



**EHF SCIENTIFIC
CONFERENCE 2013**

2nd EHF Scientific Conference

Women and Handball: Scientific and Practical Approaches

**Conference Guide
Summary of Abstracts**

22 – 23 November 2013
Vienna, Austria



**EUROPEAN HANDBALL
FEDERATION**

FOREWORD



Jean Brihault
EHF President

Don't you believe David Lodge! A scientific conference is the most serious of events. It is the necessary interface between the researcher's long term efforts and the rest of the scientific community in a given field of research. In our case, it is also the necessary interface between research and its potential applications in the field of handball.

Some of this research may be described as fundamental, some as applied. We know, however, the artificiality of this dichotomy. It is because we, in the European Handball Federation, are convinced that there is no discontinuity between abstract approaches and their concrete and practical implementation on court that we came up with two ideas a few years ago. They concerned the creation of a European Union of University Handball Teachers and the organization of an EHF Scientific Conference. It was on the proposal of Professor Frantisek Taborsky, the then chairman of the EHF Methods Commission (now a member of the Executive Committee of the International Handball Federation), that the EHF set up this Union and organized this Conference.

The Union has become a stable and hard-working body, supplying regular inputs, conveyed to the handball world through our digital publications. The Conference was organized for the first time in 2011 on the occasion of the celebration of the European Handball Federation's twentieth anniversary. It was such a resounding success that it was immediately decided that it should become a regular event.

Sport in general and handball in particular needs to steep its roots in the fundamental soil of scientific knowledge in order to progress in a controlled and responsible way towards higher levels of performance in full respect of the individual participants. Science needs to confront itself with the realities of the world around it, with the possible practical outcomes of its findings, with the dangers a misguided appropriation of its conclusions can produce.

It is therefore essential that a forum should be made available to all those concerned in the long chain of intellectual and practical responsibilities in the field of handball so that work in common, mutual understanding, and a clear preoccupation with the respect of the individual should prevail.

The abundance and diversity of the papers proposed for this conference testifies to the interest of both the scientific community and the handball world (often enough overlapping it must be said) in this approach.

I very sincerely thank all those involved and have no doubt that, together, we shall succeed in bringing both the game and the scientific understanding of all its parameters to new heights.

Prof. Jean BRIHAULT
EHF President

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UUHT Member



Helmut Höritsch
Senior Manager
Education & Development
EHF CAN

EUROPEAN HANDBALL FEDERATION

Hoffingergasse 18, 1120 Vienna
T: +43 1 80151 0; F: +431 80151 49
office@eurohandball.com
www.eurohandball.com

www.facebook.com/EHFCan
www.twitter.com/EHFMedia
#ehfSC

Conference venue

Wiener Gartenhotel Altmannsdorf Hotel 2 – Hoffingergasse 33, 1120 Wien, Austria
Tel.: + 43 (1) 80 123 7230 – Fax.: + 43 (1) 80 123 7233
E: hotel2@gartenhotel.com – W: www.gartenhotel.com/home.html

Conference Coordination

Beata Kozłowska
kozłowska@eurohandball.com
+43 1 80151 152

Anna Psintrou
psintrou@eurohandball.com
+43 1 80151 137

Layout: Richard Turner

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* For reasons of comprehension and/or grammatical coherence some of the abstracts and/or their titles have been grammatically and/or syntactically altered and thus differ from the version submitted by the author.

IMPLEMENTATION OF PROPHYLACTIC TRAINING IN HANDBALL: WHY, WHEN, HOW AND WHO?

Jesper Bencke, MSc, PhD

Merete Møller, MHSc, PT

Mette Kreutzfeldt Zebis, MSc, PhD

This lecture will discuss the implementation of injury prevention training based on scientific studies as well as subjective experience from the three presenters. The lecture will discuss how we can fit this into a – very often – tight schedule with different kinds of training regimes. The question of individualising the training will be discussed, and suggestions to when a handball player should commence the specific prophylactic training. The presenters have vast experience as elite handball or football players, and as elite coaches of both young and adult female players. After an introduction, a panel discussion will give the possibility of introducing other angles and perspectives on the topic from all participants of the conference.

WHY DO SO MANY KNEE INJURIES OCCUR DURING SIDE-CUTTING, AND WHY ARE FEMALE PLAYERS MORE AT RISK?

Jesper Bencke, MSc, PhD

This lecture will give an overview on how acute knee injuries occur in handball. Anatomical, biomechanical and neuromuscular factors will be presented and discussed based on the scientific information available today.

The side-cutting manoeuvre is a high-risk movement with regard to injuries to the anterior cruciate ligament (ACL). Studies using 3-dimensional movement analyses are used to describe how handball players perform the handball specific side-cutting manoeuvre, and yield data on knee joint angles and hip joint angles, that may influence the forces and moments loading the joint in the potential knee injury situation. Likewise, the coordination of the muscles around the knee and ankle joint varies between players, and will also greatly influence the risk of injury.

Combining the biomechanical information with data on activation patterns and levels of activity of the specific muscles, we may be very close to be able to predict the risk of injury on individual handball players. Differences in these parameters may also explain why young women are more at risk than men.

EFFECT OF KNEE INJURY PREVENTION IN HANDBALL: WHICH EXERCISES SHOULD WE CHOOSE?

Mette Kreutzfeldt Zebis, MSc, PhD

This lecture will give a short presentation of what is known about knee injury prevention today, and validated injury prevention programs will be presented. With special focus on potential risk factors for knee injury, a detailed neuromuscular evaluation of specific exercises will be given. By the use of EMG, muscle activity during execution of balance/coordination and strength exercises can be assessed, and data on the neuromuscular stimuli when these exercises are implemented in the weekly training will be presented. Are the exercises doing what they are supposed to do?

HIGH INCIDENCE OF INJURIES IN FEMALE HANDBALL: SPECIFIC CONCERNS AND IMPACT ON PARTICIPATION

Merete Møller, MHSc, PT

This lecture will give an overview of the injury burden among youth and senior female handball players, and provide a general overview of potential risk factors for injuries.

Systematic injury surveillance in handball is needed to monitor injuries, and to ensure new knowledge on injury trends, which can form the basis for further research on injury risk factors, mechanisms, and in the final step, on injury prevention.

In recent studies, injury incidence and handball exposure among youth and senior elite handball players have been assessed in Denmark by the use of the SMS-system. This SMS-system has made it possible for the athletes themselves to report injuries directly. The main results from these studies emphasized the huge injury burden and especially the very high number of knee, ankle and shoulder injuries among handball players.

Previous research has highlighted the significant consequences of these injuries, both for the athlete as well as in society at large. However, the injuries also have huge impact on participation and team results. From all perspectives, it is therefore necessary to further investigate the injury mechanism, develop new effective preventive strategies, and implement the knowledge of the effective injury prevention strategies of these injuries.

CONSTRUCTION OF AN OBSERVATIONAL SYSTEM FOR THE ORGANISED ATTACK IN WOMEN'S HANDBALL: A CASE STUDY

André Afra¹, João Prudente², Pedro Sequeira^{1,3}

¹Escola Superior de Desporto de Rio Maior, Portugal

²Universidade da Madeira, Portugal

³Unidade de Investigação do Instituto Politécnico de Santarém, Portugal

Through the years, handball has been getting more offensive, the number of attacks during the game is increasing, and the number of times that the team is in offensive process is getting higher. The game is quicker and the actions are more diversified. The offensive phase is the one that, through a set of individual, collective or team situation will provide several situations of goal scoring. The objective of this study is to build an observing instrument that permits the analysis of the offensive process of a female handball team.

9 games from Juventude Desportiva do Lis, from the final phase, 1^a Division of the Portuguese Women National Championship were observed, where 521 offensive actions with change of ball possession were registered. The results prove the efficiency of the offensive actions, as well as an overview of the games observed, concluding with actions more often used, the average of using those actions in a game, the efficiency of those actions in the game, etc. The conclusion was based on descriptive statistic data, since the main objective was to validate an instrument of observation.

NEURO-MUSCULAR COORDINATION AND BALANCE SKILLS DEVELOPMENT IN YOUNG FEMALE HANDBALL PLAYERS

¹Acsinte Alexandru, ¹Eftene Alexandru, ²Oscar Gutierrez Aquilar

¹ Faculty of Health, Sports and Human Movement Sciences, "Vasile Alecsandri" University of Bacău, Romania, ²University "Miguel Hernandez" from Elche, Spain.

In contemporary handball, we can observe a diversification of the shooting at the goal procedures, as well as a continuous adaptation of the technical elements and procedures to the game circumstances. Neuro-muscular coordination and balance skills are treated as new trends in sport performance training process.

The latest research shows that athletes, who manage their body and segments in best coordinative circumstances – even in different kinds of stressful environments –, have the best efficiency in sport performance. The aim of this material is to explore the importance of balance skills and neuro-muscular coordination as a part of training sessions, starting with young female handball players.

Evaluation of the athletes' performance has been realized using tests from "Functional testing in Human Performance, 139 tests for sport, fitness, and occupational settings" by Michael P. Reiman and Robert C. Manske (Human Kinetics, 2009). The examined data led to the following conclusions:

- the values recorded during the "T" test proves that the players' reaction was relatively low; although the left wing did not record any progress, the right wing had a progress of 0.02 sec., the same progress being recorded by the left back, and by the central back, as well;
- the pivot's data are interesting, recording a regression;
- the results recorded during the "Figure 8 Hop Test" prove that there is an increased reaction in the tested players;
- we must emphasise the fact that the effect of the drills that were used has been felt more in the non-dominant leg (0.27 sec.), in comparison to the dominant leg (0.23 sec.);
- with regards to the "ZIGZAG Run Test", the 0.21 sec. progress also confirms the fact that the specific dynamic and static balance indices were improved after the athletes performed the drills we selected.

THE USE OF INFORMATION TECHNOLOGY IN NON-FORMAL EDUCATION AND INFORMAL LEARNING OF HANDBALL COACHES

Mgr. Tomáš Augustýn

Faculty of Sports Studies, Masaryk University Brno, Czech Republic

The research focuses on the question of the use of information technology in non-formal education and informal learning of handball coaches, which play an increasingly important role in the gradation of the coaching profession.

The aim of this empirical research was to analyse the specific forms and methods of the use of information technology (video channels, social networks, electronic databases, websites, computer programmes, smart phones, etc.) in non-formal education and informal learning of coaches.

The research has demonstrated that coaches commonly use information technologies both in personal life and coaching. In connection with their coaching activities, the use of a one-way communication predominates, especially the study of methodical guidelines/materials. Two-way communication, such as internet e-learning courses, discussion forums, webinars, etc., is used significantly less.

We will present a detailed analysis comparing the use of ICT among men and women, where women express greater satisfaction with the available forms and contents, even though they use them less than men in informal learning. Contrariwise, they discuss their coaching job problems with others more over the internet.

EVALUATION OF THE TALENT IDENTIFICATION PROGRAMME OF THE GERMAN HANDBALL FEDERATION

^{1,2}Dirk Büsch, ³Jörg Schorer, ¹Jan Pabst, ⁴Bernd Strauss, ⁵Klaus-Dieter Petersen,

⁵Jens Pfänder, ⁶Peter, Sichelschmidt

¹Institute for Applied Training Science, Leipzig, *Germany*

²University of Health & Sport, Technique & Art, Berlin, *Germany*

³Carl von Ossietzky University, Oldenburg, *Germany*

⁴Westfälische Wilhelms-University, *Münster, Germany*

⁵*German Handball Federation, Dortmund, Germany*

⁶European Handball Federation, Vienna, *Austria*

The German Handball Federation (DHB) conducts a talent identification programme (TIP) with female (15-16 years) and male (16-17 years) youth handball players each year. In 2008, the DHB launched a modified TIP with anthropometric, motor and psychological tests hoping to improve the prognostic validity of the talent identification. The aim of this long term study was to evaluate the modified TIP in general and especially the prognostic validity of the different tests. Therefore, we investigated whether these tests differentiate between youth team players nominated and not-nominated by the national coaches.

The female youth handball players from 20 regional selection handball teams ($N = 240$ additional players each year from 2008-2013) performed a series of anthropometric, motor and psychological tests. Additionally they were observed playing varying forms of handball. Stepwise discriminant function analyses were conducted separately for each year.

The results indicate that the identified tests per year change quite frequently. Additionally the predictive validity is quite low. Together these results question, if previous studies that use one point in time to identify predictors might face the same problem. We also suggest that the predictors are just not sensitive and specific enough. Therefore, TIP will be expanded by tactical tests with open skills in hopes of improving the predictive validity.

HANDBALL AND GENDER DIFFERENCES – SPECIAL FOCUS ON THE COACHING PROFESSION. CASE IN POINT: SLOVENIA

Marta Bon, Mojca Doupona Topič
University of Ljubljana, Faculty of Sport

The coaching profession is of great importance in any team sport, and has a big influence not only on the success in sport, but also on the sport or professional career of (young) people, which can often define the lifestyle of athletes.

This research also deals with the issue of how Slovene society perceives athletes from the viewpoint of gender differences, with special focus on the coaching profession in handball, which is one of the most popular sports in Slovenia. The coaching profession in Slovenia is a part of the local culture, by means of which men become the carriers of masculinity and patriarchy.

We are presenting a quantitative analysis on the sum and percentage of handball coaches among the genders, and we compare data from the years 2004, 2008, and 2012. The qualitative part of our research, our experiences as professional handball players, a handball coach (Bon) and as sport researchers are included. Comparative analysis shows that the number of all coaches with an academic level of education (not coaching licences) in Slovenia has increased immensely (2004= 303; 2008= 562; 2012= 1210), as did the percentage of coaches working with female teams (from 9.6% to 10.2% and to 19.2% in 2012).

In conclusion, the situation with gender relations has not changed much until now. Female coaches are present in youth age categories, working with girls and very rarely with boys. With some exceptions, they are not present at the top level of the sport. With knowledge of the coaching profession also in other handball federations, the situation is not really different. In top-level handball (World and European Championships, Olympic Games, league), there are no women in the position of head (first) coach, though the number of women working as assistant coaches, physiotherapists and team leaders continues to increase. Though rare, there are women working with male teams, but there is absolutely none in men's top-level handball.

Finally, we can assume that the social and sports climate in Slovenia has not yet reached the point at which the abilities and success of male and female coaches can be treated and valued equally in the area of coaching athletes in handball.

ORGANIZATION OF COMPETITIONS IN YOUTH HANDBALL

Americo Ramos Cardoso¹;

João Filipe Nunes Prudente¹;

Pedro Jorge Richheimer Marta de Sequeira²

¹Universidade Madeira, Funchal, Portugal;

²Unidade de Investigação do Instituto Politécnico de Santarém,

Escola Superior de Desporto de Rio Maior, Portugal

A sport provides pleasure and social interaction, creates idols and stimulates and attracts millions of children and young people. Among these, also influenced by family, many choose to practice a federated sport at an increasingly early age.

This has aroused the interest of many scholars in the past two decades. Many papers have been published on the subject of sport for children and young people. One of the incentives to conduct this study was to ask the opinion of the coaches of Handball Portugal, about the guidelines to follow in competitive participation, preparation for competition and this format during the early stages of training.

We applied a suitably adapted and validated questionnaire (Cardoso, 2007) to the coaches at the beginning of the 2011/12 season, scanned the data into "Microsoft Excel" and we did the statistical analysis SPSS.18. The sample consisted of 276 coaches of various levels of technical training. We analysed descriptive data of normality (Shapiro-Wilk) and homogeneity (Levene). Furthermore, we tested the possibility of significant differences (for sig. 0.05) in the opinion of the coaches of different levels of training (*Kruskal Wallis*).

We concluded that most of this research supports the coaches on: 1) that competition in brackets duiker, minis, and children must start essentially with formative goals and a greater emphasis on results in competitive ranking of juveniles, 2) that one should opt for a specialised training style from youth level, 3) the sporting competition should contribute to promoting motivation, developing positive self-esteem and self-conception, social capital, socialising among peers, creating new friendships and developing values; 4) the importance of pleasure and fun of children and youth during sports; 5) ranking by level of children (10-12 years old) and minis (8-10 years) will be ideal to start participating in regular competitions; 6) further discussion of these issues and further training courses for coaches in periodic training is necessary in our country.

BEACH HANDBALL TO IMPROVE JUMPING POWER

Lara Cobos, D.¹

Zapardiel Cortés, Juan Carlos²

Rodríguez, Maria Luisa²

¹Real Federación Española de Balonmano (Madrid, Spain)

²UAH (Alcalá de Henares, Spain)

Introduction: Beach Handball is an emerging sport that is beginning to be embraced by many clubs as an alternative summer sport, although some of the clubs are a somewhat reluctant to recommend this practice to their players for fear of injury. There is inadequate evidence in this matter, and it is important to have studies that prove the virtues of beach handball in the primary target that is the traditional handball players (Gehrer & Werkmeister, 2006). In this way, we want to break down the barriers that exist among traditional handball players, so that they can play beach handball. The objective of this study was to determine the effects of beach handball on explosive force in traditional male and female handball players.

Methods: Two beach handball experimental groups: one group of ten male players and another group of ten female players, who participated in the entire summer season of beach handball at the Spanish Tour; two control groups: one group of ten male subjects and another group of female subjects who had no beach activity, participated in the study. Their age ranged between 19 and 30 (average 23.5). The variable studied was the explosive force. In order to measure the explosive force, a Quattro Jump force plate system was used. Initial tests were carried out before the start of the beach season (May 2013). The final tests will be conducted at the end of the beach season (August 2013).

Results: The results will be analysed once beach season ends (August 2013).

THE OPTIMAL WEIGHT FOR A FEMALE HANDBALL PLAYER

Gratas-Delamarche Arlette

“Movement, Sport and Health Sciences –M2S” Laboratory
University Rennes2-ENS (Rennes, France)

Coaches and female handball players are acutely aware of the importance of achieving and maintaining body weight for peak performance. Appropriate size, build and body size are critical in success, and special anthropometric characteristics often emerge as important factors depending on the position on the field. Although size and body build can only be altered slightly, body composition can change substantially through dieting and exercise. Standard height-weight tables do not provide accurate estimates of what an athlete should weigh, because they do not take into account the composition of weight.

Assessment of body composition provides additional information beyond the measures of height and weight and aims at determining the respective part of body fat and fat-free mass. Optimal body-fat levels vary depending on the sex, age, and heredity of the athlete, as well as the sport itself. Body-fat assessment techniques have inherent variability, thus limiting the precision with which they can be interpreted. Laboratory tests, such as DEXA, have emerged as precise and reliable techniques, but they are expensive and difficult to use in daily life. The most widely applied field technique involves measuring the skinfold thickness. In order to obtain reliable results, tests should be performed on a professional, who is used to these measurements.

When the pressure to achieve a weight goal is high, players are likely to attempt any weight-changing method to achieve success, regardless of the health consequences. Weight loss can be especially problematic for women. This may result in chronic dieting to maintain lower than-healthy body weight, which in turn can lead to eating disorders and in severe cases, even to clinical eating disorders. Healthy weight is one that can be realistically maintained, allows for positive advances in exercise performance, minimizes the risk of injury or illness, and reduces the risk factors of chronic disease. With this aim in view, coaches and female handball players can refer to practical guidelines for weight management.

BEHAVIOUR OF RETRACTION IN THE DEFENSE: PRESENT RESULTS IN NATIONAL WOMEN HANDBALL

Dr. Christoph Dreckmann
Technische Universität München
Fakultät für Sport- und Gesundheitswissenschaft

Introduction and research question

The attractiveness and structure of handball has changed enormously in the last ten years. The current exploration focuses on the behaviour of retraction in handball. Its importance increased with the last rule change in the late 90s (Sichelschmidt, 1988). There are no present scientific interventions available concerning this topic in the national and international literature, especially not in women's handball.

Methods

From a methodological point of view, we chose a mixed method-design, consisting of expert-interviews (Gläser & Laudel, 2006), and qualitative and quantitative game analysis (Dreckmann, Görsdorf & Lames, 2007). Data was obtained from 5 games of German male and female national handball teams (20 in total) of different age groups. We proved the data structure for different specific phenomena. Four national coaches of the German Handball Federation were interviewed, in the form of qualitative half-structured telephone interviews.

Results

The behaviour of retraction referring to male and female national teams was analysed in a first pilot study. Therefore we looked at the frequency of withdrawals, the average of goals in phases of retraction, the continuance, as well as the reasons for withdrawal. We found out that women have a higher level on running backwards in their defense than male national teams. In the text-analysis of the interviews for instance, the coaches offered different philosophies of retraction behaviour, so there are different opinions within one federation.

Discussion

One can observe a first thrust in the area of retraction behaviour in male and female handball. This pilot study should be secured with further, ideally international examinations. Then the results would be clearly recognizable and more valid. The retraction behaviour in handball is a determining factor for victory or defeat. It has to be discussed, why there is no uniform doctrine in retraction exercises.

RULING AND REALITY: THE HANDBALL CASE

Maria Luísa Estriga^{1,2}, António Ferreira¹, João Carvalho³

{¹Faculty of Sport} University of Porto, Porto, Portugal,

³Physics Department, University of Minho, Portugal

The main purpose of this work was to quantify the accuracy of the Portuguese elite Handball referees, as well as of the accredited examiners. The correlation of ruling errors with match time, score result, field place and favoured teams was investigated.

Ten elite Portuguese handball referees and four highly experienced examiners were involved in this study. Data was collected during the final phase of the Portuguese Men Supertaça (2011) - a set of 9 matches between 6 teams in 3 days on a neutral court. Each match was recorded by three HD cameras from elevated positions. At each game all four examiners were simultaneously but independently at work while their notes and audio comments were recorded synchronised to the live actions.

Immediately after matches, all the records were analysed by two of the investigators, who produced shorter video sequences (with multiple angle, HD, zoom and slow motion) containing all the non-consensual ruling situations, including the doubtful absence of intervention situations. Afterwards, both referees and examiners reviewed these sequences individually and their opinions were registered. Finally, the correctness of each ruling decision was determined based on a consensus of the off-line analysis or, in the lack of it, the original live decisions were considered correct.

Results: in 9 matches, 1476 refereeing decisions were made, 98 of which were considered incorrect and 97 were identified as an oversight of intervention. Of the 369 situations that were off-line reviewed, consensus was never obtained in 25% of them, even with ample technological aids and time to use them. In summary we observed that the number of "serious" errors per match is similar to the number of non-consensual observations made by experts.

LIVE EXERTION EVALUATION IN ELITE HANDBALL REFEREES

Maria Luísa Estriga^{1,2}, António Ferreira¹, Catarina Santiago^{3,4}

{¹Faculty of Sport, ³Faculty of Engineering} University of Porto, Porto, Portugal,
⁴INESC-Porto, Portugal

We developed and implemented a new method for almost real-time video content extraction, with a linear accuracy of 16 cm. This method was applied to the study of the handball referee's location over time, by processing the feeds from two overhead mounted cameras (1024x768/24bit/30 fps) in the final 9 matches of the Portuguese Supertaça (2011). Each referee was also equipped with a tri-axial accelerometer (10bit/128Hz) and a commercial two lead ECG device (10bit/256Hz).

The results show a tri-modal modal velocity distribution with peaks around 0 km/h (stand still), 4.5 km/h (walk) and 13 km/h (run). Average displacement is 5km, in accordance with other published results. A comparison between the usual exertion metrics (heart rate, accelerometry) and the effective displacement velocity shows that the former are very bad exertion indicators (Kendall tau=0.38).

During 46% of the match time, the heart rate is above the anaerobic threshold while the real exertion is, during 88% of the time, well below that. The referees were also submitted to additional laboratory tests (lactate anaerobic threshold, $\dot{V}O_2\text{max}$) after the tournament. These were combined with sleep and daily life monitoring data as well as in-field results (heart rate and physical exertion) to show the importance of stress in the heart rate response, even in the nights before the big matches.

Finally, these results were commissioned by the Portuguese Handball Federation and have been used to develop and propose conditional evaluation procedures to the European Handball Federation, as well as training programmes for the Portuguese elite referees. Results emphasise the need for a long term strategy to deal with high levels of stress in referees.

RELATIONSHIP BETWEEN YO YO INTERMITTENT RECOVERY TEST PERFORMANCE AND SELECTED PHYSICAL ABILITIES IN ELITE JUNIOR HANDBALL PLAYERS

Dr. Hermassi Souhail

ISSEP, Ksar-Saïd, Manouba University, Tunisia.

Member of the Union of University Handball Teachers, EHF

The aim of the present study was to investigate the relationship between Yo-Yo Intermittent Recovery Test level 1 (IR1) performance and various selected physical performance qualities of the lower body in elite handball players. Twenty four players (18.9 ± 0.4 years) completed a test of peak power of the lower limbs (W_{peak} , determined by a force-velocity test), jumping ability tests (squat and counter-movement jumps; SJ, CMJ) and an agility T-half test, in addition to the Yo-Yo Intermittent Recovery Test (IR1) performance (DC) and the maximal aerobic speed (MAS). The performance of the Yo-Yo IR1 averaged 1772 ± 343 m and the MAS were 4.38 ± 0.3 m·s⁻¹. IR1 DC and MAS were positively associated with the absolute W_{peak} for the lower limbs ($r = 0.79$ and $r = 0.80$ respectively; $p < 0.01$). Significant correlations were also found between DC and MAS and CMJ and SJ ($r = 0.62$ and $r = 0.65$ respectively; $p < 0.01$). There was a moderate correlation between DC and MAS and the agility T-half test ($r = 0.66$; $r = 0.64$ respectively $p < 0.01$). The MAS of IR1 test score were also found to have a moderate to large association with other explosive power measurements in elite handball players. Yo-Yo IR1 performance may provide a useful composite index on responses to training or rehabilitation, and could be very suitable for monitoring athletic performance of elite handball players.

THE RELATION OF WOMEN TEAM MATCH PERFORMANCE INDICATORS TO THE RESULT OF THE MATCH IN HANDBALL

Ján Hianik

The Faculty of Physical Education and Sport, Comenius University
Bratislava, Slovakia

The aim of the paper was to find out the connection between a match result and team match performance in the world women's handball. Team match indicators were hierarchically divided into general, main and additional ones. For the evaluation, we used a computer program. On the base of data obtained, we have shown that match result significantly relates ($p < 0.05$) to all general team match performance indicators. In evaluation of the main indicators the match result significantly depends on the success of the fast break, in defensive phase with defending attack. In the goalkeepers' match performance, significantly relation amongst the goalkeepers' saves has been noticed. Additionally, the match result depended on the success of the extended defensive system when defending in minority and on the goalkeepers saving the opponents' shots from near distance. Subsequently, results were obtained compared to the evaluation of the men's team match performance. Substantial differences have been noticed, mainly in the success of solving the main and additional indicators.

SELECTED EXTERNAL LOAD INDICATORS OF A BACK PLAYER, WING PLAYER AND LINE PLAYER IN THE WORLD WOMEN'S HANDBALL

Ján Hianik

The Faculty of Physical Education and Sport, Comenius University
Bratislava, Slovakia

The aim of the paper was to analyse the level of contact of the offensive player with the defender during selected activities of the individual offensive game. To obtain data we used the method of indirect observation, using DVD recordings. We watched the pre-Olympic tournament in London. The group consisted of four women's representative teams (Slovakia, Poland, China and United Kingdom). Results showed that the passes in gradual attack were very often carried out without contact with the defender (72% - 94%). The rest of the game activities contained contact of the attacking player with the defender (line players 100%, back players 84%, wing players 55%). Lower levels of contact with the defender were recorded during counterattacks than during gradual attack.

PROPOSAL ON THE ANALYSIS OF OFFENSE SET-PLAY USING SEQUENCE ANALYSIS

Shiro Ichimura¹, Tetsushi Moriguchi² and Norio Shimizu³

¹Tokyo University of Science, Chiba, JAPAN 278-8510;

²Kagoshima University; ³International Budo University

It is necessary to analyse the continued attacking plays if we know the characteristics of an offense set-play in handball. This paper attempts to establish a methodology for evaluating the characteristics of an offense set-play using sequence analysis, like a Bioinformatics study.

The offense set-plays of ESP, KOR, MNE and NOR women's teams were analyzed in the London Olympic games. The attacking plays during the offense set-play were distinguished according to the moving and throwing directions on previous player and the attacking direction of player while receiving a ball, as follows: THROUGH (T) as throwing the ball in same direction to the attack direction with less movement after receiving the ball; WALL (W) as throwing the ball in an opposite direction to the attack direction with less movement after receiving the ball; PARALLEL (P) as attacking in same direction to the attack direction of a passer while receiving the ball; HOLD (H) as attacking in an opposite direction to the attack direction of a passer while receiving the ball; REVERSE (R) as attacking while receiving the ball which thrown in an opposite direction to the attack direction of a passer; COUNTER (F) as attacking while receiving the ball, which is moving to cross in front of a passer; CROSS (B) as attacking while receiving the ball, which is moving to cross in backward of a passer.

These distinguished attacking plays were arranged in chronological order. These arranged attacking plays were clustered and analysed using a sequence analysis. We observed that these common continued attacking plays in all teams were H-B, H-H, H-P, P-B, P-F, P-P, T-P, H-H-P, H-P-F, H-P-P, H-P-R, P-B-P, and P-P-F. On the other hand, the specific continuation attacking plays were also observed in each team. Our new analysis method using sequence analysis might provide the evaluation of the characteristics of the offense set-play in handball and the specific offense set-play for each team.

CHARACTERISTICS OF EFFORT IN PLAYING HANDBALL WITH DIFFERENT TYPES OF DEFENSES IN GIRLS AGED 10 TO 12 YEARS

Kadivnik Hana, Jug Iva, Luzar Klemen, Pori Primož, Bon Marta, Šibila Marko
University of Ljubljana, Faculty of Sport, Ljubljana, Slovenia

The appropriate selection of means, by which we try to improve technical, tactical and fitness abilities of young handball players, is very important for effective learning and training. It also contributes to the later success of players. This is why we tried to determine which one of the three different game forms (individual defence, zone defence or 2 x 3 vs. 3 game form) would be the most suitable for female handball players, aged between 10 and 12 years.

During this period, coaches usually make the transition from Mini handball to Handball, played on the whole court. Eleven subjects played nine model games, using each way of defence three times. We tried to determine the level of effort to which the players were exposed during these games. As an indicator of effort, we measured the heart-rate, using Polar Team2 Pro measuring apparatus. SPSS statistical package was used to calculate basic statistical characteristics of parameters and the differences in the heart-rates obtained in different game forms. There were significant differences between measured heart-rates during games using individual defence and 2 x 3 vs. 3 game form, comparing to those games played with zone defence. But there were no significant differences between games with individual defence and 2 x 3 vs. 3 game form.

TRACKING MULTIPLE HANDBALL PLAYERS USING MULTI-COMMODITY NETWORK FLOW FOR ASSESSING TACTICAL BEHAVIOUR

António Manuel Marques de Sousa Alves Lopes^{1,2}

João Manuel Eleutério Florêncio²

Horesh Ben Shitrit³

Pascal Fua³

Sofia Cristina Carreiras Fonseca¹

¹Faculty of Physical Education and Sport of Lusófona University

²Portuguese Handball Federation

³Computer Vision Laboratory of École Polytechnique Fédérale de Lausanne

One of the main challenges in performance analysis is to identify common patterns that best explain overall team performance and inferences from sport behavior to sport outcome. Tactical behaviour usually refers to the players' actions, meaning that the position of every player at each moment is influenced by the tactical concepts. A method for assessing tactical team performance is the observation of spatial patterns. The use of spatial measures can provide an interpretation of pattern analysis.

The aim of this work is to present an approach that can help to characterize and assess teams' and players' tactical behavior using two techniques, to support handball coaches in tactical procedures during training sessions, when using position data: the multi-commodity network flow to track multiple handball players and the use of Voronoi diagrams approach.

A 6x6+GK task was performed in half court during a practice session of the Portuguese national women's team and was video recorded. Players' position data were acquired using the video recorded with the Probabilistic Occupancy Map algorithm which extracts the real coordinates of each player across the duration of the task. The % of field area covered by each team and spatial measure was calculated using routines implemented in Matlab R2008a software.

Results from this exploratory work in this task suggest that it is possible to identify a number of characteristics that can be used to describe tactical differences between fast-break and fast throw-off. The approach presented in this work may be useful to reduce the time of game analysis and to help coaches to improve the assessment of tactical and strategic performance of the team during the training sessions.

DIFFERENT TRAINING PERIODIZATION MODELS IN FEMALE HANDBALL

Carmen Manchado,¹; Helena M. Vila.²; Carmen J. Ferragut³;

¹Faculty of Education. University of Alicante. Alicante. Spain.

²Faculty of Education and Sport Science. University of Vigo. Pontevedra. Spain.

³Faculty of Medicine. University of Alcalá. Alcalá de Henares. Spain.

Traditional training periodization (TP), i.e. the division of the seasonal programme into smaller periods and training cycles, usually attempts to develop many abilities simultaneously; the block periodization (BP) concept suggests consecutive training stimulation of carefully selected fitness components.

The objective of this study is to find out which of the two training periodization models contributes more effectively in the improvement of the most important handball performance factors. Nine female players, who played two consecutive seasons in a Spanish first division team took part in this study (height = 168.4±3.45cm, weight = 63.6±5.21 kg).

During the first part of the season (August to December) and for two consecutive seasons, training was carried out following the two periodization models. During the first season, training was carried out following the TP model, and during the second season, training was carried out following the BP model. At the beginning and end of the two periods, different tests were carried out to measure handball key performance variables.

Standard statistical methods were used to calculate the mean and standard deviations. T-test for related samples was used to analyse the improvement of the different handball key performance factors. The $p \leq 0.05$ criterion was used for establishing statistical significance. Results show that more significant improvements are achieved with the BP model than with the TP model. In the case of this handball team, the BP model proved more convenient than the TP model.

PERFORMANCE ANALYSIS: A WAY TO IMPROVE COACHING METHODS IN HANDBALL

Zoltán Marczinka

International Coaching Education Centre of the Hungarian Handball
Federation (ICEC-HHF)

Monitoring and analysing performance is an integral part of everyday sporting life. In team sports particularly, it is very important to recognise success and failure and analyse them in relation to a preset team plan or tactic. At major international handball events, there is the availability of the official match statistics which satisfies the needs of the coaches from match to match. However, it is necessary for every coach to draw up a match statistic sheet, which is tailored to suit a team's needs and also functions as a useful coaching tool.

The aim of my study is to enhance performance analyses by designing a match statistics sheet, which includes as much information as possible and collecting documentary evidence about the regularity of the most important technical-tactical elements of handball. In order to achieve these objectives, I examined a number of matches from the 10th Women's European Handball Championship 2012 in Serbia, as the field of testing, and observing and collating data on the spot.

The results showed that data collated and formatted systematically provide an excellent opportunity for various analyses. Apart from categories that are traditionally used, I introduced others which add more detail to the analysis. I found that this type of performance analysis is a practical tool used to continually enhance the teams' overall performance.

PHYSICAL DEMANDS AND PHYSIOLOGICAL PROFILE IN FEMALE VS. MALE ELITE TEAM HANDBALL PLAYERS: HOW BIG IS THE DIFFERENCE?

Lars Bojsen Michalsik, Aarhus University, Aarhus, Denmark

The present study examined the possible differences in physiological profile and physical demands imposed on female vs. male elite team handball (TH) players. Elite female and male TH players were evaluated during match-play using video recording and subsequent computerized locomotive and technical match analysis during six competitive seasons. Further, physiological measurements during match-play, physical testing and anthropometric measurements were also carried out.

Female players (FP) performed a longer mean total distance covered (TDC) per match (4693 ± 333 m, group means \pm SD) compared to male players (MP, 3945 ± 538 m) when playing full time ($p < 0.01$). FP worked with a greater mean relative physical load (79.4 % of $\text{VO}_2\text{-max}$) than MP (70.9 % of $\text{VO}_2\text{-max}$, $p < 0.05$), but performed less high-intense running per match (2.6 % of TDC) than MP (7.9 %, $p < 0.01$). FP ($n=83$) also spent less time standing still (10.8 % of total effective playing time) compared to MP ($n=82$, 36.9 %, $p < 0.001$) and showed markedly fewer activity changes (663.8 ± 99.7) compared to MP (1482.4 ± 312.6 , $p < 0.001$). In offence, MP received more tackles in total (34.5 ± 21.3), while performing more tackles in total in defence (29.9 ± 12.3) compared to FP (14.6 ± 9.2 , 20.7 ± 9.7 , $p < 0.05$). Further, MP performed more high-intense playing actions per match (36.9 ± 13.1) than FP (28.3 ± 11.0 , $p < 0.05$). Mean body height and body mass differed markedly between MP (189.6 ± 5.8 cm, 91.7 ± 7.5 kg) and FP (175.4 ± 6.1 cm, 69.5 ± 6.5 kg, $p < 0.001$).

In conclusion, substantial gender-specific differences in physiological profile and physical demands in elite TH were observed, with MP performing more high-intense, strength-related playing actions and high-intensity running than FP. Conversely, FP covered a greater total distance and worked with a higher relative work load than MP. Consequently, physical training of female elite TH players may in contrast to MP benefit from gaining a greater focus on aerobic training with relative less focus on anaerobic and strength training elements.

PHYSICAL DEMANDS OF TRAINING AND MATCH-PLAY IN THE FEMALE ELITE TEAM HANDBALL PLAYER

Lars Bojsen Michalsik, Aarhus University, Aarhus, Denmark

The present study evaluated the physical demands imposed on female elite team handball (TH) players during match-play in relation to playing position and body anthropometry using video based computerized locomotion and technical match analysis of tournament matches. In addition, physiological measurements during match-play, anthropometric measurements and in separate physical tests were carried out.

A total distance of 4693 ± 333 m (group means \pm SD) was covered per match when playing full time. High-intensity running constituted 2.5 ± 1.8 % of the total distance covered and was reduced ($p < 0.05$) 21.9 % in the second half (44.9 ± 16.8 m) compared to the first (57.5 ± 21.3 m). $\text{VO}_2\text{-max}$ was 3.49 ± 0.37 l $\text{O}_2 \cdot \text{min}^{-1}$ ($\sim 49.6 \pm 4.8$ ml $\text{O}_2 \cdot \text{min}^{-1} \cdot \text{kg}^{-1}$). Mean relative work load during match-play was 79.4 ± 6.4 % of $\text{VO}_2\text{-max}$. In offence, each player made 2.8 ± 2.6 fast breaks, gave 7.9 ± 14.4 screenings, received 14.6 ± 9.2 tackles in total and performed 7.7 ± 3.7 shots along with 3.5 ± 3.8 blockings, 1.9 ± 2.7 clasping's and 6.2 ± 3.8 hard tackles while in defence.

In conclusion, modern female elite TH is a complex, intermittent team sport that comprises several types of movement categories and also is characterized by a high number of short-term, high-intense technical playing actions. Indications of fatigue and marked positional differences in the physical demands were identified. Consequently, physical training in modern female elite TH should be directed at specific positions and individual physical capacity, while also focusing on aerobic and strength training. In a typical week for an female professional top-elite handball team with one match to play, the players have 6-8 training sessions in 5 days (i.e. 2-3 days with two sessions), with the day after the match free. If there is a second match in midweek the team often trains only 1-2 days with two training sessions. To obtain information about the loading of the players, monitoring of the heart rate during training sessions can be used.

HIGHER RISK OF ACL TEARS IN FEMALE ATHLETES IN GENERAL AND WITH SPECIAL REFERENCE IN HANDBALL

Steven K. Moayad, MD, MBA
Orthopedic Hospital Speising, Vienna

ACL tears are among the most common injuries in sports. Already in 1988, de Loes proved that handball has the highest risk of all sports, followed by ice hockey and football.

There are 27,5 injuries per 1000 playing days in football. 12% of all serious knee injuries in football are ACL-tears and 10% of all knee injuries in skiing are tears of the ACL (Oberthaler 1995).

According to the genetic basis and the effect of sex hormones, male and female athletes differ in relevant anatomical and physiological aspects with a higher risk in injuries. Different studies demonstrate a five time higher risk for ACL ruptures in female than male athletes.

Beside all the above mentioned possible reasons, some neuromuscular differences might be an additional mechanism. Movement patterns in jumping and landing seem to have a high impact on injury risk in team sports.

Data on the injury risk during the menstrual cycle are controversial but nevertheless, some dependency seems to exist. On one hand, one possibility may be that ACL stability is reduced due to the menstrual cycle. On the other hand, the preventing effect of contraceptive pills is conflicting therefore not allowing any evidence-based recommendations!

From a preventing point of view, some movement patterns might be changed, like one or two leg landing in handball, the width of feet position or the ankle of knee flexion while landing, etc. Muscular imbalances should be reduced, muscular strength in the high muscles should increase and proprioception and coordination should optimise accordingly.

In an interventional study, a Norwegian group was able to demonstrate that a proprioceptive program could reduce the risk for ACL injuries in female handball players dramatically.

ANTHROPOMETRIC AND PHYSICAL PERFORMANCE CHARACTERISTICS OF ELITE AND NON-ELITE YOUTH FEMALE TEAM HANDBALL PLAYERS

Samantha L. Moss¹, Nicola McWhannell¹, Lars Bojsen Michalsik², Craig Twist¹
University of Chester, UK¹
Aarhus University, DEN²

This study examined the anthropometric and physical characteristics of female youth team handball players (16.07 ± 1.30 y) from Great Britain (non-elite; $n = 52$) in comparison to elite players from national and league teams in Denmark, Norway and Spain ($n = 73$). Anthropometric profiling included sum of eight skinfolds, body mass, stature, girths, breadths and somatotype. Performance tests included 20 m sprint, countermovement jump (CMJ), shooting velocity, a repeated shuttle sprint and jump ability test (RSSJA), and the Yo-Yo Intermittent Recovery Test Level 1. While elite players had greater body mass, stature, limb girths and breadths than non-elite players ($P < 0.05$), sum of skinfolds and waist-to-hip ratio were similar between groups ($P > 0.05$). Player somatotype for non-elite players was mesomorph-endomorph, while elite players had a central profile, with no significant differences between groups ($P > 0.05$). Elite players performed better in all performance tests ($P < 0.05$), with the exception of CMJ height. Non-elite back and wing position players were most different to their elite counterparts, suggesting that particular emphasis is needed to improve characteristics in these positions. There were no positional differences in either group for performance, but non-elite backs were taller than wings. Anthropometric characteristics were related to a variety of performance variables, highlighting the potential usefulness of these measures when identifying potential talent. Findings reveal that British players compare unfavourably to elite European players in a variety of anthropometric and performance characteristics. However, CMJ height, sum of skinfolds and hip-to-waist-ratio were not different between groups suggesting their reduced importance to elite standard performance. Such studies are useful for emerging team handball nations in designing appropriate training strategies and to improve talent identification processes.

SPRINT PERFORMANCE AND ANAEROBIC POWER IN ADOLESCENT FEMALE TEAM HANDBALL PLAYERS

Pantelis Nikolaidis¹ & Susana Cristina de Araújo Póvoas²

¹Department of Sports Medicine & Biology of Exercise,
Faculty of Physical Education and Sport, University of Athens, Greece

²CIDESD/CIDAF, Maia Institute of Higher Education, Maia, Portugal

Performance in Team Handball (TH) includes many fast high-intensity activities (e.g. sprinting, jumping, shooting, blocking) taxing mainly the anaerobic metabolic energy transfer system, which can be assessed either in laboratory or in a field setting. The aim of this study was to examine the relationship between widely used assessment methods in exercise testing: 5 m, 10 m and 20 m sprint test (Brower Timing Systems, Utah, USA), countermovement jump (CMJ), 30 s Bosco test (Microgate Engineering, Bolzano, Italy) and Wingate anaerobic test (WAnT; Ergomedics 874 Monark, Varberg, Sweden).

Eleven adolescent female TH players (age 13.8 ± 1.1 years, weight 56.5 ± 7.3 kg, height 159.9 ± 4.0 cm, body fat percentage $24.7 \pm 4.4\%$) performed the abovementioned anaerobic tests. The correlations of 5 m, 10 m and 20 m sprint with peak power of WAnT were -0.44 ($p=0.171$), -0.63 ($p=0.036$) and -0.82 ($p=0.002$), respectively; with CMJ -0.68 ($p=0.022$), -0.73 ($p=0.011$) and -0.42 ($p=0.202$); and with Bosco test -0.66 ($p=0.028$), -0.78 ($p=0.005$) and -0.59 ($p=0.054$).

Despite the small sample of participants in this study, the correlations between sprint tests and most of the anaerobic power tests were moderate to very large, suggesting the further use of laboratory methods in TH. In addition, we observed that the magnitude of these correlations was dependent on the sprint distance, i.e., the highest correlations of jumping tests were noticed in 5 m and 10 m sprints, while the highest correlation of peak power of WAnT was in 20 m. Based on these findings, it was concluded that laboratory methods can be informative about a TH player's sprint ability; however, this relationship varies according to sprint distance.

NEED AND PROPOSAL FOR CHANGE IN THE SIZE OF WOMEN'S HANDBALL BALL, SUPPORTED BY A SCIENTIFIC STUDY: "THE COVERAGE INDEX OF THE BALL"

Juan F. Oliver Coronado¹ and Patricia I. Sosa González²

¹Faculty of Educational Sciences, University of Seville (Spain);
Member of the Union of University Handball Teachers (U.U.H.T.)

²Faculty of Educational Sciences, University of Seville (Spain);
Member of the Union of University Handball Teachers (U.U.H.T.);
EHF Master Coach, and IHF Handball at School Expert

Already in 2000 and 2011, it was determined by a linear measure of the hand that women played with a proportionately larger ball than men (Oliver, 2000; Oliver & Sosa, 2011).

In the present study, data from 1612 player of handball (779 women and 833 men) were collected and analyzed, grouped into 8 categories based on age and sex (women and men, 13-14 years, 15-16 years, 17-18 years, and above 18 years).

We collected data from three linear measurements of the hand between the thumb, the middle finger and the small finger of the dominant hand of athletes. The three linear measures were moved to a spherical measure using a new formula, which we have named "coverage index of the ball". This coverage index indicates the percentage of ball that each hand is able to cover.

Until now, only linear measurements were used to determine the measures of the hands of handball players. However, with this new process, the use of this coverage index establishes a more realistic and accurate hand relationship to the ball.

Finally, this study identifies the coverage index of men and women in each sport category, and based on this we can know and determine the differences between them. With these data and through the new findings, we can propose, in a scientific way, the measure of balls in each sport category, for men and women.

**NUMERICAL SUPERIORITY DEFENSIVE ZONE:
AN APPROACH TO AN ACTIVE DIMENSION (4:1:1)**

Juan F. Oliver Coronado¹ and Patricia I. Sosa González²

¹Faculty of Educational Sciences, University of Seville (Spain);
Member of the Union of University Handball Teachers (U.U.H.T.)

²Faculty of Educational Sciences, University of Seville (Spain);
Member of the Union of University Handball Teachers (U.U.H.T.);
EHF Master Coach, and IHF Handball at School Expert

In this paper we present the use of a new zonal defensive system, the 4:1:1, useful numerical superiority in defensive situations. We describe the basics of operation and objectives. Among them are – from an individual point of view – the application of the individual tactical line interception, and collectively, the use of tactical media active, mainly the 2 against 1. The defensive solutions to possible collective responses of the attacking team are being specified, with special attention on the situations of an active pivot. The proposal was successfully tested in official competitions by the Brazilian Olympic Women's National Team.

THE EHF SUMMER CAMP FOR GIRLS 2013 AT THE AWFIS GDANSK/POLAND, FEATURING THE PILOT TEST OF BALL SIZES FOR FEMALE PLAYERS

Pollany, Wolfgang¹, Lewandowski, Daniel², Lech, Andrzej³, Nowinski, Wojciech³

¹Universität und BSPA Wien

²Jozef Pilsudski University of Physical Education In Warsaw

³University of Physical Education and Sport/ Gdansk

As from 2010 a handball summercamp for girls U15 is run by the Polish Handball Federation in cooperation with the EHF and the AWFIS Gdansk. Usually the program follows the philosophy of the EHF pilot camp that took place in Kronenburg/GER in 2005.

However this year a pilot test on ball sizes for female players was established within the framework of the camp following a 2012 suggestion of the MC of the EHF for a ball of size 1.5 dedicated for female players. This proposal was based upon the anthropometric researches that were carried out during several EChs.

EHF partner adidas provided the balls and testing was carried out in different stages. There were questionnaires for the players and the coaches, observation of matches played with a ball change between size 2 (first half) and 1.5 (second half) and a field test examined ball speed and accuracy of ground shots and jump shots.

The set-up of the field test is presented and the results of the statistical processing are listed and discussed in detail as well as the results of the questionnaires.

FUNCTIONAL MOVEMENT SCREEN OF YOUTH FEMALE SLOVENIAN HANDBALL PLAYERS

Primož Pori, Maja Pori, Marta Bon, Marko Šibila
Faculty of Sport, Ljubljana, Slovenia

The proper execution of fundamental movement patterns is very important for the motor development of young handball players. Those movements represent the foundations for more complex movements and skills. The objective of the research was to evaluate the fundamental movement patterns of youth female handball players and to analyse possible asymmetries and dysfunctional movement patterns.

The subject consisted of 49 youth female handball players (age: $14,2 \pm 0,9$ years, height: $169,6 \pm 6,9$ cm, body weight: $60,2 \pm 7,6$ kg) and 15 non-athletes females, who represented a control group (age: $14,5 \pm 1,1$ years, height: $164,6 \pm 5,7$ cm, body weight: $57,2 \pm 4,6$ kg). The Functional movement screen (FMS) was used to evaluate movement patterns. The FMS includes seven movement patterns. Three of them focus on functional patterning (Deep squat/DS, Hurdle step/HS, In-line lunge/IL), two on mobility (Shoulder mobility reach/SM, Active straight-leg raise/ASR) and two on motor control and stability (Trunk stability push up/TPU, Rotary Stability/RS). Each movement was evaluated by an independent expert on 0 to 3 scales, with 21 being a perfect score.

The comparison between the two groups was assessed with a T- test for pairs. The results show that the average score of analysed sample of youth female handball players was $15,6 \pm 2,1$ points, which is quite a low score according to the studies reported. Between the two groups statistical significance difference occurred in tests IL, ASR and RS. We have also found statistical significance differences in asymmetries between left and right sides of the body in tests HS, IL, SM and RS. Those results are very alarming, regardless the age of our subjects. Previous investigations show that defects in fundamental movements can put an athlete at greater risk for injuries.

HANDBALL 4 HEALTH: EFFECTS OF A SHORT-TERM HANDBALL-BASED EXERCISE PROGRAMME ON HEALTH AND PERFORMANCE MARKERS IN UNTRAINED ADULTS

¹Susana C.A Póvoas, ²André Filipe Teixeira e Seabra, ³Carlos Alberto da Rocha Resende, ⁴Eduardo Filipe da Cruz Coelho, ⁵Peter Krstrup
¹CIDESD/CIDAF, Maia Institute of Higher Education, Maia, Portugal, ²CIAFEL, Faculty of Sport, University of Porto, Porto, Portugal, ³CIFID, Faculty of Sport, University of Porto, Porto, Portugal, ⁴Faculty of Sport, University of Porto, Porto, Portugal, ⁵Sport and Health Sciences, College of Life and Environmental Sciences, University of Exeter, United Kingdom

In modern society, the adoption of sedentary lifestyle results in low physical fitness levels, one of the most important risk factors for chronic-degenerative diseases, especially those related to the cardiovascular system. Epidemiologists and public health promoters have focused on the detection and prevention of modified risk factors that are associated with these diseases, particularly, low cardiorespiratory fitness, throughout exercise interventions since exercise is associated with a decreased risk of cardiovascular and metabolic diseases (Halbert et al., 1997; Jeon et al., 2007). Nonetheless, few studies have investigated the health effects of regular participation in a variety of team sports (Saltin et al., 1979; Krstrup et al., 2007, 2009a, b).

Handball is a highly demanding intermittent exercise that primarily uses the aerobic metabolism, interspersed with high-intensity actions that greatly tax the anaerobic metabolism due to numerous high-intensity displacements and actions (Póvoas et al., 2012). Thus, the purpose of this study was to describe the effects of a short-term handball based exercise programme on health and performance markers in untrained adults. Sixteen participants (33-55 years old) performed two to three sixty min training sessions consisting of playing handball matches, interspersed by a ten min half-break, per week, during twelve weeks. Health and performance evaluations were performed at baseline and at the end of the intervention.

CHARACTER OF TRAUMATISM DYNAMICS IN FEMALE HANDBALL

Sakharova Marina, Fedotova Anastasia, Obivalina Maria
Russian State University of Physical Education, Sport, Youth and Tourism

Handball is one of sports for which the wide range of various sports traumas is characteristic. The traumatism problem in female handball for many years remains very actual. The traumas got by handballers at the first stages of long-term preparation, much of them bar the way to high sporting achievements. Therefore, studying of specific and typical localization of the injuryies got by handballers at different stages of long-term sports improvement, opens opportunities to creation of system of complex preventive actions.

The Russian handballers ($n=120$) took part in research aged from 14 till 28 years. The most characteristic traumas got by players in the period of training and during competitions were studied. The main reasons and factors of emergence of traumas are established.

THE RELATION BETWEEN PERCENTAGES OF BODY FAT AND MEASURES OF RUNNING SPEED, JUMP POWER, RSA AND VO_{2max} CONSUMPTION IN SLOVENIAN FEMALE SENIOR ELITE HANDBALL PLAYERS

Šibila Marko, Bon Marta, Uroš Mohorič, Pori Primož
University of Ljubljana, Faculty of Sport, Ljubljana, Slovenia

Many researchers proved that excessive amounts of subcutaneous fat in top level athletes is negatively correlated with the results achieved in the tests of specific motor abilities and with indicators of aerobic resistance (Houtkooper, Mullins, Going, Brown, & Lohman, 2001; Klossner, 2007; Šibila, Bon, Mohorič & Pori, 2011; Montcef, Said, Olfa & Dagbaji, 2012). This is why we tried to find out the correlations between the percentage of body fat and the measures of running speed, jump power, RSA and VO_{2max} consumption indicator.

The subjects were 17 elite Slovenian senior female players, who participate in regular testings of the national team. The set of variables included 11 parameters, which define running speed and jump power, RSA, VO_{2max} consumption indicator and a share of subcutaneous body fat. The SPSS statistical package was used for statistical data analysis. Descriptive statistics for the variables were computed. Correlations were established by Pearson correlation coefficients. We may conclude from our study that jump power indicators, RSA and VO_{2max} consumption are in a significantly negative relationship with the percentage of body fat tissue. But we couldn't prove the significant relationship between body fat values and results obtained in sprint tests.

HEART RATE, TRIMP, RPE, CMJ: WHICH OF THESE TOOLS ARE SUITABLE FOR TRAINING LOADS VOLUME, INTENSITY, AND FATIGUE MONITORING IN FEMALE HANDBALL?

Antanas Skarbalius
Lithuanian Sports University, Kaunas, Lithuania

In order to apply adequate loads for players, it is highly important to find out individual physiological response to loads.

14 semi-professional female players took part in the research (age 21.4 ± 2.7 ; height 176.4 ± 5.6 cm; body mass 69.5 ± 5.5 ; sporting experience 9.3 ± 2.1). Heart rate (HR) was measured before every training session ($N=37$). The preparation period lasted 6 weeks using Polar Team System (Finland) and counter movement jump (CMJ) with swing arms and it was measured before every training session. On the basis of VO_{2max} determined using an incremental exercise test individual indices of players $\%HR_{max}$, Training Impulse (TRIMP) on previous studies (Stagno et al., 2007) was calculated, and ratio of perceived exertion (RPE) in two scales (0–10 and 6–20) was registered after each training session. Total beats (TB) per session for individual players was registered as well.

The scale of training loads was found based on TB: low, 11.000; moderate, between 11.000 and 12.000; high, between 12.000 and 13.000, very high, between 13.000 and 14.000, and maximum > 14.000 . The average of $\%HR_{max}$ was $77,0 \pm 5,7$. TRIMP exceeding 310 arbitrary units is considered as high volume and intensity.

Research suggests that TB is considered as an indicative of the loads' volume, TRIMP for both aspects, $\%HR_{max}$ as a key indicator of intensity. CMJ might be used as a tool for monitoring recovery after previous loads. RPE would be used for practical needs as a simple and easy implemented tool in semi-professional environment. The final conclusion is that for different needs, it is necessary to use different tests.

COMPARISON OF EFFECTS OF 6 WEEKS OF PLYOMETRICS TRAINING WITH SQUAT TRAINING UPON DIFFERENT MOTOR ABILITIES IN ADOLESCENT HANDBALL PLAYERS

Roland van den Tillaar, Truls Roaas, Lars Waade

Faculty of Teacher education, Nord Trøndelag University College,
Levanger, Norway.

The aim of the present study was to compare the effect of plyometrics or squat training upon different motor abilities in handball. Twenty six competitive adolescent handball players from two different teams: one male ($n=13$) and one female team ($n=13$) playing at national level in their age class (age 13.8 ± 0.5 yr, body mass 57.5 ± 11.5 kg, body height 1.69 ± 0.10 m) participated in the study.

To test the different motor abilities, a counter movement jump (CMJ), an agility test, sprint over 30m, squat strength, maximal ball throwing from standing and with 3-steps and the Yo-Yo IR1 were tested at pre and post test during the end of the season. After the pretest, the subjects were equally divided into a plyometrics training based on strength performance (4 different type of jumps 156-195 jumps per session), or a squat training group (3×6 of 45% of 1-RM), which conducted 2 training sessions per week for a period of 6 weeks, integrated in their regular training sessions.

To compare the effects of the training protocols, a mixed design 2x2 ANOVA was used. After six weeks, a significant increase ($p<0.05$) in performance was observed in sprint (+2%), agility (+12.2%), 1-RM squat (+39%) and running distance at the Yo-Yo IR1 test (27.3%). No significant changes were observed in the jumping height (-2.7%), and significant decrease was observed in peak ball throwing velocity (-2.9 and -4.7%). There were no significant differences in changes marked between the groups ($p \geq 0.28$). The increase in performance in sprint, squat strength and agility were in line with earlier studies on young soccer players (Marques et al., 2013a+b). The decrease of the throwing velocity was not surprising, since the subjects did not train extra on this and they were near the end of the season. On the contrary, the fact that the jumping height did not increase was surprising, since an earlier study that used the same training program in young soccer players showed increased jumping performances (Marques et al., 2013a). This may be explained through the different movement patterns between training exercise and test exercise.

IDENTIFICATION OF OFFENSIVE ACTION PATTERNS IN TEAM HANDBALL

Tilp, Markus, Schrapf, Norbert
Institute of Sports Science, Karl-Franzens-University Graz, Austria

Computer-aided analysis systems have been used increasingly in team handball science and practice in the last years. Most systems are similar in that they are able to record single actions like shots or passes. These data entries can then be retrieved and provide valuable information for coaches. However, since team handball is a complex sports game with significant interaction between players, not all the important information can be gathered with the annotation of single actions. Several approaches have been employed in different types of sports (Borrie et al. 2002) to overcome this shortcoming. The aim of this study was to investigate the potential of artificial neural networks in order to analyse sequential offensive action patterns in team handball.

Six games of the EHF EURO Men-18, which were recorded with an eight-camera-system, were analysed for this study. To account for the complexity of the game, we analysed the position data of sequential actions consisting of shots and up to 5 preceding passes. In all, 612 sequences were annotated and then manually enlarged with 15% to a total data set of 3060 sequences. Subsequently, data was analysed by artificial neural network (ANN) software DyCoN (Perl, 2002) to identify data patterns.

The analysis by ANN identified 42 different offensive patterns of the participating teams during offensive actions. Frequency of individual patterns was up to 8.5% of all attacks. Eight different patterns were responsible for 49% of all attacks. The different teams used between 18-27 different tactical patterns per game during their offensive action.

The analysis revealed the potential to identify offensive patterns in team handball by means of artificial neuronal networks. Experts reviewed the patterns found by ANN and confirmed the similarity of the recorded action sequences. A next step is the integration of defensive behaviour in order to determine effective offensive tactics in relation to the opponent's defence tactics.

THE RELATIONSHIP BETWEEN CHOSEN FACTORS OF PLAYING PERFORMANCE AND THE LENGTH OF AN ACTIVE CAREER OF FEMALE HANDBALL PLAYERS

Martin Tůma, Kateřina Keclíková
Faculty of Physical Education and Sport, Charles University
Prague, Czech Republic

The study serves two purposes: the first goal is to detect the composition of the individual national teams according to the career's length. The second one is to find out the possible effects of a career's length based on chosen factors of playing performance. We took into consideration only those teams, which participated regularly in every European Championship during the period 2000-2010 ($n = 7$).

We used the data available on the EHF websites. The length of a career is defined by the repetitive number of participation in European Championships. We used the correlation method to determine the relationship between the career's length and the chosen factors of playing performance.

We found out that female players participate mainly in 1 or 2 Championships. The career's length influences two factors of playing performance: the number of stolen balls and also the number of turnovers. We have found small differences through the analysis of the results of the individual teams. There is only one team in which the career's length had an influence on the results of the team.

THE EFFECT OF MORPHOLOGICAL PARAMETERS ON PLAYER PERFORMANCE IN ELITE FEMALE HANDBALL GOALKEEPERS

František Urban¹, Róbert Kandrác²

¹Member of the UUHT EHF, Michalovce, Slovakia

²Faculty of Sports, University of Prešov, Prešov, Slovakia

The purpose of the cross-sectional study was to determine the relationship between morphological parameters and player performance in elite female handball goalkeepers. Seventy-eight elite female goalkeepers that participated in 2011 Women's 17 and Women's 19 European Handball Championships were tested for the following morphological parameters: body height, body mass, percentage of subcutaneous fat, arm span, shoulder breadth, palm breadth, biepicondylar breadths (humerus and femur), circumferential measures (biceps, calf and forearm girth), somatotype components and somatotype categories. The somatotypes were determined according to Heath, Carter (1967). The goalkeepers were assigned to four groups according to the final team standings: 1st to 4th, 5th to 8th place, 9th to 12th and 13th to 16th place. The results showed that U17 goalkeepers on the teams in 1st to 4th differed from the other 3 groups in body height, shoulder breadth and circumferential measures. In both U17 and U19 categories, goalkeepers with the highest goalkeeping efficiency were also tallest.

THE RELATIONSHIP BETWEEN MORPHOLOGICAL PROFILE AND PLAYER PERFORMANCE IN ELITE FEMALE HANDBALL PLAYERS

František Urban¹, Róbert Kandráč²

¹Member of the UUHT EHF, Michalovce, Slovakia

²Faculty of Sports, University of Prešov, Prešov, Slovakia

The purpose of the cross-sectional study was to determine the relationship between morphological profile and player performance in elite female handball players. One hundred eighty-five elite female players: wings - 56, centre backs - 39, backs - 56 and pivots - 34, who participated in 2011 Women's 17 and Women's 19 European Handball Championships, were tested for the following morphological parameters: body height, body mass, percentage subcutaneous fat, arm span, shoulder breadth, palm breadth, biepicondylar breadths (humerus and femur), circumferential measures (biceps, calf and forearm girth), somatotype components and somatotype categories. The somatotypes were determined according to Heath, Carter (1967). The players were assigned to two groups according to the final team standings: 1st to 4th place and 13th to 16th place. The results showed that with respect to playing function, overall shooting efficiency in the teams that placed in 1st to 4th place, as compared to their counterparts in 13th to 16th, was higher in all playing positions and the morphological profile in players on the 1st to 4th teams was more favourable.

ANTHROPOMETRIC AND FITNESS DIFFERENCES IN THE FIRST SPANISH HANDBALL LEAGUE PLAYERS

Vila, M^a Helena.¹; Manchado, Carmen.²; Ferragut, Carmen.³; Abraldes, Jose Arturo⁴

¹Faculty of Education and Sport Science. University of Vigo Pontevedra. Spain.

²Faculty of Education. University of Alicante. Comunidad Valenciana. Spain.

³Faculty of Medicine. University of Alcalá. Alcalá de Henares. Spain.

⁴Faculty of Sport Sciences. University of Murcia. Murcia. Spain.

High team handball performance needs a combination of high level of technical, tactical, and physiological skills. The aim of this study was to examine the anthropometric and fitness characteristics and to assess possible differences among foreign, national team, and national players from the first Spanish female Handball league. A total of 130 players from the first Spanish Handball league were divided into Foreign (37), national team (26) and national players (67) and were assessed for anthropometric and fitness characteristics.

Differences were found between National players with respect to Foreign and national team players in height, body mass, arm span, bone mass, muscle mass, arm flexed and tensed girth and bistyloid breadth. Significant differences were found between National players with respect to foreign players in age, several girths (forearm, wrist, medial calf and ankle) and two breadths (biacromial and bitrochanteric).

The findings of the present study suggest that some of the anthropometric characteristics may play an important role in high women's handball performance, as it is reflected in the fact that there are no significant differences between Foreign and National team players but with the National players.

TESTING GAME-BASED PERFORMANCE IN TEAM HANDBALL

Wagner, Herbert¹; Orwat, Matthias¹; Hinz, Matthias¹;
von Duvillard, Serge P.²; Müller, Erich¹

¹University of Salzburg, Salzburg, Austria;

² St. Cloud State University, St. Cloud, USA

Introduction: Team-handball is a fast paced game of defensive and offensive actions that includes specific movements consisting of passing and catching a ball, throwing, jumping, blocking, fast accelerations including stops, direction changes and frequent changes with low intensity movements as in standing, walking and jogging. The aim of the study was to develop (including these movements) and validate a game-based performance test in team-handball.

Methods: Twenty experienced team-handball players performed two game-based tests separated by six days between each test, an incremental treadmill-running test, and a team-handball test game. Peak oxygen uptake ($\text{VO}_{2\text{peak}}$), blood lactate concentration (LA), heart rate (HR), sprinting time, time of offensive and defensive actions as well as running intensities, ball velocity and jump height were measured. Reliability of the tests was calculated utilizing an interclass correlation coefficient (ICC).

Results and Discussion: For the test-retest reliability, we found an $\text{ICC} > .70$ for the maximal LA and HR, mean offense and defense time as well as ball velocity that yielded an $\text{ICC} > .90$ for the $\text{VO}_{2\text{peak}}$ in the game based test. Significant differences between experienced and elite players (construct validity) were found for the HR, defensive time and ball velocity. Percent walking and standing constituted 73% of total time. Low (18%) and high (9%) intensity running in the game-based performance test was similar to competitive games suggesting the game-based performance test is a valid test to assess performance in team-handball. However, a high cardiorespiratory fitness measured during the incremental treadmill-running test is not an essential component to play team-handball on a high level during the entire game (team-handball specific endurance). We suggest using this game-based test to measure team-handball specific performance in male and female team-handball players of different age and performance level.

THE GOALKEEPER'S EFFECTIVENESS IN THE SEVEN-METER THROW

Thiago Aguiar¹, Daniel Pinto, Geraldo Gomes¹, Luísa Estriga^{2,3}
{¹Faculty of Sport, } University of Porto, Porto, Portugal

Objective: To analyse the goalkeeper's performance in 7-meter throws.

Methods: All 460 seven-meter throws that occurred in 57 (out of 66) matches, in the first phase of the Portuguese men elite handball league (2012-13) were analysed using video images gathered during the matches (zoom and slow motion techniques were used when necessary).

Results: We computed about 8 seven-meter penalties per match (minimum 2 and maximum 15), and a season total of 54 different shooters (of around 160 registered players) and 33 different goalkeepers (from 36 registered goalkeepers).

Around 25% of the shots did not result in a goal; the majority of the shots were performed directly at the goal (69%) and only (30%) were bounced shots. The effectiveness of bounced shots (83%) was higher than of the direct shots (73%) ($p < 0.0053\%$). The goalkeepers of the teams that had qualified for the final (Group A) showed an efficiency 8% higher than those of non-qualified teams ($p < 2.8\%$). The goalkeepers were 10% more effective when acting as visitors than when playing at home ($p < 1.5\%$).

Conclusion: Our findings reinforce the importance of goalkeeper performance in the outcome of a handball match/competition. This kind of analysis is also being extended to other areas of intervention of the goalkeepers and other players, identifying weaknesses and revealing tactical options.

LOAD INTENSITY OF FEMALE PLAYERS (AGED 17-18) IN NINE COMPETITIVE MATCHES IN HANDBALL

Belka Jan, Hulka Karel

Palacky University Olomouc, Faculty of Physical Culture, Czech Republic

The present study analyses the heart rate of elite handball female players of the highest competition in the Czech Republic during nine competition matches. 50% of all contest matches were analysed in a given competition year. Fourteen female players of the Czech elite team (age $17,9 \pm 0,3$ years, height $169,6 \pm 6,9$ cm, mass $46,05 \pm 5,2$ kg, BMI $22,7 \pm 2,1$ kg/m²) participated in this study. The monitored team finished in second place in the Czech Republic in the monitored competition year. The average heart rate of the monitored team was $183,7 \pm 7,4$ beats \cdot min⁻¹ and this value corresponds to $90,6 \pm 3,6$ %HR_{max}. The average heart rate of the players in the first and second half-time was $184,8 \pm 7,4$ beats \cdot min⁻¹, more precisely $182,5 \pm 7,2$ beats \cdot min⁻¹ corresponding to $91,1 \pm 3,6$ %HR_{max}, more precisely to $90,1 \pm 3,5$ %HR_{max}. Pivots had the highest average heart rate, $185,8$ beats \cdot min⁻¹, which corresponds to $90,7$ %HR_{max}. Wings and backs had the average heart rate $183,8 \pm 6,2$ beats \cdot min⁻¹, more precisely $182,9 \pm 7,5$ beats \cdot min⁻¹ corresponding to $90,5 \pm 3,2$ %HR_{max}, more precisely to $88,1 \pm 3,7$ % HR_{max}. The players spent 76% of the playing time in the level of load intensity >85 %HR_{max}. The players spent 3% of the playing time in the lowest level of load intensity (<65 %HR_{max}). The pivot was the post of the highest load, spending 87% of the playing time in the highest level of load intensity (>85 % HR_{max}).

AN EXAMPLE OF TRANSFER CHARACTERISTICS IN THE WOMEN'S EHF CHAMPIONS LEAGUE DURING THE SEASON 2012/13: THE NATIONALITY PERSPECTIVE

Marta Bon, Mojca Doupona Topič
Faculty of Sport, University of Ljubljana, Slovenia

This study is part of a broader research on the migration paths in handball. In this study, the eight best ranked clubs in the main round of the Women's EHF Champions League in 2012/13 season - in terms of player's nationality - were analysed. All data were obtained from the European Handball Federation (EHF), which assumes the responsibility for all transfer contracts of players within Europe, in accordance with the International Handball Federations' (IHF) "Player Eligibility Code" and the "IHF Regulations for Transfer between Federations". The data include transfer characteristics (start and finish release, country from and country to) and some socio-demographical characteristics.

Results of our research show that the top eight clubs during season 2012/13 (Győri Audi ETO KC - Hungary; Larvik – Norway; Oltchim Rm. Valcea - Romania; Krim – Slovenia; Budućnost - Montenegro; Randers HK - Denmark; FTC Rail Cargo Hungaria – Hungary; and Zvezda Zvenigorod – Russia), registered 168 female handball players during the season and 4 players did leave clubs. Altogether, among the 168 players, 17 different nationalities were recorded; players from 15 countries were listed as foreign players; and only players from Slovenia (SLO) and Romania (ROU) were treated as domestic players.

From the 168 registered players, 46 (27.4%) players were sport migrants, because they played for a foreign club. When looking only at the core official squad (16 players) we can say that on average 35.9% players are sport migrants. Out of 46 foreign players, 27 (58.7%) were from non-EU members states; and 19 (41.3%) came from EU member states. From the nationality perspective in the main round, most players were from Hungary ($\Sigma=35$; 20.8%) followed by Russia ($\Sigma=25$; 15.5%) and subsequently, Norway ($\Sigma=21$; 12.5%). On a national team level, these countries have nearly always ranked at the top. The most extreme situation was found at club Krim in Slovenia. The club signed 11 foreign players, who belonged to eight different nationalities. This gave a recorded value of 68.8% foreign players in the team. At the club team Krim, there are only five native Slovenian players, who play a marginal role.

In this paper, we will analyse the national structure of all eight teams and distinguish similarities as well as differences between clubs and countries. Furthermore, we will try to stress the impact that increasingly frequent migration has on handball teams and on the quality of the teams in each country.

The results of the study will show that countries with long handball traditions and successful national teams (NOR, DEN, HUN) have a smaller amount of foreign players in their professional club teams; but at the same time, such countries play an important role in European women's handball in general.

SPECIALISED HANDBALL CLASSES IN SLOVENIA: DIFFERENCES IN IDENTIFIED CHARACTERISTICS BETWEEN MEN AND WOMEN JUNIOR PARTICIPANTS

Bon Marta, Pori Primož, Šibila Marko
University of Ljubljana, Faculty of Sport

The introduction and the subsequent experimentation of school sports classes have been known worldwide for more than three decades. The purpose of the study was to examine a special project, based on cooperation between the Ministry of Education, Šiška Gymnasium (high school), the Slovenian Handball Federation, and different clubs/players. A project of handball sports classes was started at the Gymnasium with a basic purpose of creating conditions for combined development in the fields of both handball and education. One of the goals, although not the primary objective, was also to offer a path into elite handball. The sport requires the participation of people with positive experiences from handball; adults who, at the end of education, could creatively participate in administration of the sport on various levels as coaches, managers, doctors, journalists, etc.

In this study we analysed select characteristics of young handball players in relation to their education and gender. The social structure and sports aspiration of participants after high school was also examined. In the first part of the study an investigation was carried out on a sample of 56 participants, attending handball classes. Data were acquired with the aid of a questionnaire; the differences between the groups were analysed by means of variance analysis and a χ^2 test.

The results of the research revealed that the participants in the handball classes mostly come from areas and schools with a strong handball tradition and much enthusiasm for the sport. More than half of the participants, nearly all girls, already play in a senior category, although according to their biological age they belong into the youth category. At the beginning of high school education almost half of the participants (both girls and boys) aspire to play professional handball at the end of high school; whereas in later years of their education, the participants - girls especially - increasingly prefer socialising and entertainment.

In the 15 years after the inception of the project, there are only a few female players (Deja Doler, Ana Gros, Tamara Mavsar, Branak Zec, Iris Guberinic, Nina Zulič) reaching the top level sport (EHF Champions League; national team). In the fourth and final year of high school education, almost half of the participants intend to end their playing career after high school (based on a response of 75.9% from girls). In general, most of them have nice memories, nice feelings and, with much enthusiasm, many of them are in this way prepared for a different position in handball.

Based on the qualitative analyses and interviews with two experts/teachers with regards to this project, we can conclude that the basic goal of the project has been fulfilled.

THE MECHANISM BEHIND THE HANDBALL GOALKEEPER'S DECISION PROCESS DURING A SEVEN-METER THROW

Eduardo Carvalho¹, Maria Luísa Estriga^{2,3}, Miguel Velhote¹, João Carvalho⁴
{ ¹Faculty of Engineering, ²Faculty of Sport, } University of Porto, Porto, Portugal,
⁴Physics Department, University of Minho, Portugal

The purpose of this work was to investigate whether the goalkeeper's decision process can be based on the thrower live actions during a seven-meter penalty, and if not, to determine what the thrower's main informational clues for accurate anticipatory actions at levels above chance are. Basic data gathering was obtained from a set of video cameras, EMG sensors and accelerometers synchronised and focused both on the thrower and the goalkeeper. The final resolution is around 3mm and better than 1ms. The sample included both male and female goalkeepers and throwers from the Portuguese elite teams.

The majority of the goalkeepers place themselves at about 5m from the ball. The throws are done at 70km/h or more. This leaves the goalkeepers with about 0.2s from seeing the ball released at 7m and being hit or surpassed by the ball. The results show that this is insufficient time to decide, start moving and reach a position that allows a successful action above random. The conclusion is that goalkeepers use other sources of (speculative) information to opt for anticipatory actions. To determine what the main visual clues are (that throwers can explore for deception), the visual barrier was applied to selected parts of the thrower's body. Detail results will be presented.

PSYCHOLOGICAL CHARACTERISTICS OF THE TOP PORTUGUESE HANDBALL PLAYERS: COHESION & PERSONALITY

Ana Freixo¹, Carlos Silva¹, Pedro Sequeira¹ & Carla Chicau Borrego¹

¹Sport Sciences School of Rio Maior - Polytechnic Institute of Santarém, Portugal

Group cohesion in sport it's a widely spread theme today. Research has found cohesion to be influenced by several individual and group components. Among the cognitive variables that relate to the cohesion we found the personality.

The purpose of this study was to examine the relation between task cohesion (ATG-T, and GI-T) and the big 5 personality factors (NEOPIR). Participants are 102 top handball athletes, aged between 16 to 35 years old, from Portugal's selection level. Cohesion was measured using the Portuguese version of *Group Environment Questionnaire*, (GEQp: Mendes, Serpa, & Bártolo, 1993) and to assess personality, we used the Portuguese version of the *NEO Personality Inventory - Revised*.

Our results show that female athletes report experiencing higher levels of task and social attraction to group than male athletes. Only Agreeableness relates in a significantly way with the perception of task cohesion (ATG-T) in both female and male gender.

ANALYSIS OF THE COMPETITIONAL BALANCE IN EUROPEAN WOMEN'S HANDBALL

Hantău Cezar*; Yannakos Athanasios**; Hantău Cristina***; Vărzaru Cristina*

*National University of Physical Education and Sport, Bucharest, Romania

** Aristotelis University, Salonica, Greece,

***Economical Studies Academy, Bucharest, Romania

In order to obtain the most important television rights it is necessary to first analyse the national championship at the top female echelon. One of the criteria for analyzing national championships is the competitive balance, because balance is crucial in uncertain sporting results.

In the last thirty years, research directed at the economic implications of sports has grown exponentially. Studies analysing the economic activity in sport have their origin in North American professional sports.

This research shows that if there is a perfect team able to win against all opponents, it has the effect of "killing the competition" and thus, drives the audience away from that competition. As a result, the monopoly of a team in a championship over several seasons is a disaster for that championship and for the sports industry itself.

As a conclusion, we can say that the more a championship is exciting and the battle for victory is intense, the more viewers will buy tickets, the more interested TV stations will be in broadcasting the games, and the more sponsors will be interested in investing in handball.

How balanced are women handball championships in Europe? Is the competition in Europe balanced? How do we manage to preserve public attention in domestic competition in different countries? It is appropriate to be concerned? In this document we try to find answers to these questions, based on an analysis of European female handball championships of the last 12 years.

EFFECTS OF A SHORT TERM IN-SEASON MUSCULAR STRENGTH TRAINING PROGRAM WITH HALF BACK SQUAT ON REPEATED SPRINT ABILITY AND AGILITY T-HALF TEST PERFORMANCE IN ELITE HANDBALL PLAYERS.

Dr. Hermassi Souhail

ISSEP, Ksar-Saïd, Manouba University, Tunisia.

Member of the Union of University Handball Teachers, EHF.

We aimed at investigating the effect of a 6-week explosive muscular strength training program of lower limb on measures of competitive potential Agility T-half test and repeated shuttle-sprint ability (RSA) in elite handball players. The subjects (age 20 ± 0.3 years) were randomly assigned to a control group (Gc; $n = 10$) performing their normal training schedule and an experimental group (Gex; $n = 12$) receiving additional muscular strength of half squat exercise twice per week, performed to 1-repetition maximum (1-RM). The muscular strength training consisted of 4 sets planned between 60% and 80 % of 1-RM loading. The players were tested for the agility T-half test and repeated sprint test (RSA) using a protocol of 6 x (2 x 15-m) sprints, separated by 20s of active recovery. Best time in a single trial (RSA_{best}), total time (RSA_{TT}) and decrement (RSA_{dec}) were determined. The Gex showed gains relative to controls in 1-RM muscular strength of half back squat ($p < 0.05$), RSA_{best} ($p < 0.01$), RSA_{TT} ($p < 0.01$), RSA_{Dec} ($p < 0.001$), and agility T-half test performance ($p < 0.001$). Maximal squat strength did not imply reduced maximal repeated sprint and agility performance in high level handball players. Consequently, coaches and strength and conditioning professionals should focus on maximal strength training, with emphasis on maximal mobilization of concentric movements, which may improve their sprinting and agility performances.

RELATIONSHIP BETWEEN MEDICINE BALL EXPLOSIVE POWER TESTS, THROWING BALL VELOCITY AND MAXIMAL ARM STRENGTH PERFORMANCE IN TEAM HANDBALL PLAYERS

Dr. Hermassi Souhail

ISSEP, Ksar-Saïd, Manouba University, Tunisia.

Member of the Union of University Handball Teachers, EHF

This study aimed at investigating the relationship between medicine ball explosive power tests, handball throwing velocity performance and maximal arm strength in elite team handball players. A total of 41 elite male handball players participated in this investigation (U16, $n = 20$; U18, $n = 21$). Explosive strength was measured by specific medicine ball throws. The maximal handball throw was preceded by making three types of overarm throwing on an indoor handball court: standing position (SP), 3-step running throw (RT) and a jump shot (JS). The maximal strength scores of upper limb were determined by the one-repetition maximum (1RM) of pull-over ($1RM_{PO}$). The mean ($\pm SD$) for SP, $T_{3-Steps}$, JS and $1RM_{PO}$; were $18.49 \pm 2.52 \text{ m}\cdot\text{s}^{-1}$, $33.28 \pm 3.47 \text{ m}\cdot\text{s}^{-1}$, $27.91 \pm 0.97 \text{ m}\cdot\text{s}^{-1}$ and $48.40 \pm 10.90 \text{ kg}$, respectively. The medicine ball explosive power tests was closely related to $T_{3-Steps}$ ($r = 0.70$, $p < 0.01$). A significant relation was observed between medicine ball to TR and SP ($r = 0.73$, $p < 0.05$; $r = 0.71$, $p < 0.01$ respectively). The medicine ball explosive power tests are also positively related to $1RM_{PO}$ ($r = 0.60$, $p < 0.01$). This suggests the association of the medicine ball explosive power tests to performance in throwing events. In conclusion, the medicine ball explosive power tests may be useful in training or rehabilitation, and could be very suitable for monitoring athletic performance to improve the throwing velocity of handball players.

DESIGN AND VALIDITY OF SPECIFIC HANDBALL REPEATED-SPRINT ABILITY TEST

Karel Hulka, Jan Belka
Department of Sport, Faculty of Physical Culture,
Palacky University in Olomouc, Czech Republic

Background: Tests of repeated-sprint ability are becoming popular as a way of evaluating performance capabilities in field and court sports.

Objective: The aim of this study was to create the design of specific handball repeated-sprint ability test indicating the agility and repeated-sprint ability, and verify its validity.

Methods: Twenty female handball players participated in the two highest Czech leagues (age = 20.78 ± 1.32 years), and ten well trained female university students of physical education (age = 21.34 ± 1.13 years) underwent the 10x 54.5 m specific handball repeated-sprint ability test with 24s recovery. The index of agility (average of three best sprints), Total time and Sprint decrement were observed. The one-way ANOVA and Fisher LSD post-hoc test were used to determine the criterial validity.

Results: We determined significant differences in the total time and index of agility; the results showed significantly lower performance of the group of athletes compared to handball players. As it is, the group of the second Czech league handball players reach significantly lower performance than the group of the highest Czech handball league. We did not find significant differences in sprint decrement.

Conclusions: We found out that the specific handball repeated-sprint ability test is a valid indicator of specific handball agility expressed by index of agility and the repeated-sprint ability expressed by total time. The sprint decrement seems not to be valid for the repeated-sprint ability indicator in handball.

THE EFFECT OF TRAINING LOADS ON THE PHYSICAL CAPACITY AND FITNESS OF YOUNG FEMALE HANDBALL PLAYERS DURING THE THREE-YEAR CYCLE

Zbigniew Jastrzębski¹, Urszula Bogdańska²

¹ University of Physical Education and Sport in Gdańsk

² Middle School nr 1 in Reszel

Creating an effective training loads program over several years is crucial for the conditioning and skills improvement of the players. Moreover, it is vital that the programme prevents the players from temporary or sustained overtraining state. This problem specifically regards team games because of the complexity of the preparation system, in particular when young adolescent players are concerned.

The research was conducted on a sample of 20 female handball players, all students of sports class handball profile in Middle School nr.1 in Reszel during 2007-2010. For different reasons, only 11 subjects completed all the tests within the 3-year period.

During the first year, the training program comprised 10 hours of physical education lessons weekly; that included 6 hours of teaching and developing skills and 4 hours of conditioning practice. During the second and third year of the study, the players participated in obligatory PE lessons and additionally in 2 sports training units weekly and 2 sports camps: 10-day in summer and 7-day in winter.

The tests were conducted at the beginning of the preparatory season and at the end of the competitive season during each of the one-year training cycles. The level of general fitness of the players was assessed with five different tests: strength test (strength endurance for women), power test (vertical jump), running speed test (60m run), speed endurance test (300m run), and agility test (zigzag run) [Drabik, 1992].

The aerobic capacity was assessed with the use of Cooper test [1976], and sport specific skills were tested with Pytlik-Żarek test [1975]. Training loads were applied during the study according to the original programme of the team coach.

The aim of the study was to determine the effect of the applied training loads on the changes of physical capacity and performance of the 13-15 year old female handball players, within the three-year training cycle. It was assumed that the physical capacity and skills would significantly improve as a result of applied training loads and biological development of the subjects.

DIFFERENCES IN LOAD IN GIRLS AGED 10 TO 12 YEARS IN PLAYING HANDBALL WITH VARIOUES TYPES OF DEFENSES

Jug Iva, Kadivnik Hana, Luzar Klemen, Šibila Marko
University of Ljubljana, Faculty of Sport, Ljubljana, Slovenia

The purpose of this study is to compare the load to which the players are exposed during the matches, played in three different models of defence (individual defence, zone defence or 2 x 3 vs. 3 game form) for girls aged 10 to 12 years.

Eleven subjects played nine model games (2 x 10 minutes), using each way of defence three times. All matches were recorded by the camera positioned on one side of the court. Footage was analyzed to count the number of occurrence of 15 parameters/elements. The SPSS statistical package was used for the analysis. For all variables we calculated basic statistics. Analysis of variance (ANOVA) was applied to examine potential differences between individual parameters among the three different mode of playing one-way.

Results show that statistically significant differences do exist in the following variables: "length of the attack", "number of assists", "number of goals", "number of shots", "number of technical errors", "number of attacks", "number of jump shots from a distance" and "number of jump shots from 6 meters". Based on the results and observations that we made, we came to the conclusion that in this age the most suitable games are those with man marking defence and game form 2 x 3 vs. 3. These two models allow faster, more dynamic play, which enables children more activity and greater creativity in the game.

**FEATURES OF CHANGES OF DIRECTION SPRINT (CDS)
PERFORMANCE IN ELITE JAPANESE YOUTH WOMEN
HANDBALL PLAYERS: A COMPARISON OF THE CORRELATION
COEFFICIENT BETWEEN CDS AND FIELD TESTS**

Tetsushi MORIGUCHI¹, Shiro ICHIMURA², Shuji TAMURA³, Shintaro SAITO⁴,
Takahiro ADACHI⁵, Issei OGASAWARA⁶, Yoshikuni NAKATA⁷, Kenta
YOKOTE⁸, Michiko HANAOKA³, Manabu TODOROKI⁹, Mamoru TANAKA¹⁰
¹Kagoshima University, Kagoshima, JAPAN 8900064; ²Tokyo University of
Science; ³Tokai University; ⁴Daido University; ⁵Kyushu Sangyo University;
⁶Mukogawa University; ⁷Meio University; ⁸Takamatsu University;
⁹Fukushima High School; ¹⁰Fukuoka University

The purpose of this study was to clarify the relationship of physical form and field tests to CDS performance in elite Japanese female handball players. We also conducted a comparative analysis of the CDS performance of U-15 and U-18 players. Our study sample consisted of 160 elite Japanese women handball players (U-18: 79 and U-15: 81), who participated in the Japan Handball Association's Center Training Program in 2010, 2011, and 2012. The mean speeds in the 30 m straight sprint (SS) test for the U-18 players and U-15 players were 20.74 ± 0.12 km/h and 20.56 ± 0.15 km/h, respectively, and no statistically significant differences were observed between these 2 groups. The mean speeds in the 30 m CDS test for the U-18 players and U-15 players were 14.94 ± 0.09 km/h and 14.47 ± 0.08 km/h, respectively. In this test, the U-18 players were significantly faster than the U-15 players. A negative correlation was observed among U-18 players between CDS speed and the SS-CDS ratio; as CDS speed increased, the SS-CDS ratio decreased. However, among U-15 players, no significant correlation was observed between CDS speed and the SS-CDS ratio. U-18 players displayed a strong correlation between CDS speed and the SS-CDS ratio. From these results, it was inferred that the acquisition of turning skills improved U-18 players' deceleration and reacceleration abilities when turning.

DIFFERENCES BETWEEN THE WINNING AND DEFEATED FEMALE HANDBALL TEAMS IN RELATION TO THE TYPE AND DURATION OF ATTACKS

Katarina Ohnjec, Dinko Vuleta, Lidija Bojić-Ćaćić
Faculty of Kinesiology, University of Zagreb
Croatian Handball Federation

From the video-records of the matches of the 2010 European Women's Handball Championships in Denmark and Norway, using especially designed software for statistical analysis and video games (Match Analysis Sports), 2,710 *attacks* were extracted for the analysis. The sample of variables contains attack type and duration of attacks. To determine the difference between the winning and defeated teams, we used the following tests: χ^2 – test, Kruskal-Wallis test, univariate analysis of variance (ANOVA) and post-hoc analysis, i.e. Scheffe test.

Out of a total of 2710 attacks played, the winning team played a total of 1356 attacks, and the defeated team only two attacks less, i.e. 1354. However, the played attacks of the winning and defeated teams have a different structure with respect to the basic types of attacks (position, transition, other). Winning teams played a total of 1057 positional attacks, 236 transitional and 65 other attacks. Defeated teams played a total of 1115 positional attacks, 177 transition and 62 other attacks.

Consistency in the duration of the attack can be explained by the different amount of each type of attacks for the defeated and the winning team. As the winning team had more transition attacks with shorter duration and longer construction of position attacks the compensation occurred, thus the average total duration of the attacks takes on a similar value, approximately equal to that of the winning and defeated teams.

DEFENSIVE SYSTEM 3:3: INTRODUCTION TO DEFENSE IN ZONE

Juan F. Oliver Coronado¹ and Patricia I. Sosa González²

¹Faculty of Educational Sciences, University of Seville (Spain).
Member of the Union of University Handball Teachers (U.U.H.T.)

²Faculty of Educational Sciences, University of Seville (Spain).
Member of the Union of University Handball Teachers (U.U.H.T.),
EHF Master Coach, and IHF Handball at School Expert

This article deals with the early experiences of the so-called zone defenses introduced in Spain, that later defined the characteristics of 3:3 zonal defensive system and the denomination of the players in the various specific positions.

The central part offers a "Decalogue", explaining the different roles that players must know, learn and work on. Some individual roles are those of the defender guarding the player with the ball, as well as of the defender guarding a player without the ball. The individual roles need to be coordinated, so as to serve a collective role.

The article ends by highlighting the importance of this defensive system, called dubbing or help, providing some reflections on it.

HANDBALL TEACHING AT SCHOOL: A PRE-SERVICE TEACHING EXPERIENCE AT THE PRIMARY SCHOOL

Sara Pacheco¹; Luísa Estriga^{1,2}; Geraldo Gomes¹
{¹Faculty of Sport, } University of Porto, Porto, Portugal

The goal of this study was to evaluate the success of using a more tactical and comprehensive approach to teach handball at school to 8-10 year old students. The study was a research-action concerning the usage of modified game forms, done during the Practicum (Master degree in Sports for Children and Youth). Three different modified game forms were tested: 4X4 with and without a mandatory advanced goalkeeper and simple 5X5 (mini-handball).

Twenty-three students (10 male and 13 female) from 3rd grade (8-9 years old) and seventeen students (10 male and 7 female) from 4th grade (9-10 years old) were involved, during the scholar year 2012-13. This experiment comprised 10 teaching sessions for the 3rd grade class and 6 teaching sessions for the 4th grade class, of 90 min each, all of which were videotaped, respecting the ethical canons in place (authorizations, anonymity, etc). In order to evaluate the learning progress of the essential skills and global game performance, a specific observation form was developed based on the Game Performance Assessment Instrument (Oslin et al. 1998).

The results revealed significant increase in students' learning in the motor domain, from an individual and collective perspective. The game of 4X4 with a mandatory advanced goalkeeper showed a major impact in students playing opportunities and game inclusion. In general, the students showed great enthusiasm and motivation to play handball and improved their game skills level in handball greatly.

A MULTI-FACETED ASSESSMENT OF ACHIEVEMENT MOTIVATION AND PERSONAL ORIENTATION IN RELATION TO THE GAME PERFORMANCE OF HANDBALL FEMALE PLAYERS

Sakharova Marina, Fedotova Anastasia

Russian State University of Physical Education, Sport, Youth and Tourism

The purpose of this study was to analyse the relations between achievement motivation, different types of personal orientation and the game performance of handball female players. The sample consisted of elite female handball athletes (12 juniors and 13 adolescents). Data were obtained by applying two questionnaires: test of achievement motivation (M. Sh. Magomed-Jeminov, 1988) for evaluating the general achievement motivation, and orientation test form (B. Bass, 1967) for evaluating the personal orientation, and the cumulative statistic of nine international games. The descriptive statistics (percentage, mean and standard deviation), inferential statistics (analysis of variance ANOVA, Pearson correlation coefficient) and the statistical analysis of games results were used as the research instruments.

Motivational factors and personal orientation ought to be considered as development game performance. Research data can be used to develop more effective programmes of psychological preparation of athletes.

ASSESSMENT OF PSYCHOLOGICAL SKILLS IN YOUNG ELITE FEMALE HANDBALL PLAYERS

Patricia I. Sosa González¹, Juan F. Oliver Coronado² and Rosa M. Alfonso Rosa³

¹Faculty of Educational Sciences, University of Seville (Spain).
Member of the Union of University Handball Teachers (U.U.H.T.),
EHF Master Coach, and IHF Handball at School Expert.

²Faculty of Educational Sciences, University of Seville (Spain).
Member of the Union of University Handball Teachers (U.U.H.T.).

³Faculty of Educational Sciences, University of Seville (Spain).

In recent years, there has been an increased interest in psychological training in sport. Its aim is to detect and evaluate psychological demands as well as plan and develop the training of relevant psychological skills in this context. The aim of this study was to explore the psychological characteristics of young elite women handball players and to study and analyse significant differences based on the years competing (<5 years, and >5 year competing).

The sample consisted of 137 handball players between 13 and 16 years old. The questionnaire *Psychological Characteristics Associated with Sports Performance* was administered in order to assess five relevant psychological variables in sports. The obtained results show that these handball players have similar psychological characteristics to players of other sports. Players with more years of competitive experience scored higher results in various psychological skills assessed. The results point out the necessity of psychological training as part of a complete formation.

LEVEL DOMAIN PSYCHOLOGICAL SKILLS IN YOUNG ELITE FEMALE HANDBALL PLAYERS

Patricia I. Sosa González¹, Juan F. Oliver Coronado² and Rosa M. Alfonso Rosa³

¹Faculty of Educational Sciences, University of Seville (Spain).
Member of the Union of University Handball Teachers (U.U.H.T.),
EHF Master Coach, and IHF Handball at School Expert.

²Faculty of Educational Sciences, University of Seville (Spain).
Member of the Union of University Handball Teachers (U.U.H.T.).

³Faculty of Educational Sciences, University of Seville (Spain).

The aim of this study was to explore the level domain of psychological skills of a group of female elite handball players in young categories and to compare the level of control of these skills, taking into consideration the players' level of sports experience [years playing ($M=8,68$; $SD=2,18$) and years competing ($M=5,12$; $SD=2,18$)].

139 female handball players between 13 and 16 years old ($M=14,25$; $SD=0,74$) participated in the study, and 39 of these players completed a second assessment. The *Psychological Skills Questionnaire and Behaviors in Sport Competition, Infantile-Juvenile Scale* was administered in order to assess 21 variables and psychological skills in sport. These young players demonstrated a deficient level of control in some relevant skills. Players with more years of playing experience scored lower results on various psychological skills and a lower total score. However, the only significant differences were found between more experienced players and novel players in 3 variables. The results point out the necessity of psychological training as a part of a complete formation of the athletes.

STUDY OF THE PHYSICAL CONDITION OF YOUNG ELITE FEMALE HANDBALL PLAYERS

Patricia I. Sosa González¹, Juan F. Oliver Coronado² and Rosa M. Alfonso Rosa³

¹Faculty of Educational Sciences, University of Seville (Spain).
Member of the Union of University Handball Teachers (U.U.H.T.),
EHF Master Coach, and IHF Handball at School Expert.

²Faculty of Educational Sciences, University of Seville (Spain).
Member of the Union of University Handball Teachers (U.U.H.T.).

³Faculty of Educational Sciences, University of Seville (Spain).

The main purpose of this study was to determine the physical condition profile of young elite female handball players. The second purpose was to explore whether there were differences depending on their game position.

A total of 137 young female handball players between 13 and 16 years participated in the study. Physical condition was evaluated [30m sprint, throwing a ball (standing throwing using 3 steps, and standing throwing using 3 steps and jumping), horizontal jump, squat jump test, Illinois Circuit, and Course Navette] and a basic descriptive analysis, as well as an ANOVA analysis were performed, in order to establish differences between the various game positions (left back, center back, right back, pivot, wings and goalkeeper).

The results show significant differences in all physical condition tests based on the players' game position. In general, the best results were obtained by the wings and the first line of offensive players, while the lowest results were obtained by the goalkeepers.

ANALYSIS OF 2 VS 2 IN ORGANISED ATTACK IN HANDBALL IN A SITUATION OF NUMERICAL EQUALITY OF 6 VS 6 DURING THE 2011 WOMEN'S WORLD CHAMPIONSHIP

¹Sousa, Duarte, ¹Prudente, João, ²Sequeira, Pedro
¹ UMa (Funchal, Portugal), ² ESDRM (Rio Maior, Portugal)

Many authors consider the complexity of the relationships that develop between teammates and opponents as an important and fundamental aspect in the final outcome of Handball matches (Prudente, 2006; Silva, 2008) and the success in collective sports games in general.

The analysis of playing actions observed in natural context allowed us to examine the interaction between teammates and opponents in a realistic way, as some authors argue (Prudente 2006; Silva, 2008). The use of Sequential Analysis allows detection of significant probabilities of associations between different events and the success or failure, taking into account the events of the game (Anguera, 1999).

This study aims to analyse, characterise and detect patterns of behaviour in 2vs2, relating them to the defensive organisation and the tactical means, in a numerical equality in organised attack, during the 2011 Women's World Championship. We employed the observational methodology, using the prospective sequential analysis with lags.

The sample was composed by all 2vs2 situations when organised attack occurred in numerical equality during the game, in 16 games of the group stage (8) and the eliminate phase (8) to the finals of the 2011 Women's World Championship.

As main results we detected some patterns of behaviour: 1) The 6:0 defences inhibit goal, 2) The open defence activates goal, 3) The relationship between Central and Right Back activates the crossing with continuity; 4) The relationship between Central and Left Back increases shot after crossing.

**THE INVOLVEMENT OF THE WING PLAYERS
IN A TEAM'S STRATEGY:
STUDY OF THE ROMANIAN LEAGUE, WOMEN 2012-2013**

Varzaru Cristina, Alexandrescu Nicoleta, Cezar Hantău
National University of Physical Education and Sport, Bucharest, Romania

Are wing players used enough in their team's tactical approach? What is their contribution to the team's success? Do they prefer fast breaks, position shoots, or man to man duels? Is the average scoring good enough? Are they changing positions often? Are they used to play also without the ball? These are the questions our study will give answers to, based on the game's registrations and statistics from the Romanian Women's League, season 2012-2013.

Statistics can be very useful, but they also have their degree of subjectivity if taken out of context. That is why we have chosen to pay special attention to the best ranked teams (1st-4th, also the teams with participation in European Cups), by watching video clips of their games. In the end of the paper, we will compare the wings involvement from the Romanian League with the wings performance from the European Championship in Serbia, 2012 ("Statistical model of the wing player who participated in the Women European Chamionship, Serbia, 2012", Cristina Varzaru, Igorov-Bosi Marina, 2012).

MORPHOLOGICAL CHARACTERISTICS AND MOTOR ABILITIES OF AMATEUR FEMALE HANDBALL, BASKETBALL AND VOLLEYBALL PLAYERS

Milvi Visnapuu, Riinu Veber, Meeli Saar
University of Tartu, Tartu, Estonia

Aims of the study: The purpose of this study was to primarily investigate the relationship between body composition and motor abilities in amateur female handball, basketball and volleyball players, and secondly, to compare differences in body composition and motor abilities in amateur female handball, basketball and volleyball players.

Subjects and methods: In total, 39 Estonian amateur female players (13 handball, 12 basketball and 14 volleyball players) were studied. Morphological characteristics such as body height, arms span, body mass, body fat %, fat mass, lean body mass, fat-free mass, and BMC were measured; the body mass index (BMI kg/m²) was calculated. The following motor ability tests were used: squat jump (SJ), counter-movement jump with arms swing (CMJAS), 10x5m shuttle run, medicine ball over-arm throw with dominant and non-dominant hand from sitting position and suicide run.

Results: Few significant correlations exist between morphological characteristics and motor abilities in any of the groups. In the basketball group, suicide run significantly correlates with morphological characteristics ($r=0.77-0.89$) and SJ with fat mass and fat % ($r=-0.73- -0.74$). In the handball group, medicine ball over-arm throw with dominant hand significantly correlates with morphological characteristics ($r = 0.64-0.76$). In the volleyball group, shuttle and suicide runs were significantly related to body height ($r=0.64-0.69$). The results of the present study demonstrate that female amateur handball players differ significantly ($p<0.05$) from volleyball and basketball players in most morphological characteristics. In tested motor abilities, volleyball players demonstrated better results than basketball and handball players. The results of handball and basketball players were similar.

Conclusion: According to the present study, amateur volleyball players were the ones with the most suitable morphological characteristics and in better physical shape for competitive sports than both handball and basketball players.

THE ANALYSIS OF THE EFFECTIVENESS OF 7-METRE IN HANDBALL: STUDY CONDUCTED IN THE WOMEN'S COMPETITION OF THE LONDON OLYMPIC GAMES 2012

Francisco Zacarias¹, Jasmine Weise¹, Paulo Sá³, João Prudente⁴, Pedro Sequeira^{1,5}

¹Escola Superior de Desporto de Rio Maior, Portugal

²Deutsche Sporthochschule Köln, Deutschland

³Instituto Superior da Maia, Portugal

⁴Universidade da Madeira

⁵Unidade de Investigação do Instituto Politécnico de Santarém, Portugal

Goals from 7-metre shots are one of the ways that teams seek the most as a way of finalising an attack because of its high level of efficiency compared to other forms of finalising. In women's handball, this has been relevant in the last years. During the women's competition of the London Olympic Games 2012, a total of 218 goals was thus obtained, which accounted for 11.42% of the total goals of the competition.

Through this work we intended to analyse how 7-meter shots were performed in this competition and try to relate them to their effectiveness. We took into account the type of game, the march of the game result, the time line, the 7-M Shooter, their handedness (right-handed or left-handed), the effectiveness, the point of entry of the ball in the goal and the place where the goalkeeper stands. Our sample was composed by all the 308 seven meters shots of the women's competition of the London Olympic Games 2012.

We used the videos of the games. The instrument we used for the analysis of 7-metres was the videobserver©. For statistical analysis we used the SPSS 18.0 software. It seems that the best goal scorers are also the best shooters from 7 metres. It also seems that 7-metre shooters have more efficiency when they cross the shot (to the opposite side of the shooting hand).

FINGER INJURY PREVENTION IN HANDBALL

Vanja Radić

Youth national teams of Finland, Turku (FIN)

Goalkeeper's coach in Finnish national teams boys and girls born 1996

This review discusses common types of fingers injuries in handball and presents some of the suggestions for fingers injury prevention. As previous researches showed, overall prevalence of acute injuries in handball is around 2/1000h. Match prevalence are ten times higher than training incidences. But with all the focus on knee, ankle, hip, back and shoulder problems associated with handball, finger injuries often receive little or no attention at all.

TENDENCIES IN MODERN HANDBALL AFFECTING WOMEN'S TEAMS AFTER THE OLYMPIC GAMES IN LONDON AND THE EUROPEAN CHAMPIONSHIP 2012

Ilia Varbanov, PhD

Head Assistant Professor, Dept. Basketball, Volleyball and Handball, NSA V. Levski", Studentski grad, 1710, Sofia, Bulgaria

In this work, we present a retrospective review of the current state and trends of women's handball, by analysing the game performance of 12 teams, which participated in the final handball tournament at the Olympics in London, as well as that of the 16 finalists of the European Championship in Serbia, in 2012.

We established the modern trends in handball by analysing some parameters (height, age, etc.) and basic gaming performance extracted by the above mentioned events: number of goals scored during different phases of the attack and their success rate in percentage, performance of teams in numerical equality and inequality, and effectiveness of goalkeepers after theoretical analysis of the official computer statistics.

OPTIMIZATION PROCESSES IN THE PREPARATION OF FEMALE HANDBALL PLAYERS

Prof. Ivan Yotov, PhD

The Vasil Levski National Sports Academy, Sofia, Bulgaria

The dynamics of both, offensive and defensive game, in modern handball is a constant intensification of actions. At the core of this activity is a targeted increase of the efficiency of the training session. In fact, this task is consistently solved through developing the mechanisms of optimization processes while training handball female players as follows:

First and foremost, importance is given to optimization processes aimed at enhancement of the overall fitness level delivered through the application of specialised diversity in the handball game. Secondly, we study the optimization process mechanisms of training for technical skills; these come down to the application of biomechanical models of shooting in the door and the implementation of cybernetic models for training in different types of shot in handball. Thirdly, the article examines a number of levels of adaptation while shooting at goal after physical load of various levels of intensity.

The outlined specific characteristics of the optimization processes in the preparation of female handball players are factors that contribute to a tangible increase of the level of sports training in handball.

RELATIONSHIPS BETWEEN PSYCHOLOGICAL, TACTICAL, TECHNICAL, AND PHYSICAL CHARACTERISTICS OF YOUNG FEMALE HANDBALL PLAYERS

Zshivka Zsheliaskova-Koynova¹, PhD; Ilia Varbanov², PhD

¹Associate Professor, dept. Psychology, Pedagogy and Sociology;

²Head Assistant Professor, dept. Basketball, Volleyball and Handball, NSA "V. Levski", Studentski grad, 1710, Sofia, Bulgaria

Our aim was to study the relationships between some important psychological characteristics, technical and tactical skills, and physical characteristics of young female handball players. The subjects were 79 female players aged 12-14 from 6 handball teams. Studied characteristics were: extraversion & neuroticism (measured by EPQ of Eysenck & Eysenck, 1975), hope for success & fear of failure (measured by the Bulgarian version of AMS-Sport of Elbe & Wenhold, 2005); decision making in tactical situations (measured by the test of Varbanov, 2012), tactical skills (self-assessment by the Bulgarian version of TACSIS of Elferink-Gemser et al., 2004) and tactical skills (assessment of the coaches); dribble technique (measured by the test 30 m dribbling with the strong hand); speed (measured by the test 30 m running from standing position) and explosive power of the upper limbs (measured by the test Throwing handball ball from standing position; height and weight. 4 factors explain 73% of variance. The 1st factor (Acceleration) includes height, weight, neuroticism, speed- and power characteristics of the players, and their tactical skills. The 2nd factor (Achievement motivation) includes hope for success, fear of failure, neuroticism, decision making in tactical situations, and self-rated tactical skills. The 3rd factor (Speed) is related to the speed, speed of dribbling, weight, decision making and self-rated tactical skills. The 4th factor (Introversion) includes introversion and tactical skills (assessment of coaches). Applications of those findings and their consequences for coaching practice are discussed.

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CONFERENCE PROGRAMME			
FRIDAY, 22 nd November 2013			
EUROPA			
12:00 12:45	Accreditation		
12:45 13:15	Conference Opening: Welcome Note by the EHF President Jean Brihault, MC Chairman Jerzy Elias and MC Member Nina Britt Husebo		
13:15 14:00	Keynotes Manchado: <i>Performance Factors in Women's Team Handball. Physical and Physiological Aspects - A Review</i> Taborsky: <i>The Genders Comparison of Cumulative Indicators of Team Playing Performance on Olympic Games Handball Tournaments 2008 and 2012</i>		
14.00 16.00	Medical Mini-Symposium Møller: <i>High Incidence of Injuries in Female Handball: Specific Concerns and Impact on Participation</i> Bencke: <i>Why Do So Many Knee Injuries Occur During Sidecutting, and Why Are Female Players More At Risk?</i> Kreutzfeldt Zebis: <i>Effect of Knee Injury Prevention in Handball: Which Exercises Should We Choose?</i> Bencke, Møller, Kreutzfeldt Zebis: <i>Implementation of Prophylactic Training in Handball: Why, When, How and Who?</i>		
16.00 16.30	Coffee Break		
EUROPA		KREISKY	
16:30 16:45	Delamarche: <i>The Optimal Weight for a Female Handball Player</i>	16:30 16:45	Sibila: <i>Characteristics of Effort.../Defenses in Girls Aged 10 to 12 Years</i>
16:50 17:05	Sibila: <i>The Relation Between.../Elite Handball Players</i>	16:50 17:05	Sequeira: <i>Construction of an.../Attack in Women's Handball: a Case Study</i>
17:10 17:25	Michalsik: <i>Physical Demands.../How Big is the Difference?</i>	17:10 17:25	Ichimura: <i>Proposal on the Analysis.../Set-play Using Sequence Analysis</i>
17:30 17:45	Michalsik: <i>Physical Demands.../Female Elite Team Handball Player</i>	17:30 17:45	Lopes: <i>Tracking Multiple.../Network Flow for Assessing Tactical Behaviour</i>
17:50 18:05	Moss: <i>Anthropometric and Physical.../Team Handball Players</i>	17:50 18:05	Hianik: <i>Selected External Load .../the World Women's Handball</i>
18:10 18:25	Skarbalius: <i>Heart Rate, Trimp, RPE, CMJ.../Female Handball?</i>	18:10 18:25	Hianik: <i>The Relation of Women.../to the Result of the Match in Handball</i>
18:30 18:45	Kandráč: <i>The Effect of Morphological .../Elite Female Handball Goalkeepers</i>	18:30 18:45	Tilp: <i>Identification of Offensive Action Patterns in Team Handball</i>
18:50 19:05	Kandráč: <i>The Relationship Between.../in Elite Female Handball Players</i>	18:50 19:05	Marczinka: <i>Performance Analysis.../Coaching Methods in Handball</i>
19:15 20:00	Poster Presentation		
20:15	Dinner		

CONFERENCE PROGRAMME			
SATURDAY, 23 rd November 2013			
EUROPA		KREISKY	
08:40 08:55	Estriga: <i>Live Exertion Evaluation in Elite Handball Referees</i>	08:40 08:55	Sosa: <i>Numerical Superiority Defensive Zone: an Approach to an Active Dimension (4:1:1)</i>
09:00 09:15	Pollany: <i>The EHF Summer Camp for Girls.../, Featuring the Pilot Test of Ball Sizes for Female Players</i>	09:00 09:15	Estriga: <i>Ruling and Reality – the Handball Case</i>
09:20 09:35	Sosa: <i>Need and Proposal for Change in the Size of Women's Handball Ball.../Coverage Index of the Ball</i>	09:20 09:35	Dreckmann: <i>Behaviour of Retraction in the Defense: Present Results in National Women Handball</i>
09:40 09:55	Wagner: <i>Testing Game-Based Performance in Team-Handball</i>	09:40 09:55	Zapardiel: <i>Beach Handball to Improve Jumping Power</i>
10:00 10:15	Tuma: <i>The Relationship Between Chosen Factors of Playing.../Active Career of Female Handball Players</i>	10:00 10:15	Manchado: <i>Different Training Periodization Models in Female Handball</i>
10:20 10:35	Moayad: <i>Higher Risk of ACL Tears in Female Athletes in General and with Special Reference in Handball</i>	10:20 10:35	Póvoas: <i>Handball 4 Health: Effects of a Short-term Handball-Based Exercise .../Markers in Untrained Adults</i>
10:40 10:55	Sakharova: <i>Character of Injury Dynamics in Female Handball</i>	10:40 10:55	Póvoas: <i>Sprint Performance and Anaerobic Power in Adolescent Female Team Handball Players</i>
10:55 11:20	Coffee Break		
11:20 11:35	Acsinte: <i>Neuro-muscular Coordination and Balance Skills Development in Young Female Handball Players</i>	11:20 11:35	Hermassi: <i>Relationship Between Yo Yo Intermittent Recovery Test.../Abilities in Elite Junior Handball Players</i>
11:40 11:55	Büsch: <i>Evaluation of the Talent Identification Programme of the German Handball Federation</i>	11:40 11:55	Sequiera: <i>Organization of Competitions in Youth Handball</i>
12:00 12:15	Pori: <i>Functional Movement Screen of Youth Female Slovenian Handball Players</i>	12:00 12:15	Bon: <i>Handball and Gender Differences - Special Focus on the Coaching Profession. Case in Point: Slovenia</i>
12:20 12:35	Manchado: <i>Anthropometric and Fitness Differences in the First Spanish Handball League Players</i>	12:20 12:35	Augustyn: <i>The Use of Information Technology in Non-formal Education and Informal Learning of Handball Coaches</i>
12:40 12:55	van den Tillaar: <i>Comparison of Effects of 6 Weeks of Plyometrics Training.../ Adolescent Handball Players</i>		
13:00 13:20	Closing and Awarding of Certificates		