

International Research in Science and Soccer

The Proceedings of the First
World Conference on Science
and Soccer

Edited by

**Barry Drust, Thomas Reilly and
A. Mark Williams**

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International Research in Science and Soccer

International Research in Science and Soccer showcases the very latest research into the world's most widely played sport. With contributions from world-leading researchers and practitioners working at every level of the game, from grass roots to elite level, the book covers every key aspect of preparation and performance, including:

- * Contemporary issues in soccer coaching
- * Psychological preparation and development of players
- * Physical preparation and development of players
- * Nutrition and recovery
- * Talent identification and development
- * Strength and conditioning in soccer
- * Injury prevention and rehabilitation
- * Soccer academies.

Sports scientists, trainers, coaches, physiotherapists, medical doctors, psychologists, educational officers and professionals working in soccer will find this in-depth, comprehensive volume an essential and up-to-date resource.

The papers contained within this volume were first presented at the First World Congress on Science and Soccer, held in May 2008 in Liverpool, UK. The meeting was held under the auspices of the World Commission of Science and Sports.

Barry Drust is a Reader in Applied Exercise Physiology at the Research Institute for Sport and Exercise Sciences, Liverpool John Moore's University. His main research interests are the physiology of intermittent exercise and temperature regulation. He has published numerous books and journal articles on the physiology of soccer players.

Thomas Reilly was Director of the Research Institute for Sport and Exercise Sciences at Liverpool John Moore's University from 1996 to 2009. He is the Chair of the International Steering Group for Science and Football, and for 13 years was Chair of the Exercise Physiology Steering Group of the British Olympic Association. He was awarded a Doctor of Science degree for his research work in 1999 and has worked in sports science support roles with professional football teams and Olympic Games athletes.

A. Mark Williams is Professor of Motor Behaviour at the Research Institute for Sport and Exercise Sciences, Liverpool John Moore's University. He has published widely in areas related to motor control and learning, sport psychology, performance analysis and talent identification.

Preface

This book represents the Proceedings of the First World Conference on Science and Soccer held at Liverpool, May 15-16, 2008. The event was held under the auspices of the World Commission for Science and Sports and specifically its International Steering Group on Science and Football. It was focused on the game of association football (soccer) and so differed from previous conferences held under the aegis of the International Steering Group.

The first World Congress on Science and Football held at Liverpool in 1987 represented a watershed in the application of science to the football codes. It was the first ever occasion that scientists mingled with formal representatives of the international and national codes of football; these included soccer, rugby union, rugby league, American football, Australian Rules football and Gaelic football. The Proceedings of this Congress included 88 contributions and ran to 651 pages. The book is now a collector's item that is still much sought after; it was recently advertised on the website of Amazon for £420. These congresses are held over 5 days every 4 years; further meetings were held at Eindhoven (Netherlands, in 1991), in Cardiff (Wales) in 1995, in Sydney (Australia) in 1999, in Lisbon (Portugal) in 2003 and in Antalya (Turkey, 2007). The Seventh World Congress on Science and Football is scheduled for Nagoya (Japan) in 2011.

The aims from the outset for the 'science and football' congresses were to bridge the gap between theory and practice in the various football codes and transfer knowledge across these different forms of football. As scientific findings have been increasingly incorporated into football practice, the majority of professional soccer clubs began to employ sports science personnel to provide counselling services and support for their work. This development caused an increased demand for up-to-date scientific knowledge to provide solutions to problems in the applied context of soccer practice. As circumstances and culture within the clubs changed, there was an accompanying growth in research in applied settings. These developments were the drivers for this congress targeted at soccer specifically and based on current concerns within the game and its overall environment.

The First World Conference on Science and Soccer was a two-day event that allowed practitioners working within professional soccer to come together to share their ideas and applied knowledge. Three Workshops, each repeated once, six invited keynote lectures at three separate Plenary Sessions, and twelve invited presentations to Symposia on contemporary hot topics complemented the formal scientific communications. The 52 oral and poster communications enabled delegates from academic and club settings to report their most recent findings relevant to practice and form the content of this book. In order to maintain a programme of continuing professional development for those studying, working in, and researching into soccer, a conference every two years is intended, intercalated with the less frequent and more comprehensive meetings concerned with all the

football codes. The Second World Conference on Science and Soccer is scheduled for the Republic of South Africa, immediately preceding the FIFA World Cup.

The conference in Liverpool in 2008 coincided with the city being the European Capital of Culture in 2008. Altogether 17 countries outside the United Kingdom were represented on the programme. Throughout the year tourists visited the city in unprecedented numbers to attend the various cultural events that marked this unique civic award. It was a source of pride to the organisers at Liverpool John Moores University that 'science and soccer' was linked to the programme of scientific events for the year. Its inclusion serves to emphasise the importance of soccer in the cultural life of people in the North West of England and the opportunities for research that the game provides on an international basis.

Thomas Reilly

Chair, International Steering Group on Science and Football

Introduction

This book represents the Proceedings of the First World Conference on Science and Soccer. This inaugural event was held over May 15-16, 2008 under the aegis of the International Steering Group on Science and Soccer, and is an event that is planned to occur every two years. The Conference attracted keynote and invited lectures, oral communications and poster presentations. These events were complemented by workshops and symposia on selected topics. It is the oral and poster material that forms the content of this book.

For inclusion in the programme, Abstract submissions were vetted by the scientific committee established for the meeting. Invitation for a full submission was extended to all presenters in the scientific sessions. These manuscripts were distributed among the editors and each manuscript was peer-reviewed by two referees. The content of these Proceedings is formed by those that passed through this quality control process successfully.

The content is divided into six Parts, roughly equivalent to the way the submissions were distributed to editors. These different sections are not mutually exclusive. For example the contributions in paediatric science might have been distributed elsewhere according to scientific discipline. It was an editorial decision to keep the content of research on young players together in one multidisciplinary section as far as possible. Similarly studies of body composition (including body composition of youth players) are alongside those in nutrition. Analysis of monitoring equipment is included with biomechanics where there is particular emphasis on research methods.

The content reflects the range of research activities currently engaging the science support personnel in soccer clubs and scientists concerned with the application of their work in a practical setting. It should be of interest to all students of science and football, sports science and related studies. It is immediately relevant to research workers in these areas. It is primarily of interest to practitioners and to trainers and coaches keen to increase their soccer-specific knowledge base.

We are grateful for the co-sponsorship of this conference provided by Jon Goodman, Director of Think Fitness (in association with Red Bull) and the associated sponsorship of EXF Fitness Equipment. The support of ten major exhibitors at the Conference was also appreciated in contributing to the professional parts of the overall programme. A special note of thanks goes to the staff members from the University's Conference and Events office who helped in organising the event. For the completion of this work and leaving a legacy of the event, we are indebted to the authors who responded positively to our queries and comments. We acknowledge the support of the various referees. We regret that many submissions could not be included due to space and other constraints. A special note of gratitude must be extended to the staff at the office of the Research

Institute for Sport and Exercise Sciences at Liverpool John Moores University and in particular to Zoe Miveld who helped with the technical aspects of translating the varieties of electronic material into one coherent text.

Editors: Barry Drust, Thomas Reilly and A. Mark Williams
Research Institute for Sport and Exercise Sciences,
Liverpool John Moores University,
March 2009

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Part I

Paediatric Science

CHAPTER ONE

Somatic and maturity status of youth soccer players 11-12 years: Variation by field position

A. J. Figueiredo¹, M. J. Coelho e Silva¹ and R. M. Malina²

¹Faculty of Sport Science and Physical Education, University of Coimbra,
Coimbra, Portugal

²Department of Kinesiology and Health Education, University of Texas, USA

1. INTRODUCTION

Advanced maturation within the same year of birth, during the pre-pubertal and pubertal period, is associated with advantages in body size, percentage of fat-free mass and several functional manifestations such as aerobic performance, strength and velocity (Malina *et al.*, 2004a). Therefore, in sports where the above characteristics are factors that give an advantage in competition, the athletes maturationally more advanced within a chronologically equivalent group are favoured when compared with less developed peers. For example, Helsen *et al.* (2005) found an effect of the birth month in players selected for advanced training with a bias favouring the older ones (32.6% and 16.0% in the first and last trimesters respectively), in a male sample of Under12 and Under14 soccer players. Furthermore, for the senior English national soccer team, Richardson and Stratton (1999) reported that 50.0% of the participants in the final stage of the 1998 World Cup had been born in the first four official months of competition for youth soccer (between September and December). When the authors analysed the data based on the position of the players in the field, they reported that this discriminating effect was higher for goalkeepers, defenders and forwards than for midfield players.

In a study of 13 to 14-year-old sub-elite soccer players from the north of Portugal, Malina *et al.* (2004b) reported that midfield players seem to be the lightest and the shortest of all the players, the forwards being heavier and taller. Aziz *et al.* (2005) and Brocherie *et al.* (2005) observed the same trend in samples of adult soccer players. Gil *et al.* (2007) established the anthropometric and physiological profiles of young nonelite soccer players, between 14 and 21 years old, according to their playing position, the goalkeepers being the tallest and heaviest group.

The present study considers somatic and maturity characteristics of youth soccer players aged 11-12 years by field position. Consideration of the anthropometric characteristics in youth soccer, in general, and the playing position, in particular, and their association with maturational evaluation provide a contribution to the literature in this area.

2. METHODS

The sample of the present study comprised 87 male soccer players belonging to the 11 to 12 years old competitive age-group (Table 1). The organization of youth soccer in Portugal uses two-year age groups and all players were born in 1991 or 1992. Players were from 5 teams from the midlands of Portugal that compete at a regional level in a 9-month competitive season (September-May) through the Portuguese Soccer Federation. Players participated in three training sessions per week (each about 90 minutes) and one game per week, usually on Saturday. The study was approved by the Scientific Committee of the University of Coimbra and by each club. The players and their parents provided informed consent. Subjects were informed that participation was voluntary and that they could withdraw from the study at any time.

Height (m), body mass (kg), proportions (bicristal/biacromial ratio - %), adiposity (sum of triceps, subscapular, suprailiac and medial calf skinfolds - mm), skeletal age (SA) (years) evaluated by the FELS method (Roche *et al.*, 1988), chronological age (CA) (years) and the difference between SA and CA (SA minus CA) (years) were used to compare goalkeepers, defenders, midfielders and forwards. In the collection of data, the protocol described in Lohman *et al.* (1988) was followed. Data were converted to Z-scores and mean Z-scores were compared by position using descriptive statistics.

All data were collected within a two-week period under standard conditions in an indoor facility at the University of Coimbra. The physical measurements were obtained by an experienced researcher in anthropometry.

Table 1. Age (range, mean, standard deviation) and number of players assessed per field position.

| | Chronological age | | | | |
|-------------|-------------------|----------------|----------------|-------------|-----------------------|
| | <i>n</i> | <i>Minimum</i> | <i>Maximum</i> | <i>Mean</i> | <i>Std. deviation</i> |
| Goalkeepers | 8 | 11.17 | 12.45 | 11.71 | 0.47 |
| Defenders | 32 | 10.99 | 12.84 | 11.68 | 0.47 |
| Midfielders | 28 | 10.98 | 12.82 | 11.87 | 0.54 |
| Forwards | 19 | 11.04 | 12.94 | 11.92 | 0.61 |
| Total | 87 | 10.98 | 12.94 | 11.92 | 0.61 |

3. RESULTS and DISCUSSION

Descriptive statistics by position and results of ANOVA are presented in Table 2. In addition, players were profiled by position using Z-scores (Figure 1). The position related variation was significant for two variables: discrepancy between skeletal age and chronological age ($F=2.74$, $P<0.05$, $\eta^2=9\%$) and height ($F=3.67$,

$P < 0.02$, $\eta^2 = 12\%$). Goalkeepers were larger in body size while forwards were taller rather than heavy but both were advanced in skeletal maturation (SA-CA). On the other hand, the midfielders tended to be shorter and lighter and slightly later in skeletal maturation. Besides goalkeepers being younger, they were almost a full standard deviation above their peers, in general, in skeletal maturation and height. The defenders were the fatter and the youngest field-position group. Although speculative, a possible explanation for these results may be differences between central and lateral defenders, the former group being fatter and more mature and the latter group younger and less advanced in maturity.

Table 2. Z-scores of the sample, by field position, for the variables of the study.

| | Goalkeepers (n=8) | Defenders (n=32) | Midfielders (n=28) | Forwards (n=19) | F (p) | η^2 |
|-------------------------------|----------------------|---------------------|-----------------------|--------------------|-------------|----------|
| Chronological age (CA), years | 11.7 (0.5) | 11.7 (0.5) | 11.9 (0.5) | 11.9 (0.6) | 1.10 (0.35) | 0.04 |
| Skeletal age (SA), years | 13.0 (1.1) | 11.8 (1.4) | 11.6 (1.4) | 12.3 (1.5) | 2.58 (0.06) | 0.09 |
| SA-CA difference, years | 1.3 (1.2) | 0.1 (1.4) | -0.3 (1.4) | 0.4 (1.5) | 2.74 (0.05) | 0.09 |
| Body mass, kg | 41.1 (5.9) | 38.7 (7.1) | 36.3 (5.0) | 38.4 (6.0) | 1.53 (0.21) | 0.05 |
| Height, metres | 1.498 (0.051) | 1.447 (0.075) | 1.420 (0.054) | 1.463 (0.064) | 3.67 (0.02) | 0.12 |
| Bicristal/biacromial ratio, % | 69.6 (2.2) | 71.6 (4.1) | 73.6 (4.6) | 72.3 (4.0) | 2.31 (0.08) | 0.08 |
| Adiposity, mm | 29.6 (9.8) | 37.2 (17.4) | 29.2 (13.1) | 30.1 (10.8) | 1.97 (0.12) | 0.07 |

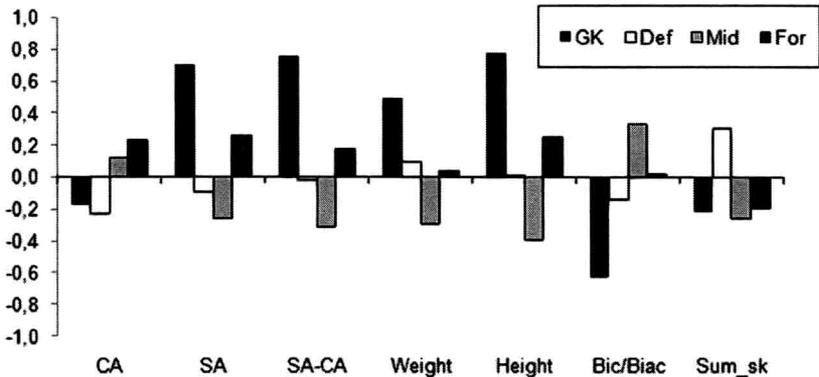


Figure 1. Z-score profiling of soccer players by position.