of a standardized 10 minute dynamic warm-up, followed by baseline LSPT measurements. Then, each participant completed a standardized soccer-specific repeated sprint ability test[1] (RSA) in order to induce game-specific, short-term fatigue. Upon completion of the RSA, each participant was immediately re-tested on the LSPT. Heart-rate (HR) monitors were used to monitor exercise intensity. Self-perceived measures for exertion (RPE), thirst and gut fullness were recorded throughout the main trial.

**Results & Discussion**
No significant differences were observed in any of the movement (mov), penalty (pen) or total (tot) time taken to complete the LSPT between the pre- and post-RSA scores (Mov: pre 55 ± 11s, post 52 ± 7s; Pen: pre 13 ± 9s post 14 ± 9s; Tot: pre 67 ± 12s, post 67 ± 13s, $p > 0.05$). Heart-rate and perceived exertion for pre- (HR: 104 ± 10 bpm; RPE: 10 ±1.2) and post- (HR: 155 ± 16 bm; RPE: 15 ± 1.8) indicated that the RSA test had induced a bout of short-term fatigue.

**Conclusion**
This study highlights an ability of elite level female players to maintain a consistent level of skill performance, despite a heightened level of physiological stress.

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3. Ali A. et al. (2008) Int J Sports Med. 11: 917-21

**Keywords:** Fatigue, LSPT, Heart-rate

**THE INFLUENCE OF TRAINING WITH THE NON-DOMINANT FOOT ON FEMALE SOCCER PLAYERS' SKILL PERFORMANCE**

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**Introduction**
Modulation of lateral preference is suggested to be of importance for sports in which bilateral proficiency is advantageous for high performance. Evidence for such modulations in athlete's laterality comes from soccer players, suggested as an effect of pronounced bilateral practice (1, 2). Thus, in line with evidence showing that lateralized practice may lead to a shift of manual dominance; our purpose of the present study was to investigate if extensive soccer-specific practice with the Non-dominant-foot (NdF) may positively affect soccer skill performance by means of accuracy and consistency.

**Methods**
Twenty-four elite and sub-elite players (age: 20.5 yrs) from outfield playing positions were randomized to a control- and NdF training-group. The NdF group trained specifically with their NdF on a variety of basic soccer skills (e.g. passing, trapping, juggling) during regular soccer practice, over a four week period (three sessions of 20 min a week). The controls continued their regular team practice. The first skill-test assessed the number of goals scored with the NdF, in a "turn and shoot" task, on a 1.0 x 2.44 meter target, 15 m away. The second task comprised a 25 m cross-pass on a ball in movement, in which accuracy and variability of the pass outcome was assessed.

**Results & Discussion**
Whereas the NdF group displayed a significant improvement in number of goals scored (1.8 +/- 0.5 goals) from pre- to post-test, the control group did not (-0.9 +/- 1.1 goals). For the cross-pass task the NpF group displayed a significant pre- to post-test improvement of the mean accuracy score by 1.6 +/- 0.5 meter, with concomitant reduced variability. No such effects were evident for the control group (0.2 +/- 0.7 meters).

**Conclusion**
From an applied perspective, more frequent training with the NdF, in a fashion that does not require special equipment or distinct tutoring, seems to improve skilled use of the non-dominant foot, thus, that may lead to higher proficiency for players even on the elite-/and sub-elite level.

**References**
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**Keywords:** perception, surfaces, injury

## NEUROCOGNITIVE AND SOMATIC RECOVERY CURVES FOLLOWING CONCUSSION IN FEMALE INTERSCHOLASTIC SOCCER PLAYERS

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**Introduction**
Girls' soccer has a high risk for sport-related concussions (SRC); in fact females in general are more likely to suffer SRC than their male counterparts (1). There exists minimal guidance supporting the duration of cognitive and somatic recovery following SRC, especially in a vulnerable interscholastic female soccer cohort. The purpose of this study (HS IRB 157873-3) was to prospectively measure the acute effects of SRC on neuropsychological performance and symptoms over a seven-day time course in interscholastic female soccer players.

**Methods**
A total of 36 interscholastic female soccer players were equally divided into concussed and non-concussed groups and subsequently examined on neurocognitive and somatic measures over a seven-day period. The concussed group consisted of soccer players who sustained an acute concussion during a competitive soccer match. The soccer players in the non-concussed group were girls best matched according to age, academic school year, height, mass, and position. We utilized the Automated Neuropsychological Assessment Metrics (ANAM-2001) to measure neurocognitive performance and throughput scores were derived. Following an acute SRC, the ANAM test battery and symptom checklist was administered at days 1, 3, 5, and 7. Data were analyzed using the multivariate approach to repeated measures ANOVA.

**Results & Discussion**
As was seen in recovery curves of American football players, deficits in symptoms and cognitive function fall in the days immediately following SRC and then gradually return to baseline by day 7 post injury (2).

**Conclusion**
The recovery curves documented in this study have great implications for clinical management—especially in our age population. Some domains resolved within 3 or 5 days, while others returned to baseline by day 7. It is important to examine the cohort in this study and speculate that our population exists as a unique and unfamiliar entity that has received very little attention in the research community. Return-to-play guidelines must be greatly considered when handling interscholastic female soccer populations. Individual recovery plans are crucial for successful management of cerebral concussion.

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2. Guskiewicz, K. M., et al. (2003). JAMA, 290(19), 2549-2555.

**Keywords:** Head Injury, ANAM, Neuropsychological, Soccer Heading, Reaction Time

**GPS PERFORMANCE ANALYSIS OF WOMEN'S SOCCER COMPETITIVE MATCHES OF THE SECOND AND FOURTH GERMAN LEAGUES**

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**Introduction**
Although the popularity of women's football has considerably increased in the last few years, scientific research on the physical demands of the women's game at different competitive levels is still limited. Therefore, the aim of this study was to compare the physical demands of women's soccer competitive matches of two different competitive levels using Global Positioning System (GPS) technology.

**Methods**
A total of 22 female football players participated in this study (23.0±3.9 yrs., 163.1±6.6 cm, 60.2±5.4 kg). Their physical performance was monitored by means of a 5 Hz GPS device and a heart rate (HR) monitor during competitive matches of the second (2L) and fourth (4L) German Women's Soccer Leagues (2L/4L: 5/5 games, 34/26 complete data sets). Only the data sets of players who completed the whole game (90 min) were used for data analysis. Distance covered was classified according to six arbitrary speed zones based on the work of (1). Significance level was set at $p < .05$.

**Results & Discussion**
Total distance covered (TDC) was significantly higher in the 2L (9321.6±902.7 m) compared to the 4L matches (8223.6±1415.4 m). Distance covered at the following speed zones (5-8, 8-12, 16-20, >20 km/h) was also higher in the 2L than in the 4L matches. No statistical differences were found at 0-5 or 12-16 km/h between the two leagues. No significant reduction in TDC or distance covered at >16 km/h (high/sprinting speed) was identified in the 2nd vs. 1st half for either league. Average HR was higher in the 2L (89% HRmax) compared to the 4L (87% HRmax) games. There were no statistical differences in peak HR (both 100% HRmax). Overall, defenders covered less total distance than midfielders and forwards in both leagues.

**Conclusion**
The physical demands of 2L competitive matches are larger than those of 4L matches, especially in terms of total distance covered (12%), distance covered at high/sprinting speed (30%), and average HR (2%). Thus, players' physical preparation should meet the specific demands of the competitive level they are currently participating in and take into account their positional role.

References
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**THE IMPACT OF CELEBRITY (WOMEN'S SOCCER PLAYER) ENDORSEMENT IN INNOVATION ACCEPTANCE ON BANK'S CUSTOMERS (CASE STUDY: BANK MELLAT IN IRAN)**

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**Introduction**

The importance of innovation adoption, in the banking industry is obvious. Matter if this issue is going to grow by entering individual bank in the industry. So companies try to use sports (women soccer players) endorsers in order to improve innovation adoption of their potential customers. The purpose of this paper is to concept test the impact of sports celebrity endorsement in innovation acceptance on Bank Mellat's club's customers. So, in order to do this, we evaluated the impact of sports endorsers on innovation adoption and also on attractiveness, expertise and trustworthiness.

**Methods**

This research is applied research based on its aim, and also is a descriptive study based on its data collection. The research is also a correlation (especially structural construction modeling) based on data gathering method. So the required data was gathered from a 327 Bank Mellat customers.

**Results & Discussion**

The results showed that "Sports Endorsement" has a significant and positive influence on "Innovation Adoption". In the research, "Sports Endorsement" consists of three sub-variables, but only one of them including "attractiveness" has a significant, positive influence on "Innovation Adoption" and the others have no significant impact on it.

**Conclusion**

It suggests that banking industry can take advantage by using attractive sports endorsers in its advertisements.

**References**

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2. Leong,R.M. Michael ,E. Abu Bakar,A.R. Ira Meilita, I. Veerappan,G. Rajamanickam,Sh.. )2012(. European J. of Social Sci. Vol.28 No1. pp 50-63.

**Keywords:** Sports endorser, innovation adoption, women soccer players

## SO3 – Youth Development

**UNDERSTANDING PERFORMANCE COACH DEVELOPMENT: HOW POSTGRADUATE COACH EDUCATION PROGRAM CAN INFORM NGB'S FOOTBALL CERTIFICATION**

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**Introduction**
A coach's development is a unique experience. The acquisition of knowledge can be obtained through varied educational environments such as formal, informal and non-formal (1) settings. The aim of this study was three-fold: to identify the knowledge development of coaches within a formal coach education context, to identify the way in which this knowledge affects their coaching practices and, lastly, to compare the tertiary formal education structures to those of the NGB's coach education model.

**Methods**
Seventeen performance coaches (>25 yrs; 12.9 + 7 yrs experience) were interviewed using semi-structured interviews (28-65 minutes). Content analysis procedures were followed to reduce the initial data in an inductive then deductive manner to determine main themes.

**Results & Discussion**
Coaches enhanced their knowledge through rich and relevant learning situations that were contextualized through their own sport. The three types of knowledge (professional, interpersonal and intrapersonal; (2)) were fostered in an environment that was socially-constructed. The coaches indicated that the knowledge they developed from the course influenced their coaching practices (e.g. pedagogy, reflective practice, planning & athlete development), and, as a result, coaches felt that they were better equipped as performance coaches. Furthermore, from a football educator's perspective, the findings show that it is imperative to understand football's technical components, but also the ability to teach, guide and assist the participants through their own teaching practices. The findings reinforce the importance of developing NGB's football accreditation courses in soccer that are learner-centered, provide opportunities for coaches to critique, question and construct knowledge with their peers, as well as developing CoP's within their course structures.

**Conclusion**
These findings reinforce the importance of developing formal coach education that is student-centered, creates diverse learning experiences and embraces informal learning concepts.

**References**
1. Coombs & Ahmed (1975) Baltimore: John Hopkins University Press
2. Côté & Gilbert (2009) Int. J. Sports Sci and Coaching. 4(3): 307-323

**Keywords:** coaching, education, football

**SIX-MONTH STABILITY OF PHYSIOLOGICAL, LOCOMOTOR AND PERCEPTUAL RESPONSES TO SMALL-SIDED GAMES IN HIGHLY-TRAINED YOUNG SOCCER PLAYERS**

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**Introduction**
While small-sided games (SSG) may be associated with high cardiac and/or neuromuscular loads, the greater session-to-session variability reported for SSG compared with generic, run-based, drills (1) might limit long-term physiological and performance adaptations. Examining the stability of physiological, neuromuscular and perceptual responses to standardized SSGs over a few months is therefore paramount to better assessing the long-term value of this training approach. The aim of the present study was to examine the 3-6 months stability of physiological, locomotor and perceptual responses to SSGs in young soccer players.

**Methods**
Fifteen highly-trained U14 soccer players from an elite academy repeated 3 times within 6 months (2 months between each SGG session) 4 x 3-min 4 vs. 4 SSG (40m x 16.5m, no goal keeper, free touch). Heart rate (HR), rate of perceived exertion (CR10 scale, RPE) and running patterns were recorded with GPS (GPSports, 15 Hz). Average HR, total distance covered (TD), distance >19 km/h, peak game speed (GS), maximal acceleration (Amax), and distance covered >2.5 m/s/s were collected. The stability of each response was examined via intraclass correlation coefficients (ICC, 90% confidence limits, CL).

**Results & Discussion**
ICC were: HR: 0.49 (0.08;0.75); RPE: 0.15 (-0.26;0.51); TD: 0.41 (0.01;0.69); distance >19 km/h: 0.05 (-0.54;0.48); GS: 0.45 (-0..2;0.73); Amax: -0.18 (-0.35;0.56) and distance >2.5 m/s/s: 0.65 (0.32;0.83).

**Discussion**
Present results show that the stability of physiological, locomotor and perceptual responses to small-sided games in highly-trained adolescent soccer players is moderate-to-low. These findings extend previous results highlighting the limited short-term reliability of the majority of these responses (1), and show that the individual stimuli for physiological and performance adaptations may vary (too much) from sessions to sessions. This partly questions the usefulness of such a training approach to develop physical capacities in this population (2).

**References**
1. Hill-Hass et al. Sport Med 2011, 41:199-220
2. Hervert et al. J. Aust. Strength Cond 2013. 21: 34-36

**Keywords:** football-specific training, conditioning, acceleration, GPS

**ANALYSIS OF THE CORRELATION BETWEEN PEAK HEIGHT VELOCITY AND TACTICAL PERFORMANCE IN SOCCER**

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*Centre of Research and Studies in Soccer, Federal University of Viçosa, Brazil; **Fluminense Football Club, Brazil

**Introduction**
Tactics have been considered the guideline for soccer training, but also maintain a close relationship with individual motor skills which, in turn, are influenced by individuals' development, growth and maturation. This study aims to examine the correlation between the distance to peak height velocity and the Tactical Performance Index (TPI) of U-13 and U-15 youth soccer players.

**Methods**
The sample was comprised of 34 youth soccer players who performed 2,468 tactical actions. The System of Tactical Assessment in Soccer (FUT-SAT) was used for collecting and analyzing data (1) and the distance to peak height velocity was assessed through the Maturity Offset (2). Descriptive analysis was performed as well as Shapiro-Wilk's, Spearman's Correlation and Cohen's Kappa tests. Significance level was set to $P<0.05$.

**Results & Discussion**
Results indicated high negative correlation (rho=-0.622; $P<0.001$) between the distance to peak height velocity and Defensive Tactical Performance Index and, therefore, that players who are closer to peak height velocity possess lower values of Defensive Tactical Performance Index.

**Conclusion**
It is concluded that the proximity to peak height velocity negatively influences the defensive tactical performance of youth soccer players.

**References**
1.Teoldo, I. et al. (2011) Motricidade7(1), 69-84.
2.Mirwald, R. et al. (2002) Med. Sci. Sport Exer. 34(4), 689-694.

**Keywords:** soccer, tactical performance, maturation

## COACH EDUCATION INTERVENTION CAUSES INCREASE IN GAMES-BASED PRACTICE ACTIVITES THAT UNDERPIN SKILL TRANSFER TO MATCH-PLAY

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### Introduction
Drill-type activities often used during practice can lead to deficits in skill transfer to match-play. Still, coaches have youth players engage in these types of activities more so compared to games-based activities that underpin positive skill transfer (1, 2). In the present study we delivered an evidence-based education intervention with the expectation that coaches would shift towards the greater provision of well-designed, game-based activities.

### Method
Seven male coaches working across seven youth academy teams (U7s to U13s) in an English professional club participated. The study had five phases: pre-intervention-observation; interview 1; coach education intervention; post-intervention-observation; interview 2. Eight coaching sessions (4 pre-and 4 post-) were filmed per age group during observation. Each session was analyzed using Studiocode to quantify the percentage of drill-type activities, games-based activities, and transition (no coaching activity). Coaches were interviewed to identify why particular activities were used. The intervention consisted of a workshop disseminating evidence-based information on practice structure.

### Results & Discussion
The time spent during pre-intervention-observation in drill-type activities was 42%; in games-based activities was 33%; and in transition was 25%. During post-intervention-observation, drill-type activities reduced to 33%; games-based activities increased to 48%; and transition decreased to 19%. The coaches stated they used drill-based activities mainly to develop technical skill and the activities were acquired from courses and by observing others. Importantly, they stated the educational intervention led to their observed increased provision of games-based activities at post-intervention.

### Conclusion
Coach education has an important role in disseminating evidence-based information to increase the provision of game-based activities that facilitate skill transfer to match-play.

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**Keywords:** coach education, game-based activities

## SO4 –Biomechanics and Technology

**A METHOD OF MEASURING THE LINEAR AND ANGULAR KINEMATICS OF A SOCCER BALL IN FLIGHT**

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### Introduction
The ability to kick the ball straight as well as with a curved trajectory are primary skills for soccer players. Few researchers have analyzed the kinematic ball flight properties between different kicks, with previous studies employing either different methods (1) or analyzing only a single kicking technique (2). The purpose of this study was to develop a methodology that accurately measures the three-dimensional linear and angular kinematics of a soccer ball during flight, to quantify kicking performance of two the straight-instep and curve kicks.

### Methods
Four male, right-foot dominant soccer players were tested using a 14 camera Cortex Motion Analysis System (Version 3.0, Motion Analysis Corporation Ltd., USA) operating at 200 Hz with inbuilt Kintools RT analyser. Subjects performed 20 randomised trials having to score within a modified soccer goal, approximately 16.5 metres away. Four trials of each technique were selected for analysis.Ball kinematics were measured by tracking three orthogonally placed reflective, spherical markers attached directly to the ball's surface. The ball segment was created by defining a joint coordinate system in the Kintools RT software, enabling the calculation of the ball's angular velocity vector, which was separated into horizontal and vertical components.

### Results & Discussion
As expected, the mean spin angular velocity of the ball was significantly higher in curved trials (7.2 rev/s ± 2.9) compared with straight trials (4.2 rev/s ± 1.1), although the ball velocities were similar (curve: 83.2 km/h ± 5.3, straight: 81.8 km/h ± 4.9). The mean vertical elevation angle of the curved kick (80.7° ± 7.6) was notably higher than the straight kick (5.9° ± 20.5). Similarly, the mean horizontal direction angle of the curve kick (70.88° ± 18.5) was also notably higher than the straight kick (-8.43° ± 10.3). This data shows the difference between the kicking types: the more vertical axis of rotation necessary to produce sideways force in the curve trials, whereas the almost horizontal axis of spin in the straight-instep minimized this force.

### Conclusion
In this study, we calculated both the linear and angular kinematics of a soccer ball in flight, the latter quantifying the spin rate, spin direction and spin elevation angle, which are established determinants of kicking performance.

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**Keywords:** kinematics, soccer ball, ball spin

**THE ACCURACY OF A SINGLE CAMERA SYSTEM TO MEASURE BALL SPEED AND SPIN IN 3 AXES**

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CCASES, University of Chichester, UK. * Quintic Consultancy Ltd., UK. **University of New England, AUS.

**Introduction**
In soccer, goals are generally scored with either the foot or the head.  Shots with the foot are most common, and the increase of ball speed and accuracy will improve the likelihood of success at this task. Feedback is instrumental to soccer coaching, and the use of technology was aimed to aid coaches in providing the essential accurate and timely feedback during sessions (1). The Quintic Ball Flight system can provide near instantaneous feedback on trajectory, speed, and spin on the soccer ball from a stationary kick using just one single camera and a number of ball markers.

**Methods**
Data was collected from two soccer players (Age 20.3yrs) using the Quintic system at 250Hz and also a 'gold standard' 10 camera Vicon T-Series system sampling at 500Hz.  A series of 5 kicks were performed in a laboratory at a 1m square target in a) maximal, and b) curved kick conditions.  Marker trajectories were processed and sphere fit calculations performed in Labview software, along with Single Value Decomposition calculations to translate vectors of all trajectories. These values were then compared to corresponding values from Quintic Ball Flight.

**Results & Discussion**
In both maximal and straight conditions the values tended to lie between 2-30rpm for both sidespin and rifle-spin. Topspin calculation in Quintic was slightly less accurate and tended to vary up to 100rpm. The overall total rpm values were affected by the topspin calculation, yet it was found that Quintic Ball flight was more accurate during a curved kick, than when little spin was imparted onto the ball. The system can detect practical differences between levels of spin imparted to a stationary kicked ball.

**Conclusion**
The Quintic Ball Flight system provides accurate data to detect changes in performance outcome of speed and spin during stationary ball kicking
References

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**COORDINATION PATTERN OF THE KICK LEG IN SOCCER**

Barnes, S., Ball, K.

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**Introduction**
Much research has been conducted to understand kicking technique; however, most have only focused on technical aspects of either maximal or accuracy kicking, with very few making a comparison between the two (1). Further, a vast majority of the literature was performed using a stationary ball. Arguably, this is of concern as the majority of kicks performed within training and match play are performed when the ball is rolling. Furthermore, it is unclear whether current principles can be generalized to each kick and ball condition. Thus, this study aims to compare the coordination pattern of the kick leg between both maximal and accuracy kicks and stationary versus rolling ball conditions.

**Method**
Nine healthy, sub-elite male soccer players took part in this study. Following familiarization, players performed three maximal and three accuracy kicks for each of the three ball conditions: stationary, rolling ball 90° relative to kicking direction and dribbling. A total of 36 reflective markers were used to identify segmental and anatomical landmarks of the lower body. Kicking technique was captured via VICON Nexus at 250Hz and analyzed via Visual 3D. Results were examined via time series, angle-angle and phase-plan plots about the hip and knee of the kick leg.

**Results & Discussion**
Coordination patterns of the kick leg were similar between maximal and accuracy kicks; however, slight differences within the working ranges were apparent. During maximal kicks, greater angular range of motion (RoM) was evident at the knee across all ball conditions. Hip angular RoM was similar between the two kick conditions however a shift occurred whereby the hip remained in a more extended state during accuracy kicks across all ball conditions. Further, greater peak hip angular velocity was evident in rolling ball kicks while greater knee angular velocity was produced in stationary ball kicks across both maximal and accuracy conditions.

**Conclusion**
Differences in coordination patterns suggest changes within the kicking technique depend on kick and ball conditions. Thus, current literature may not directly transfer between each condition.

**References**
1. Lees, A. et al. (1999) WCSF IV: 16-21.

**Keywords:** Soccer, kick, kinematics

# Invited Speaker Sessions, 4:00-5:20pm

## Session I: Youth Development II

**AN ATHLETIC DEVELOPMENT MODEL FOR YOUTH SOCCER**

**Geert Savelsberg and Jan Willem Teunissen**, VU University Amsterdam

We have developed a model for integrating Biological age of the young football player into 4 different trainingfases (p1-p4) around puberty. These fases correspond to critical periods within development of the young athletes (e.g. Peak height velocity and a higher risk for injuries). Our model aims for a reduced injury risk and less dropouts compared to the different models based on calendar-age. The exercises that follow the theory are based upon current motor learning studies (e.g. implicit learning) and many years of experience at elite and organized sport levels.

## Session II: Sport and Technology II

**USE OF ATHLETE TRACKING TECHNOLOGY IN SOCCER: APPLICATIONS AND LIMITATIONS**

**James Malone**, Catapult

**GPS TRACKING SYSTEMS IN SOCCER**

**Rod Lindsell**, GPSports Systems

## Session III: Physiotherapy and Injury Prevention

**PREDICTING AND PREVENTING SOFT TISSUE INJURIES IN SOCCER**

**Ravi Ramineni**, Seattle Sounders

This talk will cover the importance of preventing injuries by outlining the process of building a mathematical model to predict injuries. We validate and interpret the output of the model and communicate and apply of the outputs of the model to make interventions. Over the years, our model has developed and evolved to determine risk factors associated with injury risk. I will give specific examples of the application of the outputs and show how the technology and data architecture to make data modeling easy and quick.

# Saturday, June 7, 2014

## Invited Speaker Sessions, 8:50-10:10am

### Session I:  Performance and Match Analysis II

**MODERN DATA ANALYTICS IN SOCCER: A NEW ERA IN PERFORMANCE ANALYSIS**

**Hector Ruiz**, Prozone Sports

Technology gives us the possibility to capture anything that happens during a soccer game, from the thousands of ball-related events that take place to the location of every player every tenth of a second [1]. However, the sheer volume of data available can be challenging and difficult to manage. Data analysis techniques aim to provide insights into the underlying processes and relationships present in an environment. To do so, observations are collected by measuring any accessible variables, and the outcomes are carefully studied to find patterns that uncover new information and knowledge about the mechanisms that generated the data. The use of these methodologies becomes especially useful when the problem of interest is complex or takes place under noisy conditions, both statements that apply naturally to soccer. The open and collective character of the game gives rise to an overwhelming amount of different possible situations on the pitch. With so many factors and variables to consider, the dependencies between effects and causes often remain hidden, and finding a winning formula is proving to be much more challenging than in other less noisy sports [2]. Rigorous methods are therefore needed to map the structure of multivariate associations, providing a broader picture than that produced by traditional univariate analyses. Multidimensional tools like clustering, conditional independence maps or network analysis all have the potential to expose those relationships, but this is not enough: it is crucial to take approaches that retain the interpretability of simpler methods such as linear regression or correlation coefficients. Overlooking this aspect will hinder the acceptance of the outputs by the practitioners in the field, thus diminishing the practical usefulness of the methodologies implemented. In this talk, we discuss ways of making sense out of the available information by combining efficient advanced data analysis with intuitive statistics and visualisations to deliver results to the end user. The outcome is an original take on performance analysis that illustrates the potential and exciting future of data analytics in sports. References: [1] Di Salvo, V., Collins, A., McNeill, B., and Cardinale, M. Validation of Prozone: A new video-based performance analysis system. Int J Perform Anal Sport, 6(1):108-119, 2006. [2] Lewis, M. Moneyball: The art of winning an unfair game. W.W. Norton, New York, 2003.

**PERFORMANCE ANALYSIS IN ELITE SOCCER - PRINCIPAL TO PRACTICE**

**Ben Knapper**, Arsenal FC

Over the last decade, performance analysis has become an increasingly prominent discipline within elite soccer, with organizations continually investing in the quest to maximize impact in the hope of creating competitive advantage. The success and sustainability of such an effort depends on finding a workable balance between theoretical principals of performance analysis and their practical application within an elite club setting. The manor in which performance analysis can be applied is dependent on a number of organizational-specific factors. These affect where exactly performance analysis fits into the coaching process, and in soccer operations as a whole, and more importantly the scale of the impact it can have upon performance. Such is the emphasis now placed upon performance analysis in elite soccer, the role of an analyst has evolved tremendously. The scale of the work undertaken, as well as the specific skill-set required of individuals' demands that any performance analysis department be truly multi-faceted. Specialists are now employed in order to increase the level and depth of such work, with departments ever increasing in both size and expertise. Today, a focus is on 'big data' and how organizations can glean the most value from their vast data-sets, continually growing thanks to new technologies. Investment in addressing this is very much in-vogue at present, with organizations increasingly looking further afield for specialist input to drive progress and innovation. It is this area of focus that we will see the biggest advances in the way in which performance analysis is applied in elite soccer, ultimately progressing more-and-more towards data-assisted decisions. This session will explore the way in which performance analysis is integrated within an elite EPL organization, sharing insight into the day-to-day application of this discipline to all aspects of soccer operations. Moreover, the role of performance analysis in the pre-and-post-match cycle, as well as its application to player recruitment and talent identification will be discussed.

## Session II: Sports Medicine

**NEW INSIGHTS IN CONSUSSION DIAGNOSIS, REHABILITATION AND RETURN TO PLAY**

**James Chesnutt**, Oregon Health and Sciences University

Concussions are a serious and frequent injury occurring in soccer players of all ages. Although increasing concussion risk in soccer is related to increased forces involved in the game, risk factors associated with increased incidence overall, especially in women, and factors involved with frequent concussions or poor outcomes are not well understood.  I will highlight recent research  and address evidence-based factors associated with the diagnosis and prognosis of concussions and discuss ways to further evaluate, treat and rehabilitate those with concussion to improve outcomes and help ensure safe and timely return to play, academics and work.

**Session III: Sport Psychology**

**PSYCHOLOGY AND ELITE SOCCER PERFORMANCE**

**Geir Jordet**, Norwegian School of Sport Sciences

How can sport psychology research provide soccer managers/coaches and players the basis for effective performance development? This presentation will provide the status quo from our research on psychology and soccer, to give a soccer-specific empirical basis for psychology applied to elite soccer performance. This will include characteristics of elite performance, the path to elite performance, and information about when and how elite performance breaks down. The focus is on identifying the psychological processes that support functional performance development behaviors in relevant soccer contexts. Methodologically, the research that lays the foundation for this presentation include; a) close-up video analyses from about 150 professional soccer players from the big-5 European leagues (Premier League, Bundesliga, Serie A, Primera Division, and Ligue 1); b) video analysis of all 498 shots ever taken in penalty shootouts from the World Cup, European Championships, and Champions League; c) questionnaires with every single elite/professional player from 14 years and up in the top-32 clubs for men and the first teams in the top-12 clubs for women in Norway, a total of about 1600 players; d) best practice visits to more than 30 top European soccer clubs; and e) a series of intervention studies testing out some of the applied predictions from this research. The presentation will conclude with a comprehensive model for psychology and elite soccer performance, a system for profiling and monitoring the psychological processes that support and facilitate performance, as well as specific suggestions for how to work with these processes in practice.

**APPLIED SPORTS PSYCHOLOGY SUPPORT IN ENGLISH PREMIER LEAGUE FOOTBALL: CRITICAL MOMENTS, TRANSITIONS AND IDENTITY**

**Martin Littlewood**, Liverpool John Moores University

The journey from an Academy to the 1st team professional environment in English professional football places a considerable number of psychological demands on young players (Richardson et al., 2013, Cook et al., 2014).  This presentation draws on the author's extensive experience of delivering applied sports psychology support in the EPL, and will outline the unique situations and challenges that Academy players may encounter in the quest for a professional playing contract.  More specifically, it explains how an existential psychological approach can be used to support players through a number of critical moments and transitions during their careers (Nesti & Littlewood, 2011).  The concept of identity will be introduced and the importance of developing a broader identity will be further explored.  Case studies will be presented to illustrate how this approach can be integrated into practice to support player development and complement the role of the coach.  The presentation will also outline how practitioners can develop a sound and rigorous psychological development programme for an Academy environment. The author will also consider the cultural challenges that practitioners may encounter in attempting to integrate a psychological development programme into an organisational structure.

# Short Oral Presentations, 10:50am-12:05pm

## SO1 – Performance and Match Analysis III

**PREDICTORS OF PHYSICAL FITNESS AND TECHNICAL SKILLS IN SOCCER PLAYERS**

Matta, M.O.*, Figueiredo, A,**, Silami-Garcia, E.***, Werneck, F.Z. ****, Seabra*****, A.

*Federal University of Juiz de Fora, Brazil, **Federal University of Minas Gerais, Brazil, ***University of Coimbra, Portugal, **** Fedral University of Ouro Preto, Brazil, ***** University of Porto, Portugal.

**Introduction**
The purpose of this study was to examine the association between morphological and biological maturation indicators and physical fitness and technical performance of young soccer players.

**Method**
119 Brazilian soccer players' boys participated in this study: 74 in the under-15 category (U-15) and 45 in the under-17 category (U-17). Stature, body weight, and subcutaneous adiposity were assessed using standardized protocols. The stage of pubic hair and the skeletal age were used as indicators of biological maturity status. Fitness tests included 5-meters and 30-meters sprint, a running-based anaerobic sprint test (RAST), agility, squat jump, countermovement jump and Yo-Yo intermittent endurance test - level 2 (YY-IE2). Technical tests included ball control, dribbling and kick accuracy. Indicators associated with physical fitness and technical performance were investigated using multiple linear regression modeling.

**Results**
A careful analysis of the present results showed that these indicators contributed to physical fitness and technical performance differently in the U-15 than in the U-17 category. In the U-15 category, biological maturation was positively related to physical fitness, whereas subcutaneous adiposity was negatively associated with physical fitness and technical performance. Similar results were also observed by Figueiredo et al. (2011) in the age category of 11 and 12 years. Malina et al. (2004), in a sample of soccer players aged 13 through 15 years, showed a positive association between body weight and the 30-m speed test. In the U-17 category, biological maturation was negatively related to technical performance and years of soccer experience was positively associated with physical fitness and technical performance. The percentage of variance explained differed between tests. The physical fitness composites in the U-15 category (55%) and the technical composites in the U-17 category (54%) were the indicators with the highest percentage of variance explained.

**Conclusions**
Biological maturation, subcutaneous adiposity, and years of soccer experience were significantly associated with physical fitness and technical performance of young Brazilian soccer players.

**References**
1. Figueiredo, A. et al. (2011) Scand J Med Sci Sports   21, 446-454.
2. Malina, R. et al. (2004). Eur J Appl Physiol, 9,1 555-562.

**Keywords:** Predictors, Performance, Young Brazilian soccer players

**IMPROVING TALENT IDENTIFICATION OF SOCCER PLAYERS USING ANALYSES OF INDIVIDUAL PERFORMANCE DEVELOPED IN EVOLUTIONARY BIOLOGY**

Wilson, RS.*, David, GK.*, Ortiz-Barrientos, D.*, Niehaus, A*, Murphy, S.**, Russell, T.***, & Smith, M.D.***

School of Biological Sciences, The University of Queensland (UQ), Australia; ** School of Psychology, UQ, Australia; *** School of Health & Rehabilitation Sciences, UQ, Australia

**Introduction**

All physical activities rely on a complex assortment of anatomical, physiological, motor and behavioral traits. Identifying how such traits combine to determine success is central to the study of evolutionary adaptation and talent identification; yet sports science rarely uses methodologies developed in evolutionary theory to improve assays of individual quality. Using evolutionary analyses, we explored the relative importance of morphology, athletic capacity, motor skill and balance for individual success in match performance.

**Method**

We measured six parameters of morphology, five measures of athletic ability, five measures of motor skill and a single measure of static balance for 30 soccer players. We then explored the relative importance of these possible predictor traits for performance in 11-a-side matches, using metrics of match performance derived from individuals as well as from the team as a whole, using social network analyses.

**Results & Discussion**

We found that a composite measure of motor skill – encompassing all five skill-based measures – was the best predictor of individual success in matches. Individuals with higher levels of overall motor skill were more likely to be better performers during these complex activities, while athletic ability was unrelated to match performance. The success of teams was also associated with the motor skill of individual players – individuals with higher skill were more connected with others in a team and were more important for winning.

**Conclusion**

Our work highlights the importance of using both multivariate analyses and assays of individual variation when assessing player quality – reliance on such an approach could revolutionize the process of talent identification. In addition, it is clear that the overwhelming focus of soccer research on athletic traits (speed, stamina, strength), rather than skill-based traits is misguided – and a refocus towards skill assessments could provide an innovative advantage for smaller National Football Associations.

**Keywords:** skill, multivariate analyses, performance, talent identification

**SQUAD MANAGEMENT, INJURY AND PHYSICAL, TACTICAL AND TECHNICAL PERFORMANCE IN A PROFESSIONAL SOCCER TEAM**

Carling, C. 1,2, McCall, A. 2,3, Franck Le Gall 2, Nédélec, M. 2,3 and Dupont, G.2,3

Institute of Coaching and Performance, University of Central Lancashire, Preston, UK.; LOSC Lille Métropole Football Club, LOSC Lab, Domain de Luchin, Camphin-en-Pévèle, 59780,France3University of Lille Nord de France, UDSL, EA 4488, 9 rue de l'Université, Ronchin, 59790, France

**Introduction**
Attempts have been made to identify performance-related components that underpin success in professional soccer (1). The aims of this study were to investigate squad management, injury, physical, tactical and technical performance in a professional soccer team across five consecutive competitive seasons (2008-2013), with specific focus placed on a League Championship winning season (2010/11).

**Methods**
Squad management, injury and physical, tactical and technical match performance were investigated in a professional soccer team across five consecutive League seasons (2008-2013, 190 League games), with specific focus on a Championship winning season (2010/11). Key defending and attacking tactical and technical performance indicators included: ball possession and possession in opponents half, passes, forward passes, completed passes and completed forward passes, crosses and completed crosses, goal attempts and goal attempts on target, successful final third entries, free-kicks and 50/50 duels won/lost. Physical performance measures included: total distance and distance covered in high-speed running ($\geq$19.1km/h). Time-loss injuries were prospectively diagnosed by the team's physician.

**Results & Discussion**
Key attacking and defensive technical and tactical indicators and physical performance were generally not distinguishing factors during the 2010/11 season. In contrast, the team won its highest number of points and conceded its lowest number of goals (both especially over the second-half of this season). The team also won its highest number of games directly via a goal from a substitute and scored and conceded first on its highest and lowest number of occasions respectively. Finally, squad utilization thereby player availability was lowest owing to a reduction in match injury occurrence and working days lost to injury.

**Conclusion**
While no single component can be highlighted, higher player availability for selection linked to the ability to remain injury free combined with improved defensive (globally represented by a reduction in goals conceded) rather than attacking performance indicators almost certainly made an important contribution to team success in 2010/11. Before any generalizations can be made in an attempt to establish a winning performance model, similar longitudinal data are required from a larger pool of domestic Championship winning teams.

**References**
1. Carling, C. & Court, M. (2012). In M. Williams (Ed.), Science and Soccer:

**Keywords:** time motion analysis, skill, football

**PRELIMINARY VALIDATION OF A SOCIAL NETWORKS METHOD FOR APPLIED SOCCER PERFORMANCE ANALYSIS**

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**Introduction**
Recent studies using social networks analysis have revealed that teams characterized by high intensity (higher passing work-rate) and low centralization (distributed work) are associated with better team performance (1). However, social networks methodologies used in these studies were not designed to provide practical soccer performance analysis insights (2). Thus, the aim of this study was to develop and preliminarily validate a social networks method for applied performance analysis in soccer.

**Method**
The original methodology was designed considering the complementarity of information that multiple context-dependent networks would provide to analysts. Thus, in addition to the global team network, we developed a set of specific social networks based on passing distribution in different game contexts: goalkeeper's distribution, defenders' distribution, midfielders' distribution, forwards' distribution and shooting opportunities path analysis. Graph visualizations and individual players' metrics (betweenness, closeness, pagerank, eigenvector and clustering coefficient) of each specific network were obtained and organized in a match report. Content validity was evaluated by 3 expert match analysts working at elite professional level. Next, we compared the mean and variance of team players' metrics in each match within the different networks, using repeated measures ANOVA.

**Results & Discussion**
Significant differences were found in the mean and variance of all the players' metrics according to the multiple context-dependent networks ($p \leq .001$), with large effect sizes ranging from .73 to .95. Bonferroni's post hoc tests revealed also significant differences between almost all the networks ($p \leq .05$).

**Conclusion**
The present findings suggest the existence of relevant differences in the way players interact with each other in different game contexts, providing evidence for the complementary use of multiple context-dependent networks.

**References**
1. Grund, T. (2012) Soc. Networks, 34(4), 682–690.
2. Yamamoto, Y. & Yokoyama, K. (2011) PLoS ONE, 6(12), e29638.

**Keywords:** short-term effects, long-term effects, coach turnover

**SO2 – Training and Testing II**

**THE EFFECT OF SEQUENCING STRENGTH AND ENDURANCE TRAINING IN YOUNG SOCCER PLAYERS**

Chaouachi, A., Makhlouf, I., Manzi, V., Behm, D., Castagna, C.

Tunisian Research Laboratory ''Sport Performance Optimization''National Center of Medicine and Science in Sports (CNMSS), Tunis, Tunisia

**Introduction**
This study examined the effects of Strength (S) and Endurance (E) training sequencing on relevant fitness variables in youth-soccer.

**Methods**
Fifty-seven young elite-level male field soccer-players (age: 13.7±0.5 years; height: 164±8.3 cm; body mass: 53.5±8.6 kg ; body fat; 15.6±3.9%) were randomly assigned to a control (n=14, CG), and three experimental groups training (twice a week for 12 weeks) S prior, after or on alternated days of E (SE, n=15, ES, n=14 and ASE n=14, respectively).

**Results & Discussion**
Results showed a significant (p=0.001) intervention main effect. The CG showed large (⬜2) Squat 1RM and medium (⬜2) sprint, change of direction ability (CODA) and jump improvements. Post-training difference in E, CODA and lower limbs explosive strength were trivial (⬜2), with small (⬜2) difference for strength and short-sprint performance between ES and SE (p>0.05). The ASE showed trivial difference in E performances with ES and SE (p>0.05). Large to medium difference were reported between ASE and either SE and ES for sprinting over 10 and 30m (p<0.02). The SE Squat 1RM was higher than in ASE (moderate, p<0.02). Post-intervention differences between ES and SE with CG fitness variables were small to medium (p<0.05) except for Yo-Yo intermittent recovery test with the SE (p<0.001, Large).

**Conclusion**
The results of this study showed a trivial post-intervention effect of S and E intra-session sequence on soccer fitness-relevant variables. The provided evidence suggests superior result of intra-session S and E sequence compared to alternated days strategy. Concurrent training may be safely used in youth soccer for the development of the perspective player.

**Keywords:** Concurrent Training, Squat, vertical jump, horizontal jump, Yo-Yo Intermittent Recovery test.

**SALIVARY CORTISOL IS HIGHLY CORRELATED WITH TRAINING INTENSITY IN ENGLISH PREMIER LEAGUE PLAYERS**

Dunbar, J*., Rosen**, B., Gimpel**, M., and Jehanli, A*.

*Ipro Interactive Ltd, Wallingford, UK.  **Department of Sports Medicine & Science, Southampton Football Club, Southampton, UK.

**Introduction**
In most English Premier Leagues (EPL) soccer clubs, training load is measured using GPS systems to monitor outputs by players on an individual and group basis.  In recent years, the measurement of a number of salivary biomarkers has become commonplace in EPL soccer teams, in an attempt to monitor responses to training, competition, lifestyle factors and stress. The purpose of this paper is to investigate the relationship between salivary cortisol (sCort) and an index of training load in Premier League players during the first half of one season.

**Methods**
Data from the routine monitoring of a cohort of 25 first team squad players (mean (±SD) age 25.6 (4.93) yrs, mass 83.4 (8.56) Kg) in one EPL team was analyzed from the start of pre-season training until the December.  This period covered 22 weeks (6 weeks of Pre-Season training) and included 16 EPL matches.  All outfield training sessions were monitored using STATSports GPS and the group mean weekly High Metabolic Load (HML) distance calculated.   On the first morning back to full training after each match, saliva samples were collected before training at the same time of day using an IPRO Oral Fluid Collector (1) and sCort concentration determined immediately using an IPRO LFD Point of Care device (2).

**Results & Discussion**
The overall mean weekly HML distance was 3628 (1520) m and was between 4063-6989 m in pre-season, as opposed to 1525-4587 m in season. Similarly overall group mean sCort was 8.51 nM and between 8.09-15.14 nM during pre-season as opposed to 4.91-12.23 nM in season. Excluding weeks with FIFA breaks, the mean weekly HML distance was well correlated with mean sCort (n=19, r=0.547, P<0.015) and removing the weeks with 2 matches, the two variables were highly correlated (n=16, r=0.81, P <0.0001).

**Conclusion**
Measurements of external training load (weekly HML distance) are highly correlated with internal load (sCort) during both pre-season and in-season in this cohort of EPL soccer players.

**References**
1. Jehanli, A. et al. (2011) Proceedings 10th Symposium Intl. Soc. Ex. Immunol.2. Dunbar, J. et al. (2013) Int. J. Ex. Sci. 10(1): 45.

**Keywords:** monitoring, cortisol, training load

**HEART RATE- VERSUS SPEED-BASED HIGH-INTENSITY INTERVAL TRAINING IN YOUNG SOCCER PLAYERS**

Rabbani, A*,. and Buchheit, M**.

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**Introduction**
High-intensity Interval Training (HIT) is one of the most popular forms of exercise to improve athletes' cardiorespiratory fitness (1). While heart rate (HR) is often used to control exercise intensity during HIT, this approach has several limitations, including the difficulty for practitioners to regulate running intensity during HIT, and the inability of HR to inform on intensities above maximal aerobic speed. To overcome these limitations, using the speed reached at the end of the 30-15 Intermittent Fitness test (VIFT) as the reference for running intensity has been suggested (2). The aim of the present study was to compare the effect of a HR- vs. VIFT-based HIT training program on high-intensity intermittent running performance in young soccer players.

**Method**
Twenty two soccer players (15.12 ± 0.5 yrs) were divided in two different experimental groups including HR-based (n=10) or VIFT-based (n=12) HIT during their preseason preparation. The VIFT -based HIT group performed a 30-15 Intermittent Fitness Test before the intervention to detect the player's VIFT. All players performed a Yo-Yo Intermittent Recovery Test level 1 (YYIRT1) before and after the intervention. All players underwent the same conditioning and technical/tactical training programs for 5 weeks, except the method of individualizing soccer-specific HIT sessions with the ball (2 sessions of HIT=3 sets of 3:30 min):  either according to 90-95% of maximum HR or 65-70% VIFT. We then compared the improvement in YYIRT1 between the two groups using magnitude-based inferences (3).

**Results & Discussion**
VIFT-based HIT produced likely greater improvement (chances for greater/similar/lower values of 95/4/1) in YYIRT1 performance than HR-based HIT (+101%, 90%CL (18- 241); standardized difference: +0.84(0.2- 1.49)).

**Conclusion**
Using VIFT as a reference speed for HIT programming may elicit greater high-intensity intermittent running performance improvements than using HR in young soccer players.

**References**
1- Buchheit, M. and P. B. Laursen (2013) Sports Med: 43(5): 1-262- Buchheit, M. (2008) J. Str. Cond. Res: 22(2):365-374.3- Hopkins WG, et al (2009) Med Sci Sports Exerc: 41(3):3-13.

**COMPARING TWO DIFFERENT APPROACHES TO PHYSICAL TRAINING ORGANISATION ON FITNESS CHARACTERSTICS IN YOUNG SOCCER PLAYERS**

Paul, D.J. 1, Marques, J.B. 1, Versloot, O. 1, Ribeiro, F. 1, Nassis, G.P. 1

1 National Sports Medicine Programme, Excellence in Football Project, ASPETAR - Qatar Orthopaedic and Sports Medicine Hospital, Doha, Qatar

**Introduction**
Soccer training can be periodized using concentrated and accentuated workloads to enable greater performance at selected stages of the season (Mallo, 2011). Hence, the aim of this study was to compare the effects of two different methods of organizing endurance training in young soccer players.

**Method**
Nineteen male soccer players participated in the study (mean±SD age: 16.2±0.8 yrs; weight: 58.2.±7.6 kg; height:170.8.±7.7 cm). One team performed small-sided games and high intensity interval training (SSG & HIIT;n=12) and the other team traditional training (TRAD;n=7). The SSG & HIT performed 4 SSG and 1 HIIT session per week.  The TRAD group performed 4 SSG as well as general fitness components (speed, strength etc) per week. Endurance, countermovement jump, sprint (0-40m) and agility were performed pre and post the 4-week training intervention. Technical and tactical training were similar and remained the same during both periods. Heart rate (Polar team 2, EO, Finland) and rating of perceived exertion were recorded and player load calculated (RPE*minutes) for all sessions. Statistical analysis was performed using ANOVA repeated measures.

**Results & Discussion**
A statistically significant difference was shown for endurance (17 vs 18.4 km/h; $p<0.05$) following the 4-week SSG & HIT intervention. No other significant differences were found for either group. Average % of maximum heart rate (active time) and player load were 83% and 344 (AUT) for the SSG&HIT vs 70% and 253 (AUT) for the TRAD group.

**Conclusion**
A 4-week intensive period of SSG & HIT may offer a time efficient way of improving endurance performance in youth soccer players. Longitudinal data is required to identify the long-term benefits and any possible negatives associated with this training approach.

**References**
Mallo, J. et al (2011). Int J Performance Anal Sport, 11. 476-485

**Keywords:** Soccer, training, youth

**INVESTIGATION OF YOUNG PLAYERS', WHO ARE BETWEEN 8-14, PHYSICAL FEATURES ACCORDING TO AGE.**

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(*)Ankara University, Faculty of  Sport  Sciences, Ankara –Turkey

**Introduction**
The aim of this study is to determine the physiological and biomotor features and age group difference in youth soccer athletes 8-14 year of age who play in Ankara district.

**Methods**
One-hundred seventy-four young soccer players, ages 8-14 and who play in Gençlerbirliği , Ankaraspor, Etimesgut Belediyespor and Gazi Üniversity soccer clubs, participated voluntarily in this research.

The athletes were tested for sprints (5-10-20-30, meter, photocell with supplied), flexibility, push-ups, sit-ups, standing long jump, weight- ball throw, jumping rope and endurance tests (1 mile).

**Results & Conclusions**
The results were treated statistically with one way ANOVA. Significant statistical differences were found for all tests ($p > 0.05$) except the push-ups and flexibility tests.

At the end of the study it was observed that physical and physiological characteristics increased with age.  Strength, endurance and speed were also age dependent, with higher values observed with increasing age.

Our results suggest that when determining soccer players' physical and physiological features through periodic tests and applying age-appropriate training methods, we should observe enhanced player developments.

**Key Words:** Soccer, Young Players, physical and physiological features

## SO3 – Sport Psychology

**GENDER DIFFERENCES IN PARTICIPANT MOTIVATION IN MASTERS FOOTBALL AT THE 2010 PAN PACIFIC MASTERS GAMES**

Heazlewood, I*.,  Walsh, J**.,  Climstein, M***.,  Adams, K****.,  T. Sevene, T****.,  M. DeBeliso, M*****., and  Kettunen, J******.

*Charles Darwin University, Darwin, NT, Australia.   **Independent Researcher, Sydney, NSW, Australia. ***Bond University, Robina, QLD, Australia.   ****California State University, Monterey Bay, CA, USA. *****Southern Utah University, Cedar City, UT, USA.  ******Arcada University, Helsinki, Finland.

### Introduction
Previous research has identified factors of masters athletes in motivating participation in sport (1). In order to ensure that these strategies are effective, it is important to identify motivating factors that are related to gender. The aim of this study was to assess gender differences in the motivational factors of masters athletes competing in football that may enable development of specific motivating strategies to promote participation in masters football.

### Methods
The sample was selected from participants at the 2010 Pan Pacific Masters Games, Gold Coast, Australia. There were 115 males (age 49.5 years: s.d. = +/_ 6.42) and 65 females (age 42.3 years: s.d. = +/_ 5.52). Participants completed Motivations of Marathoners Scale (MOMS) self-report instrument consisting of 56 questions (2,3), a 7-point scale graded participant's responses; 1 = item is not a reason to 7 = item is a very important reason. Constructs were psychological coping, self-esteem, life meaning, health orientation, weight concern, affiliation, recognition, competition and goal achievement. Descriptive, t-test and discriminant analyses were applied.

### Results & Discussion
No differences occurred on eight constructs. Significance occurred for competition; males 3.46 and females 2.97. Psychological coping, life meaning, recognition, weight concern and competition were not important for either gender (range 2.25-3.46). Self-esteem, goal achievement and health orientation were moderate factors (range 3.38-4.43) and affiliation was important (range 4.46-4.74). This indicates both genders are motivated by similar constructs.

### Conclusion
Understanding factors that motivate athletes in masters football will enable strategies to focus on what is important to these athletes, such as self-esteem, goal achievement, health orientation and affiliation to promote participation in physical activity at the masters level.

### References
1. Heazlewood, I. et al. (2012) ICSEMIS 2012 Pre-Olympic Conference. 19-24 July 2012 Glasgow, UK.
2. Masters, K. et al. (2000) Res. Quarterly for Ex. & Sp. 64(2), 134-143.
3. Ogles, B. et al. M. & Masters, K.S. (1993). J. Sp. Beh. 23(3), 1-14.

**Keywords:** motivation, masters, football

**PSYCHOLOGICAL ASPECTS AND DEMANDS FOR REFEREES IN ROMANIAN FOOTBALL**

Antonie, Andrei

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**Introduction**
Football refereeing has become more demanding in terms of physical and mental preparation. Elite football referees are seen as athletes nowadays and the latest changes have brought major challenges in terms of job and occupation. The officials have changed their perspectives regarding their sport involvement due to the national football associations, which have decided to have a certain number of professional referees. Therefore, top-level football referees have taken the path towards professionalization.

**Method**
The present study is using a qualitative research approach with participant observation and guided in-depth interviews. Romanian top league referees (N= 5) were interviewed during the Romanian Elite Referees' Conference in Antalya (Turkey) in February 2009.

**Results & Discussion**
The proposed career model has five stages and represents the professionalization path from a free-time activity to a full-time job. Each stage represents a certain period in the referee's life, and the psychological aspects will be discussed in each part of the study. Maintenance is the most important period in a referee's career because they are refereeing at the highest national level and have the opportunity to be selected as a FIFA referee. Through the interviews, the following psychological aspects were found, which were discussed as mental preparation, physical and verbal violence, and drop out or burn out.

**Conclusion**
Realizing the importance of psychological preparation, the football bodies might improve the referees' performances by providing professional psychological support to referees.

**References**
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2. Krustrup P. et al.,2009, Journal of Sport Sciences, Vol.27 (11), 1167 – 1176

**Keywords:** football referees, mental preparation, burn out, verbal violence

**HOW STRESS AND SKILL INFLUENCE THE CHOICE AND PERFORMANCE OF A PENALTY KICK**

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**Introduction**
The outcome of a penalty kick (PK) is assumed to be affected by several factors (1), such as stress, skill, and the thought-battle in this simultaneous zero-sum game (2) between kicker and goalkeeper . Thus, PKs are predestinated for an analysis of the underlying components.  Most studies, (3) being one exception, only look at the direction, ignoring the spot where the ball enters the goal. In order to investigate the performance of the kicker and the influence of skill and stress, a novel measurement involving the exact shot-placement, risk and general shooting conception is developed.

**Methods**
Internet video data was collected for 157 PKs taken in five seasons of Bundesliga and two seasons of Premiere League. Here, only clutch (partial score -1 or 0 and 2nd half) penalty kicks were looked at, as performance is assumed to be affected by stress (1). The study consists of two analyses. First, I perform a game-theoretic analysis (including Nash frequencies), which is then contrasted with existing findings. Second, I perform regression analyses on the outcome and the shot-placement using, for the first time, skill approximating data from FIFA football games and kicker.de.

**Results & Discussion**
The game theoretic analysis yields that clutch penalty kicks do not meet the normal assumptions about the scoring chances and frequencies (2), indicating that stress seems to affect behavior. The regression results, however, suggest that skill seems to be more important for the outcome and performance than stress-related variables. Only extremely high levels of stress affect the decision, while the skill levels of both players affect outcome and performance.

**Conclusion**
The new measures of skill and shot-placement help to understand, in more detail, what influences the PK behavior. The level of skill of both kicker and keeper seems to play a role for both the scoring chance and the shooting behavior. The role of stress is still ambiguous and should be looked at within a broader frame.

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**Keywords:** penalty kick, stress, decision making

**SELF-CONTROL AMONG PROFESSIONAL SOCCER PLAYERS**

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**Introduction**
It has recently been argued that pathways to world-class performance are rocky and that the "bumps in the road" may help performers grow (1). It was suggested that the effectiveness of talent development programs may be increased by incorporating interventions that focus on how to deal with such challenges, thereby developing performers' self-control, mental toughness and/or resilience. The aim of the current study was to investigate the relationship between self-control, engagement in daily activities and performance of professional soccer players.

**Methods**
A number of 586 male professional soccer players (mean age = 23.6; SD = 4.8), representing 1st teams of clubs playing in the Norwegian Premier (n = 322) and Second League (n = 317), completed the Brief Self-Control Scale (2), and filled out the number of hours/minutes of engagement in several daily activities. Players' performance level was assessed in three ways: League level (Premier/Second League), senior national team experience (yes/no) and team performance (end-of-season league ranking).

**Results & Discussion**
Self-control scores of professional soccer players were found to be higher than general population scores as reported in a recent meta-analysis (3). A MANCOVA indicated that, within the group of soccer players, those scoring low on self-control (based on median split) spent more time on social and play activities. Two logistic regression analyses showed that self-control predicted performance: players with a higher score were more likely to play at the highest professional league level (OR = 1.37) and more likely to have senior national team experience (OR = 1.80). Lastly, pre-season team self-control scores predicted teams' end-of-season league ranking (β = .58, p < .001).

**Conclusion**
Self-control is associated with players' lifestyle and soccer performance, but the underlying mechanisms remain unclear. We recommend coaches to focus on self-control to develop and maintain players' soccer performance.

**References**
1. Collins, D., & MacNamara, A. (2012) Sports Med. 42: 907-914.
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3. De Ridder, D. et al. (2012). Pers. & Psych. Rev. 16: 76-99.

**Keywords:** performance, talent development, willpower

**DEVELOPMENT STAGES CHARACTERISTICS: FOOTBALL COACHES IN AUSTRALIA AND MALAYSIA**

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**Introduction**
Sport coaches have a crucial role in contributing to individual and team performance. Unlike the scientific study of athlete development, scant attention has been paid to the intricacies of coach development stages. In this series of studies, the defining stage development characteristics of A, B and C licence coaches of Australian and Malaysian teams were examined from the perspective of identifying critical issues and challenges.

**Methods**
This research was guided by principles of evolved grounded theory (EGT), (Strauss & Corbin, 1990) and linked to cognitive psychology research investigating the development of expertise (Glaser, 1992). Evolved grounded theory was selected because, although it permits analytical techniques, it also allows a richer and deeper framework for understanding the complexity of development in the dynamic field of coaching development (Pellegrino et al, 2001). Coaches' learning can be likened to a changing of perceptions, as they learn from different sources that change their cognitive structure (Werthner & Trudel, 2006). Data was collected in accordance with methods recommended by Strauss & Corbin, (1990), including in-depth interviews, observations and research notes.
Twenty four participants were selected based on the principles of theoretical sampling (Strauss and Corbin, 1990 1998). At the beginning of this study, however, a selective sampling, (SS) strategy was used, aiming at phenomenological variation, and then we proceeded to theoretical sampling. Consequently, and eventually, a heterogeneous (different) cross section of "A", "B" and "C" licence coaches were recruited that adequately represented the various levels, from community, youth and senior levels.

**Interviews**
In-depth, semi-structured interviews were used to explore how participants organized and understood their coaching experiences. A semi-structured interview guide was used with a recursive design, whereby newly identified themes could be explored in subsequent interviews. Furthermore, probe questions were also used to explore idiographic themes and issues relevant to each interviewee. Initially, data analysis involved creating electronically-written transcripts of the participant's answer during the interviews. To this end, interviews were recorded and transcribed verbatim resulting in 372 pages of single-spaced text. For data checking purposes and familiarization of the text, both authors carefully read the 24 transcripts. Following the principle of Strauss & Corbin's (1990) EGT, we systematically conducted data construction, data deconstruction and data re-construction stages. These processes were used to improve data reliability and verify the categories and hypotheses against the data by comparing the categories with each other.

**Results**
*Stages of Development for study 1 and 2.*
As expected, stages of development (SOD) emerged as a central overarching category. Based on the analysis, the following four stages emerged: *Pre-accreditation coaches, Participation coaches, Developmental coaches and Performances coaches. These categories were relevant for both Australian and Malaysian football coach samples and to a degree corroborate the findings of Schinke, Bloom and*

*Salmela (1995). See figure 2, for a schematic diagram of stage development constructed from the data generated in studies 1 and 2.*
*Cultural Perspective for study 3*
A key result specific to the multi-level, cross-cultural sample was the identification of differences generated from a cultural perspective. Two sub-themes, related to the practices of egalitarianism in Australia and hierarchical practices in Malaysia, were clearly evident for the current sample of football coaches. Coaches in Australia identify strongly with the prevailing practices of egalitarianism in their stages of development. This is evident, for instance, where coaches subscribe and espouse a perception of equality of coaching capabilities and competencies regardless of experience and context; whereas the Malaysian coaches generally subscribe to a more hierarchical approach, where the majority of coaches assume they are at the beginning or novice stages of development, particularly if they are coaching at the grassroots, youth or local football. For those who are coaching at the senior football level, they are more likely to believe they are at the peak of their career and are the most knowledgeable and resourceful.

**Conclusion**
There was almost universal ambition among the participant coaches that coaching at the senior level is the most desirable outcome, and grassroots and youth levels are essentially temporary situations or stepping stones toward eventually coaching at the senior level.

**References**
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**Keywords:** Football coaches, Development stages

# Short Oral Presentations, 1:30-2:45pm

## SO1 – Performance and Match Analysis IV

**USING ACCELEROMETERS IN-BUILT INTO PORTABLE GPS UNITS TO CAPTURE THE RAPID DECELERATIONS NEEDED FOR TURNING MOVEMENTS IN SOCCER.**

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**Introduction**
The integration of directly measured accelerations to the GPS technologies used in team sports should improve the assessment of athlete physical demand (1). From a physiological perspective, accelerations and decelerations may be more important than speed thresholds for examining external load in soccer players. For elite players, most decelerations (prior to turning) last less than 1 second (2). As these decelerations are high-frequency movements, it is important to determine whether accelerometers in-built into GPS units adequately sample and quantify those characteristics.

**Methods**
Ten male recreational soccer athletes (age 21 ± 3 years) performed rapid 'V' cut turns at five different intensities. Acceleration data were collected at 100Hz from a triaxial accelerometer in a commercial miniature GPS unit (SPI Pro, GPSports, Canberra, Australia) mounted in a tightly-worn vest. Acceleration data were also collected at 500 Hz from a wireless reference accelerometer (DTS 3D, Noraxon U.S.A Inc., Scottsdale, U.S.A) mounted on the GPS unit with parallel sensing axes. Peak resultant decelerations for the last three foot-ground contacts (FGC's) of the turn were determined. A three-way ANOVA (FGC's, turn intensity and accelerometer) was used to explore deceleration changes.

**Results & Discussion**
There were significant correlations between the two transducer peak decelerations at the different intensities and FGC's($r = 0.772 – 0.987$, $p < 0.01$) but, overall, the peak values recorded by the GPS accelerometer were significantly lower than the reference (4.17g ± 0.04 versus 4.45g ± 0.04). A significant FGC and accelerometer interaction was due to greater peak decelerations being recorded during steps prior to turning using the reference accelerometer (7-12 percent higher) while there were little differences between transducer mean peak values during the final turning step. The underestimation of peak values by the GPS transducer was partly due to the lower sampling rate (100Hz). Increasing the sampling rate to 200Hz or modifications in data processing would likely improve validity.

**Conclusion**
Decelerations for the preceding steps of a rapid turning manoeuvre had high frequency characteristics that were underestimated with the data obtained from a commercially available GPS unit.

**References**
1. Aughey, R. J. (2011)Int J Sports Physiol Perform, 6(3), 295-310.
2. Bloomfield, J. et al.(2007)J. of Sports Science and Medicine, 6(10), 6.

**ANALYSIS OF HIGH-INTENSITY ACTIVITY IN ELITE-FEMALE SOCCER MATCH-PLAY**

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### Introduction
The work-rate demands associated with soccer match-play have been extensively examined in elite male players. Few attempts have been made to examine the demands of elite female match-play using contemporary technologies (1, 2). Therefore, we aimed to provide a detailed analysis of high-intensity (HI) running activity completed by elite female players during match-play.

### Method
Altogether, 149 individual match work-rate observations were undertaken on 112 outfield female players (median of 1 game per player; range = 1-4) competing in international matches (2011/2012 to 2012/2013) using a computerized tracking system (Prozone®, Leeds, England). High-intensity activities selected for analysis included running (14.4-19.7 km/h), high-speed running (HSR; 19.8-25 km/h), sprinting (>25.1 km/h), total high-intensity running (THIR) (>14.4 km/h) and very high-intensity running (VHIR; >19.8 km/h) distance. Total high-intensity running was also expressed as the distance completed with the respective players team in possession (HIRP) and without (HIRWP) possession of the ball. The percentage of explosive and leading sprints was also analyzed. Data were analyzed using factorial linear mixed modeling.

### Results & Discussion
Running (range: 1366-2029 m), HSR (423-700 m), sprinting (110-221 m), THIR (1899-2882 m), VHIR (533-920 m), HIRP (101-530 m) and HIRWP (274-485 m) distance were dependent upon playing position with central midfielders and central defenders generally completing the highest and lowest distance, respectively ($p < 0.001$). The percentage of explosive (48-54%) and leading (46-52%) sprints was similar between positions ($p > 0.05$). Running (93±9 m), HSR (37±6 m) and sprint (10±3 m) distance declined during the second half ($p < 0.001$), however, the magnitude of this decline was not dependent upon playing position ($p > 0.05$).

### Conclusion
Overall match HI running activity in elite female match-play is influenced by playing position; however, between half changes in HI activity are consistent across positions.

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1. Andersson, H et al. (2010). J Strength Cond Res. 24(4), 912
2. Vescovi, JD. (2012). J Sport Sci, 30 (12), 1259-65

**Keywords:** Match-play, performance, female

**THE CHALLENGE OF DETECTING SPRINT ACTIONS IN SOCCER – A NEW METHODOLOGICAL APPROACH**

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**Introduction**
Sprint actions are important in soccer and are often performed over short distances and from different initial speeds (1). Traditionally, absolute speed thresholds (e.g. >7 m/s) have been used to identify sprint actions (2), whereas newer studies have introduced individual speed thresholds (3). Recently, it was postulated that, additionally, an absolute acceleration threshold (e.g. >2.78 m/s2) be used to detect sprint actions (4). However, these methods do not take into account the initial speed from which players accelerate, which could affect maximal acceleration. This study aimed to illustrate existing limitations of previously-defined speed and acceleration thresholds by taking into account initial speed and its effect on maximal acceleration.

**Methods**
139 young male elite soccer players (age 17.0±0.6 yrs) participated in the study. They performed maximal accelerations out of four different constant initial speeds (0, 6, 10.8 and 15 km/h). A radar-based tracking system (LPM, Inmotiotec GmbH, Regau, Austria) recorded covered distance, speed and acceleration continually.

**Results & Discussion**
From a standing start, 7 m/s was attained only after 7.9 m (range: 4.7-18.3 m). Moreover, maximal acceleration decreased linearly with increasing initial speed: 5.7 m/s2 (range: 4.1-7.1 m/s2), 4.3 m/s2 (3.3-5.4), 3.3 m/s2 (2.5-4.2) and 2.4 m/s2 (1.4-3.3) with initial speeds of 0, 6, 10.8 and 15 km/h, respectively.
Thus, traditional speed thresholds underestimate very short sprint actions occurring out of low initial running speeds. An absolute acceleration threshold over- or underestimates frequencies and distances of sprints, depending on the initial speed. Additionally, there is a large interindividual variability in maximal acceleration, suggesting that criteria for identifying sprints should be defined individually.

**Conclusion**
For increasing the level of precision in detecting sprint actions, the dependency of maximal acceleration on initial running speed for each individual player should be taken into account. Further work will analyze intensities of actions during games using a combination of initial speed and acceleration.

**References**
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2. Di Silvo, V. et al. (2009) Int. J. Sports Med. 30(3): 205-212.
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4. Varley, M.C. et al. (2013) Int. J. Sports Med. 34(1): 34-39.

**Keywords:** performance analysis, sprint, acceleration

**INTEGRATING DIFFERENT TRACKING SYSTEMS IN SOCCER: MULTIPLE CAMERA SEMI-AUTOMATIC SYSTEM, LOCAL POSITION MEASUREMENT AND GPS TECHNOLOGIES**

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**Introduction**
During the past decade, there has been a substantial development of computer-aided tracking technology for the examination of player activity. Limited attempts, however, have been made to comprehensively evaluate the agreement between these different systems/technologies (1, 2). Therefore, we aimed to provide calibration equations to allow the interchangeability of three different tracking technologies used in professional soccer to measure on-field running movements.

**Methods**
Eighty-two highly-trained soccer players (U14-U17) were monitored during five training sessions and one game. Player activity was collected simultaneously with a semi-automatic multiple-camera (Prozone), local position measurement (LPM) technology and two global positioning systems (GPSports and VX). Data were analyzed with respect to three different field dimensions (small, <30m2; medium, <50m2; and full-pitch, match). Variables provided by the four systems (389 player-files for each system) were compared, and calibration equations (linear regression models) between each system were calculated for each field dimension.

**Results & Discussion**
Overall, most metrics differed between the four systems with the magnitude of the differences dependent on both pitch size and the variable of interest. Trivial-to-small between-system differences in total distance were noted. However, high-intensity running distance (>14.4km/h) was slightly-to-moderately greater when tracked with Prozone, and accelerations, small-to-very largely greater with LPM. For most of the equations, the typical error of the estimate was of a moderate magnitude.

**Conclusion**
Interchangeability of the different tracking systems is possible with the provided equations, but care is required given the moderate typical errors of the estimate.

**References**
1. Harley JA, et al., (2011). J Strength Cond Res 25:2334-6.
2. Randers M, et al., (2010). J Sports Sci 28:171-82

**Keywords:** Tracking system, agreement, calibration equations

**THE INFLUENCE OF CHANGING THE RATIO OF AREA PER PLAYER DURING SMALL-SIDED SOCCER GAMES**

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**Introduction**
The role of small-sided games (SSGs) for skill acquisition and performance enhancement in soccer has been widely employed (1). However, current investigations of SSGs have been restricted to the study of game actions and conditioning effects. For instance, decreasing the number of players in SSGs typically increases physiological demands and increases the number of individual game actions performed. The aim of this study was to investigate the influence of changing the ratio of area per player (189 m2 in 4-aside vs. 151 m2 in 5-aside) on attacking and defending game phases, analyzing spatial and speed team dispersion measures.

**Methods**
Twenty two participants (males aged 13-14 years old) were observed playing two formats of SSGs (4v4 and 5v5) with a goalkeeper on the same 46m x 33m field dimensions for 4 minutes. Positional data of every player were obtained with GPS units (15 Hz). Longitude and latitude degree coordinates were converted into 2D Cartesian coordinates using a universal transverse mercator (UTM) coordinate system. Four team compound spatial variables (width, length, surface area and stretch index) and two compound speed variables (contraction-expansion speed - CES - and the team average speed - AS) were used to capture each team's dispersion behaviors during sequences of play leading to shots on goal (n=6 in 4v4 and; n=6 in 5v5).

**Results & Discussion**
Results from standard deviation analyses showed that the magnitude of variation in width of the attacking teams was higher than in defending teams. This result suggested that attacking teams tended to change their width more deeply compared to defending teams in order to achieve their performance goals. The 5v5 format displayed higher magnitude of variation (SD) in surface area values compared to 4v4, probably due to the higher number of players. Results from analysis of mean and SD dispersion values of CES and AS showed no effect of different game formats and game phases.

**Conclusion**
Data imply that coaches could use SSGs with a smaller ratio of area per player to impose more constraining tactical demands on players during training, leading to more frequent adjustments in intrinsic team dynamics.

**Reference**
1. Hill-Haas, S. et al. (2011) Sports Med. 41(3), 199-220.

**Keywords:** small-sided games, spatial metrics, team speed

## SO2 – Soccer and Health Promotion

**SOCCER FOR HEALTH – FITNESS AND HEALTH EFFECTS OF SOCCER FOR SEDENTARY INDIVIDUALS ACROSS THE LIFE SPAN**

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Inactivity and poor physical fitness are major contributors to the increasing prevalence of cardiovascular diseases, type 2 diabetes and osteoporosis. It is now well-known that physical training is a cornerstone in the prevention and treatment of lifestyle diseases and it has recently been concluded that sport participation reduces all-cause mortality by 20-40% (Khan et al. 2012). However, less is known about the specific fitness and health benefits of various types of physical activity and sports. Most training studies have investigated moderate-intensity aerobic exercise training or strength training, but over the last decade an increasing amount of evidence suggest that high-intensity interval training (HIIT) may be an effective method to improve performance and health. Since 2006, we have conducted a series of randomized controlled trials investigating the activity profile, physiological demands, fitness effects and health benefits of recreational soccer for untrained individuals across the lifespan. A total of 55 scientific articles have been published in this period, documenting that small-sided soccer has broad spectrum fitness and health effects for 6-80-year-old participants, as it combines elements of HIIT, endurance and strength training (Krustrup et al. 2009, 2010, 2013, 2014). Small-sided soccer played 3v3, 5v5 or 7v7 elicits high heart rates and involves multiple intense actions such as sprints, turns, jumps, tackles, dribbles and shots, independently of age, gender, fitness status, socio-economic status and prior experience (Randers et al. 2010, 2012). The high average heart rates and periods with near-maximal heart rates provide effective cardiovascular training with multiple effects on maximal oxygen uptake, heart structure and function, endothelial function, capillarisation, lipid profile and oxidative enzyme activity. Additionally, the soccer-specific intense actions involves all muscle groups and provide multiple favorable effects on muscle mass, muscle function, postural balance and bone mineralization (Krustrup et al. 2010, Helge et al. 2010, 2014). These findings are of great public interest, considering that soccer is the most popular sport in the world with an estimated 400 million active players. Soccer also has positive motivational and social factors that may facilitate compliance and persistence with the sport and contribute to the achievement and maintenance of a physically active lifestyle. Recently, the health effects of soccer have been investigated specifically for patient groups with mild-to-moderate hypertension and type 2 diabetes. Just 3 months of soccer training, 2x1 hour per week, lowered systolic and diastolic blood pressure by 12/8, 8/8 and 11/9 mmHg, respectively, in the studies by Krustrup et al. (2013), Schmidt et al. (2013) and Knoepfli-Lenzin et al. (2010), which is a more pronounced effect than usually seen after 3-6 months of aerobic moderate-intensity training or strength training. In one of these studies, three-quarters of the participants normalized their blood pressure during the soccer training period (Krustrup et al. 2013), and the participants had additional benefits that lowered their cardiovascular risk, including an increase in $VO_2$max, improved cardiac and endothelial function and a lowered fat mass (Krustrup et al. 2013, Andersen et al. 2014). In a special issue of Scandinavian Journal of Medicine & Science in Sports being published in June 2014, we have also presented data showing that soccer is a feasible and effective type of training for 65-80-year-old sedentary men (Rostgaard Andersen et al. 2014, Helge et al. 2014), which improves bone mineralization, functional capacity and $VO_2$max within 3 months. These results and other recent results will be presented at the WCSS conference, altogether providing evidence that recreational soccer is a joyful, social and all-in-one type of HIIT training that can improve fitness and serve as prevention and treatment of lifestyle diseases for individuals across the life span.

**SOCCER VS. RUNNING TRAINING EFFECTS IN MIDDLE-AGED MEN: WHICH OF THE PROGRAMS IS MORE EFFECTIVE IN**

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**Introduction**
Recreational soccer in the format of small-sided games has been shown to be an effective performance-enhancing and health-promoting activity for untrained and inexperienced men aged 20-55 (1, 2). The aims of this paper were: 1) To determine the effects of a 12 week recreational soccer training program on the body composition of middle-aged men and 2) to determine which of these two programs were more effective concerning the body composition.

**Methods**
Sixty-three participants completed the study and were randomly assigned to one of three groups: soccer training group (SOC; n=20), a running group (RUN; n=20) or a control group performing no physical training (CON; n=23). All participants, regardless of group assignment, were tested before and after training for each of the following dependent variables: body weight, body height, body mass index, percent body fat, body fat mass, lean body mass (absolute and relative values) and total body water.

**Results**
The experimental and control groups were well matched on the pre-training tests with no significant differences found for any variable between the three groups. The SOC and RUN groups significantly decreased (p<0.05) their body composition parameters from pre- to post training on all measures with the exception of lean body mass (absolute values) and total body water. Body mass index, percent body fat and body fat mass did not differ between groups at baseline, but by week 12, were significantly lower (p<0.05) in the SOC and RUN groups compared to CON. Relative values of lean body mass was significantly increased (p<0.05) only in SOC group (76.23±1.35 vs. 80.90±3.44 %) after the training program, while RUN and CON groups increased lean body mass but not significantly (p>0.05). There were no statistically significant differences (p>0.05) between SOC and RUN groups in any parameters of body composition after the training program.

**Conclusion**
To conclude, recreational soccer training provides at least the same changes in body composition parameters as continuous running in middle-aged men.

**References**
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2. Krustrup, P. et al. (2010) Scand. J. Med. Sci. Sports. 20(s1), 1-13.

**Keywords:** football, small-sided games, aerobic training, recreational activity

**INCREASED RISK OF CONCUSSION IN FEMALE SOCCER PLAYERS, IS REACTION TIME TO BLAME?**

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**Introduction**
In an epidemiological investigation of NCAA women's soccer players from 1988-2003, 8.6% of all game and practice injuries were concussions (1). The rate of concussions in women's soccer (WS) is nearly double the rate of that in men's soccer MS) (2). Although there is no clear reason why WS are more prone to concussions, some possibilities include: the predisposition of concussion to women vs. men, the differences in neck strength, neck muscle activation, and/or head mass in women compared to men. Reaction time (RXT) has been investigated in the American football population; and it is believed that players with slower times are predisposed to concussions because they are delayed in anticipating and reacting to head impacts. Because similar data does not exist in soccer, the purpose of this study was to determine if WS have a slower neurocognitive RXT than MS.

**Methods**
One hundred and fifty-nine NCAA Division-I freshmen soccer players (82 females, 77 males, 18.2±0.9 years, 172.8±9.9 cm, 67.5±9.5 kg) were recruited for this study over a five-year period. All student-athletes took the ImPACT (ImPACT Applications, Inc. Pittsburgh, PA) test prior to the start of their initial fall season. Using an independent samples t-Test RXT composite scores were then compared between MS and WS soccer players.

**Results & Discussion**
There was a significant difference between MS (0.54±0.07 s) and WS (0.57±0.08 s) neurocognitive RXT ($p=.003$). Determining whether or not this difference in neurocognitive RXT translates into slower neuromotor RXT remains unknown. Further comparisons are needed to draw definitive answers.

**Conclusion**
Results of this project offer some interesting insight into neurocognitive RXT differences in collegiate WS vs. MS. We are limited by the fact that we did not look at concussion histories. Further studies are needed to determine whether or not the connection between the higher incidence of concussions in WS and RXT can be linked.

**References**
1. Randall, D. et al. (2007). J Athl Train. 42(2), 278–285.
2. Marar, M. et al. (2012). Am J Sports Med. 40(4), 747-755.

**Keywords:** concussion, ImPACT, reaction time

## SO3 – Talent Identification

**INFLUENCE OF MATURATION, COORDINATION AND PHYSICAL CAPACITY ON SELECTION AND MATCH PERFORMANCE IN YOUTH SOCCER**

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**Introduction**
The aims of this study were to examine how maturation, coordination (motor competence and technical ability) and physical capacity related to team selection and playing position, and their effect on physical match activity and involvement in youth soccer players.

**Methods**
224 soccer players (aged 10-16 y), ranging from recreational to sub-elite, participated in the study. Maturity was estimated using non-invasive anthropometrical measures of stature, body mass and leg length. Physical capacity, motor competence (KTK) and technical ability (UGent Soccer Dribble Test) were also measured. Physical match activity data was collected during matches using 15Hz GPS devices. Involvements with the ball were recorded during each match. Coaches graded players into three playing levels (A, B and C) and selected playing positions.

**Results & Discussion**
In agreement with previous research (1), the present study showed physical capacity, motor competence and technical ability to influence playing level in youth soccer players ($p<0.001$). Furthermore, playing level significantly influenced total distance/min, distance/min in all intensity categories, and total involvements with the ball during match-play. Multivariate analysis also revealed physical profiles to influence playing position ($p<0.05$), with defenders taller, heavier and earlier maturing; midfielders possessing the greatest technical ability; and attackers displaying superior speed and motor ability. Match performance was also different between positions ($p<0.001$), with midfield players covering more total distance/min with more involvements, and attackers performing significantly more very high intensity activity.

**Conclusion**
A multitude of physical- and coordination-related factors influence team selection and playing position in youth soccer - these may also influence physical match activity and skill involvement. As young players may not retain physical attributes into adulthood, team and position selection based on physical characteristics is not recommended.

**References**
1. Vaeyens, R. et al. (2006) Br. J. Sports Med. 40(11), 928-34.

**Keywords:** talent identification, soccer, multidimensional, motor competence

**AGE RELATED DIFFERENCES OF ELITE JUNIOR PLAYERS PERCEPTION OF DECISION-MAKING SKILL AND TACTICAL KNOWLEDGE**

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**Introduction**
In soccer decision-making (DM) is fundamental to skilled performance. One aspect that may contribute to the development of DM skill is tactical knowledge. There has however been little exploration into the relationship between DM skill and tactical knowledge. Therefore the aim of this study was to determine whether there is a relationship between self-reported DM skill and tactical knowledge, and whether there are age related differences in elite level junior soccer players.

**Methods**
Elite junior male soccer players were recruited for the study (Under [U] 13, n = 114; U14, n = 137; U16, n = 136; U17, n = 20). Participants individually completed the Tactical Skills Inventory for Sports (1), which contained 22 questions on a 6 point Likert scale, and a self-reported DM ability scale, which contained 3 questions on a 7 point Likert scale. A total score calculated for each scale. Approval was granted by the University of Sydney research ethics board.

**Results & Discussion**
There was a significant relationship between DM score and tactical knowledge $r_s$=0.253, 95%Bca CI[0.168, 0.341], p<0.001. When separated by age group, there was a significant difference in DM score H(3)= 39.67, p<0.01. Pairwise comparisons with adjusted p-values indicated significant differences in DM score between U13 and U16 (p<0.001, r=0.257), U13 and U17 (p=0.012, r=0.692), U14 and U16 (p<0.001, r=0.330) and U14 and U17 (p=0.001, r=0.302) age groups. Furthermore, there were no significant differences in Tactical knowledge score between age groups, H(3)=1.742, p=0.628.

**Conclusion**
The findings make a significant contribution to the knowledge by providing initial evidence of a relationship between self-reported DM ability and tactical knowledge. Furthermore, as the results demonstrate significant age related differences in DM score but not tactical knowledge, it potentially indicates that as players grow older their perception of their DM ability changes. However, age related changes may not influence tactical knowledge in the same manner.  Further research may be needed to confirm or refute this finding.

**References**
1. Elferink-Gemser, M. T. et al (2004) Percept Mot Skills. 99: 883-895.

**Keywords:** Tactical Knowledge, Decision-making, Skill Development

**MOTION ANALYSIS OF U11 TO U16 ELITE ENGLISH PREMIER LEAGUE ACADEMY PLAYERS**

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**Introduction**
There has been just one previous match analysis study of elite academy youth players in the UK and no study has examined 3 different methods of calculating the speed zones and the performance of retained and released players across different age group squads (1, 2). The present study examined: 1) the distances and speeds covered during match play for U11 to U16 English Premier League Academy players; 2) the differences in match performance between retained and released players; and 3) the effect of calculating speed zones in different ways when analyzing match performance.

**Method**
Eighty-one Academy field players (10 to 16 years old), competed in 11-a-side matches,  which were analyzed using a 1 Hz Global Positioning System (GPSport, Australia) with three speed zones (absolute, squad, individual) based on 5 m flying sprint speed. The players who were retained in the Academy for more than two seasons after the season in which the match analysis was completed were categorized as the retained group and players released from the Academy within two seasons or less after the season in which the match analysis took place were categorized as the released group.

**Results & Discussion**
Total match running distance increased with age from 5687 +/- 319 m/h (U11) to 6706 +/- 330 m/h (U15) ($p < 0.01$). Using the absolute speed zones, it was possible to discern differences in high intensity (> 6.0 m/s) distance covered with age (U11: 29 +/- 22 m/h, U16: 164 +/- 71 m/h, $p < 0.01$). Using the squad speed zones, it was possible to discern differences between retained and released players in the U11/U12s (moderate speed running) and in the U15/U16s (walking, jogging and low speed running) ($p < 0.01$).

**Conclusion**
Thus, total and high intensity running distances increase with age and walking, jogging, low speed and moderate speed running distances are greater in retained than released players.  These differences are best identified through the use of absolute and squad speed zones, respectively.

**References**
1. Carling, C. (2013) Sports Med. 43(8): 655-663.
2. Harley, J. et al. (2010) J. Sports Sci. 28: 1391-1397.

**Keywords:** High intensity running

**COMPARISON OF DECLARATIVE TACTICAL KNOWLEDGE BETWEEN U-11 AND U-17 YOUTH SOCCER PLAYERS**

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**Introduction**
Skilled players show a more elaborate knowledge basis during the performance of specific tasks (1). Therefore, these players differ from the less-skilled ones with respect to the kind and amount of knowledge they possess, besides the way they employ this knowledge during tasks. Thus, the aim of this study was to compare the declarative tactical knowledge between U-11 and U-17 youth soccer players.

**Methods**
The sample comprised 36 youth soccer players, equally grouped into U-11 and U-17 age levels. The instrument used to assess declarative tactical knowledge was the test developed by Mangas (1999). This instrument includes the assessment of 13 offensive soccer video sequences. The scenes are projected onto a large screen and, prior to the end of each sequence, the video is paused and the participant verbalizes the best move for the player in possession. For data analysis, scores were calculated according to the quality of response in which 1 point is given for the best, 0.75 for the second best, 0.5 for the third best and 0.25 for the worst response. No points are given for wrong answers. Descriptive statistics (means and SD) were performed. Shapiro-Wilk test was used to verify data distribution. To compare means between both age levels, Mann-Whitney U was utilized ($P<0.05$). SPSS 18.0 was used for statistical procedures.

**Results & Discussion**
Statistically significant differences were observed between the two age levels in scores 1 ($P=0.001$), 0.5 ($P=0.04$) and 0.25 ($P=0.026$), while only in the best responses (1 pt.) U-17 players were superior when compared to U-11 players. These results are explained by the fact that more experienced players present a larger knowledge basis, thus being able to identify more relevant stimuli underpinning decision-making, and therefore becoming more efficient (1).

**Conclusion**
It is concluded that U-17 players display better declarative tactical knowledge in comparison with U-11 players.

**References**
1. Williams, M. et al. (1993) Percept. Mot. Skills 76(2), 579-593.

**Keywords:** soccer, tactics, declarative tactical knowledge

**PROGNOSTIC VALIDITY OF MOTOR DIAGNOSTICS IN THE GERMAN TALENT IDENTIFICATION AND DEVELOPMENT PROGRAM**

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**Introduction**
The German Football Association (DFB) promotes approximately 5,000 U12-players, i.e. the top 4% of players in this age group, at training centers all over Germany. The talent identification and development program is scientifically supported by nationwide diagnostics of speed abilities and technical skills. This longitudinal study examines the prognostic validity of the U12-diagnostics regarding success in late adolescence.

**Methods**
The study sample consisted of 19,638 U12-players from five seasons (2004/05 to 2008/09). The diagnostics comprised six tests (sprint, agility, dribbling, ball control, shooting, juggling) with satisfying psychometric criteria (1). Test results were combined into a U12-performance score. Success in late adolescence (U15 - U19) was ascertained from the players' highest performance level in the seasons 2010/11 to 2012/13. The selection levels ranged from not selected (NS, N = 17,889), to youth academy (YA, N = 916) and regional association (RA, N = 655), to youth national players (YN, N = 178). The study was approved by the DFB Scientific Board.

**Results & Discussion**
ANOVAs revealed significant selection level effects for the score (eta^2 = .03) and the single tests (0.01 ≤ eta^2 ≤ 0.17). Players who were selected in late adolescence had already reached significantly higher U12-scores than NS-players (41.85 +/- 2.04). Even between the levels of selected players, significant differences were found. YN-players (43.70 +/- 2.08) scored significantly higher than RA-players (43.11 +/- 2.03) and YA-players (42.91 +/- 2.09) (d = .29 resp. d = .38). The most discriminating performance variable was the score, followed by sprint, dribbling and ball control. The order of most discriminating single tests varied between selection levels.

**Conclusion**
The U12-diagnostics proved group-based prognostic validity for success in late adolescence. Yet the specification of fixed, cut-off values remains illusory. Future research should include psychological predictors and valid measures of game performance (2).

**References**
1. Votteler, A. & Höner, O. (2013) Eur. J. Sport Sci., in press.
2. Unnithan, V. et al. (2012) J. Sport Sci. 30(15), 1719-1726.

**Keywords:** talent prognosis, soccer

# Invited Speaker Sessions, 4:10-5:30pm

## Session I: Training and Testing

**DEVELOPING MONITORING SYSTEMS FOR FOOTBALL: THEORETICAL BASIS AND PRACTICAL APPLICATIONS**

Aaron Coutts, Sport & Exercise Discipline Group, Faculty of Health, University of Technology, Sydney (UTS), Lindfield, AUSTRALIA

Most high level football teams now invest significant time and resource into developing athlete monitoring systems. These systems are often devised to assist coaches and scientists, in determining how individuals are coping with, or recovering from training, and also to guide future training and recovery activities. In addition to assessing player readiness, these systems can also be used to identify individuals who may at risk of injury and / or illness. The theoretical foundation from which these systems can be based upon has been described as the fitness/fatigue model,[1] which describes the short and long-term influences of training load on fitness and fatigue responses and estimates these effects on performance. According to this model, most training monitoring systems include the systematic assessment and analysis of both the training dose, and the athlete's physiological (fitness) and perceptual (fatigue) responses to this dose. In this presentation, the components of a working athlete monitoring system will be described. Furthermore, approaches to data analysis and issues relating the validity and reliability of the typical monitoring tools will also be examined. In addition, specific examples of how this approach has been used to monitor and inform training, assess how football players are coping training and assist in the planning and control of training dose will be provided.

**Reference**

1. Banister EW, Calvert TW, Savage MV et al. A systems model of training for athletic performance. *Aust J Sports Med Exerc Sci* 1975; **7**:57-61.

**MANAGING TRAINING LOADS IN COLLEGE SOCCER**

**Chris West**, University of Connecticut

The collegiate soccer season presents unique challenges which include a short pre-season team preparation period and a very dense competition schedule which includes frequent travel. Managing fitness-fatigue-performance is critical in order to maintain a high level of physiological and psychological components.


## Session II: Sport Science and Coaching

**CAN YOU TEACH DECISION MAKING IN SOCCER?**

**Donna O'Connor**, University of Sydney

Coaches strive to create an effective learning environment for their athletes. One of the main challenges for coaches is developing game intelligence skills or their players' ability to 'read the play'. However this skill needs to be taught and developed like any other skill. This presentation examines the development of decision making and has three parts. Firstly it will examine research findings related to decision making and skill learning. This will include: key factors a coach must consider when designing a practice session; scheduling and type of practice activities; coach behaviour, instructional and feedback strategies that best facilitate the development of decision making skills. It will examine optimal practice schedules, the most appropriate instructional and feedback strategies to use to optimise learning. Secondly it will provide an overview of coaches and players perceptions of expert decision making in football and how it can be measured and developed. Finally I would also like to discuss preliminary findings of a project that is examining current football training environments in NSW and the implementation of the national curriculum. These practice sessions are analysed in relation to opportunities for developing decision making in players.

# Poster Session Abstracts: Saturday, June 7, 2:50 – 3:45pm

## Training and Testing I

**1-NORMATIVE DATA OF ISOKINETIC STRENGTH, BILATERAL AND IPSILATERAL RATIO IN YOUNG ELITE SOCCER PLAYERS**

Maly,T., Zahalka, F. Mala, L. Hank, M.

Research Sport Centre, Charles University, Czech Republic

**Introduction**
The isokinetic strength (IS) assessment should become an integral part of a player's diagnostics before the preparatory period aimed at detection of the level of strength predispositions, as well as knee extensor and flexor asymmetries (1). The high level of the ratio of hamstring and quadriceps muscle strength is an essential parameter of identification of increased risk of injury (2). The aim of this study was to provide normative values of IS parameters in elite young soccer players.

**Methods**
The sample consisted of elite youth soccer players of U16 category (n = 134). Diagnostics were performed on the isokinetic dynamometer during concentric contractions at an angular speed of 60 °/s. We evaluated the following parameters: maximum peak muscle torque of knee extensors (PTE) and flexors (PTF) in the preferred (PL) and non-preferred leg (NL), ipsilateral ratio for both extremities (H:QP and H:QN), bilateral ratio between the knee extensors (QP:QN) and flexors (HP:HN). Percentile scale and parametric t-test were used to do data analysis.

**Results & Discussion**
Normative values for the observed parameters were as follows: (N/kg): PTE-PL: P25 = 2.85, P50 = 3.11, P75 = 3.40, PTE-NL: P25 = 2.89, P50 = 3.06, P75 = 3.30; PTF-PL: P25 = 1.66, P50 = 1.82, P75 = 2.00, PTF-NL: P25 = 1.58, P50 = 1.75, P75 = 3.30. Bilateral force deficit in knee extensors was (%): P25 = 3.0, P50 = 6.00, P75 = 12.00 and in knee flexors (%): P25 = 4.00, P50 = 8.00, P75 = 13.00. Ipsilateral ratio H:Q was in the preferred leg (%): P25 = 53, P50 = 59.00, P75 = 64.00 and in the non-preferred leg (%): P25 = 51.00, P50 = 58.00, P75 = 63.00.  The players achieved significantly higher PTKF-PL(p<0.01). The bilateral deficit between the legs was higher (p<0.01) in flexors (HP:HN) than in extensors (QP:QN). Ipsilateral ratio in the NL was lower in comparison to the PL (p<0.05).

**Conclusion**
Results of the study may be used as a portfolio performance related to the comparison of normative values. More attention should be paid to knee flexors and ipsilateral ratio in the non-preferred leg.

**References**
1. Croiser, J.L. et al. (2005). Brit. J. Sport. Med. 39(6), 379.
2. Fousekis, K. et al. (2010). J. Sport. Med. Phys. Fit. 50(4), 465-474.

**Keywords:** testing, isokinetic strength, muscle asymmetries, norms, imbalances

## 2-INVESTIGATION OF THE EFFECTS OF PASSIVE AND ACTIVE RESTING ON PHYSIOLOGICAL RESPONSES ON SMALL SIDE

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1 Ankara University, Faculty of Sport Sciences, Ankara, Turkey
2 Pamukkale University, School of Sport Sciences and Technology, Denizli, Turkey

**Abstract**

The purpose of this study was to investigate of the effects of resting regimes (passive and active) on physiological responses and time motion characteristics between bouts on small sided soccer games (SSGs) – including 2-a-side, 3-a-side, and 4-a-side games – in young soccer players.

**Methods**

Sixteen soccer players (average age 16,87±0.34 years; mean body height 176,69±3,216 cm; mean body mass 62,40±2,59 kg; mean training age 3,75±0,44years) participated in this study voluntarily. The subjects were informed about all small-sided games (SSG) and underwent anthropometric measurements followed by the Yo-Yo Intermittent Recovery Test 1. After Yo-Yo IRT1 measurements, players were ranked according to the distance covered in this test. Then, each player took place in 4 bouts of SSGpr (passive resting) and SSGar (active resting) soccer-specific SSGs in random order at 2-day intervals. During the all small sided games Heart Rate (HR) responses, percentage of HRmax and time motion characteristics were measured by SPI-Pro X portable global positioning system unite. In addition, Rating of Perceived Exertion (RPE) was determined for each bouts and Lactic Acid (LA) were measured at the end of SSGs. Paired t-tests were used to assess differences between SSGpr and SSGar in terms of physiological responses and time motion characteristics during the all small sided games.

**Results and Discussion**

The results demonstrated that there were significant differences in RPE, LA and time motion characteristics between passive and active resting in all SSGs, and also found significant differences in RPE, LA between passive and active resting in 3-a-side and 4-a-side games (p<0.05).

**Conclusion**

The results of this study suggest that both SSGpr and SSGar could be used for the soccer specific aerobic endurance. However, if coaches want both higher physiological responses and greater distance covered in the intensity running zone from their teams, SSGar should be organized. Furthermore, this study also suggests that 2-a-side SSGs may promote some anaerobic adaptations for youth soccer players.

**Keywords:** Growth and Development, Physical and Physiological Characteristics, Soccer

**3-CONCURRENT SPEED ENDURANCE AND RESISTANCE TRAINING IMPROVES SHORT AND LONG TERM PERFORMANCE AS WELL AS RUNNING ECONOMY AND MUSCLE NHE1 IN TRAINED RUNNERS**

Skovgaard, C.*, Christensen, P.M.*,**, Larsen, S.*, Rostgaard, T.*, Thomassen, M.*, Bangsbo, J.*

* Department of Nutrition, Exercise and Sports, Section of Integrated Physiology, University of Copenhagen, Denmark, ** Team Danmark (Danish elite sport organization), Copenhagen, Denmark

**Introduction**
It is common for athletes to perform different types of training on the same day. This may evoke cross-talk in muscle signaling such that one type of training may impair or stimulate the molecular response to another type of training. The aim of the present study was to examine whether repeated sprint and heavy resistance training are compatible when performed on the same day as concurrent training (CT). We hypothesized that runners performing CT with a reduction in training volume would cause a higher content of hydrogen and potassium transport proteins as well as better RE and short- and long-term endurance performance.

**Methods**
The study examined if speed endurance training (SET, repeated 30-s sprints) and heavy resistance training for the legs (HRT, 80-90% 1 repetition maximum) performed in succession are compatible and leads to performance improvements in trained subjects. For an 8-week period (intervention period; INT), 21 runners (maximum oxygen uptake (VO2-max): 59±1 mL/min/kg; means ± SE) either maintained their training (CON, n=9) or performed high intensity concurrent training (HICT, n=12) consisting of two weekly sessions of SET followed by HRT and, on separate days, aerobic moderate (~50 min) and intense training (4x4 min) with a total reduction in running distance of 42%.

**Results & Discussion**
Following 4-weeks of HICT, performance was improved ($P<0.05$) in a 10-km run (42:30±1:07 vs. 44:11±1:08 min:s) with no further improvement during the last 4 weeks. Performance in a 1500-m run (5:10±0:05 vs. 5:27±0:08 min:s) and in the Yo-Yo IR2 test (706±97 vs. 491±65 m) was also improved ($P<0.001$), but only at the end of INT. In HICT, running economy (189±4 vs. 195±4 ml/kg/km), content of NHE1 (35%) and dynamic muscle strength was augmented ($P<0.01$) after compared to before INT, whereas VO2-max, content of muscle $Na^+/K^+$ pump subunits and MCT4 were unaltered. No changes were observed in CON.

**Conclusion**
The present study demonstrates that SET and HRT, when performed in succession, leads to improvements in both short- and long-term running performance together with improved running economy, as well as increased muscle strength and capacity for muscular $H^+$ transport.

**References**
Nader GA. Med Sci Sports Exerc 38: 1965-1970, 2006.

## 4-THE EFFECTS OF A 6.4% CARBOHYDRATE-ELECTROLYTE DRINK ON SOCCER SPECIFIC PERFORMANCE DURING A SIMULATED HIGH-INTENSITY SOCCER PROTOCOL

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University of Bedfordshire, Institute of Sport and Physical Activity Research (ISPAR), Department of Sport and Exercise Science, Bedford, UK

### Introduction
A plethora of equivocal literature regarding the efficacy of carbohydrate-electrolyte (CHO-E) drinks on sports performance, including soccer specific performance exists (1). One facet of this equivocal paradigm pertains to whether CHO-E drinks can delay the onset of fatigue in soccer specific performance, in the field or laboratory. The purpose of this study was to assess the effects of consuming a 6.4% CHO-E supplement compared to water (WAT) on the physiological capacity associated with soccer match-play performance utilizing an individualized, validated and reliable non-motorized treadmill soccer simulation (intermittent soccer performance test (iSPT)) (2).

### Methods
Ten male university soccer players reported to the laboratory on 5 occasions; Visit 1-3: 3 familiarization sessions, 4-5: iSPT (90 min duration; 45 min - 1st half, 15 min - half time, 45 min - 2nd half) was completed twice with a minimum of 7 days separation. A randomized cross-over design was employed in which participants had to consume 500ml of a 6.4% CHO-E supplement or WAT prior to iSPT and then 500ml during the half time break. Typical physical performance, physiological and perceptual measures were recorded throughout. Changes in body mass and hydration were assessed pre and post iSPT.

### Results
Results show total distance (TD) covered (CHO-E: 9246.64m ± 167.65m; WAT 9083.95m ± 195.98m, P=0.007), sprint distance (SD) (CHO-E: 1067.19m ± 38.83m; WAT: 1043.07m ± 43.50m, P=0.03) and high speed distance (HSD) (CHO-E: 2222.96m ± 55.15m; WAT: 2177.95m ± 49.95m, P=0.01) were all significantly greater in CHO-E condition. HSD was significantly less in the final 15 min (170.13m ± 10.30m, P=0.029) compared to first 15 min (179.14m ± 6.99m) in WAT compared to CHO-E.

### Conclusion
CHO-E supplementation prior to and during iSPT appears to be ergogenic following improvements in physical performance capacity after consumption.

### References
1. Phillips et al (2011) Sports Med; 41 (7): 559-585
2. Aldous et al (2013) J. Str. Cond. Res. DOI: 10.1519/JSC.0000000000000310

**Keywords:** Carbohydrate-electrolyte, Fatigue, iSPT

**5-HYPOXIA MEDIATED DECREMENTS IN SOCCER-SPECIFIC CAPACITY UTILISING A NON-MOTORISED TREADMILL SOCCER-SPECIFIC SIMULATION (iSPT)**

Taylor, L.*, Chrismas, B.*, Beel, L.*, Akubat, I.**, Dascombe, B.*** , Aldous, J.*

*University of Bedfordshire, Institute of Sport and Physical Activity Research (ISPAR), Bedford, UK, **Newman University College, Birmingham, UK, ***The University of Newcastle, Applied Sports Science and Exercise Testing Laboratory, Newcastle, Australia

**Introduction**
Soccer at moderate altitude (1000-2000m) reduces maximal capacity, compared to sea-level performance (1). Utilizing an individualized, validated and reliable non-motorized treadmill soccer simulation (intermittent soccer performance test (iSPT)) allows for the quantification of maximal performance capacity in environmental conditions. Maximal performance capacity is not expressed during soccer match-play, due to environmental factors (tactics and opposition) (2). This study aims to assess the maximal performance capacity of soccer players in a hypoxic (18oC, 50% RH, 1000m altitude; HYP) and sea-level environment (18oC, 50% RH, 0m altitude; CON).

**Method**
8 male soccer players reported to the laboratory on 5 occasions. Visit 1-3: 3 familiarization sessions. 4-5: iSPT (90 min duration 45 min - 1st half, 15 min - half time, 45 min - 2nd half). All familiarization was conducted in line with (2). Participants completed iSPT on two occasions (visits 4-5) in CON and HYP. Both physiological and perceptual measures were recorded continuously. Body mass and hydration were assessed pre- and post-iSPT. Blood lactate was measured every 15 min.

**Results**
Total distance (TD) covered (CON: 9542±353m; HYP: 9420±543m; P<0.001; ↓1.27%) and high speed distance (HSD) (CON: 2386±154m; HYP: 2084±124m; P=0.01 ↓12.65%) were significantly greater in CON compared to HYP. A greater reduction was reported in HYP compared to CON for HSD (CON: 23.60±8.4m, P=0.02, ES: 0.22; HYP: 46.96±13.4m, P=0.001, ES: 0.41) during the last 15 min of iSPT.

**Conclusion**
Results demonstrate a reduction in performance capacity in HYP compared to CON. Furthermore, a greater decrement in HSD was reported in the last 15 min in HYP compared to CON; therefore, the maximal performance capacity is decreased in HYP. This data is the first utilizing an individualized, valid and reliable soccer simulation (iSPT) to quantify decrements in performance between CON and HYP, which is not possible during soccer match-play due to environmental factors (tactics and opposition).

**References**
1. Aughey et al (2013) Br. J. Sports. Med. 47 107-113.
2. Aldous et al (2013) J. Str. Cond. Res. DOI: 10.1519/JSC.0000000000000310.

**Keywords:** Hypoxia, NMT, iSPT

## 6-FAST ISOKINETIC KNEE EXTENSORS AND FLEXORS PEAK TORQUE CORRELATES WITH PERFORMANCE IN ELITE JUNIOR PLAYERS

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**Introduction**
Soccer players are required to sprint, jump and change direction several times during a match. Such ability has been generally related to lower limb strength (Young, 2006). The aim of the study was to specifically investigate the relationship between performance and lower limb strength measured in several contraction modalities.

**Methods**
Twenty-seven professional junior team soccer players participated in the study. Knee extensors and flexors strength was measured using isokinetic dynamometer. Both concentric and eccentric peak torque was recorded at 60°/s and 300°/s, in addition to isometric contraction at 60° (0°= full extension). Squat jump(SJ) and counter movement jump(CMJ)height, time of 20+20m shuttle test,10 and 30m dash and multiple direction change sprint test(T test) were considered as performance parameters. Correlation was calculated using Pearson coefficient.

**Results & Discussion**
Knee extensors concentric 300°/s peak torque was significantly ($p<0,05$) correlated with CMJ(r=0,457), 30m dash(r=-0,475), shuttle test(r=-0,462) and T test(r=-0,481). Knee flexors eccentric 300°/s peak torque was significantly correlated with 10m dash(r=-0,420), 30m dash(r=-0,469) and shuttle test(r=-0,514). Knee extensors 60°/s concentric peak torque resulted significantly correlated with shuttle test(r=-0,475) and T test(r=-0,574). Knee flexors 60°/s eccentric peak torque was correlated with shuttle test(r=-0,489). In addition, T test resulted correlated with knee extensors 300°/s eccentric(r=-0,533) and knee flexors 300°/s concentric peak torque(r=-0,483). No correlation resulted with knee extensors isometric peak torque.

**Conclusion**
The specificity of fast contraction modality both of knee extensors and flexors strength resulted strictly linked to high rate of force development performances. Interestingly, most of the correlations with performance variables resulted when functional Hecc/Qconc ratio components were considered, both at fast and slow velocities. We conclude that functional fast velocities isokinetic test can partially predict soccer players' ability to sprint, change direction and jump.

**References**
Young, W.B.(2006). Int J sports phys and perf, 1(2), 74-83

**Keywords:** isokinetic, jump, sprint, change direction ability

**7-SECRETORY IgA RESPONSES IN AN ENGLISH PREMIER LEAGUE SOCCER SEASON**

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**Introduction**
In recent years, the measurement of a number of salivary biomarkers has become commonplace in English Premier League (EPL) soccer teams, in an attempt to monitor responses to training, competition, lifestyle factors and stress.  Oftentimes, the aim is to provide "readiness to train data" about individual players or the squad as a whole to coaching staff.  A point of care test for sIgA has been shown to be valid and appropriate in the soccer environment (1), however no published data exists describing typical responses during routine monitoring through a EPL season.  The purpose of this paper is to describe sIgA behavior in EPL players.

**Methods**
A total of 786 saliva samples were taken from 22 players at 53 timepoints from the start of Pre-season training to the end of the competitive season.  The timepoints were typically 72 hours post match to assess recovery status.  The data analysis was restricted to a cohort 12 outfield players (4 defenders, 6 midfielders and 2 forwards (mean (±SD) stature 1.76 (7.88) m, mass 71.6 (8.52) Kg, age 26.1 (3.68) years) who had been tested during 39 or more timepoints (total of 534 samples).  Saliva was collected 30-60 minutes before training using an IPRO Oral Fluid Collector (2) and sIgA concentration determined immediately using an IPRO LFD Point of Care device (3).

**Results & Discussion**
The sIgA levels were seen to be highly variable both within (CV 81.0%) and between players (CV 57.3%) across the EPL pre-season and in season period.  The mean sIgA for each player across the season varied from 150.6 (127.5) µg/ml to 305 (208.2) µg/ml.  The group mean at each timepoint ranged from 93.4 (55.8) µg/ml to 453 (243.9) µg/ml.  REML revealed clear spikes in group mean sIgA levels in the mid to end of pre-season period and during and after the Christmas period, where fixtures where more condensed and the pitch conditions had become more challenging.

**Conclusion**
This is the first paper to describe sIgA responses of a squad to a whole season in the EPL.  The high variability within and between players speaks to the need to individualize training load and interventions in an attempt to maintain optimal health and performance.

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**Keywords:** sIgA, monitoring, soccer

## 8-RELATIONSHIP BETWEEN SYMPATHETIC NERVOUS SYSTEM ACTIVITY AND FITNESS PERCEPTION IN PROFESSIONAL SOCCER PLAYERS

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**Introduction**
In soccer games, physical performance depends on the recurrence and the intensity of the players' involvement. It's commonly held that the Autonomic Nervous System (ANS) may help to evaluate fatigue and physical fitness of athletes (1). On the other hand, Sympathetic Nervous System (SNS), as a part of ANS and through its effects (eg. heart rate (HR) increase), is stimulated, even by the slightest stimuli, like the standing-up position; underlying the high sensitivity of this system. The aim of this study was to investigate the relationship between physical fitness perception and SNS responses to stand test in professional soccer player.

**Methods**
Fourteen professional soccer players participated in 4 match plays during 12 days. In each morning of match-day, HR was recorded during 7 min in standing position after 10 min of a supine position. The physical fitness perception was assessed using a visual analogue scale (VAS) after each game. SNS responses were estimated by the power spectrum analysis of heart rate variability (HRV).

**Results & Discussion**
Statistical analysis (Spearman-test) emphasized a highly significant correlation (0.55, $p<0.0001$) between perceived physical fitness level and the logarithm of the spectral power at low frequencies and then with SNS responses. Conclusion This study highlighted a relationship between ANS activation during a standing position and physical fitness perception in professional soccer game.

**Reference**
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**Keywords:** Autonomic Nervous System, Heart rate variability, Football, Sympathetic Nervous Activity

# Training and Testing II

**9-COMPARISON OF REACTION TIME AND TACTICAL PERFORMANCE BETWEEN U-15 YOUTH SOCCER PLAYERS**

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**Introduction**
Reaction time is a variable that is intrinsically related to the process of decision-making, and is able to affect the tactical performance of soccer players. The aim of this study is to compare the reaction time and tactical performance between U-15 soccer players.

**Methods**
The sample comprised 100 U-15 youth soccer players. The instruments used to evaluate reaction time and tactical performance were CPT (Continuous Performance Test) and FUT-SAT (1), respectively. FUT-SAT enables the evaluation of the ten core tactical principles of soccer game. These principles are: (i) penetration; (ii) offensive coverage; (iii) depth mobility; (iv) width and length; (v) offensive unity; (vi) delay; (vii) defensive coverage; (viii) balance; (ix) concentration and (x) defensive unity. Reaction time data was grouped in tertiles (low, moderate and high). Players from "low" and "high" tertiles had their values compared with respect to their tactical performance. Kolmogorov-Smirnov and Mann-Whitney tests ($P<0.05$) were performed through SPSS for Windows, version 18.0.

**Results & Discussion**
Statistically significant differences were observed between reaction time and tactical performance of soccer players for the tactical principle of offensive coverage ($U=472.5$; $P=0.048$). No statistically significant difference was found in any of the other tactical principles. Results can be explained by the uniqueness of the principle, which demands from the defensive player some rationalization of the playing space when approaching the player in possession (2).

**Conclusion**
It is concluded that reaction time influenced tactical performance, especially the principle of offensive coverage.

**References**
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**Keywords:** soccer, reaction time, tactics

**Acknowledgements**

**10-THE EFFECT OF IN-SEASON NEUROMUSCULAR TRAINING ON FMS SCORE IN ADOLESCENT MALE SOCCER PLAYERS**

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**Introduction**
The aim was to examine the effect of in-season neuromuscular training on FMS score in adolescent male soccer players.

**Methods**
Participants were 294 junior, male soccer players (age 10 – 16 years) from English Football League clubs. Each player was assessed on the FMS at the end of the pre-season period and was retested 8 months later at the end of the season. The FMS is a series of 7 tests, each scored 0-3 on a categorical scale, whereby perfect execution on each test would score a maximum 21. Age from peak height velocity was estimated from anthropometric measures (Mirwald et al., 2002). Players were subsequently grouped as pre- (n = 204) and post- (n = 90) peak height velocity (PHV). Players were provided an individual training program that supplemented the football-training.  The 20 min program was completed at least x2 per week. We compared the proportion of the sample before and after the intervention, reaching a score of ≥14 for FMS; equivalent to scoring a '2' on each test - 'satisfactory' performance.

**Results & Discussion**
Post-intervention, the proportion of the sample making the cut-point of ≥14 increased in both pre- and post-PHV groups. In the pre-PHV group, the proportion increased from 19% to 30% - an additional 11 players out of every 100 making the grade (95% confidence interval 5% to 17%). In the post-PHV group, the proportion making the cut-point increased from 32% before the intervention to 55% afterwards - an additional 23 players out of every 100 making the grade (13% to 34%). The proportion of pre-PHV players making the cut-point after the intervention is approximately the same as the proportion in the post-PHV sample before the intervention. The intervention appears to be more beneficial for the post-PHV group, with a difference in the change in proportion meeting the cut-point of 12% (0% to 24%) For both groups, the improvements in FMSt were mainly due to beneficial effects of the intervention on the movement and stability tests. The addition of control groups would help to clarify the benefits of the intervention further, but we think it unlikely that improvements of this magnitude would occur through maturation alone over the duration of the intervention.

**Conclusion**
In-season, individualized neuromuscular training appears to improve FMS score in adolescent soccer players, particularly those post-PHV.

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**Keywords:** screening, movement mechanics, junior players

**11- ANALYSIS OF LOWER LIMB PERFORMANCE AND FORCE ASYMMETRIES IN YOUNG SOCCER PLAYERS**

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**Introduction**
Effective execution of a vertical jump depends on explosive power of lower limbs and their symmetrical integration mainly. The aim of this study was to assess jump height, maximal force production and bilateral force deficit in relation to player's age and the type of jump.

**Method**
Elite players of 4 age categories (U16=34, U17=43, U18=43 and U19=46) of the highest national league participated in the study. Forces of two isolated lower limbs during the jump were recorded by two Kistler B8611A force plates (KISTLER AG, Switzerland). The players carried out three types of vertical jump: countermovement jump free arms (CMJFA), countermovement jump (CMJ) and squat jump (SJ). The assessed parameters included jump height (JH), maximal force production during the take-off (Fmax) and bilateral force deficit (BD). Performance differences regarding age and the type of jump were examined using ANOVA and Bonferonni's post-hoc tests. Eta square ($\eta2$) coefficient was used for effect size.

**Results & Discussion**
Analysis of variance showed a significant effect of age on jump height performance ($F_{3,498}$ = 2.97; p<.05, $\eta2$ = .02) but an insignificant effect on Fmax production ($F_{3,498}$ = 0.8; p>.05, $\eta2$ = .00) and on bilateral force deficit between the lower limbs ($F_{3,498}$ = 1.61; p>.05, $\eta2$ = .01). Post-hoc tests revealed lower performance in U16 players in comparison to U19 players (p<0.05). The type of jump had a significant effect on jump height performance ($F_{2,498}$ = 128.37; p<.01, $\eta2$ = .35), Fmax production ($F_{2,498}$ = 181.3; p<.01, $\eta2$ = .428) and bilateral force deficit between the lower limbs ($F_{2,498}$ = 22.39; p<.01, $\eta2$ = .08). Players achieved lower jump height in SJ test vs. CMJ test (p<.05) and in CMJ test vs. CMJFA test (p<.01). Players produced higher Fmax in CMJFA test (2.61 N.kg-1) in comparison to CMJ test (2.51 N.kg-1) and SJ test (2.17 N.kg-1). The highest bilateral force deficit was found in CMJ test (9.43%), while the lowest was in SJ test (4.8 %).

**Conclusion**
From the perspective of age, performance differences between the oldest (U19) and the youngest players (U16) were found. Bilateral force deficit achieves high values in CMJ test in favour of the take-off leg.

**12-EFFECTIVENESS OF TREADMILL VS GROUND-BASED REPEATED SPRINT TRAINING ON SPRINT TIME AND HIGH-INTENSITY RUNNING ABILITY IN YOUTH FEMALE SOCCER PLAYERS**

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**Abstract**

In Canadian youth soccer, the pre-season period prior to the outdoor season typically comprises 6 - 8 weeks, beginning in mid-to-late March and ending in mid-to-late May. Repeated sprint training is a commonly used training method during the soccer pre-season.  The aim of this study was to examine the efficacy of a treadmill-based (TT) versus a ground-based (GBT) protocol on repeated sprint training by measuring differences in speed over short distances and high intensity running ability.

17 female soccer players (aged 14 – 17) from a Toronto-based youth soccer club were randomly assigned to either TT or GBT using a simple, computer-generated randomization. 9 players participated in the Treadmill Training Group, and 8 players participated in the On-Field Training group.  Both groups performed a 6-week, 2 sessions per week repeated sprint training protocol, comprising of 15 repetitions of a 6-second maximal effort, separated by 60 seconds of passive recovery. Sprint times over 10, 20 and 35-m distances, as well as high-intensity running ability (Yo-Yo Intermittent Recovery Test), were performed prior to and after the training program. Following 6 weeks of training, players randomly assigned to TT had significant improvements in 10m, 20m and 35m sprint performance ($p=0.008$, $p=0.0013$, $p=0.0275$ respectively, Student's t-test). There was no difference in distance covered pre- and post- training between TT and GBT in the Yo-Yo Intermittent Recovery Test ($p=09654$).

When evaluating program effectiveness, there was a significant improvement in player performance in the TT group for all tests post-training (10m, 20m, 35m sprint and Yo-Yo Intermittent Recovery Test) But the GBT group showed improved performance in 35m sprints and the Yo-Yo Intermittent Recovery Test, but not in the shorter sprint distances.

Results of the study indicate that Treadmill-based repeated sprint training produced a significantly greater increase in running speed, with a small – but also greater – increase in high intensity running ability, than a traditional On-field training protocol.

**Keywords:** Treadmill, Treadmill Training, High Speed Treadmill, High Speed High Incline Treadmill

**13-BODY COMPOSITION, BONE MINERAL DENSITY AND CONTENT IN COSTA RICAN SOCCER PLAYERS**

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**Introduction**
It is widely accepted that sports such as soccer impact bone health (1). Dual X-ray absorptiometry (DXA) has been used to describe bone mineral density (BMD), content (BMC), fat mass (%Fat) in soccer players (2). However, this technique has not been used to describe intermuscular adipose tissue-free skeletal muscle mass (IMAT-F SMM) (3) of professional, Central American soccer players. Therefore, the aim of this study was to describe the body composition, BMD, BMC, %Fat, and IMAT-F SMM in professional Costa Rican soccer players.

**Methods**
Soccer players from the Costa Rican National team (CNT, n = 12), and two local teams were measured by DXA to determine overall body composition. The CNT players were competing in the World Cup Brazil 2014 qualifiers, local team 1 (LT1, n = 14) was ranked third among 12 teams in the professional tournament, and local team 2 (LT2, n = 12) was the new division II champion among 18 teams. All players were measured on a Lunar Prodigy Advance DXA (General Electric, Madison, WI, USA), a device that uses direct-digital array detector and narrow-angle fan-beam (4.5° angle) technology to enhance measurements. Descriptive statistics and one-way analysis of variance we computed to determine significant mean differences between teams and between player position in the field (i.e., goalkeepers, defenders, midfielders, and strikers) in dependent variables BMD, BMC, %Fat, and IMAT-F SMM.

**Results & Discussion**
We found no significant mean differences in players from the three teams on age (26.0±4.7 yrs.), height (176.8±5.8 cm), weight (75.3±7.2 kg), total BMD (1.3756±0.0871 g/cm2), BMC (3.7±0.4 kg), %Fat (13.4±4.4), and IMAT-F SMM (33.1±3.2 kg). Field position analyses indicated that defenders (181.4±4.8 cm) were taller than strikers (175.0±5.0 cm) and midfielders (174.1±5.8 cm) (p < 0.05). Goalkeepers had a higher IMAT-F SMM (36.4±1.5 kg) than defenders (34.5±2.5 kg) and midfielders (31.2±3.2 kg) (p < 0.05), and defenders had higher IMAT-F SMM than midfielders (p < 0.05).

**Conclusion**
Goalkeepers showed the highest muscular development profile, compared to other players. Body composition and bone health variables were similar among players from the National team and two professional league teams.

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**Keywords:** bone density, intermuscular adipose tissue-free skeletal muscle mass, Costa Rica

## 14-CORRELATION BETWEEN THE TRAINING LOAD AND THE RECOVERY IN SUBSEQUENT DAY OF YOUNG SOCCER PLAYERS

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### Introduction
The coaching staff must adopt scientific methods in the development of optimal training programs, aiming at an adequate recovery for an enhanced performance level. The use of simple and low-cost methods has been studied lately. Among these methods, the use of Rating of Perceived Exertion (RPE) and Rating of Perceived Recovery (RPR) could be highlighted. To correlate the training load with the recovery level measured in the subsequent day during seven microcycles.

### Methods
19 under-16 soccer players had their training load and recovery level monitored during seven microcycles consisting of six training sessions each.
The training load magnitude was determined by the RPE score times the total duration (minutes) of the training session. The RPE was collected 20-30 minutes after the training session using the CR10 Borg's scale (1982) modified by Foster et al. (2001).
The athletes' pre-session recovery level was measured at the beginning of the session using the Rating of Perceived Recovery (RPR) according to Laurent et al. (2011). To verify the correlation between the training load and the correspondent recovery level, a Pearson product moment correlation coefficient was used.

### Results & Discussion
The correlation values for the seven microcycles monitored were: M1 -0.73; M2 -0.80; M3 -0.78; M4 -0.91; M5 -0.85; M6 -0.69; M7 -0.75. A moderate correlation was found between RPE and RPR in the M6 and strong in other microcycles.

### Conclusion
The magnitude of the training load influenced the recovery level of the athletes in the subsequent day. There must be a balance between the stress-recovery processes, which could result in a positive adaptation to the training stimuli. It is suggested to apply different training loads among the sessions of the same microcycle with appropriate recovery period. Besides, it is still necessary to confirm the validity and the use of these methods considering other variables, which also may indicate stress and recovery level.

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**Keywords:** soccer, soccer players, training load, recovery, overtraining, training monitoring, young athletes

**15-DOES THE SAQ TRAINING METHOD IMPROVE SPEED AND FLEXIBILITY OF YOUNG SOCCER PLAYERS?**

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**Introduction**
SAQ training is suggested to enable soccer players to become better at reacting to stimuli, improving acceleration, moving effectively in multiple directions and changing direction or stopping quickly to make a play in a fast, efficient, smooth and repeatable manner (1). The aim of this research was to determine the effects of a speed, agility and quickness (SAQ) training program on speed and flexibility of young soccer players.

**Methods**
One hundred thirty-two young soccer players were randomly assigned to experimental (EG; n = 66, body mass: 71.30 ± 5.93 kg; body height: 177.15 ± 6.50 cm) and control groups (CG; n = 66, body mass: 70.63 ± 4.87 kg; body height: 175.85 ± 5.65 cm). Sprint performance was assessed by a test of quickness – the 5 m and 10 m sprint and a test of acceleration – the 20 m sprint. Flexibility was assessed using sit and reach, V-sit and reach, leg lift from supine position and lateral leg lift while lying on the side tests.

**Results**
Sprint over 5, 10 and 20-m did not differ between groups at baseline, but by week 12, 5-m sprint significantly improved ($P < 0.05$) in the SAQ training group compared to the control group (1.40 ± 0.13 vs. 1.46 ± 0.12 sec, respectively) although this improvement had a trivial effect size (ES=0.15). The 10-m sprint time had improved by 3.3% ($P < 0.01$) in the SAQ group with a moderate effect size (ES=0.66). No significant differences ($P > 0.05$) in all flexibility tests were found between experimental and control group at baseline and after the training programs.

**Conclusion**
Consequently, SAQ training was found to be a more effective way of improving quickness and sprint time over 5-m and 10-m, but not for acceleration and flexibility in comparison to more traditional training methods. These results indicate that SAQ training may be more effective for improving sprint performance for some soccer players, but more research is required to determine ideal training methods for improving acceleration and flexibility in young soccer players.

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**Keywords:** range of motion, specific agility, change of direction, youth soccer player

## 16- VARIATION OF ANTHORPOMETRIC AND PERFORMANCE MEASURES IN TALENTED MALE YOUTH FOOTBALL PLAYERS

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### Introduction
In order to determine meaningful changes in players' performances through natural development and training, variations of performance need to be taken into considerations. As the developing player goes through different maturation stages (i.e. pre-, mid-, and post-PHV) it seems plausible that variations in performance measures are different depending on the maturation status of the players. The AIM of this study was to investigate the variation of anthropometry and physical performance measure in youth soccer players in different maturation status.

### Methods
One-hundred and thirty-nine talented male football players from three national talent centers in New Zealand were tested for a age, height, estimated peak-height-velocity (PHV), YoYo Intermittent Recovery Test Level 1 (YYIRTL1), 20-meter sprint (20M) and horizontal jump (HJ) on four different occasions, each separated by 6 month. Two consecutive measurements were used to determine percent variation in anthropometry and physical performance resulting in a total of 172 measurements. Participants were then grouped in three different groups determined by their estimated time of PHV. <-1.0 years of PHV was determined as post-PHV, >-1.0 - <1.0 was set as mid-PHV and >1.0 was determined as pre-PHV. An ANOVA with Bonferoni Post-hoc analysis was used to investigate differences between the different conditions.

### Results & Discussion
Height varied significantly different between all groups (post- < pre- <mid-PHV). Body mass variation was significantly greater in mid- compared to pre- and post-PHV group. YYIRTL1 variation in pre-PHV group was significant different from mid-PHV participants.

### Conclusion
Variations play a significant role between maturation status in developing athletes. Furthermore it seems that variations in anthropometry and physical performance seems to be more pronounced in mid-PHV compared to pre- and post-PHV participants.

# Training and Testing III

## 17-TIME-MOTION CHARACTERISTICS AND HEART RATE IN 3 VS 2 SMALL-SIDED SOCCER GAMES IN DIFFERENT PITCH SIZE

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**Introduction**
Small-sided games (SSGs) containing teams of equal numbers of players (e.g. 2 vs 2 and 3 vs 3) have been well documented. However, few studies have examined SSGs containing teams of unequal numbers of players. The purpose of this study was to examine the influence of altering the pitch size on time-motion characteristics and heart rate (HR) in 3 vs 2 SSG, which is one of the most often employed for almost all levels in Japan.

**Methods**
Eighteen collegiate soccer players performed two 2 min 3 vs 2 SSGs in the two different pitch sizes (10 x 10m and 15 x 15m). The SSGs were performed with the instructions to keep the ball possession as long as possible, by three offensive players being allowed 3 ball touches, and interrupt the ball possession by two defensive players. Once a defensive player touched the ball, that player took the place of the offensive player who caused the interruption. The time-motion characteristics were measured using a GPS. HR was recorded using standard chest strap. Paired t-test was used to examine differences in performance.

**Results & Discussion**
Total distance covered (TD), peak speed (PS), average speed (AS), and HR in 15 x 15m were significantly greater than 10 x 10m. TD per min and PS were smaller than the result of 2 vs 2 and 3 vs 3 SSG in larger pitch (20 x 15m) in a previous study (1), and PS didn't reach >18.0 km·h-1 usually categorized as sprinting. Number of balls lost per min was higher than 2 vs 2 and 3 vs 3 SSGs in larger pitch (20 x 15m) in a previous study (2). %HRmax was in same level often observed during 11-a-side matches (3).

**Conclusion**
To induce higher levels of time-motion characteristics and physiological response in 3 vs 2 SSGs, 15 x 15m pitch size is more effective than 10 x 10m. 3 vs 2 SSG may have more beneficial training effects to improve technique used in narrow and compact space with same %HRmax of the regular match, but does not have enough training effects to improve PS, especially in 10 x 10m pitch size.

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**Keywords:** small-sided game, time-motion characteristics, heart rate

**18-IMPACT OF SIX WEEKS OF COMBINED SOCCER PLYOMETRIC AND SPRINT TRAINING ON SPEED AND AGILITY AMONG UNDER WEIGHT MALES**

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King Fahd University of Petroleum & Minerals

**Introduction**
The purpose of this study was to find out the impact of combined soccer, plyometric, and sprint training on speed and agility among underweight males.

**Method**
A group of 26 underweight male subjects were selected for this study from King Fahd University of Petroleum & Minerals. Subjects with BMI (kg/ m2) less than 18.5 were considered for this study. Ages of the subjects were between 18-22 years. The selected physical fitness tests before and after the training program were 20m sprint, 40m sprint, and agility. The training program was employed for six weeks, 45 minutes per training session, two days per week. The combined training was given as per the schedule, plyometric training combined with sprints for 25 minutes and followed by soccer game for 20 minutes. Paired t-test was used to compare pre and post-test for all the selected variables. Data was analyzed using SPSS Version 16.

**Results**
The results of the present study indicate that the participants had improved significantly when pre-test was compared with post-test by 7% in 20m sprint ($3.41 \pm 0.18$ vs. $3.18 \pm 0.25$ sec; $p < 0.001$), by 4% in 40 m sprint ($6.20 \pm 0.46$ vs. $5.93 \pm 0.36$ sec; $p < 0.001$), and by 3.8% in agility test ($18.10 \pm 0.82$ vs. $17.36 \pm 0.74$ sec; $p < 0.001$). The result of 40m sprint time was comparable with the findings of a previous study, which revealed improvement by 1%, (Ronnestad, et al.2008). The enhancement of agility was also evident and supported by an earlier study (Mark et al. 2013).

**Conclusions**
It was concluded that the impact of combined soccer, plyometric and sprint training on underweight participants showed significant performance in all the selected fitness variables from pre to post test, which is very encouraging and significant.

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**Keywords:** metric, speed, underweight

**19-SPRINT-START PERFORMANCE IS RELATED TO THE DIFFERENCES BETWEEN CONTINUOUS FORWARD AND YO-YO SHUTTLE RUN TESTS**

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**Introduction**
Sprinting abilities and endurance performance were shown to be crucial factors of soccer players' performance, and different soccer-specific and unspecific methods are used to assess the endurance performance of athletes (Stolen et al., 2005). Some players show relatively better results in unspecific continuous forward run tests, others in the soccer-specific Yo-Yo shuttle run tests.

The aim of this study was to analyze the relationship between explosive sprint-start performance (SP) and maximal running speed (MS) to the performance in continuous forward run and yo-yo shuttle run tests.

**Method**
20 young soccer players (14.6±0.6 years) performed a sprint test and two incremental running tests within one week in randomized order. The running tests were performed as continuous circle runs (CR) as well as yo-yo shuttle runs (SR), where running direction changed every 20 meters. Starting at 6 km/h, running speed was increased 0.5 km/h every 200 m till exhaustion. Heart rate (HR) was measured continuously and HRTP was determined in both running tests (Hofmann & Pokan, 2010). SP (0-5 meter) and MS (20-30 meter) were determined by a 30 meter maximal sprint test after a 20 min warm up.

**Results & Discussion**
Mean SP and MS were 1.10±0.07 s and 26.8±1.9 km/h respectively. Mean running speeds at HRTP (11.9±1.3 km/h vs. 10.4±0.8 km/h) and maximal velocities at termination of the tests (15.1±1.6 min-1 km/h vs. 12.8±0.9 km/h) were significantly different between CR and SR (p<0.01). SP showed a significant relationship to running speed at HRTP (r=0.597, p<0.05) and velocities at termination (r=0.642, p<0.05)) at CR but not at SR. Differences in maximal running speed between CR and SR significantly decreased with increasing SP (r=0.604; p<0.05) but not at HRTP (r= 0.542; p=0.068) and MS.

**Conclusion**
Increased SP reduced the loss of performance in the SR indicating that SP is a necessary component of the running performance in the SR. We may suggest soccer specific SR and sprint tests as well as CR tests to interpret the endurance performance of soccer players.

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**Keywords:** Sprint performance, endurance performance, soccer

**20-RELIABILITY OF FIELD BASED PERFORMANCE MEASURES IN ELITE FEMALE SOCCER PLAYERS**

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**Introduction**
Field tests are used extensively for evaluating the fitness of elite soccer players (1). A factor of primary importance in test selection is the test reliability (2). To date limited information exists on the reliability of field-based performance tests in elite female soccer players particularly junior players (3). Therefore, we aimed to determine the reliability of a battery of field-based performance tests in a group of junior and elite female soccer players.

**Method**
A total of 140 elite female soccer players from within the English national system (U15, U17, U19, U23, senior) were studied. Performance tests were measured on two occasions at the same time of day, separated by seven days. All players were fully familiarised with performing the test battery. The test battery included jump tests (static, drop and countermovement jumps), acceleration (5-30 m), repeated sprint (7 x 30 m with 30 s recovery) and Yo-Yo intermittent recovery level 1 (YYIR1). Paired t-tests were used to assess evidence of systematic bias between repeated trials. Data were further explored using the standard error of measurement (SEM) and percentage SEM (% CV).

**Results & Discussion**
There was no significant difference between repeated trials in any performance test across all age groups (p>0.05). When expressed as a %CV values ranged from 2.0-4.9%, 0.6-2.6%, 1.2-2.2% and 3.2-7.8% in the jump, acceleration, repeated sprint and YYIR1 tests, respectively. Reliability generally improved in the jump, repeated sprint and YYIR1 tests with increasing age. This trend was not apparent in the acceleration tests.

**Conclusion**
Both elite junior and senior female soccer players are able to adequately reproduce a variety of soccer related performance tests.

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**21-THE EFFECTS OF NITRATE GELS ON HIGH-INTENSITY INTERMITTENT REPEATED SPRINT PERFORMANCE**

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**Introduction**
Team sports, such as soccer, are characterized by high intensity intermittent exercise (Drust, 2000). To support performance, nutritional aids are frequently used. A new and innovative research area that has shown favorable results during continuous exercise is inorganic dietary nitrate ($NO_3$-) supplementation. Research in this area has shown beneficial effects for health and exercise. These findings provide a rationale for the supplementation of dietary $NO_3$- within intermittent exercise. The aim of this study was to investigate the effects of dietary $NO_3$- supplementation on repeated sprint performance (RSP), measured as time to exhaustion (TTE), following a standardized bout of RSP.

**Method**
9 healthy recreational football players (22 + 2 yrs; 75.8 + 6.6 kg; 1.79 + 0. 7m) volunteered. Loading periods were either a $NO_3$- gel (NG; containing 250 mg of $NO_3$-) or placebo gel (PG), conducted in a double blind, repeated measures, counter balanced format. The supplementation process consisted of 2 gels per day for 4 days. The experimental protocol (Drust et al., 2013) consisted of 3 distinct phases. An initial exercise phase included ten 15 s sprints at 23 km/hr interspersed with 15 s of static recovery, a subsequent static recovery period of 5 mins, and finally a performance test in which the sprint increased by 5 s while the static recovery decreased by 5 s after five sprints until exhaustion. Measurements collected pre, during and post-test include: HR, RPE, lactate and VO2 ml/min-1. Performance was analyzed using a paired-t test, whilst physiological measures were analyzed using a 2-factor repeated measures ANOVA.

**Results & Discussion**
TTE was not significantly different between conditions during the RSP ($p = 0.230$). No significant physiological difference ($p > 0.05$) was observed between conditions for any of the measured variables during the protocol.

**Conclusion**
This data suggests dietary $NO_3$- supplementation in gel format does not improve RSP. This may indicate that $NO_3$- may not be an effective ergogenic aid for high intensity intermittent sport such as soccer.

**References**
Drust, B. et al (2000) J Sports Sci. 18(11):885-92.

Drust, B. et al. (2013) Sci & Foot VII. 107-111.

**Keywords:** Ergogenic aid, High intensity intermittent exercise

**22-COMPARISON OF GPS AND INERTIAL SENSOR TRAINING DATA WITH FIELD PERFORMANCES**

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**Introduction**
GPS and inertial sensor technology is commonly used to monitor training, but it is not clear if the data are able to predict adaptive responses. The aim of the present study was to monitor changes in training load through pre-season and early competition and compare them to field based performance measures.

**Methods**
18 male elite soccer players (age 18.3± 1.2 yrs) were monitored over 50 training sessions covering early pre-season (EPS), late pre-season (LPS) and early competition (C). EPS focused on aerobic development through extended area and duration small-sided games and interval running; LPS and C focused on anaerobic development with reduced area and duration small-sided games and high velocity interval running. Distance, velocity, acceleration and deceleration data were recorded using 5Hz Catapult Minimaxx units. Aerobic performance, speed and power were measured at 6-week intervals by YoYo IR2 test, 20m sprint and squat jump.

**Results & Discussion**
The average distance covered per week during training was significantly reduced from EPS to LPS (total distance 37.9±3.7 to 27.8±4.3 km; relative distance 70.1±3.5 to 65.0±4.1 m.min-1 [$P<0.05$ in both]). Only total distance covered was reduced from LPS to C (27.8±4.3 to 24.8±1.8 km, $P<0.05$). During EPS the average distance covered in the YoYo IR2 was 1082±184 m, increasing to 1383±217 m in LPS ($P<0.05$) and remaining higher in C at 1400±277 m (but not different from LPS). The average distance at speeds over 21 km.hr-1 was higher at LPS when compared to EPS (1.18±0.7 vs 0.70±0.2 km) but lower at C when compared to EPS (0.42±0.1 vs 0.70±0.2 km) [$P<0.05$ in both]. 20 m sprint performance was worse at LPS compared to EPS (3.12±0.07 vs 3.05±0.11 s, $P<0.05$) but not different at C when compared to EPS (3.09±0.06 vs 3.05±0.11 s).  The accumulated amount of decelerations (>3m.s-1) progressively decreased from EPS through LPS to C (916±236 to 742±159 to 657±61, $P<0.05$ in each comparison). Squat jump performance did not change during the different phases (EPS 60.5±5.9 cm, LPS 61.0±4.6 cm and C 63.8±6.2 cm).

**Conclusion**
These data suggest that performance is not easily predicted by monitoring training without match play.

**Keywords:** GPS, Training Load

**23-RELIABILITY, VALIDITY AND MINIMAL DETECTABLE CHANGE OF A NEW MULTI-CHANGE OF DIRECTIONAGILITY TEST FOR SOCCER PLAYERS**

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**Introduction**

This study examined the test-retest reliability, validity and external responsiveness of a new multi-change of direction agility test (NMAT) designed for soccer players.

**Methods**

Forty-four Tunisian soccer players were recruited and were divided into two groups according to their playing levels (International, n = 21 and National, n = 23). Following familiarization, athletes performed squat jump (SJ), countermovement jump (CMJ), running speed test (5 m and 20 m), 15-m agility run (Agility-15 m), 15-m ball dribbling (Ball-15 m), and NMAT and ball dribbling NMAT (Ball-NMAT) in 2 sessions, 48 h apart.

**Results & Discussion**

The intraclass correlation coefficient and SEM values were .96 (CI 95%: .94 - .98) and .05 seconds for NMAT and .97 (CI 95%: .94 - .98) and .09 seconds for Ball-NMAT, respectively. The smallest worthwhile changes were greater than their SEM for both NMAT and Ball-NMAT. The MDC95 values were .15 seconds and .25 seconds for NMAT and Ball-NMAT, respectively. Both NMAT and Ball-NMAT were respectively correlated with Agility-15 m (r = .78; p < .001) and Ball-15 m (r = .81; p < .001). Similarly, significant correlations were observed between both NMAT and Ball-NMAT and leg power and straight sprint (.01 < p < .001). International-level soccer players were better than national-level in all tests including NMAT and Ball-NMAT (.01 < p < .001). The areas under their receiver operator characteristics curve were > .7 (.85; CI 95%: .71 - .94 and .91; CI 95%: .78 - .97 for NMAT and Ball-NMAT, respectively). These results indicated that NMAT provides excellent absolute and relative reliabilities.

**Conclusion**

The NMAT can distinguish soccer athletes of different competitive levels. Thus, the NMAT may be suitable for field assessment of specific agility of soccer players.

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**Keywords:** Agility, Field-Testing, Change of Direction, Soccer, Relative Reliability, Absolute Reliability

**24-COMPARING ATHLETIC PERFORMANCES, STABILITY, AND COMFORT IN ATHLETES WEARING THE UNDER ARMOUR® BLUR CLEAT DURING DIFFERING EXTERNAL ANKLE SUPPORT CONDITIONS**

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**Introduction**
Ankle sprains have the highest incidence rate in soccer with 3.19 injuries occurring per 1000 exposures (1). These injuries occur due to insufficient stability and proprioception at the ankle joint, but previous research has demonstrated that external ankle supports decrease this incidence by increasing joint stability and proprioception. Research has been inconsistent regarding these exact mechanisms and their effects on athletic performance (2). The purpose of this study (HS IRB 395019-1) was to determine if the addition of elastic taping (ET) or a neoprene sleeve (NS) alters performance, stability, and comfort in soccer players compared to wearing a soccer cleat without any external support (C).

**Methods**
Twenty male club soccer players (age 19.8) were recruited and randomly assigned to the 3 conditions. The Under Armour (Baltimore, MD) Blur cleat was used for all testing sessions.  Functional testing (40-yd dash, vertical jump, 10-yd pass, and 10-yard dribbling through cones) and comfort assessment (questionnaire) for each condition took place in 1 testing session, while stability testing (BESS test, ankle arthrometer, and a threshold to detection of passive movement (proprioception) measure using an isokinetic dynamometer) was completed during an additional session held no less than 7 days apart.

**Results & Discussion**
There was a significant difference (P=.001) between the C, ET, and NS in inversion/eversion (I/E) ROM (46.4 vs. 39.6 vs. 42.7 deg). There was no significant difference for the 40-yd dash (5.07 vs. 5.02 vs. 5.03 sec), vertical jump (66.2 vs. 64.4 vs. 66.0 cm), 10-yd pass (30.2 vs. 29.9 vs. 30.8 cm), 10-yard dribbling through cones (9.94 vs. 10.22 vs. 9.94 sec), comfort (60.6 vs. 65.9 vs. 65.8 mm), support (1 vs. 13.9 vs. 11.9 mm), BESS (2.3 vs. 2.9 vs. 2.2 errors), AP translation (7.2 vs. 6.7 vs. 7.1 mm), and proprioception (1.5 vs. 1.5 vs. 1.5 deg. of error). These results suggest that both the NS and ET provide a reduction in I/E ankle ROM (improved stability) without a detrimental effect on comfort or performance.

**Conclusion**
Despite the reluctance of some soccer players to have ankles taped or utilize external supports, evidence from this study suggests that comfort and stability can be provided for simultaneously without any decrement in soccer performance.

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**Keywords:** soccer, injury, ankle, proprioception

# Youth Development

## 25- POSITIONAL SPECIFIC ANTHROPOMETRIC AND PERFORMANCE DATA OF TALENTED MALE YOUTH FIELD FOOTBALL PLAYERS

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### Introduction
Several publications suggested positional specific performance data for professional soccer players and there seemed to be only limited normative data for youth football players. In particular the AIM of this study was to investigate positional specific anthropometric and performance data of talented male youth field football players in New Zealand.

### Methods
Talented youth field football players from three national talent centers in New Zealand were tested for a age, height, estimated peak-height-velocity (PHV), YoYo Intermittent Recovery Test Level 1 (YYIRTL1), 10- and 20-meter sprint (10M, 20M) and horizontal jump (HJ) on four different occasions, each separated by 6 month. A rolling average was applied to all data and therefore a total of 509 measurements obtained from the testing. Participants were then grouped into FIFA suggested age bands FIFA (U17, U15, U13) with respect to their playing position. An ANOVA with Bonferoni Post-hoc analysis was used to investigate differences between positions within the same age band.

### Results & Discussion
U17 defenders were significant heavier compared to midfielders and strikers. U15 strikers were significant faster (10M & 20M) compared to midfielders. Unlike positional specific professional football performance data, there seemed to be only limited differences between positions within a FIFA age band.

### Conclusion
Only limited positional specific performance data differences exist in New Zealand talented youth field football players.

**26-TIME-MOTION ANALYSIS OF ELITE YOUTH SOCCER ACCORDING TO PLAYING POSITIONS: A TOURNAMENT SCENARIO**

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**Introduction**
While elite professional soccer competition has a well-established activity profile (1), few studies have investigated how time-motion demands of elite youth soccer vary according to playing position. The main purpose of this study was to analyze the time-motion characteristics of U15 elite soccer players according to their playing positions, during a series of tournament matches.

**Methods**
A total of 82 young soccer players (U15) were monitored using a 15 Hz's GPS system (GPSports, Camberra, AUS) during 12 matches of "The Next Generation Trophy 2013", lasting 50-to-60 mins. Players were distributed by six playing positions: Goalkeepers (GK), Central Defenders (CD), External Defenders (ED), Central Midfielders (CM), External Midfielders (EM) and Forwards (FW). Total distance covered (m), maximum speed (km/h), average speed (km/h), number of impacts (n), number of sprints (n), distance covered at high speed (m) and speed zone exertion (km/h) were measured. One way ANOVAs were performed to examine differences between positions. Bonferroni's post hoc tests were used also for pairwise comparisons.

**Results & Discussion**
The GK showed significant differences ($p \leq .002$) from all the other positions in all variables. Total distance covered and average speed were significantly lower for CD ($5219.0 \pm 262.7$m and $6.2 \pm 0.4$km/h) and ED ($5254.6 \pm 459.6$ m and $6.2 \pm 0.5$km/h) than for CM ($5860.2 \pm 596.0$m and $6.9 \pm 0.7$km/h) and EM ($5284.7 \pm 474.5$m and $6.9 \pm 0.5$km/h; $p < .05$). Concerning the number of sprints, the CD ($20.6 \pm 4.7$) showed significant lower values than CM ($28.9 \pm 9.9$) and EM ($34.5 \pm 9.0$), while the ED ($24.5 \pm 5.2$) showed also significant differences from EM. The distance covered at high speed was significantly lower in the CD ($353.6 \pm 64.9$m), than in the EM ($528.0 \pm 194.7$m) positions.

**Conclusion**
These data revealed that time-motion demands of elite youth soccer players have a similar trend as their elite professional counterparts. Namely, midfielders tend to cover higher distances than defenders while EM obtained the highest number of sprints and the highest distance covered at high speed (1).

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**Keywords:** Positional role, GPS, Elite youth soccer

**27-CORRELATION BETWEEN TRAINING VOLUME AND TECHNICAL SKILLS DEVELOPMENT IN YOUNG SOCCER PLAYERS**

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**Introduction**
This study aimed to assess the influence of the amount of practice on the development of technical skills in youth soccer players during an entire training season (2012/13).

**Methods**
Parental consent was obtained for 33 youth players who participated at the same local (Fermo, Italy) Under 14 championship and belonged to two official clubs, although they shared the same property, facilities, technical direction and annual planning of matches and training [i.e. weekly frequency (n=3) and duration (90') of units, and qualitative and quantitative aspects of loads]. Accordingly, two different rosters were provided for players born in 1998 (U.S. Fermana, n=15; age 14) and in 1999 (AFC Fermo, n=18; age 13), respectively.
The players' technical skills were assessed at the beginning (September=T0) and end (June=T1) of the season by means of a technical skill tests battery (1): Ball control with the body (CB), Ball control with the head (CH), Dribbling (DR), Dribbling with pass (DP), Pass accuracy (PA) and Shooting (SH). Number of touch (n) for CB and CH, time of performance for DR and DP and points for PA and SH were registered as tests outcome, respectively.
To assess the influence of workout exposure, the sample was pooled and an inter-quartile range was used to create two sub-groups based on the annual amount of effective training. Pearson's correlation was applied to test the relationships between amount of training and tests variance (T0–T1) in both groups.

**Results & Discussion**
In relation to the workout exposure, two ranges of 5433-6479 and 3167-5385 hours of effective training (without rest periods) were defined as higher (n=17) and lower (n=16) exposure, respectively. The higher group showed significant ($P<0.05$) relationship between workout exposure and DP ($r=-0.65$) and DR ($r=-0.62$), while no relationships emerged in other skills for both the higher and lower groups.

**Conclusions**
Findings suggest that workout exposure is mainly related to tests' outcomes expressed as time of performance (DR and DP), rather than those expressed as score and touches, particularly in the higher group of exposure.

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**Keywords:** youth, technical skills, time of practice

## 28-HORMONAL LEVELS (SOMATOTROPIC AND CORTICAL-GONADOTROPIC AXIS) AND PHYSICAL FITNESS IN ELITE YOUNG SOCCER PLAYERS : TWO-YEAR FOLLOW-UP

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### Introduction
The state of somatotropic, gonadal and cortical axis hormones is well known to be affected by physical training in both sexes (1). This is true for soccer, as the hormonal responses of young players during intense training (as well as during single game) are tremendously affected (2). However, effects of long-term intense soccer training on the hormonal adaptations are not well known. Consequently, in this study, we evaluated the effect of two soccer-training seasons on hormone concentrations of somatotropic and cortical-gonadotropic axis and physical fitness of elite young soccer players.

### Methods
Twenty elite soccer players (SP, age 14.5 ± 0.4 years) and 20 control untrained subjects (CS, age 14.3 ± 0.3 years) participated to the study. Anthropometric measurements, aerobic and anaerobic soccer relevant performances and plasma Testosterone (T), Cortisol (C), sex hormone binding globulin (SHBG), T/C ratio, insulin-like growth factor-1 (IGF-1), insulin-like growth factor binding protein-3 (IGFBP-3), and growth hormone (GH) were assessed 5 times (from T0 to T4) during two competitive seasons.

### Results and Discussion
Both groups increased their physical performances over the 2-year period, but the changes were greater in SP. Significant differences from basal values (Δ) of T and C concentrations between SP and CS were observed at (T2-T3), (T3-T4) and (T0-T4) (p<0.01). Significant differences of Δ for SHBG between SP and CS were observed at (T1-T2) and (T0-T4) (p<0.01). SP significantly (p<0.05) increased T and T/C ratio and decreased SHBG and C concentrations. Additionally, the hormonal changes for T and T/C ratio were positively correlated to physical performance (p<0.05). SP had higher GH, IGF-1 and IGFBP-3 than CS at all-time points. Significant correlations over the 2-year time period were only observed in SP between IGF-1, IGFBP-3 and the jumping tests (r=0.45-0.48; p<0.01).

### Conclusion
Our results suggest that intense soccer training was associated with positive hormonal changes, which did not impair growth and performance in young SP.

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**Keywords:** Football, Exercise, Training, Hormones

**29-SOCIO-CULTURAL CONSTRAINTS INFLUENCING THE DEVELOPMENT OF BRAZILIAN FOOTBALLERS**

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**Introduction**
According to many commentators, Brazilian footballers have traditionally played with a uniquely creative and flamboyant style, which encompasses a high level of expertise of perceptual-motor skills. Under the view of dynamical system theory, expertise in sports emerges from the interaction of multiple constraints (e.g., interaction of individuals with the available environmental constraints such as, family, training, and play)[1]. However, the few studies in sport expertise have considered the role of socio-cultural constraints or investigated how informal, and even aversive, learning environment constraints can affect skill development[2]. In this study, we investigated a variety of socio-cultural contexts of Brazilian football through a multi-qualitative methodological approach, based primarily on Bronfenbrenner' bioecological model.

**Method**
Data was generated by the triangulation of three techniques commonly employed in this type of qualitative research: open-ended interviews, participant observations and historically contextualised analyses.

**Results & Discussion**
Collectively, the results show that different levels of socio-cultural constraints have contributed to the development of a commonly-perceived Brazilian style of playing (i.e., ginga), which demands a high calibre of perceptual motor skills. Such constraints include: pelada (pick-up games), family support and clubs, poverty, samba/capoeira and malandragem (i.e., means by which one may gain advantage over another, other illicit; also indicating a person who is a quick thinker in finding a solution for a problem).

**Conclusion**
A range of unconventional, and apparently aversive, socio-cultural constraints have influenced the development of Brazilian footballers. Despite this fact, some of the best players in the world have emerged from the intense practice environments typical of Brazil.

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**Keywords:** brazil, environment, expertise

**30-EVALUATION OF THE NUMBER OF FOREIGN FOOTBALL PLAYERS PLAYING IN THE TURKISH PROFESSIONAL FOOTBALL LEAGUE ACCORDING TO THE OPINIONS OF THE SPORT SOCIETIES**

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**Introduction**
The success expectancy from football clubs and national team has always been high in Turkey. Kuper & Syzmanski (2009) associated the football success of a country with 3 factors which are population, income per capita, football experience and claimed that Turkey would be one of the leading countries in football due to its population size and potential players (1). However, when these expectations are compared with the performances of football clubs and national team's performance, the club teams fail to show consistently performance (2) and also consider that the Turkish national football team did not qualify for the Brazil 2014 and is experiencing its worst season within the past 20 years (3,4) proves that Turkey hasn't met the standards in international football yet. In this case, while the factors affecting the success of both the club teams and the national football team are being discussed, the affects of having a number of foreign footballers playing in the league is worth discussing. The aim of this study was to evaluate the pros and cons of having numerous foreign footballers playing in the Turkish Football League on the success of the Turkish football according to the opinions of the sport societies.

**Methods**
The survey was nationwide with a sample of 2602 people aged 15 years and over who were thought to have an in interest in football or any other sports and have knowledge about Turkish football, mostly supporters, students, footballers, trainers, media staff, managers, sportswriters and spectators.

**Results & Discussion**
The results, according to the sport societies, indicated that having numerous foreign footballers in the Turkish league, would improve the quality of play and make it more enjoyable to watch. In addition, having more foreign footballers would increase the competitiveness of Turkish teams in international organizations on the club level and would contribute to improvement of transfer market and help promote Turkey.   On the other hand, respondents believe that having too many foreign players would have negatively impact the national team, infrastructure and the clubs' financial situations.

**Conclusion**
It is thought that having an unlimited number of foreign footballers may not positively contribute to improvement in Turkish football.

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**Key Words:** Turkish Football, Foreign Footballer, Number of foreign footballers.

**31-DIFFERENCES IN DECISION-MAKING TIME BETWEEN SOCCER AGE GROUPS**

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**Introduction**
Soccer-related research indicates that decision-making is important for the quality of actions in a match (1). According to players' experience in a sport, there is some variability in decision-making time, as the higher a player's experience, the better and quicker his/her decisions will be over his/her soccer development years (2). Thus, the aim of this study is to examine decision-making time of soccer players from different age levels in a test of declarative knowledge.

**Methods**
The sample comprised 46 male soccer players, 25 from the U-15 and 21 from the U-17 age levels. The instrument used was the test of declarative knowledge developed by Mangas (1999). Tests were video recorded and players' decision-making times were obtained considering the interval between the scene pause and the start of players' verbalizations. Shapiro-Wilk's test and Mann-Whitney U were performed to verify data distribution and to examine differences between groups. This study had the approval of the Ethics Committee for Research with Human Beings from the Federal University of Viçosa, Brazil.

**Results & Discussion**
Significant differences were observed in the mean response time (P=0.039) and in the mean time for incorrect responses (P=0.008) between U-15 and U-17 levels. It is noted that U-17 level spent less time to make decisions, an important factor due to the specific sport's constraints. U-17 players were also quicker in making decisions when responses given were incorrect, thus indicating that players tend to make quick decisions, despite not being concerned with the quality of such decisions.

**Conclusion**
U-17 youth soccer players take less time in their decision-making even when such decisions are not the most appropriate.

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2. Allard, F. et al (1993) Cognitive issues in motor expertise. 95-107.

**Keywords:** Soccer, Youth Levels and Decision-Making

**Acknowledgements**

**32-COMPARISON OF DECLARATIVE TACTICAL KNOWLEDGE BETWEEN U-11 AND U-17 YOUTH SOCCER PLAYERS**

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**Introduction**
Skilled players show a more elaborate knowledge basis during the performance of specific tasks (1). Therefore, these players differ from the less-skilled ones with respect to the kind and amount of knowledge they possess, besides the way they employ this knowledge during tasks. Thus, the aim of this study was to compare the declarative tactical knowledge between U-11 and U-17 youth soccer players.

**Methods**
The sample comprised 36 youth soccer players, equally grouped into U-11 and U-17 age levels. The instrument used to assess declarative tactical knowledge was the test developed by Mangas (1999). This instrument includes the assessment of 13 offensive soccer video sequences. The scenes are projected onto a large screen and, prior to the end of each sequence, the videos are paused and the participants verbalize on the best move for the player in possession. For data analysis, scores were calculated according to the quality of response in which 1 point is given for the best, 0.75 for the second best, 0.5 for the third best and 0.25 for the worst response. No points are given for wrong answers. Descriptive statistics (means and SD) were performed. Shapiro-Wilk test was used to verify data distribution. To compare means between both age levels, Mann-Whitney U was utilized ($P<0.05$). SPSS 18.0 was used for statistical procedures.

**Results & Discussion**
Statistically significant differences were observed between the two age levels in scores 1 ($P=0.001$), 0.5 ($P=0.04$) and 0.25 ($P=0.026$), while only in the best responses (1 pt.) U-17 players were superior when compared to U-11 players. These results are explained by the fact that more experienced players present a larger knowledge basis, thus being able to identify more relevant stimuli underpinning decision-making, and therefore becoming more efficient (1).

**Conclusion**
It is concluded that U-17 players display better declarative tactical knowledge in comparison with U-11 players.

**References**
1. Williams, M. et al. (1993) Percept. Mot. Skills 76(2), 579-593.

**Keywords:** soccer, tactics, declarative tactical knowledge

**33-UTILIZATION OF PUPILLOMETRY FOR THE ASSESSMENT OF TACTICAL KNOWLEDGE OF SOCCER PLAYERS WITH DIFFERENT POSITIONAL ROLES**

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**Introduction**
Studies based on pupillary assessment indicate that the pupil dilates gradually as a higher degree of cognitive effort is demanded (1). Therefore, this assessment method seems to be important to examining the level of knowledge of different groups by a more objective form. Thus, the aim of this study is to verify whether there are differences in the pupillary behavior of soccer players with different positional roles in a test of declarative tactical knowledge.

**Methods**
The sample comprised 12 U-17 youth soccer players (6 forwards and 6 defenders). The test of declarative tactical knowledge developed by Mangas (1999) was conducted. Mobile Eye-XG was used to assess pupil diameter. Video footage of the test was classified in four moments: M1) from the start to the end of the video scene; M2) from the end of the video scene to the start of player's verbalization; M3) from the start to the end of player's verbalization, and; M4) from the end of player's verbalization to the start the next video scene. Descriptive analyses (means and SD) were performed for the values pupil diameter. Student's t-test and one-way ANOVA were performed through SPSS 18.0 to verify differences between the four test moments, and to compare values between players from different positional roles, respectively ($P<0.05$).

**Results & Discussion**
Inter-group analysis displayed significant differences between all the four test moments ($P=0.001$). Pupil diameter reached its peak during the information-processing phase (M2) and decreased as the player verbalized his decision (M3). These results corroborate some studies that indicated that during this phase, pupil diameter tends to reach its peak (1, 2). Intra-group comparisons did not display significant differences in pupillary behavior of soccer players with different positional roles [($F(3)=1.342$; $P=0.274$)].

**Conclusion**
There are no differences in pupillary behavior of soccer players of different positional roles during a test of declarative tactical knowledge.

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2. Cardoso, F., Teoldo, I. (2013) R. Min. Educ. Fis. 9(1), 1087-1094.

**Keywords:** Pupillometry, declarative tactical knowledge, soccer

**Acknowledgements**

# Women's Soccer

**34-RELATIONSHIP BETWEEN STRAIGHT AND CHANGE-OF-DIRECTION SPRINTING IN WOMEN SOCCER PLAYERS**

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**Introduction**
Regardless of gender, to cope with the specific game demands of soccer, players need a high ability to accelerate, decelerate, and change direction in a short distance and in different directions. The literature on male players has demonstrated that sprinting straight (SS) and change-of-direction (COD) tasks are relatively independent qualities (1). Considering the lack of information on female athletes, this study aimed to investigate the relationship between SS and COD tasks in women soccer players.

**Methods**
Eighteen female players (age: range 15-19 yrs; height: 165±5 cm; body mass: 56.1±6.8 kg) competing in the Italian "Serie A" (highest standard) were recruited in this study. They were administered 15m SS and COD (with two 60° change of direction) sprint tests (2). In both SS and COD tasks, time (s) at 5m, 10m, and 15m and split time (0-5m, 5-10m, and 10-15m) were registered by means of photocells (Microgate, Italy). The relationship between the two tests and differences between split times for the COD test were analyzed ($p<0.05$).

**Results & Discussions**
A significant correlation ($r=0.50$; $p=<0.05$) between SS and COD was found only for total time at 15m. For the COD test, mean split time at 0-5m (1.49 s) was significantly ($p<0.05$) slower than at 5-10m (1.35 s) and 10-15m (1.38 s).

**Conclusions**
The lack of significant correlation between SS and COD time at 5m and 10m split distances and the low correlation at 15m ($r2=0.25$) indicate a little commonality between the two tasks.
When COD split times are considered, the slower performance at 0-5m with respect to those at 5-10m and 10-15m highlights the high influence of deceleration ability over a short distance with a standing start position. In conclusion, these findings support the knowledge that SS and COD tasks are somewhat independent (1), regardless of gender of soccer players.

**References**
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2. Condello, G. et al. (2013). Int J Sports Physiol Perform. 8(2), 211-212.

**Keywords:** change of direction, straight sprinting, deceleration ability

**35-PHYSICAL DEMANDS OF REGULAR SEASON AND PLAYOFF MATCHES IN PROFESSIONAL FEMALE SOCCER PLAYERS**

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**Introduction**
Researchers have described the movement profiles of domestic and international matches for high-level female soccer players (1,2). To date, no studies have reported on the physical demands of playoff matches. The aim of this study was to compare the locomotor demands and metabolic power profile between regular season and playoff matches in professional female soccer players.

**Methods**
Professional female soccer players from two teams wore a GPS monitor (SPI-Pro, GPSports, Canbarra AUS) during two regular season matches and one playoff match. Players completing the entire match (n=9) for all three matches were included in the analysis. We compared the absolute and relative distances in 6 locomotor categories (3) as well as the metabolic power (4) during each match.

**Results & Discussion**
There was less walking (8%) and sprinting (15%) but greater distances in other locomotor categories (13-33%) during the playoff match than the regular season matches. Total distance (9%) and workrate (9%) were also higher in the playoff match. The relative proportion of walking was lower and moderate-intensity running was higher in the playoff match. Distance in high (18%), elevated (21%) and maximal (23%) metabolic power categories were greater during the playoff match as well as total (10%) and mean metabolic power (10%).

**Conclusion**
We demonstrate for the first time that professional female soccer players have a greater workrate and cover greater distances within moderate and high-intensity velocity bands during a playoff match. Furthermore, distances in all metabolic power categories, as well as mean and total metabolic power, were elevated in the playoff match. This information has implications for coaches and trainers working on the training-recovery balance, as well as those responsible for developing playoff schedules.

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2. Mohr, M. et al. (2008) J Strength Cond Res, 22(2):341–9.
3. Vescovi, JD (2013) Int J Sports Med, in press.
4. Osgnach, C. (2010) Med Sci Sports Exerc, 42(1):170-8.

**Keywords:** women's soccer, locomotor demands, metabolic power

## 36-RELATIVE AGE EFFECT AMONG ELITE YOUTH FEMALE SOCCER PLAYERS ACROSS THE UNITED STATES

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**Department o

### Introduction
Relative age effects (RAEs) have been detected in sport when asymmetry in birthdate distribution significantly differs from the distribution of the birthdates of the general population.  Research findings over the last two decades have demonstrated asymmetry in birthdate distributions among elite youth and senior male professional soccer players. The consequence of RAEs has been an overrepresentation of athletes born early in the cohort and an underrepresentation of athletes born late in the cohort, indicating systematic discrimination against the youngest. Despite the growth in women's soccer around the world and the wealth of research published on RAEs, there are significantly fewer studies that examine this phenomenon among female soccer players, and even less on elite youth female players across the U.S.  Therefore, the purpose was to determine the existence of RAEs among elite youth female soccer players competing in the Elite Clubs National League (ECNL) during the 2012-2013 season.

### Methods
Player birthdates (u14-u18 N = 7,294) were collected from the ECNL website and compared to the birthdate distribution for the general population.

### Results & Discussion
Player birthdates were organized into quartiles (Q1-Q4) based upon the ECNL competition year of August 1st-July 31st. The data revealed a RAE across all age groups (u14-u18) indicating a preference for the selection of the oldest in the cohort.  An overrepresentation of players was observed in Q1 and an underrepresentation of players in Q4 among the u14-u17 age groups.  Among the u18 age group, an overrepresentation of players was detected in Q2 and an underrepresentation of players in Q4.  The birthdate distribution for the first and second halves of the playing season showed strong RAEs among the u14-u17 age groups, demonstrating a bias in favor of selection of players born between August and January. No statistically significant difference was found between the first and second halves of the playing season among players in the u18 age group.

### Conclusion
The current research indicated that female players born toward the end of the selection year are disadvantaged in the ECNL.  Future research should focus on key mechanisms that contribute to RAEs in youth soccer.  A framework designed to reduce or eliminate RAEs should be examined and implemented where appropriate.

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1. Baker, J. et al. (2003) J. Sports Sci. Med. 2(1), 1-9.
2. Beunen, G. et al. (1988) Exerc. Spo

**Keywords:** Relative age effect (RAE), youth soccer, females

**37-SUBSTITUTION PATTERNS AND ANALYSIS IN DIVISION I WOMEN'S COLLEGE SOCCER**

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**Introduction**
Soccer is a strategic game, which includes many variables. Two main variables include player fatigue and skill set. Coaches can control either of these variables by making substitutions. The aim of this study was to search for patterns of player substitutions and the position they play; opponent, ranked (R) or unranked (U); by location of game, home (H) or away (A); and elapsed game time.

**Method**
Twenty-four women's Division I soccer games were reviewed for substitution and re-substitution data. Eight games each were reviewed for ranking comparison, UvsR, RvsR, UvsU. Substitutions and re-substitutions were evaluated at 3-30minute time periods (0-30, 30-60, 60-90 minutes) and by position. Data was run through a chi-squared test. A significance of statistical value was set at $p < 0.05$. Further, a bonferroni adjustment was made for post-hoc analysis.

**Results & Discussion**
Total substitutions per team per game averaged 13.8 ± 5.3. Re-substitutions per team averaged 9.6 ± 4.3 with a re-substitution ratio of 70.0%. The number of player who played a 90-minute game was 5.1 ± 1.7. Total number of players involved in the game was 14.6 ± 1.5, not including goalkeepers. There was statistical difference in SUBS between the time periods of 1-30 and 61-90, as well as time periods of 1-30 and 31-60 ($p<.001$), and for each position (defense, midfield, forward) ($p<.001$). A statistical difference in re-substitutions was observed for R (10.63) and U (8.3) teams ($p<0.05$). There were no significant differences between H and A teams ($p=0.876$).

**Conclusion**
This study showed that time, position and opponent all play a role in determining substitution patterns. The total number of substations per team remains high, compared to international standards for this age group. Permissive NCAA substitution rules may affect players' fitness and long term soccer development.

**Keywords:** substitution, match analysis

**38-AGE DIFFERENCE IN THE CHANGE OF DIRECTION ABILITY IN ELITE FEMALE SOCCER PLAYERS OF VARIOUS AGE CATEGORIES**

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**Introduction**
It is well known that change of direction (COD) ability plays an important role in soccer (1). Thus, it is important for coaches to develop a player's COD speed right through adolescence to improve their soccer performance. However, there is little information about when and how the COD ability in female soccer players can be developed (2). Therefore, this study primarily aimed to clarify the age at which COD ability can be developed in female soccer players. The study's secondary purpose was to investigate how their COD ability can be improved.

**Method**
Participants of this study comprised 135 elite female soccer players aged 12.2 to 27.9 years, and they were divided into eight categories (U13 to U19 and Adult). We measured their body height and lean body mass (LBM), and conducted 10 m × 5 COD (10 × 5), 5 step bounding (Bounding), and 10 m sprint (Sprint) tests. Next, we compared all measurements within each category using and Scheffe's test. We also investigated the fitness and anthropometric factors that contribute to the COD ability in younger (U13 to U17) and older (U18 to U19 and Adult) age categories by multiple regression analysis. Values of $p < 0.05$ were considered to be statistically significant.

**Results and Discussion**
The 10 m × 5 COD of U18, U19, and Adult players were significantly faster than those of U13 to U17 players. This result may imply that the COD ability in elite female soccer players improves drastically from ages U17 to U18. Furthermore, in the older age groups, both Bounding ($r = -0.45$) and Sprint ($r = 0.56$) exhibited correlation to 10 × 5, whereas in the younger age group, only Sprint ($r = 0.57$) exhibited a significant correlation. This result may suggest that different strategies are required to improve COD ability in young adult and adolescent players.

**Conclusion**
Coaches should be required to have a specific, age-dependent strategy to develop a female player's COD speed through adolescence.

**References**
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2. Vescovi JD, et al. (2011) Scand. J. Med. Sci. Sports. 21(5), 670-678.

**Keywords:** Change of Direction, Elite female soccer, Training

**39-NUTRITIONAL REVIEW FROM THE FEMALE UNDER-19 EUROPEAN SOCCER CHAMPIONSHIPS**

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**Introduction**
Nutritional provision for tournament soccer is an essential requirement for player preparation. With elite tournament competition lasting up to 4-weeks in duration, requirements for nutritional practices to provide correct and appropriate provision is vital. During UFEA female youth final competitions, all competing nations follow the same menu prepared by UEFA officials. These menus are very generic and may not be suited to the nations training schedules in the build up to matches, or specific tastes. No prior investigation has attempted to gain player feedback on the nutritional provision in competition and forms the rationale for this investigation.

**Method**
18 international female U19 soccer players, from the same national team, were asked to provide their subjective ratings on three key nutritional areas, following the UEFA U19 European Championship. Areas included general food and beverage provision, specific food choices, and sports foods/supplements (Pelly et al. 2009). Players provide values between 1 (very poor) – 5 (very good) to summarize their feelings. Furthermore, players were able to provide specific comments on additional items they would like to receive in future tournaments and generic feedback on the nutritional provision.

**Results & Discussion**
Poor-moderate results for menu variety (mean: 2.64+0.64 AU) and taste (mean: 3.47+0.70 AU) were the two items that were highlighted with reference to general food and beverage provision. Mean values from all variables within the specific food choices (4.17+0.80 AU) and sports foods/supplements (3.92+0.89 AU) suggest these were generally well received. Some additional suggestions were identified that can be utilized in future.

**Conclusion**
For elite competition, both variety and taste of general provision need to improve to ensure adequate food intake to promote recovery, but also support match day preparation. Governing bodies should provide a more suitable menu that provides players with a greater variety of food selection and liaisons with individual nations may provide nutritional practices specific to the teams and allow for more familiarity.

**References**
Pelly, FE. et al. (2009) Nutr Rev. 69(6):321-32.

**Keywords:** Nutrition, Tournament Soccer, Women's Soccer

# Soccer and Health

**40-INTRA-SEASONAL VARIATIONS IN INFLAMMATORY, IMMUNE & HORMONAL SALIVARY BIOMARKERS IN YOUNG ELITE MALE SOCCER PLAYERS**

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**Introduction**
Elite soccer players endure high levels of physical strain and are potentially at risk of non-functional overreaching state or even of overtraining syndrome (1). Signs of disturbance, such as alterations in inflammatory and hormonal responses, may be used to monitor fatigue, recovery and overreaching in athletes (2). In addition, over the course of the playing season, soccer players might have an increased risk of infection because of transient immune suppression (3). The aim of this study was to analyze intra-seasonal variations in inflammatory, hormonal, and immunity salivary biomarkers which may be related to overreaching state in young elite male soccer players.

**Methods**
The cohort belonged to the reserve team from a professional soccer club and was initially composed of 12 players. Drop outs through injury, illness and/or logistical issues led to complete datasets for only 5 players (age: 19.4+0.6 years). Saliva samples were taken from each subject before breakfast, at the same time of the day and prior to morning training, and at least 24 hours after the last training session or match. Sampling was performed once per month over an 11-month period (July-May). Saliva samples were systematically analyzed by the same independent laboratory to determine cortisol, testosterone, dehydroepiandrosterone (DHEA), tumor necrosis factor (TNFα), interleukin-6 (IL-6), and Immunoglobulin-A (IGA) concentrations.

**Results & Discussion**
Over the course of the season, month by month hormonal salivary concentrations varied significantly: testosterone (p=0.002), cortisol (p<0.001) and DHEA (p=0.005). In contrast, this was not the case for concentrations of inflammatory and immunity related biomarkers: TNFα (p=0.111), IL-6 (p=0.476) and IGA (p=0.842).

**Conclusion**
Within the limitations of the small sample size and sampling frequency, the present results could be used both as part of a health screening process and the monitoring of training and match load, fatigue and recovery in young elite male soccer players.

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3. Nieman DC, Bishop NC (2006). J Sports Sci. 24(7): 763-772.

**Keywords:** immune function, testosterone, cortisol, cytokines

**41-EFFECT OF SOCCER TRAINING ON THE SELECTED HEALTH REALATED FITNESS VARIABLES AND MOTOR LEARNING AMONG UNTRAINED MALES**

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**Introduction**
The game of soccer is very popular around the world. Soccer players need a combination of technical, tactical, and physical skills in order to succeed (M.Rajavelu, 2012).Speed may be defined as the capacity of an individual to perform successive movements of the same pattern at the fastest rate. (Kelvin N, 2006). The purpose of this study was to investigate the effect of soccer training on the selected health-related fitness variables and motor learning among untrained males.

**Method**
A group of (N=30) untrained males were selected randomly for this study from the various classes of physical education orientation course; age of the subjects was between 18-20 years. The soccer training was employed on the subjects for 09 weeks, 45 minutes of training per session, two days of training per week at the evening session. The selected health-related fitness variables were Body composition, 50 M. Sprint, and sit –ups. The motor learning ability was tested by kicking ability .To find out the mean differences from pre to post test, mean, S.D and t-tests were computed by means of Statistica Software.

**Results and Discussion**
The analyzing of data reveals that the mean and standard deviation with regard to body mass index of participants from pre to post-test were (25.03, 8.07) and (24.66, 7.45). Regard to 50M sprinting performance with mean and S.D were (8.88, 1.86) and (7.99, 1.62). Sit and reach performance with the mean and S.D were (19.20, 4.04) and (22.93, 4.78). Kicking ability with mean and standard deviation was (0.800, 0.55) and (1.57, 0.50).

**Conclusion**
It is concluded that soccer training enhances the health-related fitness of college males, who showed greater performance from pre to post test in all the selected variables, which is very encouraging and significant. It is also concluded that soccer training showed greater performance on the kicking abilities among the subjects.

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M.Rajavelu, (2012). Factors associated with successful performance of all India inter University football players. Pg: 19-20.

**Keywords:** Resistance, Strength, Intensity, Enhances

**42- THE IMPACT OF PLAYING FOOTBALL IN AN EXTREMLY HOT ENVIRONMENT ON LEUKOCYTE COUNT**

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**Introduction**
Laboratory and field-based experiments have implicated immune suppression as being at least partly responsible for the reported increase in incidence of infection in athletes and is influenced by the level of stress the individual experiences.  These stressful inputs can include a number of factors including intensity and duration of exercise,  the psychological stress of training and competition or a combination.  However, there is little known about whether there is an immunosuppressive effect resulting from the addition of exercise and an extremly hot environment. Therefore, the aim of this study was to compare the impact of playing a football match in a hot environment compared to a cool environment on differential leukocytosis.

**Methods**
Seventeen semi-professionals football players (27±5yrs) completed a football match in a COOL condition (21C; RH 55%) and six days later another match was played in a HOT condition (43C; RH 34%).  Core body temperature was recorded throughout both matches with blood being sampled before and after each match to determine the combined impact of exercise and environment condition on leukocytes cell counts.

**Results & Discussion**
Preliminary data shows that playing condition at no impact on circulating leukocyte cell numbers or the proportion of monocytes, neutrophils or lymphocytes.  Playing football in the HOT condition resulted in some players exceeding a core body temperature in excess of 40C; however, the average was 39.6C, which was significantly higher that what occurred in the COOL (38.3C) condition.  Despite this, it is possible that these players did not reach a critical core body temperature capable of initiaing a significant immune response.

**Conclusion**
This study showed that playing football in an extremely HOT condition does not cause a different response in monocytes, neutrophils or lymphocytes compared to a COOL environment

**43-DO DIFFERENCES IN BASELINE NEUROCOGNITIVE SCORES EXIST BETWEEN COLLEGIATE SOCCER PLAYERS AND NON-CONTACT SPORT CONTROLS?**

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**Introduction**
Some have suggested negative long-term effects of cognitive function and brain physiology from soccer (SOC) heading (1). Purposeful SOC heading is an integral part of the game. Although exposure to purposeful heading is limited during a youth career, it expands as players develop as adolescents. Before embarking on a collegiate SOC career it is theorized that players have had a career of heading exposures that could potentially span 10-15 years. The purpose of this study was to determine if differences in neurocognitive function exist between SOC players and their non-contact (NC) sport counterparts prior to the start of their collegiate playing careers.

**Methods**
Computerized neurocognitive (ImPACT Application, Inc. Pittsburgh, PA) test scores were examined on 318 NCAA Division-I freshmen student-athletes (SA) (164 females, 154 males, 18.6±1.4 yr., 173.5±9.6 cm, 68.9±9.9 kg) over a five year period. Of the 318 SA, 159 participated in SOC and 159 participated in non-contact sports (golf, tennis, swimming). The ImPACT test is a required part of the pre-season medical exam process for all SA and measures a variety of cognitive functions including verbal/visual memory, reaction time, attention, and processing speed. Using ANOVA differences in ImPACT composite scores were examined between male (MS) and female (FS) SOC players as well as their NC sport counterparts.

**Results & Discussion**
Visual memory (p=.009) and reaction time (p=.001) were significantly different between MS and the other 3 groups. Post-hoc analysis indicated that the MS players scored better in both categories. There were no significant deficits in any of the three composite categories: verbal memory (p=.180), visual motor speed (p=.695), and impulse control (p=.388). Interestingly these results suggest that despite various levels of exposure to purposeful heading prior to the start of their collegiate SOC careers, both MS and FS do not demonstrate any deficits in ImPACT composite scores, in fact the MS players even scored better in two categories.

**Conclusion**
There is no evidence of diminished cognitive function between SOC and NC SA at the start of their collegiate careers, despite years of exposure to purposeful soccer heading. We are limited in that we did not control for previous concussion history and/or accurate heading exposures, and recommend future analysis involving these considerations.

**References**
1. Lipton, M. et al. (2013) Radiology. 268(3), 850-857.

**Keywords:** concussion, ImPACT, heading

**44-CHARACTERISTICS ON RUNNING PERFORMANCE AND PHYSICAL RESPONSE OF JAPANESE FOOTBALL PLAYERS IN THEIR 70s**

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**Introduction**

In previous studies over the last 30 years, the distance covered by football players during official matches has been analyzed (Bangsbo et al., 1991). However, no studies have focused on senior players, aged 70s. Therefore, the purpose of this study was to analyze Japanese senior soccer player's running performance and physical response.

**Methods**

Twenty-four healthy senior soccer players (age; $73.2 \pm 3.0$ years, height; $168.0 \pm 6.3$ cm, body weight; $65.9 \pm 6.3$ kg, and BMI; $23.3 \pm 2.0$) volunteered to participate in this study. Subjects were asked to perform 40min. (20min. half) soccer game on full size pitch. Total distance and running speed were analyzed using a GPS device (4Hz, VX Log90, Visuallex Sport International Ltd.). HR was measured every 5 sec. by a heart rate monitor (S610i, POLAR). The locomotion categories were as follows; standing & walking (0-4.4km/h), low-speed running (LSR, 4.4-8.8 km/h), moderate-speed running (MSR, 8.8-13.2 km/h), high-speed running (HSR, 13.2-17.6 km/h), and sprinting (17.6-22 km/h).

**Results & Discussion**

Total distance covered in 40 min. was $3288 \pm 344$ m and ranged from 2758m to 3839m. This was significantly decreased in the 2nd half ($1577 \pm 158$ m) compared with that in the 1st half ($1680 \pm 232$ m) ($p<0.001$). In addition, average running speed was significantly decreased in the 2nd half (1st: $5.0 \pm 0.7$ km/h., 2nd: $4.8 \pm 0.5$ km/h, $p<0.001$). LSR, MSR, and HSR in the 2nd half were significantly decreased compared with those in the 1st half ($p<0.05$). On the other hand, HR during the game was $150 \pm 14$ bpm. HR in the 2nd half was significantly increased compared with that the 1st half (1st: $149 \pm 16$ bpm, 2nd: $152 \pm 11$ bpm, $p<0.05$). These data showed that the exercise was extremely intense in the 2nd half for these senior players, which was caused by accumulation of fatigue.

**Conclusion**

This study provided two important suggestions for seniors: (i) sufficient time on regular training of intensity and (ii) risk management to prevent injury or any other physical trouble in the match.

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**Keywords:** Health, senior, Soccer

**45-VARIABILITY OF CARDIOVASCULAR-DERIVED INDICES OF RECOVERY IN ELITE SOCCER REFEREES**

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**Introduction**
Soccer referees' match heart rates demonstrate a high level of cardiovascular stress (1). An understanding of the physiological stress imposed by matches is required by sports scientists to inform post-match recovery and training protocols. Cardiovascular-derived indices, such as heart rate variability (HRV) and morning resting heart rate (RHR) are useful methods for assessing recovery (2). However, an understanding of the variation in these measures is needed to avoid the misinterpretation of true exercise-induced changes (3). Therefore, the aim of our study was to examine the variation in post-match HRV and RHR in elite soccer referees.

**Method**
Data were collected on 19 North American professional soccer referees across the duration of a 10-month season. Immediately upon waking on the two mornings following competitive matches (9.6 ± 5.7 [mean ± standard deviation] matches per referee), a 150-s period was used to collect HRV (RMSSD) and RHR data. The referees lay motionless in a supine position throughout the 150 s and the lowest value recorded during this time was used for analysis. Heart rate measures (HRVday1, HRVday2, RHRday1, RHRday2) were analyzed using a mixed linear model (IBM SPSS version 21) with random intercepts to estimate the within- and between-referee variability. Variability is expressed as a coefficient of variation and the uncertainty in our estimates displayed as 90% confidence limits (90% CL).

**Results & Discussion**
Within-referee variability was 11.2% (90% CL ±0.8%), 8.9% (±0.6%), 11.3% (±0.8%), and 9.6% (±0.7%), for HRVday1, HRVday2, RHRday1, RHRday2, respectively. Between-referee variability was 11.0% (±3.4%), 9.6% (±3.0%), 12.0% (±3.7%), and 14.2% (±4.4%), for HRVday1, HRVday2, RHRday1, RHRday2, respectively.

**Conclusion**
Moderate to large within- and between-referee variability in cardiovascular-derived indices of recovery should be considered when using these measures to interpret recovery.

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**Keywords:** referee, heart rate, recovery, variability

## 46-THE IMPACT OF SOCCER-SPECIFIC EXERCISE ON POTASSIUM CONCENTRATIONS

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### Introduction
Fatigue during soccer-specific exercise (SSE) has been reported to occur transiently after intense periods of play and in the final stages of competition (1). Increased potassium (K+) efflux from exercising musculature is a suggested mechanism for fatigue during SSE (2). Surprisingly, limited data exists regarding the time-course of K+ accumulation during SSE, as previous authors have measured K+ concentrations pre and post exercise.  Therefore, transient changes in K+ concentrations may be a factor in the reduced physical and technical performance observed throughout match-play. Consequently, the current study aimed to profile K+ response to SSE.

### Methods
Following approval by the Human Ethics Committee at Swansea University and habituation, 13 academy soccer players (age 18 years) completed a Soccer Match Simulation (SMS; 3).  The SMS is a reliable and valid (3) protocol that simulates the physical and technical demands of actual match-play. Blood samples were collected at rest, before each half and every 15 min throughout exercise using 170µl heparinized capillary tubes and analyzed for K+ concentration (GEM Premier 3000). Participants consumed 3.5ml·kg-1 BM of water (containing 23 mmol·l-1 sodium and 14 mmol·l-1 chloride) 10 min prior to each half and after 15, 30, 60 and 75 min of exercise.

### Results & Discussion
Exercise significantly influenced K+ concentrations ($F_{(8,96)}$ = 12.331, $P \leq 0.0005$).  Relative to resting values, K+ concentrations were elevated for the first 45 min (+18.0 ± 8.5%; $P<0.05$) and at 90 min (+19.2 ± 9.8%; $P<0.01$) of exercise.  Notably, during half-time, K+ concentrations dropped below resting values (-11.1 ± 5.8%, $P<0.01$).

### Conclusions
This is the first study to profile the K+ response to the SMS.  Our data suggests that SSE and half-time influences K+ concentrations. However, the influence of K+ concentrations on soccer-specific physical and technical actions remain unclear and thus present themselves as future research opportunities.

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**Keywords:** soccer, potassium, fatigue

# Performance and Match Analysis

**47-SOCCER INJURY PROFILE DURING 19<sup>TH</sup> NIGERIAN UNIVERSITY GAMES HOSTED BY THE UNIVERSITY OF IBADAN, NIGERIA**

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**Introduction**
Soccer, the most popular team sport in the world is associated with injuries. Due to the contact nature of soccer, players are prone to severe injuries which could prevent them from future participation in active sports. The profile of soccer injuries at the 19th Nigerian University Games was studied and the incidence, causes, locations, severity, mode of treatment and effect of play position on injuries were studied.

**Method**
Observational technique was used to obtain relevant data during the competition. A total of 16 matches were played and studied.

**Results & Discussion**
The results were analyzed using frequency, percentages, pie chart and bar chart. Fifty seven players were injured with 113 incidence of injuries recorded. The ankle was most frequently injured with 25 (22.12%) cases, while the groin and the foot regions were the least injured body part (1 case, 0.88%). The incidence of injury to the knee joint was 22 (19.47%). The most frequently injured body segment was the lower extremity, while the least injured body segment was the trunk. Minor injuries recorded were 48 (42.48%), while 2 (1.77%) serious injuries were observed. Most of the injuries sustained were due to direct trauma. Physiotherapy treatment included cryotherapy, massage and passive stretching of muscles. Midfielders recorded the highest number of injuries, while the highest number of injuries was recorded among University of Ibadan soccer players. Federal University of Technology, (FUTA) players sustained 5 (8.8%) the least injury.

**Conclusion**
The most frequently injured segment of the body and body part were the lower extremity and the ankle respectively. Existing rules of the game should be enforced or modified to reduce the incidence of injuries in this body parts.

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**Keywords:** Soccer, Injury, Pattern

**48- THE INFLUENCE OF POSITIONAL INTERCHANGES ON THE TECHNICAL AND PHYSICAL PERFORMANCES OF ELITE SOCCER PLAYERS**

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**Introduction**
Positional variation in physical and technical match performance parameters can be found in elite soccer. However, no data exists on the impact of the same player interchanging from one position to another. Thus, the present aim was to examine the influence of positional interchanges on physical and technical performances of elite soccer players.

**Methods**
Match performance data were collected from eight English FA Premier League seasons (2005-06 to 2012-13) using a multiple-camera computerized tracking system (Prozone Sports Ltd®, Leeds, UK) and consisted of 57 players across 1457 observations. Players completed the entire 90 min across multiple observations in more than one position, a minimum of 2 observations in each. Centre back-full back (CB-FB), centre back-centre midfield (CB-CM), full back-centre midfield (FB-CM), full back-wide midfield (FB-WM), full back-attacker (FB-AT), centre midfield-wide midfield (CM-WM), centre midfield-attacker (CM-AT), wide midfield-attacker (WM-AT), left-right side (L-R) interchanges were analyzed. Magnitude based inferences were calculated using effect sizes (ES) with three classifications: small (>0.2), moderate (>0.5) and large (>0.8).

**Results & Discussion**
Top speed in CB-CM (ES: -1.55) and CM-AT (ES: 1.16); high intensity distance with ball in CB-FB (ES: -2.07), CB-CM (ES: -2.35) and FB-WM (ES: -1.47); high intensity distance without ball in CB-CM (ES: -1.24), FB-AT (ES: 1.02), CM-AT (ES: 1.09); total distance covered in CB-FB (ES: -1.43), CB-CM (ES: -3.22), FB-CM (ES: -1.29), FB-WM (ES: -1.12) were affected by positional interchanges. Sprint distance, numbers and high-intensity distance were influenced by CB-FB (ES: -1.49, -1.42, -1.77) and CB-CM (ES: -1.48, -1.53, -2.14). Technical parameters including total number of shots (ES: -1.02), dribbles (ES: -1.02) and passes (ES: -1.51) were influenced by CB-CM interchange; number of tackles was influenced by CM-AT interchange (ES: 1.03).

**Conclusions**
Positional interchanges place different physical and technical demands on players indicating that positional requirements (physical, technical) are more influential on match performance than physical capacity of players.

**49-ANTHROPOMETRIC AND PHYSICAL CHARACTERISTICS OF TUNISIANS YOUNG SOCCER PLAYERS**

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**Introduction**
The aim of this investigation was to provide anthropometric, physical and physiological performance characteristics of Tunisian young soccer players and to examine the relationship between selected parameters according to their playing standard position.

**Methods**
One hundred under 13-year old (U-13) male soccer players were tested. They were classified according to their playing standard positions (goalkeeper: GK, defender: DF, midfield: MF, and forward: FW). Testing consisted of anthropometric measurements including weight, height, and body mass index, and performance measures of speed (5, 15, and 20 m), agility run (Agility-15 m and Ball-15 m), vertical jumping, ball shooting and aerobic capacity (Hoff Dribble Test and Yo-Yo intermittent Endurance Run, YYIER). GK were taller and heavier than other players.

**Results & Discussion**
Significant differences of playing positions for the majority of the physical tests include 20 m sprint, Agility-15 m and Ball-15 m times (all $p < .01$), as well as squat jump and counter movement jump (all $p < .01$). In addition, weight was significantly correlated with 20 m sprint ($r = .29$, $p < .01$), Agility-15 m ($r = .30$, $p < .01$) and Ball-15 m ($r = .31$, $p < .01$) times as well as ball shooting speed ($r = −.42$, $p < .01$). Multiple regression analyses showed that weight and height were the most significant predictors of 20 m sprint time and the YYIER distance, respectively.

**Conclusion**
Performance abilities between positions in young soccer players appear to be different. Anthropometry can discriminate physical capacities and soccer skills providing a scientific rationale behind the coaches' practice of selecting young soccer players.

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**Keywords:** Young Soccer Players, Anthropometric, Performance, Playing Positions, Relationship

**50-MODELING AND VISUALIZATION OF ACCELERATION ABILITY OF PLAYERS**

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**Introduction**
We have proposed a match analysis method based on the dominant region (1). The dominant region of a player is computed by players' position, velocity and acceleration pattern (AP). An AP includes acceleration vectors for all directions, and it can be regarded as an index of acceleration ability of the player. We have used the same AP for all players, because there is no suitable way to measure the AP of an individual player. Therefore, the aim of this study is to calculate the AP of each player and visualize the acceleration ability.

**Methods**
The best way to collect players' acceleration ability is to use actual match data. The moving speed of players is classified into five levels (Walking, Jogging, Running, High-Speed Running, and Sprinting), and the strength of accelerations to all directions is calculated on each speed level. First of all, moving velocity and acceleration vector are calculated at each time from the positional coordinates of the time series. Then, the maximal strength of accelerations to each direction is extracted, and finally, the parameter of the circle which approximates them is calculated.

**Results & Discussion**
We calculated the AP for 7 players from 13 England premier league matches. For example, in a case of Sprinting (moving speed is over 7 m/s), the strength of acceleration to the forward direction, that of the backward direction, that of the left side and that of the right side were 0.74+/-0.14, 6.35+/-0.31, 3.59+/-0.40 and 3.49+/-0.40, respectively. From these results, we found that there is a difference in acceleration ability among players, and that some players have different acceleration abilities between right and left.

**Conclusion**
From the AP, the differences in acceleration ability of players are easily observed. In the same manner as the moving distance of players, we think that the AP becomes a useful criterion in analyzing individual performance.

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**Keywords:** acceleration ability, dominant region

**51-INFLUENCE OF AN INTENSIFIED INTERNATIONAL COMPETITION SCHEDULE ON PHYSICAL MATCH PERFORMANCE IN YOUTH SOCCER PLAYERS**

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**Introduction**
Previous studies have shown that periods of intensified competition schedules can reduce match-related physical performance, negatively affect recovery and increase injury risk in adult and junior sport team athletes (1, 2).  At present, however, relatively little is known about the effects of a congested match schedule on physical performance variables in youth soccer players.

**Methods**
Fifteen Brazilian soccer players completed five matches performed within 3 successive days in a U15 competition (Austria), and were tracked using a commercial global positioning system (15 Hz, SPI Elite, GPSports, Canberra, Australia). Players who performed at least 75% of the match time in each assessed match were included in the analysis (n = 10; 15.1±0.2 y, 171.8±4.7 cm, and 61±6 kg). Two matches were played during the first day of the competition, two on the second day [25 x 25 min], and one during the third day [30 x 30 min]. Total distance (TD), maximal speed, frequency of accelerations (> 1.8 m•s-1), number of sprints (>18km•h-1), TD performed in sprinting, and body impacts (zone 1 of G force) were analyzed. A MANOVA with a Tukey's post hoc was performed to examine the differences between matches. Statistical significance was set at $p < 0.05$.

**Results & Discussion**
Significant between match differences (p = 0. 004) were observed for the accels/min, body impacts, and body impacts/min. The accels/min were greater during the first match (1.82±0.33; vs. Austria Wien) compared to the second (1.35±0.22; vs Athletic Bilbao), and final match (1.20±0.36; vs. Manchester City). A greater number of body impacts were observed during the final match (2069±1070; vs Manchester City) compared to all other matches; whilst the number of body impacts /min was higher during the last match (37.2±23.1 N/min) compared to matches 2 (16.2±7.9; vs. Athletic Bilbao), 3 (13.5±4.5; vs. New York Red Bulls) and 4 (16.2±7.1; Bayern Munchen).

**Conclusion**
Player acceleration profiles and body impact counts are influenced by congested competition schedules, and these may be sensitive to fatigue or altered tactical strategies. Future studies should examine the mechanisms underlying these changes.

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**Keywords:** Game Analysis, load monitoring, GPS

**52- THE EFFECT OF HOT ENVIRONMENT AND DEHYDRATION ON MATCH PERFORMANCE**

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**Introduction**
It is well known that exercise performance is limited in a hot environment (Nybo, 2008) and during soccer games conducted in hot environments, this could be a major factor influencing various performance aspects (Mohr et al., 2012). However, detailed knowledge is lacking, and therefore the present study was conducted to examine the influence of hot environment and dehydration on match performance.

**Methods**
Match performance was assessed by active profile during game analyzing a computer-based tracking system. Six men's professional soccer players were competing in the match played in temperate (Ta 16.8 °C, Rh 61.7 %; CON) and hot conditions (Ta 31.0 °C, Rh 76.9 %; HOT) for an official Japanese domestic league (J-league). Also 10 men's collegiate soccer players were divided into 5 players with dehydration (3.62 ± 0.51 %; DHY) and 5 players with normal hydration state (0.87 ± 0.42 %; NHY) at the end of game. We compared their match performance during 6 official games in the hot environment (Ta 27.1 ± 1.3 °C, Rh 54.4 ± 14.2 %) to examine the effect of dehydration. Differences in the match performance CON vs HOT and DHY vs NHY were evaluated by a Student's paired t-test.

**Results & Discussion**
The percentage of high speed running during game in HOT was lower than in CON (p<0.05), while that of jogging in HOT was higher than in CON. There were no differences in the total game distance between DHY and NHY. However, the mean values for high intensity running performed in last 15 min period decline compared to first 15 min period of DHY compared with NHY (p<0.05).

**Conclusion**
This study demonstrates that high intensity performance during game decrease in a hot environment, which were associated with dehydration.

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**53-RELATIONSHIP BETWEEN TECHNICAL PERFORMANCE AND DISTANCE COVERED IN PROFESSIONAL SOCCER PLAYERS**

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**Introduction**
The competitive soccer practice presents intensive dispute. Some scholars have tried to associate physical load imposed by the game with the technical performance. The objective of this study is to verify the correlation between distance traveled and utilization of passes in professional soccer players, as well as whether there are differences between the distance traveled and technical efficiency, through the pass in different positions between the first and second period in the game.

**Methods**
The sample consisted of 21 players of a professional football club from the A series tournament of Brazilian soccer, distributed in five positions (defenders, side back, defensive midfielders, wide midfielders and forwards). The study analyzed fifteen games in three different competitions. Technical data (passes) and physical data (distance traveled) were obtained from the technical and physical statistics, respectively.

**Results & Discussion**
The results did not show any significant correlation. There was only one difference between the distance traveled and percentages of successful passes between different positions, as well as the distance traveled between the first and second period ($p < 0,05$; $3401 \pm 672$m *vs.* $3095 \pm 884$m, respectively). The defenders had the best utilization of certain passes and forwards the worst, which is explained by the different actions and functions in the game. The highest average was covered by the defensive midfielders, followed by side back, and wide midfielders.

**Conclusion**
We conclude that there is no relationship between the efficiency of the pass and the distance traveled. Players in all different positions tend to cover less distance in the second half.

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**Keywords:** analysis of physical activity, distance covered, soccer statistics

**54-MORPHOLOGICAL, FUNCTIONAL AND TECHNICAL PROFILE OF YOUNG BRAZILIAN SOCCERS**

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**Introduction**
The purposes of this study was to describe and compare anthropometric characteristics, physical fitness and specific soccer skills in youth, Brazilian soccer players, as well as possible differences in the variables referenced in function of biological maturation in age categories.

**Methodology**
The sample was comprised of 245 male soccer players (under 15, n=161; under 17, n=84). The assessed anthropometric measures included body mass, stature and skinfolds. Biological maturation was assessed using the development of pubic hair. Functional assessment was done with the following tests: squat and countermovement jump, Yo-Yo intermittent endurance test (level 2), RAST, 5 and 30 meters speed and the T agility test. Soccer-specific skills were assessed using three tests: ball control, dribbling and kick accuracy. Statistic procedures included descriptive statistic, independent t-test and analysis of variance (ANOVA).

**Result**
The results indicated that U17 soccer players, in comparison with U15, showed higher body size (stature and body mass), more sports experience (years of practice and training volume) and better performance in most of the functional tests. No significant differences were found in adiposity and soccer- specific skills between competitive levels. Significant differences were observed depending on the maturational stage only in the sub-15 in anthropometric and physical fitness variables.

**Conclusion**
In conclusion, the under -17 players differ from the under-15 players in anthropometric characteristics and functional capacities. However, no effect was detected in two out of three soccer-specific skills. Maturation was only associated with physical fitness components in under-15.

**Keywords:** Anthropometry, Fitness, Young Brazilian soccer players

**55-DO TACTICAL AND TECHNICAL PERFORMANCE INDICATORS DIFFER WITH RESPECT TO MATCH RESULT IN PROFESSIONAL SOCCER**

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**Introduction**
Numerous attempts have been made to identify key performance indicators (KPI) that underpin success in professional soccer competition (1). The aim of this study was to investigate whether simple, isolated key indicators of tactical and technical performance differed when winning, drawing and losing matches.

**Methods**
Match performance in a French professional soccer team was investigated in a total of 210 League games played across 6 seasons (2008-2014). Isolated key defending and attacking tactical and technical performance indicators included: goals scored/conceded, overall ball possession (and 1st and 2nd half and last 15-minutes of play), possession in opponents half, passes, forward passes, completed passes and completed forward passes, crosses and completed crosses, goal attempts (and 1st and 2nd half) and goal attempts on target, successful final third entries, free-kicks and 50/50 duels won/lost (and 1st and 2nd half and last 15-minutes of play).

**Results & Discussion**
Altogether, the team recorded 108 wins, 62 draws and 40 losses. Multiple analysis of variance revealed a significant main effect for attacking indicators [$F(46, 370.00) = 3.729$, Wilks' lambda = .467, $p<0.001$)] and defending indicators [$F(44, 372.00) = 3.827$, Wilks' lambda = .474, $p<0.001$] with respect to match result. Offensively, in winning games, there were statistically more goals scored, goal attempts (and in 1st half), goal attempts on target (frequency and %), and duels won in the final 15-minutes of play. Defensively, in winning games, there were statistically less goals conceded, goal attempts conceded in the 1st half, goal attempts on target (frequency and %) and duels lost in the final 15-minutes of play.

**Conclusion**
This investigation suggests that the frequency of and efficiency in performing and preventing goal attempts were key performance indicators that aided in winning games. Before any generalizations can be made in an attempt to establish a winning performance model, similar longitudinal data are required using a substantially larger sample of teams (2).

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**Keywords:** skill, football, notational analysis

# Physiotherapy and Injury Prevention

**56-INJURIES AND MUSCULOSKELETAL COMPLAINS IN SOCCER REFEREES – A SHORT REVIEW**

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**Introduction**
One of the most important aspects for soccer referees to perform in a successful way is to be healthy (1), with the least possible injuries. The literature available on referee injuries is still scarce and most of the studies are retrospective. It is, therefore, important to understand the profile of the injuries amongst soccer referees, so that injury prevention programs can be developed.

**Methods**
An unlimited date search was conducted on PubMed. The keywords used were "soccer referees" and "soccer referees injury," 107 articles were found and, after, selections were made for abstract.

**Results & Discussion**
Injuries in referees are influenced by several factors, such as age of the referees; competitive level of the game and the context (match or training session). Regarding the age of the referees and the competitive level, it appears that the higher these factors are, the higher the risk of injury (1, 3). For the context, it is noted that, during matches, the risk of injury in referees is similar regardless of the competitive level of play (3). However, when we compare this context with training, there is a higher incidence of injury in training than in matches; this could be explained by greater exposure (in time) of the referees to training than to matches (2). The most common injuries in soccer referees are the non-contact ones, strains in the hamstrings, strains in the calf and ankle sprains are the ones that happen more often. Considering complaints, the most usual regions are the lower back, hamstrings, knee and Achilles tendon (2, 3, 4).

**Conclusion**
The profile of injuries of soccer referees are the result of their performance requirements, so it is important to develop and implement injury prevention programs in training routines.

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**Keywords:** soccer, referee, injury

**57-MECHANISMS OF THE NONCONTACT ANTERIOR CRUCIATE LIGAMENT (ACL) INJURY IN SOME MALE SPORTS ACTIVITIES**

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**Introduction**
This research examined ACL injury mechanisms in some sports men. Of course, an understanding of the noncontact ACL injuries mechanism has lagged behind diagnosis and treatment. However, a growing research implicates hormonal, anatomic, environmental, and biomechanical factors that may predispose athletes to these injuries.

**Methods**
For this study selected 839 athlete for assess ACL injury mechanism by two different method: (A)Questionnaire and (B) Interview that information collected among athlete who were play soccer, volleyball, futsall, basketball, wrestling, ski and gymnastics.

**Results & Discussion**
Our results indicate 52.6% of injuries occur during practices and 47.4% during competition. It also became clear that 72.3% of injuries are due to noncontact mechanism, 4.7% by accidents and 23% with unknown mechanism. Furthermore Dynamic alignment at the time of the injury included: Knee-in & Toe-out 47.1%, Knee-out & Toe-in 17.7%, and Hyperextension 11.4%. The ACL prevents the femur from moving forwards during weight bearing. It also helps to prevent rotation of the joint. Injury of the ACL most often occurs when an athlete is pivoting, decelerating suddenly or landing from a jump. The injury can also be caused by another player falling across the knee. ACL injuries are, probably, the most common, devastating knee ligament injuries amongst sports persons.

**Conclusion**
Usually, these injuries are isolated, mainly in noncontact sports, but may often be a part of more complex ligamentous injuries. They occur more often in contact sports, such as football, and road traffic accidents. These injuries are most likely to lead to the need for surgery. So, that's why it seems necessary to understand the ACL mechanism injury.

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**Keywords:** Anterior Cruciate Ligament, sport activities, injury

**58-THE PERCEPTIONS OF PROFESSIONAL SOCCER PLAYERS ON THE RISK OF INJURY FROM COMPETITION AND TRAINING ON NATURAL GRASS AND 3RD GENERATION ARTIFICIAL TURF**

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**Background**
The purpose of this study was to describe professional soccer players' perceptions towards injuries, physical recovery and the effect of surface-related factors on injury resulting from soccer participation on 3rd generation artificial turf (FT) compared to natural grass (NG).

**Methods**
Information was collected through a questionnaire that was completed by 99 professional soccer players from 6 teams competing in Major League Soccer (MLS) during the 2011 season.

**Results**
The majority (93% and 95%) of the players reported that playing surface type and quality influenced the risk of sustaining an injury. Players believed that playing and training on FT increased the risk of sustaining a non-contact injury as opposed to a contact injury. The players identified three surface related risk factors on FT, which they related to injuries and greater recovery times: 1) Greater surface stiffness 2) Greater surface friction 3) Larger metabolic cost to playing on artificial grounds. Overall, 94% of the players chose FT as the surface most likely to increase the risk of sustaining an injury.

**Conclusion**
Players believe that the risk of injury differs according to surface type, and that FT is associated with an increased risk of non-contact injury. Future studies should be designed prospectively to systematically track the perceptions of groups of professional players training and competing of FT and NG.

**Keywords:** Artificial turf, Injury

**59-ANALYSIS OF KNEE EXTENSOR AND FLEXOR STRENGTH FOR INJURIES PREVENTION IN GERMAN SOCCER PLAYERS**

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**Introduction**
Some physical fitness components of soccer, such as strength imbalance, are poorly understood. Therefore, the aim of this study was to perform a data collection to provide figures on the muscular strength imbalance and establish normative parameters for the professional, amateur and junior's soccer players' muscular performance, supporting scientific research and future studies.

**Methods**
52 soccer players from a professional soccer club in Hamburg participated in the study. In order to evaluate muscular performance, an isokinetic dynamometer Isomed2000 was used. The tests consisted of measuring Peak Torque during maximum isometric and eccentric strength at 90° and 88°-93° by leg press and the concentric and eccentric strength of the knee extensors and flexors at 60°/s and 180°/s. Analyses of variance (ANOVA) were used to the evaluated parameters. In all the statistical procedures, the confidence interval was of 95% ($p<0.05$). Evaluation and detailed comparison with the help of the LSD post – hoc test confirmed. The Excel version 2010 and SPSS.21 used in all analyses.

**Results**
The results of this study characterized the knee extensor and flexor strength muscular profile of Professional, Amateur and juniors soccer players on the capacity of torque, maximum power and conventional and functional H: Q ratio. Moreover, significant differences were observed between legs by considering some of the study variables.

**Conclusion**
The normative data set can be used as reference values for training, prevention and rehabilitation of athletes, and serve as reference for future studies with the aim to relate parameters of muscular performance and incidence of injuries in soccer.

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**Keywords:** strength imbalance, soccer, injury, prevention

## 60- METHODOLOGICAL CRITERIA IN SPORTS FUNCTIONAL REHABILITATION AND RETURN TO TRAINING AND COMPETITION AFTER THE INJURY

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### Introduction

Sports functional recovery of the soccer player must be an organized, systematic and evaluated process by a qualified professional. This professional must be integrated within a multidisciplinary team of experts or specialists in the different areas of intervention (medical doctor, physiotherapist, physical trainer,...) and whose characteristics should be a physical trainer with training in physiotherapist and specialist in football.

The same process must be planned and programmed according to methodological criteria determined by the injury profiles (type, severity, mechanism of injury), the characteristics of player (specific position, anatomical, etc), training (training model, type of trainer), sport (soccer), as well as include some specific phases to organize the objectives and contents of work, design and prescribe exercise according to functional progression of the athlete and to assess the process.

### Methods

Have been reviewed and analyzed three full seasons (more than 60 sports functional recovery processes developed) in a professional football club; the injuries had been reviewed and compared, analyzed depending on the type of injury, the time off estimated from the clinical point of view; the number of matches, training sessions completed, the time of incorporation, etc., following the methodological criteria of the sport functional recovery coach (1)

### Results & Discussion

In general, the time off training process and the number of matches not available has decreased and relapses has decreased too. This trend was confirmed by similar professional teams in the European Champions League and with other teams at the same League.

### Conclusion

A specialist with specific responsibilities in this area and within a multidisciplinary group, which carry a systematized and organized process on sports physical rehabilitation which allow to reduce the time of absence, both matches and training and incorporate as soon as possible to the injured player is necessary.

**61- NEW APPROACH TO THE SPORT-FUNCIONAL RECOVERY COACH IN SOCCER**

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**Introduction**

The process of sport-functional rehabilitation, ranging from the time of the injury to the full incorporation of the footballer to the competition must be planned, controlled and conducted by specialized professionals.

The figure of the sports-funtional recovery coach consists of a specialized trainer that creates and prepares the injured player, in an individualized manner, with the aim of achieving the most immediate possible incorporation, in an effective and efficient, both to the reference group and to the competition. (1)

**Proposal**

On the other hand the process to be followed by this professional should be structured systemically in different stages, with different objectives in each one of them in order to have a controlled and secure process to reinstatement, were the subjectivity not will be the only control method.

The literature shows a series of criteria that focus on therapeutic aspects and, rarely, develop or shown the methodological aspects relating to the development and improvement of the specific skills, the game or the specific position related to the injury.

**Competencies and criteria**

The proposal of the sport-funtional recovery coach must be complemented with functions, competencies and responsibilities (2):

- Injury Prevention;
- Preliminary assessment of the injured athlete;
- Planning and design of programs of physical rehabilitation;
- Implementation of the retraining effort and its progression plan;
- Control and monitoring of the evolution of the injury during the period of rehabilitation and after, on training and competition;
- Collaboration in the strategy of decision making for the injured athlete;
-Training and advisory to the medical and technical team in physical and functional rehabilitation about the injured athlete.

**Conclusion**

At the soccer teams need more and more specialization in the professionals involved in this process and

is intended to establish a methodology of intervention in order to incorporate the more quickly and surely the athlete on training and competition.

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**62-EFFECT OF GARMENT KNEADED WITH NANOPLATINUM AND NANODIAMOND ON RECOVERY FROM TRAINING IN SOCCER ATHLETES**

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**Introduction**
Quick recovery from a training session is needed to maintain the performance level and prevent over-training. Recently, a mixture of nanodiamond and nanoplatinum (DPV576-F) has been studied for their immune modulatory effects. However, there is no study to evaluate the effect of DPV576-F on recovery of soccer athletes. The aim of this study was to examine the effect of the special garment with DPV576-F on recovery from the training.

**Method**
Twelve men's collegiate soccer athletes (age 21.2 yrs.) were divided into experimental groups (EXP) and control groups (CON). EXP wore the special garment with DPV576-F (VENEX recovery wear) and CON wore normal wear throughout resting time. Two-hour training was executed in the morning and afternoon, respectively. Four five-minute Heart Rate Variability (HRV) were recorded. Curved sprint test (CST) and short dribble test (SDT), described by Bangsbo and Mohr (1), were performed in both training sessions. A two way ANOVA with Tukey's post hoc test was used. P level was set at ≤ 0.05. This study was approved by the university IRB.

**Results & Discussion**
EXP showed significantly shorter CST time than CON at the afternoon session. SDT time in EXP tended to decrease at the afternoon session. EXP showed significantly higher pNN50 than CON and maintain higher level throughout the day. pNN50 in CON decreased significantly in second HRV recording after morning training session and didn't recover afterward. EXP showed higher rMSSD than CON in the second and forth HRV recording. Higher percentage in the cardiac vagal index (CVI) (2), was shown in the EXP in the second and forth HRV recording. The pNN50, rMSSD and CVI are known as the index of parasympathetic activity and related to recovery mechanism. These results suggest that post-exercise parasympathetic activity was activated and the recovery mechanism in EXP was enhanced by the garment used in this study.

**Conclusion**
Wearing of garment with DPV576-F during the resting time induces enhanced parasympathetic activity and higher performance level for soccer athletes.

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**Keywords:** recovery, Nanoplatinum/Nanodiamond(DPV576-F)

**63-PHYSICAL REHABILITATION IN KNEE INJURIES CHONDRAIS ASSOCIATED WITH THE SUPPLEMENT OF "TYPE II" COLLAGEN FOR ATHLETES OF SOCCER**

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**Introduction**
In soccer players, lesions are found in the cartilage of the knee, especially after episodes of ligament and meniscal injuries. Pharmacological chondroprotectives have joint function of delay or slow down joint wear, and physical therapy can perform the same function through physical resources applied to articular cartilage.

**Methods**
The aim of this study was to investigate the clinical effects of physical therapy associated with nutritional supplementation with "type II" collagen in soccer players with chondral knee injury. The aim of the study was to find electromyographic parameters of running in professional soccer players with chondral injury. The study included four professional soccer players with a mean age of $29.75 \pm 5.79$ years, diagnosis of injury time of $4.25\pm0.95$ months, with all players having undergone surgery with arthroscopy, and knee against without lateral cartilage lesion. The study period was 3 months, pharmacological intervention with 10g of collagen (Mobility TM – Fortigel TM) 2 times per day associated with physical therapy (6 days per week) with electrotherapy, manual therapy and exercises for motor control. Biomechanical evaluation of Counter-Movement Jump (CMJ) with forces bipedal platform was performed before and after treatment (Emgsystem do Brasil), and subjective pain assessment by visual analog scale (VAS) ranging from 0 to 10.

**Results & Discussion**
After 12 weeks of physical therapy and pharmacological intervention, results CMJ showed an increase in concentric maximum force (Body Weight (BW)) of 12.31% ($1.95\pm0.09$ to $2.19\pm 0.09$), Maximum Velocity Output (m/s) of 22.78% ($1.80\pm0.06$ to $2.21\pm0.05$), Maximum Power (W/BW) of 18,06% ($3.71\pm0.25$ to $4.38\pm0.29$), Rate of Force Development (N/(BW*s)) of 6.12% ($3.27\pm 0.08$ to $3,47\pm 0.16$). While the assessment of pain VAS decreased by 68.75% ($8.0\pm 1.83$ to $2.50\pm 1.29$). These clinical results are in accordance with other studies of pharmacological intervention with collagen peptides that showed new synthesis of "type II" collagen in cartilage matrix after pharmacological treatment.

**Conclusions**
The association of physical therapy with nutritional supplementation of "type II" collagen showed an improved clinical evolution in soccer players with chondral knee injury. However, other studies should be conducted to better understand the results found in this study.

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**Keywords:** Cartilage, Soccer, Collagen, Physiotherapy

**64-ELECTROMYOGRAPHIC ANALYSIS IN PROFESSIONAL SOCCER PLAYERS WITH CHONDRAL LESIONS ON THE KNEES**

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**Introduction**
To analyze the clinical evaluation of soccer players with chondral knee injury, surface electromyography is a study area of biomechanics that can contribute to a better understanding of motor control of the athlete during the movements used in this sport, for example, the running used throughout the soccer game.

**Methods**
The aim of the study was to find electromyographic parameters of running in professional soccer players with chondral injury. The study included four professional soccer players with a mean age of 29.75 ± 5.79 years, diagnosis of injury time of 4.25±0.95 months, with all players having undergone surgery with arthroscopy, and knee against without lateral cartilage lesion. For the evaluation of running, a wireless surface electromyography device (Emgsystem do Brasil) with a frequency of 1,000 Hz and 8-channel was used for data collection.
The athletes performed 5 times in the running treadmill, 5 minutes each running, with the speed of 10 km/h and an interval of 48 hours between each running.

**Results & Discussion**
After treatment of the data was determined variable Roots Means Square (RMS) for analysis of the electromyographic signal, and the muscles of the limb injury that had significant differences in reduction of RMS in relation to the opposite limb, were the rectus femoris (18.04 ± 3.56 %) and gluteus medius (10.78 ± 3.01%) in the phase in contact with the floor of the calcaneus, addition to the biceps femoris (13.08 ± 4.32%) during full foot contact with the floor.

**Conclusions**
It was possible to use a biomechanical analysis with surface electromyography to quantify the evaluation of motor control of professional soccer players with chondral injury. However, further research should be conducted to better understand the results found in the present study.

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**Keywords:** Cartilage, Soccer, Electromyography, Biomechanics

**65-BIOMECHANICAL ANALYSIS OF THE VERTICAL JUMP (CMJ) IN PROFESSIONAL SOCCER PLAYERS WITH CHONDRAL INJURY IN THE KNEE**

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**Introduction**
In soccer players, lesions are found in the cartilage of the knee, especially after episodes of ligament and meniscus injuries. For a better understanding of compensatory biomechanics after cartilage injury, it is important to study the quantitative analysis of motion deficits and outcome of soccer athletes with chondral lesion parameters.

**Methods**
The aim of the study was to find kinetic parameters of counter-movement jump (CMJ) in professional soccer players with chondral injury. The study included four professional soccer players with a mean age of $29.75 \pm 5.79$ years, diagnosis of injury time of $4.25\pm0.95$ months, with all players underwent surgery with arthroscopy, and knee against without lateral cartilage lesion. To appraise the CMJ a platform for bipedal forces (500 Hz -Emgsystem of Brazil) and kinematic system with cameras, high-speed (300Hz) was used.

The athletes performed the jumps (CMJ) 10 times on a force platform with the interval of 5 seconds between jumps.

**Results & Discussion**
After the analysis of the kinematic and kinetic variables were found as main characteristics, the tendency for the curve of vertical ground force (GRF) of the CMJ maximum concentric force variable (CFM) present in all athletes a reduction of the second peak concentric force in the lower limb with the cartilage lesion, and opposite knee of all athletes, this did not show this pattern.

**Conclusion**
It was possible to use the biomechanical analyses of CMJ to determine a quantitative indicator for the evaluation and evolution of motor control of soccer with chondral lesions on knees. However, other studies should be conducted to better understand this indicator that was found.

**References**
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**Keywords:** Cartilage, Soccer, Biomechanics, Physical Therapy

# Sport Psychology/Talent Identification/Technological Innovation and Turf

**66-A QUALITATIVE STUDY ON SELF-REGULATED LEARNING AMONG PROFESSIONAL SOCCER PLAYERS**

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**Introduction**
Self-regulated learning (SRL) refers to self-directed processes that enable learners to transform their mental abilities into performance skills (1). Self-regulation processes have been suggested to not immediately produce high levels of expertise, but to help individuals acquire knowledge and skills more effectively (1). Athletes who self-regulate well may derive more from practice than others (2). Recently, the best among Dutch elite youth soccer players reported higher reflection scores than the "next best," indicating that they may benefit more from practice through reflective thinking (3). The purpose of the current study was to qualitatively investigate the self-regulated learning process of professional soccer players.

**Methods**
Based on the results of a large quantitative study among all professional soccer players in the Norwegian Premier and Second League (N = 639), eight players whose SRL scores on a soccer-specific SRL questionnaire (4) were among the highest 2% of scores were invited to participate in this study. We used qualitative methods with semi-structured interviews.

**Results & Discussion**
Qualitative content analysis revealed that the players were engaged in the complete SRL process (planning, monitoring, evaluation, and reflection), meaning that they linked SRL phases to each other. How players did this was individually determined. They also showed flexibility in adapting their process to the requirements of the situation. All players regarded a professional lifestyle as a prerequisite for quality practice. The downside of SRL was addressed as well, in that these players may find it hard to disengage from thinking about soccer all day.

**Conclusion**
Players who are good at SRL flexibly incorporate each SRL phase in their learning process. Practitioners must be aware of the downside of SRL and acknowledge that SRL processes are individually determined.

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**Keywords:** learning, performance, talent development

## 67-PSYCHOLOGICAL PREPARATION IN FOOTBALL

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### Introduction
The important task of sport psychology appears to be the creation of a psychological programs system for football, securing decision of the tasks, constantly arising before coaches. It is the following tasks: formation of psychological stability, formation of mental reliability, leading of the sportsmen (team) on peak of psychological readiness.

### Methods
The system of psychological securing, consisting of three programs, was worked out.
The first program: "The leading of sportsmen (team) on an optimum level of psychological stability. The main psychological principle of realization of this program is the principle "LIMITATION" of a number of attempts at performance of the technical and tactical tasks with taking into account per cent individual effectiveness.
The second program: "Mental reliability formation of the sportsman in extreme situations of the game". The main psychological principle is the principle "ONE ATTEMPT" in the time of the training and games. The realization of this principle in training promotes formation of the sportsman's psychological readiness at the most responsible moment of game.
 The third program: "Leading team to the peak of psychological readiness". The main psychological principle is the principle of "PLANNING MENTAL STRAIN IN THE TRAINING BY PREPARATION OF THE TEAM FOR IMPORTANT GAMES".

### Results
The realization of these programs in teams of High and Super league allowed for more effectiveness in inclusion of psychological methods in the training and competition process preparation teams, and had a positive estimation of coaches.

### Discussion
At the same time, the use of these programs demands essential change of ordinary organization of the training and competition process. The main principle of this change consisting in that, the effectiveness of the training work of sportsman and team will be defined not by quantitative criterions of carry out number of the technical-tactic acts, but by psychological criterion-per estimation sent of effectiveness carry out acts.

**Keywords:** psychology, preparation, football

**68-RELATION IN YOUTH FOOTBALL TEAMS**

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**Introduction**
The research organized at School of Football Reserve has shown that almost 70% of young sportsmen instability of sport outcome, and many of them leave the sport.

**Methods**
The reason for such a situation was revealed during research of mutual relations between the sportsmen and coaches. It was revealed that there are 2 types of coaches: the coaches that are set on having sports results only, and coaches with a professional - pedagogical set. Dynamics of parameters of a psychological climate after 3 years of trainings were investigated. The technique the coach - sportsman was used for research. In this technique, the relationship of the sportsman to the coach on emotional, behavioral, professional components from 6 points was measured.

**Results**
The deterioration of relations between coaches and sportsmen was observed in teams where coaches were set on results. It was marked the reduction of estimations on emotional (4,4 and  2,6 ), behavioral (5,6 and 3,2 ), professional (6,4 and 3,1 ) components of the relations. This leads to the increase of parameters "of absence of co-operation"   (4,1 and 5,6 ),   "disagreement" (4,2 and 6,1  ), coldness in the relations" (5,0  and 6,4 ), "indifference" (3,6 and 6,1 )  and "dissatisfaction" (4,2 and  6,3,  P<0,01-0,001) in sport activity. On the contrary, the deterioration in mutual relation between coaches and sportsmen is not observed in teams where the coaches had a professional - pedagogical set. The preservation level on emotional  (6,4 and 6,5), professional  (7,3 and 6,5) and behavioral (6,3 and 6,2) components  in relations and the authentic improvement of parameters on scales "warmth" (5,0 and 6,8), "cooperation" (4,9 and 5,3), interest (3,0 and 3,8 ) and satisfaction (4,2 and 4,8) is simultaneously marked in these teams. Higher and more stable levels of sports results for the sportsmen in teams where the coaches had professional - pedagogical installation were simultaneously marked.

**Keywords:** Relation, psychology, youth, team

**69-DEVELOPMENT OF A SELF-PERCEIVED SOCCER COMPETENCE SCALE FOR YOUTH SOCCER PLAYERS**

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**Introduction**
Although researchers have tried to develop many questionnaires to assess physical- and sport-related competence, few studies have been conducted to develop a scale which evaluates soccer players' competence. The purpose of this study was to develop a self-rating scale that would enable the measurement of the level of youth soccer player's self-perceived competence.

**Methods**
The total of 611 Japanese male youth soccer players (13ys-18ys) completed a questionnaire, which was composed of 60 items selected from a preliminary study. Exploratory factor analysis was applied to reveal a factor structure of self-perceived soccer competence. Participants were also asked to score their own soccer ability out of a hundred. The players' score of their own soccer ability was used as a criterion variable.

**Results & Discussion**
Exploratory factor analysis revealed that the scale had 9 sub-scales: pass & control skill with appropriate decision making, speed, motivation, endurance, dribble skill, heading skill, defense skill, physical strength and leadership. The scale contained individual ball techniques & group skill (pass & control skill with appropriate decision making, dribble skill, heading skill, defense skill and leadership), physical fitness (speed, endurance and physical strength) and mental fitness (motivation), thus it seems that the scale covered enough area to evaluate a youth soccer player's self-perceived competence. Additionally, the players that displayed higher soccer ability scores showed significantly higher levels of self-perceived soccer competence compared to that of the players who displayed lower soccer ability scores. This result suggests that criterion validity of the developing scale was confirmed.

**Conclusion**
The developed self-perceived soccer competence scale would multi-dimensionally and precisely reflect Japanese youth soccer players' competence.

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**Keywords:** self-perceived competence, youth soccer players

**70-ACHIEVEMENT GOAL ORIENTATIONS AND SELF-DETERMINATED BEHAVIORS IN SOCCER – A CLUSTER ANALYSIS**

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**Introduction**
The concept of motivation is one of the most popular constructs in sport psychology. This study aimed to identify motivational profiles of adult football players that compete at different levels using cluster analysis.

**Methods**
The participants were 304 male football players (professionals, semi-professionals and amateurs), age 17 to 39 years (Mage=25.4±5.65). Participants completed the Task and Ego Orientation in Sports Questionnaire and the Self-Regulation Questionnaire. Based on the constructs of the questionnaires, a cluster analysis was performed. Qui-square was used to determine relationship between players and clusters.

**Results and Discussion**
The cluster 1 (n=113) was considered the most adaptive in motivational terms, since these players reported high values for task orientation (Zscore=0.76), were intrinsically motivated (Zscore=0.74), displayed high levels of identified (Zscore=0.86) and introjected regulation (Zscore=0.58), and had high negative levels of motivation (Zscore=-0.53). Also the cluster 2 (n=80), where the professional and semi-professional footballers were most represented, was characterized by average levels present in almost all variables, ranging from positive (task orientation and introjected regulation) to negative (ego orientation, intrinsic motivation and identified regulation) values. Only the values for the external regulation and motivation were high. Professional players were significantly less represented in cluster 4 (n=25), which seems to be the least advantageous in motivational terms, because present high values for the external regulation (Zscore=0.94) and motivation (Zscore=1.84). Moreover, the values of ego orientation, intrinsic motivation and identified regulation were negatively high, which demonstrates that are the most motivated players.

**Conclusion**
Results underline the existence of four motivational profiles. While some are characterized by translating "adaptive" features for the sport participation, there are maladaptive profiles in this group of players. Careful attention is needed in relation to this specific group of players, as they will have a higher probability of dropping out the activity.

**Keywords:** Motivation, Football, Performance

**71- ANTHROPOMETRIC AND PERFORMANCE DATA OF NEW ZEALAND MALE YOUTH FOOTBALLERS PRIOR WORLD CUP SELECTION**

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**Introduction**
Testing of talented youth football players is part of the identification and monitoring process. The AIM of this study was 1) to monitor players biannually until the national coach of the U17 New Zealand men's national team selected the squad for the World Cup (WC) preparation six month prior the event and 2) to provide normative values for future male WC cycles biannually starting 2.5 years prior WC squad selection for New Zealand football players.

**Methods**
Anthropometric (height, weight) and physical measurements (20-meter sprint (20M), horizontal jump (HJ), YoYo Intermittent recovery test level 1 (YYIRTL1)) were taken twice a year for two consecutive years for different age groups and then analyzed with regards to the duration remaining until "squad selection" resulting in 5 groups (-0.50, -1.00. -1.50, -2.00 and -2.50 years until WC). All testing was conducted indoors under standardized conditions. A total of 585 measurements were conducted as part of a national training camp for the male U17 WC cycles. Normative values are sorted for height, body mass, 20M, HJ, YYIRTL1.

**Results & Discussion**
Normative values -0.50 group (73 measurements) were 175 cm (± 5.31), 65.2 kg (± 8.41), 3.19 seconds (± 0.06), 2.19 meters (± 0.14), 2044 meters (± 395) respectively.Normative values -1.00 group (120 measurements) were 172 cm (± 5.99), 60.7 kg (± 7.62), 3.24 seconds (± 0.14), 2.12 meters (± 0.19), 1821 meters (± 439) respectively.Normative values -1.50 group (170 measurements) were 165 cm (± 9.77), 53.3 kg (± 10.1), 3.38 seconds (± 0.18), 1.99 meters (± 0.21), 15578 meters (± 404) respectively.Normative values -2.00 group (170 measurements) were 158 cm (± 8.27), 47.5 kg (± 8.88), 3.50 seconds (± 0.17), 1.83 meters (± 0.19), 1218 meters (± 388) respectively.Normative values -2.50 group (52 measurements) were 152 cm (± 7.78), 42.4 kg (± 8.17), 3.55 seconds (± 0.17), 1.79 meters (± 0.17), 1027 meters (± 336) respectively.

**Conclusion**
The data provided display normative data for future male WC cycles.

**72-WHAT DOES A SOCCER PLAYER'S CULTURAL CAPITAL SAY ABOUT THEIR PROSPECTS?**

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**Abstract**
When looking for young talent in football or predicting the performance of a soccer player, the method most often used is scouting (observing a player's technical and tactical abilities during a match) and functional diagnostics (measuring a player's motor abilities – strength, endurance, co-ordination, speed and flexibility).

As sport is molded entirely through social processes, an athlete, i.e. a soccer player, is also molded by their living environment. Therefore, our study aims to establish the cultural capital of a soccer player (their sociological profile) which has so far received little research attention. We assume that a soccer player's performance (in the sense of their career) is defined by their previous thoughts/conduct or behavior (habitus) and thus determined by their life events, experience gained and previous successes in the sport and school domain (sport cultural capital). Using a sample of Slovenian former male soccer players, we studied the influence of the primary family, education variables and the environment on the players' cultural capital. The sample of subjects in the pilot study consists of 80 male soccer coaches (license seminar A, Football Association of Slovenia (NZS), 2012/2013) aged between 20 and 51. Data processing includes basic statistical analysis and factor analysis. The latent structure of cultural capital will be identified using Principal Component Analysis, including an Oblimin rotation with a Kaiser normalization.

Based on data on the soccer players' transfers and performances, a potential model of a successful soccer player will be created in terms of cultural capital. This model will serve as a basis for planning the careers of young soccer players in the future.

**Keywords:** cultural capital, talent, soccer

**73-FOOTBALL-SPECIFIC ACCURACY AND RELIABILITY OF A NEW MULTI-CAMERA TRACKING SYSTEM**

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**Introduction**
Video-based performance tracking systems and GPS are the majority of technologies in football to acquire data on match-play and/or training. There is, however, limited data on comparison of accuracy and reliability with both systems. This study aimed to investigate accuracy and reliability of a new multi-camera tracking system (MCTS) and GPS on a team sports-specific track.

**Methods**
Five trained male football players (22±1yr, 1.82±4 m, 73±3 kg) participated in the study. Each player completed 4 sets of a standard circuit designed to reflect demands of movement patterns during team sports (Coutts & Duffield, 2010). Each trial was filmed by 4 full HD cameras and subsequently distance and speed were analyzed by MCTS. Fifteen-Hz portable GPS (SPI ProX®, GPSports Ltd.) were simultaneously utilized to collect activity profiles. The accuracy of measurements was evaluated by mean difference of distance obtained by each technology from real values. A coefficient of variation (CV) was expressed as intra-technology reliability.

**Results & Discussion**
GPS underestimated the real distance (RD) of a lap, set and total  but those variables were overestimated by MCTS (mean difference, GPSLAP, -10.7m; GPSSET, -53.5m; GPSTOTAL, -214.1m: MCTS LAP, 2.7m; MCTS SET, 13.4m; MCTS TOTAL, 53.7m). CV of each technology decreased with increasing course length (GPSLAP, 8.3%; GPSSET, 7.2%; GPSTOTAL, 5.5%: MCTS LAP, 3.2%; MCTS SET, 1.8%; MCTS TOTAL, 0.5%). In accordance with repetition (time x distance interaction), the distances of a discrete lap and set obtained by GPS were significantly different from the RD (GPSLAP, p=0.000; GPSSET, p=0.001) but those observed by MCTS were not different (MCTS LAP, p=0.242; MCTSSET, p=0.107). MCTS appears to have greater accuracy and intra-model reliability than GPS in terms of short, middle and long distance during intermittent sports-specific activities.

**Conclusion**
A new multi-camera tracking system could produce highly accurate and reliable data on performance profiles of players in team sports.

**Acknowledgement**

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**Keywords:** Football, Reliability, Tracking system, GPS

# Other Posters (not formally presented)

**74-POSITIONAL ROLE INFLUENCES SOCCER TACTICAL PERFORMANCE**

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**Introduction**
Tactics are considered a key component for top performance in soccer (1). There are no shortly time that this capacity can be studied individually by researchers (2). For this reason, there is little information about this subject in literature. Understanding how players' positional roles are related to tactical performance can offer a sound basis of information for coaches and researchers. Therefore, this study aimed to examine how players' positional roles influence tactical performance in soccer.

**Methods**
The sample comprised 17927 tactical actions, performed by 268 U-17 youth soccer players. The instrument used to collect and analyze data was the System of Tactical Assessment in Soccer (FUT-SAT). This system was designed to assess the tactical actions performed by the players, according to ten core tactical principles of the soccer game. Players were grouped according to their positional roles, categorized in five groups: center-backs, full-backs, defensive midfielders, attacking midfielders and forwards. Data distribution was verified through Kolmogorov-Smirnov test. One-way ANOVA was performed to compare the values of these measures.

**Results & Discussion**
Results displayed significant differences in performance in the principle of defensive unity, with respect to players' positional role. The performance of such principle was able to influence the Defensive Tactical Performance Index, a tactical indicator of performance during the defensive phase. This principle is characterized by a unitary conception of defense, which directs the performance of cohesive moves by the players. This indicates that U-17 players' positional role influences the performance of the principle of defensive unity.

**Conclusion**
These data suggest that players' position is likely to influence soccer tactical performance of U-17 youth players.

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2. Teoldo, I. et al. (2010) Rev. Port. Cien. Desp. 10(1), 147-157.

**Keywords:** soccer, tactics, positional role

**Acknowledgements**

**75-MEAN LOCATION OF TACTICAL ACTIONS OF YOUTH SOCCER PLAYERS FROM DIFFERENT BIRTH PERIODS**

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**Introduction**
Tactical actions are performed by the players on the field respecting the criteria of ball possession, performed with or without the ball. Tactical actions are important because they are performed with the purpose of managing playing space, in accordance with the organization and adaptation players' movements in the field (1). Thus, this study aims to examine the locations where tactical actions are performed within the field, according to the offensive and defensive tactical principles.

**Methods**
The sample comprised 100 soccer players. The instrument used to collect data was FUT-SAT that enables the analysis and assessment of tactical actions performed by players, with or without ball possession (2). The sample was grouped in birth quartiles. One-way ANOVA (with Tukey's HSD post hoc) and Kruskal-Wallis tests were performed to compare the percentage of the number of tactical actions performed in the inverse half of the field, between players from different birth periods (quartiles). SPSS for Windows, v. 18.0 was used for statistical procedures.

**Results & Discussion**
Statistically significant differences (P=0.021) were observed in the principle of offensive coverage between players from the fourth quartile. Therefore, we can infer that younger players, due to their physical disadvantage in relation to older ones, prefer to perform offensive actions in safer locations (within the defensive half), thus giving spatial support to players with possession.

**Conclusion**
It is concluded that players from the fourth quartile perform most of their tactical actions of the principle of offensive coverage within the defensive half.

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2. Teoldo, I., et al. (2011) Motricidade 7(1), 69-84
3. Malina, R., et al. (2004) Eur. J. Appl. Physiol. 91(5-6), 555-562.

**Keywords:** soccer, assessment, performance

**Acknowledgements**

**76-INFLUENCE OF FLOATERS PLAYER ON PLAYERS' TACTICAL PERFORMANCE IN SOCCER SMALL-SIDED GAMES**

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**Introduction**
The opposition between two teams, and the resulting interaction between players during soccer matches, produce situations in which frequency and chronological order of tactical actions are random and hard to predict (1). Nevertheless, complex situations during a soccer match demand from coaches the necessary stimuli to fulfil players' needs when trying to solve tactical issues. One of the stimuli that simulate actual match demands and help develop tactical performance is the utilization of floaters in small-sided games (2). Thus, the aim of this study is to examine the influence of floaters on players' soccer tactical performance.

**Methods**
The sample comprised 168 U-17 who performed 23,071 tactical actions. The instrument used was the System of Tactical Assessment in Soccer (FUT-SAT), which provides researchers with tactical performance data, through the Tactical Performance Index (TPI). Tests were conducted in a field of 36 m long by 27 m wide with the arrangement GK+3 vs. 3+GK, in two different situations. The first was designated as "Floaters On" and the second "Floaters Off". Wilcoxon's test was performed to examine differences in players' tactical performance between both situations (P<0.05).

**Results & Discussion**
Results showed that Tactical Performance Indexes (TPIs) displayed differences between both situations in the principles of width and length (Z=-3.925; P<0.001) and concentration (Z=-2.571; P=0.010). This indicates that during the offensive phase, floaters placed in the sidelines stimulated players in the search for better spaces within the playing field, through the occupation of the opponents' defensive half by having the whole team moving offensively, thus providing the player in possession with better passing options. In the defensive phase, the principle of concentration demonstrates that players aimed team packing and the protection of their own goal due to their numerical inferiority.

**Conclusion**
This study suggests that floaters influenced players' tactical performance in soccer small-sided games.

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2. Teoldo, I. et al. (2010) Motriz 10(1), 147-57.

**Keywords:** soccer, tactical performance, floaters

**Acknowledgements**

## 77-COMPARISON OF TACTICAL BEHAVIOR EFFICIENCY BETWEEN YOUTH SOCCER PLAYERS FROM DIFFERENT AGE LEVELS

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**Introduction**
Tactical skills have received considerable attention as important contributors to high performance in soccer. Successful players display well-developed tactical knowledge that enables them to make appropriate decisions and to perform efficient tactical behaviors. Tactical behavior efficiency refers to players' accuracy when performing soccer tactical principles. It is possible that players from different age categories present differences in tactical behavior efficiency related to the time of practice in this sport. Thus, the aim of this study is to compare tactical behavior efficiency between young soccer players from different age categories.

**Methods**
The sample comprised 132 (36 U-11, 36 U-13, 30 U-15 and 30 U-17) youth soccer players from a Brazilian club. They are assessed through the System of Tactical Assessment in Soccer (FUT-SAT) (1). The procedures followed the test protocol. To examine tactical behavior efficiency, the accuracy rate of offensive, defensive and game tactical actions performed by participants in FUT-SAT. Comparative analysis was performed through Kruskall-Walis and Mann-Whitney non-parametric tests (P<0.05). Statistical procedures were performed through SPSS v. 18.0.

**Results & Discussion**
Comparative analysis revealed statistically significant differences in game accuracy rate (P=0.001), between U-11 and U-13 youth soccer players (P=0.003), U-15 (P<0.001) and U-17 (P=0.012). Significant differences were also observed in offensive accuracy rate (P<0.001), between U-11 and U-13 (P<0.001), U-15 (P<0.001) and U-17 (P=0.001). Results suggested that the U-11 soccer players were less efficient when performing tactical actions in comparison to players from the older age levels. Such differences might be related to the lesser practice time, resulting in worse technical and tactical development. There were no differences among the others groups. Furthermore, no differences in defensive accuracy rate were noticed.

**Conclusion**
It is concluded that the U-11 soccer players presented less game and offensive tactical behavior efficiency than the older U-13, U-15 and U-17 soccer players.

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1. Teoldo, I. et al. (2011) Motricidade 7(1), 69-83.

**78-INDIVIDUAL DEFENSIVE BEHAVIOR DISCRIMINATES BETWEEN SOCCER PLAYERS WITH HIGH AND LOW TACTICAL PERFORMANCE VALUES**

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**Introduction**
In soccer, players' behavior has been widely investigated with the aim of providing coaches with information about several aspects of the game that might support the training process, such as movement patterns, work rate and technical skills, among others (1). However, the importance of players' actions to the tactical context, and, in particular, to tactical performance, has not been clarified and apparently needs further analysis (2). Thus, the aim of this study is to examine the influence of tactical behavior efficiency on tactical performance of U-15 youth soccer players.

**Methods**
The sample comprised 100 U-15 youth soccer players from Brazilian soccer clubs. The System of Tactical Assessment in Soccer (FUT-SAT) was used to assess players' tactical behavior efficiency and tactical performance (3). The field test is conducted in a small-sided area with the following arrangement: GK+3 vs. 3+GK. The sample was grouped in tertiles according to players' Tactical Performance Indexes (TPIs). Independent-Samples t-tests was performed to compare offensive and defensive tactical behavior efficiency between players with high and low TPI values (P<0.05). SPSS v.21 was used for statistical procedures.

**Results & Discussion**
The high TPI group displayed superior defensive tactical behavior efficiency in comparison with the low TPI group (P=0.005). No significant differences were found between both groups with respect to offensive tactical behavior efficiency. These results suggest that defensive tactical skills play a major role in players' overall tactical performance and also that the focus on the development of such skills through practice routines might improve team's tactical performance (4).

**Conclusion**
Defensive tactical behavior efficiency affects players' overall tactical performance and discriminates between players with high and low tactical performance values.

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**Keywords:** tactical performance, defensive tactical behavior

**79-COMPARISON OF REACTION TIME AND TACTICAL PERFORMANCE BETWEEN U-15 YOUTH SOCCER PLAYERS**

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**Introduction**
Reaction time is a variable that is intrinsically related to the process of decision-making, and is able to affect the tactical performance of soccer players. The aim of this study is to compare the reaction time and tactical performance between U-15 soccer players.

**Methods**
The sample comprised 100 U-15 youth soccer players. The instruments used to evaluate reaction time and tactical performance were CPT (Continuous Performance Test) and FUT-SAT (1), respectively. FUT-SAT enables the evaluation of the ten core tactical principles of soccer game. These principles are: (i) penetration; (ii) offensive coverage; (iii) depth mobility; (iv) width and length; (v) offensive unity; (vi) delay; (vii) defensive coverage; (viii) balance; (ix) concentration and (x) defensive unity. Reaction time data was grouped in tertiles (low, moderate and high). Players from "low" and "high" tertiles had their values compared with respect to their tactical performance. Kolmogorov-Smirnov and Mann-Whitney tests ($P<0.05$) were performed through SPSS for Windows, version 18.0.

**Results & Discussion**
Statistically significant differences were observed between reaction time and tactical performance of soccer players for the tactical principle of offensive coverage ($U=472.5$; $P=0.048$). No statistically significant difference was found in any of the other tactical principles. Results can be explained by the uniqueness of the principle, which demands from the defensive player some rationalization of the playing space when approaching the player in possession (2).

**Conclusion**
It is concluded that reaction time influenced tactical performance, especially the principle of offensive coverage.

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**Keywords:** soccer, reaction time, tactics

**Acknowledgements**

**80-TACTICAL PERFORMANCE IN SOCCER: COMPARISON BETWEEN U-12 AND U-13 YOUTH PLAYERS**

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**Introduction**
In soccer, youth levels are categorized according to players' chronological age. For the selection of a competitive squad, coaches conduct certain assessments through the utilization of performance indicators. Among these indicators, Tactical Performance Index (TPI) indicates the efficiency of the tactical actions performed by players during the matches, and can be used as a parameter to differentiate such players and identify which of them are more capable of being selected for the starting eleven. Thus, this study aims to compare the Tactical Performance Index between U-12 and U-13 youth soccer players.

**Methods**
The sample comprised 58 soccer players born in 1998 and 35 born in 1999. The instrument utilized to assess players' performance was FUT-SAT, which enables the assessment of tactical actions with and without ball possession, through the "GK+3 vs. 3+GK" field test, during 4 minutes, in an area of 36m long by 27m wide. This research had the approval of the Ethical Committee for Research with Human Beings from the Federal University of Viçosa, Brazil.

**Results & Discussion**
Significant differences were found for the performance of the principle of delay, as players born in 1999 displayed higher mean values (34.86; SD=11.62), in comparison with players born in 1998 (29.65; SD=11.26). No significant differences were found for other tactical principles. Players from both birth years performed actions that supported team collective aspects in the game. However, only younger players seem to possess the necessary marking skills to prevent opponents from performing offensive actions.

**Conclusion**
Players from both birth years are equally skilled and able to be selected for the starting eleven in real matches, with respect to tactical performance.

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**Keywords:** soccer, tactical performance

**Acknowledgements**