



Scientific Conference 2019



EUROPEAN HANDBALL
FEDERATION

5th EHF Scientific Conference

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“Handball for Life”

Conference Guide
Summary of Abstracts



Deutsche
Sporthochschule Köln
German Sport University Cologne

FOREWORD



Michael Wiederer
EHF President

With the 5th edition of the EHF Scientific Conference in 2019, the European Handball Federation (EHF) celebrates a jubilee of a well-received event. In cooperation with the Union of University Teachers (UUHT) the EHF tries to bring professional, medical, and scientific experts together to share their research, findings, and ideas on the physical and mental welfare of the professional athlete in the areas of performance and training as well as in the technological development of the sports.

The EHF Scientific Conference has been created to give handball experts a forum of communication to share their knowledge, their theoretical as well as their practical approaches. This conference emphasises the importance of scientific perspectives within handball as everybody in the handball family strives to broaden his or her competence.

The first conference in 2011 focused on sports training and medicine; in 2013 the emphasis was on women's handball and knee injuries. At the 2015 convention, we were enthused to host several presentations on the medical aspects of the handball sports. The 2017 symposium was aiming at the player's mental, physical and social health, with a special focus on equipment issues. Now, at the 2019 conference, the time has come to look at handball as a comprehensive sport as it reaches from early stages of childhood to maturity. "Handball for Life" represents an approach to accompany players of all ages during their Handball journey. In the upcoming years our emphasis will be laid at this area. Is there a better way to start than with a Scientific Conference?

The EHF is grateful to host the anniversary at the German Sport University Cologne since it is known as a flagship within the European Sports Science Community and an important EHF Partner for offering educational services such as the European Handball Manager Certificate programme. With almost 50 presentations this year's edition shows the enormous engagement of handball enthusiasts to scientifically explore the game and its environment. Moreover, those academic approaches aim at the advancement of handball within a rapid changing world of sports.

I very sincerely thank the members of the 2019 EHF Scientific Conference Organising Committee and the members of the EHF Scientific Network for administering this special anniversary which was also made possible with the engagement of the EHF Competence Academy & Network. I hope that the presenters and participants of the 5th EHF Scientific Conference are inspired to further engage their endeavours to enlarge the horizon of the handball world.

Michael Wiederer
EHF President

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KEYNOTES

INTEGRATING INJURY PREVENTION IN HANDBALL ATHLETE DEVELOPMENT

Maarten Barendrecht, Ati Claessen, Linda Coppens. Avans+, Breda, Nederland

Background: The burden of injuries in team handball can be lowered if effective preventive measures are well adopted by handball clubs, trainers and players.

Purpose: To reach consensus between Dutch handball experts on the integration of preventive measures in handball athlete development.

Methods: Based on a literature review of preventive measures and athlete development a focus group of five experts established the theoretical framework for a Delphi-procedure. An expert panel of handball trainers, sports/paediatric physiotherapists, physical education teachers and officials of the Dutch Handball Association were invited to reach consensus on the practical applicability, exercise type, guidance and priority of eight preventive measures for different levels of play and stages of athlete development. Consensus was set at 70% agreement.

Results: Twenty-five experts participated in the Delphi procedure. Preventive measures were linked to handball age categories and levels of play. Consensus was reached on integration of the following preventive measures: basic motor skills, falling skills and stabilisation, coordination and balance from the age of 5 years on; warm up with technical elements from 11years on; mobility and strength training from 13 years on; plyometrics and position specific exercises from 15 years on. Preventive measures were also prioritised (1-8) per age category to enable selection of measures based on available training time and level in practice. Stability, coordination and balance and warm up with technical elements were prioritized in the top 3 for all relevant age categories. Falling skills were seen as 3rd most important in ages 5 to 10 but least important from 15 years on. Mobility and strength were not among the top 3 for all relevant age categories.

Conclusion: Effective preventive measures can be integrated in handball athlete development per age group and level of play to facilitate their implementation. The results from this study can be used as a consensus guideline for clubs, handball schools and/or trainer courses

SOCIAL AESTHETICS AND GRASSROOTS HANDBALL

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From the moment they are born, human beings are social animals. Only by living in real communities and interacting with others can an individual grow to become fully human. Social aesthetics is the science that studies how people live together in their social environment. As a multi-professional discipline it has developed perspectives, concepts, models and behaviors (such as hospitality, dialogic paraverbal and verbal communication, the right time (kairos) and the right place (genius loci), auras and atmospheres, etc.) that enable us to understand and constructively organize the way people live together. Psychosocial development takes place in “development windows” that open up at certain ages and then close again during subsequent stages of the life span. Handball as a team and contact sport appears to be particularly suitable for promoting psychosocial development in accordance with the principles of social-aestheticism. As psychosocial skills are primarily acquired in development windows in childhood and early adolescence, the development and implementation of social-aesthetic perspectives, concepts, models and modes of action in grassroots handball is crucially important. The aim of this lecture is to introduce and discuss the meaning and significance of social aesthetic approaches in general and also in particular in grassroots handball.

THE HANDBALL 4 HEALTH PROJECT – IMPLEMENTATION, DISSEMINATION AND RESEARCH

Susana Póvoas

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This year, the EHF scientific conference puts a “special emphasis on grassroots handball to underline that interest in sport should be initiated at a very young age and does not necessarily need to end at a higher age”. Indeed, team handball in its recreational version can be used as an effective exercise mode to improve participants’ health, physical fitness and well-being status in both young and older populations, regardless of their experience with the sport, showing high adherence (Hornstrup et al., 2018a,b; Póvoas et al., 2018). This is aligned with the current World Health Organization Global Action Plan, aiming at reducing physical inactivity and the United Nations Sustainable Development Goals (2030 Agenda). It responds to the call for innovative exercise modes that could meet the population interests. This because, physical inactivity is the primary cause of most chronic diseases (Both et al., 2012), being responsible for 5.3 million deaths per year worldwide (Lee et al., 2012) and considered one of the most important public health problems of the 21st century (Blair, 2009). Nevertheless, a third of the adults worldwide do not meet the recommended guidelines for physical activity (Hallal et al., 2012). In this presentation, a summary of the research performed within the Handball4Health project, a multidisciplinary, international, innovative initiative supported by the European, Portuguese and Danish Handball Federations, will be provided and implementation and dissemination issues will be addressed. Barriers of implementation, settings, human resources training, recommended game formats, materials and rules will be covered.

This work is supported by national funding through the Portuguese Foundation for Science and Technology, I.P., under project UID/DTP/04045/2019.

TESTING SPECIFIC PHYSICAL PERFORMANCE IN MALE TEAM HANDBALL PLAYERS AND THE RELATIONSHIP TO GENERAL TESTS IN TEAM SPORTS

Wagner, Herbert, Benedikt Sperl, von Duvillard, Serge
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Introduction: Team handball is exemplified by frequent changes in intensities and different complex movements during games, whereas physical performance has often been tested predominantly via standardized general tests. The aims of our study were (1) to measure team handball specific physical performance as well as (2) general physical performance tests commonly used in team sports in experienced male team handball players, (3) to determine the relationship between specific and general physical performance as well as between specific aerobic capacity and agility, and (4) to ascertain the relevance of these tests for strength and conditioning professionals.

Methods: Seventy-two male indoor court players performed a game based performance test (GBPT) including team handball specific techniques, upper-body and lower-body strength tests, a 30m sprint test, a counter movement jump (CMJ) test, and an incremental treadmill-running test. To assess the specific physical performance via the general test performance, we employed linear regression calculations. Additionally, a principal component factor analysis was calculated.

Results and Discussion: Linear regression analyses revealed a low correlation ($R < 0.5$) between specific and general aerobic performance, 30m sprinting time and specific agility in the GBPT, jump height in the CMJ test and jump height in the jump shot as well as isokinetic shoulder rotation torque and ball velocity in the jump shot. However, a moderate correlation ($R > 0.5$) was found between specific aerobic performance and specific agility in the GBPT. Principal component factor analysis yielded separate components for specific and general physical performance with a cumulative variance of 69%. The results of the present study clearly indicated that general and team handball specific performance are separate components that should be measured, coached, and implemented separately.

ORAL PRESENTATIONS

PREVALENCE OF INJURIES IN DUTCH HANDBALL, PRELIMINARY ANALYSIS

Tim Arnts, Linda Coppens, Maarten Barendrecht. Avans+, Breda, Nederland

Background: Dutch handball has gained popularity since the recent successes of the female national team. Downside is the risk of injuries.

Purpose: To gather information on the prevalence and distribution of injuries in Dutch handball for the development and/or implementation of targeted preventive measures.

Methods: In a repeated cross-sectional design, Dutch handball players 16 years or older were asked to fill in a monthly online survey from September 2018 to February 2019. All handball players active in Dutch leagues of any playing level were invited to participate through social media, club mailings and the website of the Dutch Handball Association (NHV). The survey included questions about age, gender, playing level, playing position, the (in)ability to fully participate in handball training and matches, injury type and location and the Oslo Sports Trauma Research Centre Questionnaire (OSTRCQ).

Results: In total, 1148 respondents (female 81%), covering all Dutch playing levels, filled in one or more monthly questionnaires (2290 in total). Monthly prevalence was highest in September (43%), October, November and January (all 40%). Injuries of the knee (29%; female 30%, male 25%), ankle (14%; female 14%, male 17%), shoulder (13%; female 14%, male 10%) and lower leg (12%; female 13%, male 7%) were most frequently reported. Injured players reported mean OSTRCQ scores of 70 for the knee, 62 for the lower leg, 58 for the ankle and 55 for the shoulder. Backs and wing players showed highest prevalences for knee injuries (32%). Ankle injuries were most prevalent (16%) in pivots and goalies, shoulder (18%) and lower leg injuries (18%) in wing players and elbow injuries (10%) in goalies.

Conclusion: Injury prevalence in Dutch handball is high and distributions by body locations are compatible with results from previous handball studies. Preventive measures that have been proven effective in other handball populations can be implemented in Dutch handball as well.

HANDBALL GOALIES' ELBOW, STILL A BIG PROBLEM? PREVALENCE, AETIOLOGY AND CONSEQUENCES IN DUTCH TEAM HANDBALL

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Background: Handball goalies' elbow is a common problem in team handball goalies. Up to date information on prevalence and burden is needed to develop treatment and preventive measures.

Purpose: To gather insight in current prevalence, aetiology and associated complaints of handball goalie's elbow in Dutch handball goalies.

Methods: In a cross-sectional survey in March 2018, current- (previous 4 weeks), half season- (August-December 2017) and career prevalence of elbow complaints in Dutch handball goalies (>15 years) were investigated. Prevalence was calculated for each period. The Oslo Sports Trauma Research Centre Questionnaire (OSTRCQ) and the Numeric Pain Rating Score (NPRS) were used to quantify current injury burden and pain during sports respectively. Complaints, aetiology, treatment and preventive options were investigated as well.

Results: Of 809 (75.9% female) respondents, 52.8% suffered from elbow complaints at least once during their career (77.8% more than once). Elbow complaints were (one of) the reason(s) to quit playing in 19% of retired handball goalies (n=361). Of the 448 (78.1% female) goalies still active in the ongoing season, 29.9% reported current complaints with a mean OSTRCQ-score of 30.5 (sd 18.9). Half season prevalence was 27.2%. Injury onset was predominantly acute (70%). High impact shots, overreaching, insufficient strength and incorrect technique were frequently (25.9 - 42.4%) reported contributing factors. Complaints (including pain, reduced range of motion and muscle weakness) lasted less than 1 week in 29.4%, 1- 4 weeks in 27.1% and more than 4 weeks in 43.5% of all cases. Mean NPRS-score was 4.8 (sd 2.2). Bracing/taping and strength training were most common treatment and preventive measures.

Conclusion: Handball goalies' elbow is still a major problem in team handball. Results from this study can be used as a first step to develop adequate treatment and preventive measures.

THE PLAYER'S HEALTH AND SOCIAL ENVIRONMENT - SOME CHARACTERISTICS OF INJURIES IN TOP ELITE FEMALE HANDBALL PLAYERS

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Introduction: Handball is characterized by intense body contact, frequent intermittent running, demanding one-on-one confrontations, and quick direction changes in combination with challenging technique and coordination elements like catching, throwing, passing, and dribbling. Also because of all that demands, in the elite female handball, we are following the phenomena: "the injuries are part of the game". Sports medicine is the most important factor for fast recovery, but also some psychological factors and predispositions are important. At the time of injury, social support can optimize the recovery time. The importance of social support for coping with competitive stressors has been noted previously (Gould et al., 1999; Holt & Hogg, 2002; Rees et al., 2007), and the potential stress-buffering effect has been pointed out (Rees & Hardy, 2004). There are different types of social support, the emotional one is very important.

Objectives: In the assignment, we studied the frequency and characteristics of injuries of top-elite sport female handball players (Champions League level) (N= 51, from 18 to 36 years old; average year: 26.5+0.2) from the point of social support at the time of the injury and recovery period.

Material and Methods: The study was conducted with an online questionnaire, data were processed with the statistical program SPSS. Results: The most common injury in elite women's handball players are sprains (86.3%)(usually of the ankle and the fingers on the hands); and some fractures (52.9%) the knee injuries hold the greatest influence on the course of sporting careers, and knee rehabilitation takes the longest. Only three (5.88%) players are with no injury in the career; players are not looking for external factors of the injury and personal guilt or feeling of responsibility is not detectable; there is not significant correlation between years of active career and frequency of injuries ($\chi^2 3.181$; $p = 0.528$). During the time of the injury, they assume the support of the family as most important. Next, the support of teammates means the most to them, followed by the support from a physical therapist or masseur. In the time of recovery and especially in returning to an active player status they are missing support from the coach and from other team officials.

Conclusion: The findings revealed the need for optimization of social support in female handball. The importance of good team officials-players relationship (especially at the time of injuries) in order to recover fast as possible, train optimal and perform well after an injury.

PHYSIOLOGICAL DEMANDS OF 5V5 INDOOR AND OUTDOOR RECREATIONAL TEAM HANDBALL MATCHES FOR INACTIVE OVER 60-YEAR-OLD MEN

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This study aimed at analyzing the physiological demands of recreational team handball (RTH) played as 5v5 matches, in indoor and outdoor team handball courts (80m²/player in a 40x20m) for over 60-year-old inactive men with no prior experience in this sport. Heart rate (HR), rating of perceived exertion (RPE), fun and blood lactate were analyzed for twenty-two participants (68±3 years; 168.1±5.3 cm; 79.0±10.6 kg and 27.8±5.9% fat mass) during two 45-min indoor and two outdoor 5v5 RTH matches. The outdoor matches were held under neutral temperature (20-22°C) and humidity conditions (50-60%). During the indoor and outdoor matches, mean HRs were 77±5 and 76±4%HR_{max}, peak values were 86±6 and 85±5%HR_{max}, and HR was >80%HR_{max} for 44±22 and 35±23% of total match duration, respectively. Rate of perceived exertion was 7.1±2.4 and 6.5±2.4 (AU, 0-10) and fun was 9.1±0.7 and 9.1±1.1 (AU, 0-10), respectively. Mean and peak blood lactate values were 4.1±1.7 (1.7-8.1) and 4.7±1.8 (1.7-8.3) mM for the indoor matches and 3.7±1.6 (1.4-6.1) and 4.6±2 (1.4-7.3) mM for the outdoor matches, respectively. No significant differences were shown between the indoor and outdoor matches in the analyzed variables. RTH, played as 5v5, is an intermittent high-intensity fun exercise mode with physiological demands expected to induce positive effects on cardiovascular health in middle-aged and older men, regardless being played in indoor or outdoor courts.

This work is supported by national funding through the Portuguese Foundation for Science and Technology, I.P., under project UID/DTP/04045/2019.

EVALUATION OF ANKLE BRACING IN FEMALE YOUTH HANDBALL TALENTS

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Background: Literature prescribes bracing to prevent ankle injuries, but does it really work for female youth handball talents?

Purpose: To evaluate preventive ankle bracing in a real-world setting

Methods: Ankle injuries were registered and evaluated over two consecutive seasons in a group of 21 Dutch female national handball talents (born in '00-'01). During the third season, two different ankle injury prevention policies were introduced and evaluated in this group and a second group of 21 Dutch female national handball talents (born in '02-'03). In the '00-'01 group, all talents who had a previous ankle injury were strongly advised to use bracing during training and matches (in national team and club) in the next season. In the '02-'03 group all talents, regardless of previous ankle injuries, were obliged to use preventive ankle bracing.

Results: Fourteen talents (66%) got injured during the first season, six of them were injured twice. Complete return to play took the talents on average 70 days (range 14-350 days). During the second season fourteen talents (66%) had one or more ankle injuries (21 in total) with an average of 80 days (range 10-292) to complete return to play. Ten talents (48%) already had one or more injuries in the previous season(s). Four talents (19%) were already using ankle bracing in the first season, three talents (14%) started in the second season. During the third season, a total of sixteen talents (79%) in the '00-'01 group were using ankle bracing. A total of eight injuries (38%) occurred in the '00-'01 group in the third season, with an average of 33 days (range 5-60) to complete return to play. In the '02-'03 group, a total of five ankle injuries (24%) occurred in this season. It took the talents an average of 58 days (range 12-93) to complete return to play.

Conclusion: Ankle injuries are a serious problem in Dutch female youth handball players. Bracing policies seem to have positive influence on prevalence and time loss, but further research is needed.

THE EFFECT OF RESIN AND BALL SIZE ON THE THROWING VELOCITY

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The International Handball Federation announced the intention of prohibiting the use of resin in handball, addressing the reluctance of many administrators of indoor facilities to its usage. Much of the debate and controversy is about how the resin prohibition will affect players' shooting skills, mainly the throwing speed and tricky shots from narrow shooting-angles, such as the spin shots. As resin facilitates ball manipulation and shooting mastery, a lot of effort has been placed in finding a technical solution for the problem.

This is a preliminary and exploiting study about the effect of resin and ball size on ball throwing velocity. A single session was organized, with the participation of ten trained handball players (from junior and adults categories). The protocol uses balls size 2 and 3. Each player performed several 7-metre throws to the goal with these balls with and without resin and an empty goal. The ball speed was measured with a handheld radar gun.

A repeated measures ANOVA with verified sphericity showed that the ball velocity differed significantly between different ball sizes and resin usage ($F(2,50)=155.8$, $p<0.0005$). Post-hoc tests with the Bonferroni correction don't reject the hypothesis that the shooting speed of a size 2 ball without resin is equal to that of a size 3 ball with resin.

$V(\#3, \text{with resin})=84.4\pm7.2 \text{ km/h}$

$V(\#2, \text{without resin})=83.2\pm7.1 \text{ km/h}$

$V(\#3, \text{without resin})=69.2\pm7.0 \text{ km/h}$ * (statistically different, $p<0.0005$)

Our preliminary results suggest that for adults, banning the resin usage should be accompanied by a downsize of the ball if similar shooting velocities – and general game characteristics - are to be preserved. The resin usage amounts to an effect on speed (a gain) of about 22%.

More biomechanical and performance studies are needed with other handball population, including women and players with different stages of maturation.

INNOVATION OPTIONS IN THE WORLD OF HANDBALL: FUTURE PROSPECTS AND CHALLENGES

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When environmental changes occur in the world of sports, usually there are major calls for innovation. While innovation can mean many things, it is generally understood as the generation, acceptance, and implementation of new ideas, processes, products or services, new to the relevant unit of adoption.

Handball is one of the most popular team-sports with one of the highest economic values, currently described as affected by the major trend of increased commercialization through big data and digital transformation. Characterized as an evergreen journey, the digital transformation approach is a new way to understand business and technology for all handball clubs. In order to stay economically and athletically competitive, handball clubs are spending an incredible amount of time with lots of digital transformation opportunities as a consequence of the disruption of innovations. Supported by the national governing bodies they are increasingly focusing on digital transformation processes as strategic success factors with specific regard to their products and services and to their stakeholders such as players, fans, sponsors and the likes.

According to academic literature, digital transformation processes have not deeply been investigated in the world of handball yet. Thus this work in progress aims at exploring and detecting innovation options applied to the handball business with special focus on digital transformation (which might include but is not limited to players' analytics, virtual reality, and social media development). Specifically, the paper sets out to examine how clubs (professional/grassroots) assimilate and exploit innovation knowledge and validate potential benefits of its deployment. Devil's Circular - Compartement Syndrome – Rhabdomyolysis

EFFECTS OF SPECIFIC TRAINING ON BIOMECHANICAL RISK FACTORS OF ACL INJURY IN ELITE FEMALE HANDBALL PLAYERS

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Background: Deficient motor control is considered a risk factor for anterior cruciate ligament (ACL) injury in landing and cutting sports [1]. The purpose of this study was to investigate the effects of six-weeks progressive sport-specific sensorimotor training (PSSMT) vs. machine-based hypertrophy training (HYPT) on knee biomechanics and neuromuscular activity of elite female handball players in sport-specific risk situations. In a sub-hypothesis we examined the correlation between knee kinematics and kinesiophobia.

Methods: 19 female athletes participated in this intervention study. 13 female handball players from the third German Handball League were assigned via matched randomization into a PSSMT (n=6) or a HYPT group (n=7). 6 female sports students were tested twice to determine test-retest-reliability. Kinematics and kinetics were captured via a VICON motion analysis system (120 Hz) and two KISTLER force plates (1080 Hz). Surface EMG was collected bilaterally from the gluteus medius (GluM), vastus medialis (VM), Biceps Femoris (BF) and Gastrocnemius Medialis (GM). Functional dynamic testing included a DJ (30 cm) and the modified "Heidelberg-Jumping-Coordination-Test" (mHJCT, adapted from [2]). The mHJCT is a single leg jumping test with an unanticipated change of direction after hitting an overhead goal (jump-land-side-cut=JL-SC, jump-land-stabilize=JL-Stab, jump-land-cross-cut=JL-CC). All subjects underwent a clinical knee examination according to the IKDC 2000 form [3] and filled in questionnaires concerning self-reported knee function and kinesiophobia.

Results: The majority of the tested variables showed good to excellent reliability for the DJ and variable results for the mHJCT. Striking was the throughout excellent reliability for the kinematics of the JL-Stab maneuver for the non-dominant (nd) side (ICC: .844-.948). Regarding group effects PSSMT was superior to HYPT. PSSMT significantly reduced joint excursion in transverse plane for JL-Stab ($p=.043$) and joint excursion in sagittal plane for JL-SC ($p=.011$) for the nd side. Latter was involved with an increased BF activity (n.s. group effect). HYPT increased peak valgus for JL-Stab ($p=.015$) for the nd limb. These findings were accompanied by a decreased GluM and GM activity (n.s. group effect). Kinesiophobia: We found a moderate inverse correlation between higher kinesiophobia and increased peak valgus of the nd side during the DJ ($r=-.490$, $p=.023$).

Discussion & Conclusion: PSSMT improved dynamic knee stabilization in transverse plane in unanticipated single leg landings after an overhead ball action; a movement modification which is beyond doubt in favour of ACL injury prevention. HYPT worsened dynamic valgus for the same maneuver. Hypertrophy training without functional input should be considered critically, because it is questionable if the strength transfer is guaranteed in all three planes. Questionnaires of kinesiophobia should be incorporated in ACL injury prevention research; they might have the potential to identify high-risk athletes without expensive equipment.

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[3] International Knee Document Committee 2000

BEACH HANDBALL – FROM THE GRASSROOTS

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The sports game Beach Handball has a short history, first steps have been made in the early 1990s in Italy. Over the last three decades, Beach Handball grew up and more and more sportsmen followed and participated in the game. Whereas in 2004 the first Beach Handball World Championship took place in Egypt, in 2018 Beach Handball made its debut in the Youth Olympic Games in Argentina. Since this tournament, the game is in the focus of the International Olympic Committee in order to become an Olympic sport one day. The lifestyle (e.g. fun, sun, action) and the advantages (playing on sand, playing in small teams) of this game satisfy in particular the needs of kids in playing a game as a team sport. Nonetheless, a gameplay which focuses on the abilities, needs and the motivation of kids under 12 years of age is missing. Based on social-psychological theories concerning the sports enjoyment of kids, the advantages of playing Beach Handball and the major topics to learn, two frameworks of rules have been developed. The framework of rules for the game Mini Beach Handball refers to kids under 10 years of age. The framework of rules of the game Ultimate Beach Handball refers to kids under 12 years of age. These two games have the purpose to make kids familiar with some major topics of Beach Handball (e.g. point-scoring-system, playing without body-contact, fast substitutions) and in particular foster the sports enjoyment of the kids to prepare a life-long sport- (Beach Handball) participation.

THE IMPACT OF A TOP PLAYER INJURY ON ROMANIAN NATIONAL HANDBALL TEAM PERFORMANCE AT THE FRANCE EHF EURO 2018

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In December 2018, France hosted, for the first time, the European Women's Handball Championship. In this 13th edition, Romanian women's national team ended on the 4th place out of 16 competitors, losing the small final to the Dutch. The last notable result of the team had been obtained in 2010, when Romania won the Bronze Medal at the European Championship hosted by Denmark and Norway. The team's outstanding performance in the 2018 edition suggested that great performance could still be achieved. The aim of this study is that of analyzing whether the injury suffered by Cristina Neagu, the captain of the national team, in a key moment of the competition influenced the team's subsequent performance and whether the position achieved was the one they truly deserved. Individual and collective effectiveness have been analyzed, based on data provided by the European Handball Federation's website and application, as well as on data collected by the author by re-watching and reviewing the matches.

Keywords: Handball; women; injury; analysis; national team.

DIFFERENCES IN ATTENTION ATTRIBUTES FOR FEMALE HANDBALL PLAYERS

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Abstract

Increased competition among women's handball teams at major international competitions and the domestic Championship of Russia among super league teams dictates the need to further improve the training system for highly qualified handball players. In this regard, the study of the characteristics of the attention properties of handball players of different roles becomes relevant, as it creates the possibility of a directed increase in their individual manifestations.

A preliminary analysis of the effectiveness of the game activity of the team of handball players demonstrates the presence of certain dynamics of indicators of erroneous actions in the conditions of competition - loss of the ball during dribbling, passing and catching, other errors.

The study of the volume of attention of handball players of different position in the test with proof-reading breakdown showed that the best indicators, as expected, were the center back and left wings players. The smallest value of the volume of attention is identified and handball players function the right wings.

Accounting for errors made by handball players allowed us to calculate the accuracy coefficient of attention. In this indicator, the best results are the back court players (0.92) and the left wings (0.88). Linear players (pivots) showed the lowest results (0.79).

The highest speed of information processing, was shown by center back players - 6.58 characters per second. The most important thing is that this speed was shown at the 4th, last minute of the test, which characterizes the high productivity of the attention of this position players.

FEATURES INJURIES HANDBALL PLAYERS 18-20 YEARS OLD IN COMPETITION

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Abstract

The tournament of the European Championship among handball players no older than 20 years was held from July 19 to 29 in Slovenia and included 3 stages - preliminary, intermediate and main. Over 11 days, teams (a total of 256 participants) played 56 matches.

The total number of recorded injuries was 45 during official matches, 1 injury was received during training and 1 injury during warm-up of the team before the game.

Considering the dynamics of the number of injuries received by athletes, it was revealed that most of them were received by handball players at the beginning of the tournament - at the preliminary stage - 22 injuries, which makes up almost half of all injuries in the tournament.

The characteristic of the time of handball players being injured during the match shows that their greatest number occurs mainly at the beginning of the 2nd half and especially in the middle. This fact indicates the need for players to warm up at the end of a break between halves or to reduce the rest time in the competition rules.

The localization of injuries to handball players shows that the lower limbs - 21 cases, the upper limbs and the body - 13 cases each, are most often injured in young men aged 18-20.

Other important information is provided by data on the conditions of injury - in contact with or without an opponent, that is, when performing any individual actions. An analysis of all injuries sustained by handball players during the tournament shows that a tough force confrontation leads to 34 injuries sustained precisely in contact with an opponent.

COACHES' EMOTIONAL SKILLS AND INTERPERSONAL BEHAVIOURS IN SPORTS COACHING

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Backgrounds: The coaching process in sport is framed in an empowering, mutual trusting and respectful coach-athlete relationship recognized as a powerful performance factor. The key strength of this positive approach is the major role played by the sports coach in promoting motivational coaching environments (Cotê, 2009; Ntoumanis & Mallet, 2014) and shaping the psychological experiences his athletes derive from their sport participation (Mageau & Vallerand, 2003). The purpose of this study is to measure self-rated coaches' emotional skills and their perception about own interpersonal behaviours with their athletes and explore the relationships between emotional and behavioural evaluated variables.

Methods: The Emotional Intelligence Scale for sport (EIS: Schutte et al., 1998; Lane et al., 2009) and the Interpersonal Behaviours Questionnaire (IBQ-Self) in sport (Rocchi, Pelletier & Desmarais, 2016) were administered to sports coaches (n=65, of which 35 are handball coaches).

Results: Results highlighted that coaches perceive less skill in terms of awareness and appraisal of others emotions and utilization of own emotions. On the other hand, there is a clear option for supportive behaviours (than controlling or thwarting) during the coaching process. Handball coaches differ from others in their lower ability to use their own emotions and perceived less competence-thwarting behaviours in the coaching process.

Discussion: The supportive interpersonal style revealed by collected data, according to self-determination theory (SDT), is a key point to promote the satisfaction of athletes' psychological needs and to increase their motivation. Our study also adds comprehensive evidences to recommend that coach education programmes must include emotional skills training.

Keywords: handball, coaches, education, emotional skills, interpersonal behaviours

PSYCHOMETRIC PROPERTIES AND FACTOR STRUCTURE OF THE COACH'S BEHAVIOUR TOWARDS REFEREES AND FAIR-PLAY SCALE

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Backgrounds: A pedagogical approach to sport leadership must include the coach's behavior toward an effective culture of fair-play (Siedentop, 2004) in taking the development of their own responsibility and others, for the appropriate behaviour. The purpose of this study was to develop a new scale, the Coach's Behaviour towards the Referees and Fair-Play Scale.

Methods: The exploratory factor analysis was administered to a sample of 97 handball coaches, followed by an examination of the relationship between the newly derived factors and the other personal and coaching variables (own experience, gender and age of athletes) measured.

Results: After rotation, four factors expressing coach's behaviour towards referees and fair-play could be identified that accounted for 44% of the variance: determine and rectify athletes' behaviour towards referees and opponents (4 items), advise the passive acceptance of referees' decisions (3 items), promote respect for the referees' role (5 items) and encourage the following rules and fair-play (4 items). One item was dropped from the final analysis due to low item-to-total correlation. Cronbach's alphas were .50 overall and .57 to .41 for the subscales.

Discussion: The obtained results on this new scale structure were acceptable for the initial purpose and the obtained four-factor structure was validated across subgroups by gender, age and the other coaching variables measured. Psychometric properties need to be more rigorously investigated to increase its reliability and the amount of the variance explained in coach's behaviour concerning fair-play and referees' role and decisions.

Keywords: handball, coaches, education, fair-play, psychometrics

EFFECTS OF TRAINING SPECIFICITY INTO INFLUENCING AGILITY AND SPRINT PERFORMANCE OF TEAM HANDBALL PLAYERS

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ABSTRACT

The purpose of this study was to determine if straight sprint training transferred to agility performance tests that involved various change-of-direction complexities and if agility training transferred to straight sprinting speed in handball players. Subjects were randomly divided into an experimental group (EG: n=10) and a control group (CG: n=10). Measurements of T-half test, ZIG-ZAG test, 15 m and 30 m sprints were assessed in both groups prior to any training (T1), between four week (T2) and after (T3) a 10-week training intervention program. The test-retest reliability for all tests were excellent and the ICC ranged from 0.76 (ZIG-ZAG test) to 0.99 (Agility T-test). The interday measurement error was below 1% for all tests (CV range: 0.2 - 0.8). Time effects for T-half test ($p=0.012$, $\eta^2p=0.245$) and sprint 15 m ($p=0.035$, $\eta^2p=0.190$) were found. For the agility T-test, a total interaction effect ($p=0.001$, $\eta^2p=0.380$) and a partial interaction effect were calculated between T2 and T3 ($p<0.001$, $\eta^2p=0.603$). A large effect size ($d=0.87$), was observed in EG from T2 to T3. The second relevant ($d\geq 0.5$) effect size was calculated for the parameter sprint 30 m. The CG showed a significant sprint performance reduction from T2 to T3 ($d=-0.60$; parameter: sprint 30 m). All other effect sizes were less than 0.44. The ZIG-ZAG test revealed the largest main and partial effect sizes for all parameters. The EG group showed the largest improvement between T2 and T3 ($d=2.00$). We concluded that speed and agility-training methods are specific and produce no transfer to the other. These findings have implications for the design of speed and agility training and testing protocols in team handball players.

TEAM HANDBALL TRAINING IN OVERWEIGHT UNTRAINED WOMEN – NO NEED FOR PRIOR EXPERIENCE TO IMPROVE PHYSIOLOGICAL PARAMETERS

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Short title: Health effects of team handball training

Key-words: Team sports, team handball training, premenopausal women, body composition, maximal oxygen uptake, echocardiographic parameters

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Abstract

Purpose: We tested the hypothesis that participation in small-sided team handball training could provide beneficial effects on cardiovascular, metabolic, and musculoskeletal parameters in overweight premenopausal women with special focus on the importance of prior handball experience.

Methods: A randomized 16 week RCT training intervention in overweight premenopausal women were conducted for three groups; a team handball training group without prior experience (UN; n=13), a team handball group with prior experience (EXP; n=10) and an inactive control group (CON; n=9). Both UN and EXP completed 1.6±0.3 training sessions per week with average heart rates of 84±5 and 85±9% of maximal heart rate, respectively. Cardiovascular, metabolic, and musculoskeletal parameters were assessed before and after the training intervention by DXA scans, blood samples, echocardiography and physical tests.

Results: Compared to CON, UN had significant increases in VO₂max (7±4%) and intermittent endurance performance (26±14%) as well as reduced total fat mass (4±6%), total fat percentage (4±5%) and android fat mass (7±12%), respectively (all p<0.05). Compared to UN and CON, EXP displayed increased left ventricular mass and left ventricular mass index (both p<0.05). Applicable to both UN and EXP was a significant increased proximal femur BMD (1±1%) after the training period compared to CON. There were no significant changes between any of the groups in muscle mass, blood lipids, resting heart rate and blood pressure (all p>0.05).

Conclusion: Small-sided team handball training in overweight premenopausal women was associated with cardiovascular, metabolic, and musculoskeletal adaptations for participants with minimal handball experience, indicating that prior handball experience is not a prerequisite for improving physiological parameters of importance for health.

PLAYERLOAD OF BEACH HANDBALL PLAYERS DURING COMPETITIONS

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INTRODUCTION: Beach handball (BH) games are characterized by high intensity activities (Pueo, 2017; Bělka, 2015) and few studies have been published on performance analysis of BH (Skandalis 2017; Navarro 2018; Zapardiel 2018a, 2018b; Gkagkanas 2018a, 2018b; Cobos 2018a, 2018b; Jimenez-Olmedo, 2019). To best of our knowledge, only 2 studies investigated the physical demand (Cobos, 2011; Pueo, 2017) of BH players during matches but no information about the PlayerLoad (PL) of BH is available. Hence, the aim of this study was to identify the external (EL) and internal (IL) PL of youth BH players during official matches. **METHODS:** 11 players from the same BH team competed during 7 matches of the YAC17 BH tournament. For the EL, GPS units (Catapult Optimeye S5 and T6, Australia) have been used for PL and PL/minute, whereas for the IL, Polar® H7 heart rate (HR) monitors (Polar®, Kempele, Finland) were used. For a subjective assessment of the IL, Rating of Perceived Exertion (S-RPE) was administered after each game and then the Session-RPE (S-RPE) was calculated. Means and standard deviations were calculated for all the variables. **RESULTS:** EL was lower (PL: 100.3±15.8 AU; PL/min: 3.8±0.7 AU/min) than basketball matches (PL: 449±118 AU; PL/min: 4.35±1.09 AU/min) (Fox, 2018). The IL (% of time spent in each HR zone, according to Edward's method) was higher (zone 1: 24.8±2; zone 2: 22.2±5.2; zone 3: 18.8±5.8; zone 4: 24.3±5.6; zone 5: 14.4±6.1) than the results (zone 1: 19.1±16.5; zone 2: 25.5±12; zone 3: 26±11.5; zone 4: 20.3±14.4; zone 5: 8.9±14.6) showed by Pueo (2017) about BH players. For the S-RPE results have been 123.8±21.5 AU, lower than reported by Fox (2018) (638 ± 194 AU). **CONCLUSION:** This was the first study aimed to describe the IL and EL of a BH team; therefore, further research is needed to compare these values with other samples of BH players.

PATHOANATOMY, EVALUATION AND MANAGEMENT OF ATRAUMATIC AND TRAUMATIC POSTERIOR SHOULDER INSTABILITY

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Posterior instability has been considered to represent less than 10% of all instability cases however, posterior subluxation and translational instability can be easily overlooked and misdiagnosed. More recently, there has been increasing recognition of this pathology in active populations.

Competitive athletes are among the most common patients owing to overuse (microtrauma) or a single traumatic episode (offensive linemen, direct blow or a fall on a forward flexed arm) resulting in posterior subluxation or dislocation.

Currently there is limited research into the conservative management of posterior instability, although it is recommended as first-line treatment prior to surgical review, particularly in those with an atraumatic instability mechanism. Patients with atraumatic instability have increased joint volume; the joint capsule is enlarged, the glenohumeral ligament is lax and thin, or the dynamic stabilizers (rotator cuff, deltoid, scapular muscles) may be weak or uncoordinated.

General approach for rehabilitation consists progressive strengthening, proprioception enhancement and active motion with special attention to control scapula and rotator cuff. The program needs to be multidisciplinary with special attention to patient education, in some cases psychological support and time. In posttraumatic cases and failed rehabilitation surgery may be an option. Postoperative rehabilitation is also an important part of whole recovery process and has to be well planned in advance of surgery.

DETERMINANTS OF SHOOTING VELOCITY IN ELITE TEAM HANDBALL PLAYERS

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Shooting velocity is a key factor to win games in team handball, thus this study aimed to explore widely the determinants of shooting velocity. Methods: We measured the upper (n=14, maximal strength and force velocity profile) and lower (n=20 jump test and sprint tests) body performances of 12 elite young handball players (17.4±2.9 years). We also retrieved some anthropometric (n=6, upper body measures) and mobility (n=6) variables. Shooting velocities were collected in three different conditions (standing shot (90.5±3.5), run-up shot (99.4±6) and jump shot (92.1±6.8). To assess relations between velocities and performance determinants, we calculated the Pearson's correlations coefficient between each variable and the three type of shots. We interpreted correlations using the Hopkins's scale. Result: Standing shot velocities were largely related to height (188±7 cm), weight (81.9±11.2 kg), hand length (17.5±1 cm) and arm length. We did not find any substantial relation in the lower body and mobility variables but large and very large relations exist between maximal bench pull (BPL 76.7±13.3), and bench press (BPR, 77.6±12.1 kg) strength and low load maximal velocity in BPL (30kg, 1.28±0.1m/s) an BPR (20kg, 1.4±0.1 m/s) respectively. Run-up shots velocities were largely related to body mass index, hand span, dominant leg counter movement jump height (29.4±3.7 cm), maximal strength and very largely to low load maximal velocity in BPL and BPR. Jump shot velocities were largely related to body mass index, weight, hand span, sprinting speed and low load maximal velocity in BPL were largely linked and very largely to maximal strength in BPL and BPR. Conclusion: Our results showed that the upper body strength play a major role in shooting velocity. Of interest, this study demonstrates for the first time that the bench pull performances contribute to the same extent as bench press in shooting velocity.

OPTIMAL PHYSICAL TRAINING: THE BEST WAY TO PREVENT INJURIES IN TEAM HANDBALL?

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Recent studies have shown that team handball match-play imposes substantial physical demands on elite players in the increasing number of matches and national/international tournaments during the competition period, now covering 9–10 months per year. Unfortunately, various studies have also shown that elite team handball, independently from sex, due to these high physical demands bears a high risk for both acute and overuse injuries. Injuries to the lower extremities, especially severe knee joint injuries and muscle-tendon injuries of the thigh and the lower leg are more frequently due to indirect contact or non-contact mechanisms and thus of prime interest in prevention studies and interventions.

In recent years, several studies in team handball have demonstrated promising effects in preventing injuries, especially non-contact and overuse injuries. Typically, these effects have been found in controlled and supervised study settings. Despite scientific evidence from these prevention studies, most prevention training programs, which at present are available in team handball, have not been successfully implemented into the training routine of elite team handball clubs and national teams. We hypothesize that one main reason is because they are mainly delivered in strict, unspecific routines that are not suitable to the normal construction of team handball training.

Moreover, recent meta-analyses indicate, that targeted strength training, when planned and conducted correctly, seems to be superior to multicomponent proprioception and coordination interventions in preventing injuries. The fact that strength training already is highly integrated as daily business in elite sports may be the decisive point in this case. Strength training does not need new facilities, equipment or specialised personnel which makes it cost-effective for athletes and clubs and thus has a higher chance to become accepted and adapted. In addition, strength training may have a higher impact on important modifiable injury risk factors than multicomponent prevention training.

A high level of physical fitness is a precondition for being able to tolerate a high volume and intensity of training and to constantly perform at a high level throughout a whole tournament season without getting overloaded and hence potentially injured. Thus, it is crucial that team handball trainers have an in-depth knowledge of the principles and the effects of the various types of physical training which is essential for the correct individual planning and execution of an optimal physical training program for team handball players. In conclusion, the implementation of well-planned and monitored strength training is of key importance in order to reduce the high number of both acute and overuse injuries in elite team handball. However, in a second step, strength training may be assisted of other targeted prevention interventions like multicomponent proprioception and coordination exercises.

PLANNING OF THE TRAINING IN TEAM HANDBALL

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Any training schedule for a team handball player should be based on an analysis of the demands of the game to determine what qualities are important for a good performance. This must be compared with a capacity analysis of the individual players, so that their strengths and weaknesses can be identified. Even though elite team handball is a team sport, the players must be loaded differently. It is important to emphasize that aspects regarding playing positions, individual physical capacity and need for recovery, and gender must be taking into consideration, while designing physical training regimens for team handball players. Knowledge from scientific studies combined with practical experience provides a good basis for the planning of optimal training programs.

It is during breaks between training sessions that the improvement of the physical capacity occurs (supercompensation). Therefore, adequate recovery between training sessions is an important part of proper training planning. The recovery time from training and matches is complex and is typically dependent on the nature of the training/game (intermittent exercise, volume, intensity and duration), the player's training level, the total training volume and the conditions for recovery (diet, sleep, relaxation, treatment, massage etc.), and also outside stress factors such as health, lifestyle, nutrition, psychological stress and environment.

The training must be periodized, so the players will reach the best possible performance in the most important matches/tournaments of the competitive match season. The physical training should be organized with preplanned, systematic variations in training specificity, intensity, and volume in different periods or cycles within the overall training program for the season. Training programs for team handball players should use periodisation (e.g. linear, non-linear and block periodisation) to break up the training into e.g. the off-season, pre-season, in-season (and divide it further to provide multiple peak performances during the competitive period), and the post-season, which should focus on different goals in the various periods of training.

The elements that are crucial for the anaerobic performance are built up faster than the factors which are important for the aerobic performance. Thus, anaerobic training should only be intensified as the competition season approaches. Performance gains and improvements in physiological parameters can be achieved up to important matches and tournaments by using tapers with large reductions in training volume, moderate reductions in training frequency, and maintenance or increase of training intensity.

A sensible training planning requires knowledge of the aims for the training period, the starting level, the different types of training, time perspective for training adaptations, rehabilitation, maintenance and detraining, tapers to matches/tournaments, and concrete planning of training duration, intensity and frequency.

THE STRUCTURE OF NEKA – ACADEMY FOR THE DEVELOPMENT OF HANDBALL

Tamás Mocsai

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Hungary's first state-run handball academy was founded in 2013 in Balatonboglár. The athlete and student of the 140 girls and boys are taught the highest level of training, which is proven by the 18 gold medals earned in a short time in different age groups. The head coaches of the youth national teams are the coaches of the National Handball almost without exception, while 49 players represent NEKA in the teams.

The National Handball Academy wishes to play a leading role in the youth education in Hungary, and aims to use thoughtful, synergy-based training structures. The three pillars of the Academy's work: professional work based on international sports science, the highest level of competition and personality development.

Thanks to the infrastructural developments in recent years, the Balatonboglár sports center has become one of the most beautiful handball centers in Europe.

Nowadays, in addition to the planned sport professional work, the prevention, regeneration and rehabilitation also play an important role in the promotion of sports performance. In the area of the renowned Balaton Coast dormitory, situated in the wonderful ancient park, it is also possible to spend a lot of leisure time there.

Keywords: handball academy, youth development, innovation, whole person education, scientific work

ACTIVITY PROFILE, HEART RATE, TECHNICAL INVOLVEMENT AND PERCEIVED INTENSITY AND FUN IN U11 MALE AND FEMALE TEAM HANDBALL PLAYERS: EFFECT OF GAME FORMAT

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Objective The aim of the study was to compare activity pattern, heart rate (HR), technical involvement and subjective perceptions in U11 boys and girls in five game setups. **Methods** Four girl's teams and four boy's teams played a 1-day tournament with 15-min games on five different court setups: medium court size 4v4(M4v4), 5v5(M5v5) and 6v6(M6v6), and large court size 5v5(L5v5) and 6v6(L6v6). Activity pattern, HR, technical involvement, perceived fun and exertion were recorded. **Results** Boys covered more total distance (TD) and high-speed running (HSR, 13-17.99 km•h⁻¹) on the large court compared to the medium court (P<0.05). Boys covered more distance as sprints on the large court compared to medium court with the same number of players (M5 vs. L5; P<0.05). Girls covered more HSR-distance in L5 compared to games at medium size court. Girls had fewer accelerations and decelerations in L6 compared to M4 and higher peak HR in L5 and L6 compared to M5 (P<0.05). Boys and girls had fewer shots on the Large court compared to M4 and scored less goals in L6 compared to M4. **Conclusion** Team handball for U11 boys and girls are a high-intensity physical activity irrespective of court size, even though more distance is covered on the large court. Increasing the court size changed the activity pattern, whereas manipulating the number of players on a fixed court size doesn't appear to influence activity pattern, HR and technical involvement.

Keywords: Team Handball; Team sport; Children; Small-sided-games

EFFECTS OF BLOCKING ON DEFENSE PERFORMANCE IN BEACH HANDBALL

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The defense in beach handball consists of three defense players and a goalkeeper trying to prevent the attackers from scoring. Zapardiel (2018) mentioned that the best four teams of the European beach handball championship 2017 had higher percentages of goalkeeper saves, and that their spin shot performance seemed to be a critical factor for their top positions. In his analysis, goalkeeper saves and blocks were categorized into the same group and could not be analyzed separately. In the current study, we investigated whether the higher percentages of goalkeeper saves in the best four teams of the 2017 championship can be explained by better blocking performances of the defense. A quantitative video analysis of 23 games of the male European beach handball championship 2017 was conducted. Eight categories of throws/shots were differentiated (spin shot, faraway spin shot, backyard spin shot, inflight throw, specialist throw, goalkeeper throw, 6m, one point throw). In addition, the position of the shooter (left, center, right), blocking (yes, no), and scoring (goal, no goal) were observed. Ten throws had to be excluded from analysis because of a restricted view. Significant differences in defense performances were found between situations in which a block was used and those in which it was not ($\chi^2(1) = 39.13$, $p < 0.001$, $V = 0.163$). Moreover a block increased the defense performance significantly for spin shots ($\chi^2(1) = 16.92$, $p < 0.001$, $V = 0.15$), for specialist throws ($\chi^2(1) = 8.69$, $p = 0.003$; $V = 0.306$) and for goalkeeper throws ($p = 0.049$, $V = 0.224$). The fact that overall the defensive performance was improved by the presence of a block, led to the conclusion that blocking plays a crucial role in beach handball. Furthermore, it seems important that the defense performance improved for spin shots, considering that spin shot performance seems to be one of the most important factors for successful game performance.

LOAD PARAMETERS ASSOCIATED WITH QATCH MATCHES USING MICROSENSOR TECHNOLOGY

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Introduction: Qatch is not only a brand-new sport itself but also a Quality Alternative Training Concept for Handball. Due to the frequent jumps and high intensity micromovements in Qatch, it is useful for the physical preparation of handball players. To date there is no objective data about the load parameters associated with Qatch matches and how it compares to the handball matches.

Methods: 6 male Qatch players (22 ± 5 years) took part in this cross-sectional study, in which 2 teams (3 against 3) played 4 matches on different days. During the matches the players wore a custom-made vest between the shoulder blades fitted with a Catapult S5 GPS unit (Catapult Innovations, Australia) with in-built microsenors (accelerometer, gyroscope, magnetometer). The number of micromovements (accelerations, decelerations, changes of directions) and jumps were normalized to the playing time (number/min). To measure the internal load, the athletes also wore Polar H10 heart rate sensors (Polar Electro, Finland). Blood lactate values were determined from the fingertip before, during and after the matches (Lactate Pro).

Results: The number of high intensity micromovements was 2.9 ± 1.5 /min, which was comparable to the values measured during official handball matches (Luteberget and Spencer, 2017). The players executed 2.3 ± 0.6 jumps/min which was higher than those during handball matches for most of the positions (Povas et al, 2014). In addition, the cardiovascular load was also comparable to handball.

Discussion: Our preliminary results suggest that qatch is a good quality alternative training concept for handball.

RECREATIONAL TEAM-HANDBALL HAS POSITIVE EFFECTS ON BONE HEALTH, BODY COMPOSITION AND PHYSICAL FITNESS OF INACTIVE POSTMENOPAUSAL WOMEN

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This study aimed to analyse the effects of a short-term recreational team handball programme on bone health, body composition and physical fitness of inactive postmenopausal women. Sixty-eight postmenopausal women (68.2 ± 6.2 years; 156.9 ± 5.9 cm; 67.2 ± 9.5 kg; $37.7 \pm 5.4\%$ fat mass) were randomly allocated into team handball (THG; $n=42$) or control groups (CG; $n=26$). The THG performed a 16-weeks recreational team handball programme, 2-3x60-min per week. The participants performed a DXA-scan and a set of physical fitness, at baseline and after 16 weeks. Mean heart rate (HR) was $76 \pm 6\%$ HRmax, with peak values of $88 \pm 6\%$ HRmax and $44 \pm 20\%$ of total match duration HR was $>80\%$ HRmax. After 16 weeks, the THG decreased body mass by 1.5% ($p=0.003$), increased lumbar spine bone mineral density (BMD) (1.5%; $p \leq 0.001$) and bone mineral content (BMC) (2.3%; $p \leq 0.001$) and hip total BMC (2.2%; $p=0.004$). Both groups decreased body fat (-2.5% and -1.7%; $p \leq 0.001$ and $p=0.009$; THG and CG, respectively) and no differences were observed in lean mass in both groups. Only the THG improved muscle strength (upper body: 17.5%; lower body: 26.3%; $p \leq 0.001$), flexibility (upper body: 3.7cm; lower body: 2.6cm; $p \leq 0.011$), agility (14.0%; $p \leq 0.001$) and decreased the number of falls in the postural balance test (-8.5%; $p=0.017$). Recreational team handball is an effective exercise mode to improve health and physical fitness, counteracting some of menopause-related adverse effects.

Rita Pereira is supported by a FCT grant, SFRH/BD/136789/2018.

AN APPROACH TO THE PHENOMENON OF HANDBALL PLAYERS RETENTION IN PORTUGUESE CONTEXT

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Keywords: Handball; Portuguese federation; retention; survival analysis

Physical activity has gain terrain in athletes not only for the health benefits as also as integration feelings. Handball has evolved alongside with consolidation of sport's culture. Portugal is not an exception in this profile. The present study aims to explore the retention and dropout of handball federated athletes. Survival analysis was conducted to the database of the athletes registered from 1 of august of 1997 until 31st July of 2018. The sample consisted of 133,717 handball players who were registered at least for one year. Overall survival was calculated using Kapplan Meier and Log-Rank test was used to compare the differences in the survival of the athletes between gender and origin country group. Results from the survival analyses indicate a median length of stay of the athletes is two years, with an associated probability of 41% to continue more than that period. It is also evident that there is an average of 3 years of being registered as an active player. The probability of retention between female and male's athletes present statistical differences (log-rank test, $p < 0.005$). The country has no statistical differences (log-rank test, $p = 0.74$). The study suggests that gender may play an important role in the retention and / or dropout, contrasting with the inexistence of differences in country of origin. Females have lower survival rates. The findings require more research to assess other factors leading to dropout.

E-HANDBALL: TECHNOLOGIE HELPS DEVELOPMENT

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Handball is a growing Sport all around the World but specially in Europe. Today, Handball is a very intense and spectacular game! Athletes, Coaches, Referees, Delegates, Officials and Managers need to have the best performance to maintain Handball, in all it's variants (Indoor, Youth, Mini-handball, Beach Handball, Wheelchair Handball, ...).

Education plays a crucial role in the development of any Sport. Since the existence of the European Handball Federation, Education was always at the first stage of it's mission. As in many others areas, also Education is evolving. With the new Technologies and it's tools it's now possible to teach in different ways that in the past did not exist. For example, today all the Courses organized by the EHF (and also the National Federations) for Coaches, Referees, Delegates or Managers use Videos in its contents and presentations. The "Visual Education Process" proved to have enormous success in the last years. The EHF has a very good platform with documents, videos and other materials. Now this is used through a new methodology and pedagogical process, named e-learning. Being asynchronous, the graduates have access when they want, the tutor/lecturer teaches through forums, messages, documents and many other tools that the e-learning platform provides. If it's synchronous, then the tutor/leturer and the students have hours where they are simultaneous online and interact during the education process, using the tools referred before. But new challenges are coming. VR glasses will help Coaches "to see" as their players see and then correct them. But also to teach Coaches to "see better" everything that happens during practices and games. Also e-sports is a future challenge to Handball. Not only to promote the game and players (FIFA 2019 and Football Manager 2019 are very good examples) but also as an education tool because they will help Coaches and Referees to understand better all the components of the game!

Keywords: Handball, Education, Technology, E-learning, VR

E-SPORTS: HANDBALL NEW CHALLENGE

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EA Sports© FIFA 19 is one of the most popular franchises in video games. During the 2019 fiscal year, the soccer sim drew 45 million unique players on PC, PlayStation 4, Switch, and Xbox One. In 2018, the video game Football Manager 2019 sold 1 million copies and in the same year, NBA 2K sold 10 million of copies.

There is no evidence to say that people who buy video games are already Football or Basketball supporters, or if they are coaches, players or referees. But, even with this doubt, the numbers show that e-sports have an impact in video games, creating opportunity to promote teams, players and coaches in real life sports, for millions of people around the World. Also, in countries where some sports are not known or not so popular, video games are a reality. For instance, imagine a Handball Video game being sold in the USA - the impact that this would have for the promotion of the game itself!

Handball has some video games like Handball 17© and Handball Manager© but they are very complex concerning gameplay, with low visual attractiveness and digital effects. Moreover, these do not belong to the big Video Game developers, hence they have a lack of promotion.

Following the previous statements, we propose an investment in good Handball Video Games, because we believe this would have a positive impact in promoting the game, as well as in coaches, players or referee's education. Moreover, Virtual Handball can help players and coaches to test several issues concerning their roles in the game.

DECISIONS MAKING VERSUS AGE & SENIORITY OF REFEREEING IN DIFFERENT LEVEL OF FORMAL COMPETENCE IN HANDBALL

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The aim of the study is examine level of rightness referee's decisions in handball and also determinate relations between the quality of decisions making and age as well as work experience.

The main method used to assess the quality and quantity referee's decisions is categorized observation of 72 handball matches based on the research tool such as a decisions registration sheet. The referee's assessment was based on 10193 decisions and the study involved 72 referees.

The results indicated that referee's made more mistakes at lower standard of competition. It was found that there is a relation between age & experience and the number of wrong and correct decisions as well as total lack of response to the violation of the rules of the game.

There is a reasonable need to continue this type of research in order to look for factors determining the proper work of referees.

PECULARITIES OF MOTIVATION IN THE ACTIVITY OF PROFESSIONAL HANDBALL PLAYERS

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Key words: motivation, motivation of sports achievements, sport of higher achievements.

Introduction. The motivation of sport achievements is one of the most important and positively influencing factors in sports activities of professional handball players, the preservation of effective game activity during the whole career of the player depends on motivation. That's why the motivation of sports achievements is one of the most important and acute problems of sport of the highest achievements both in theoretical-methodological and practical plane.

Material and methods. The subjects of the research were 23 adult and professional handball players. The experimental group (EG) consisted of 16 handball players with high qualification. The control group (CG) consisted of 7 handball players who were of reserve handball players. In our research we have used the tests, developed by D.A. Leontyev (Methodology of life-purpose orientations), H. Eysenk (Methodology for temperament determination), T. Ehlers (Methodology for diagnostics of a personality for the motivation to succeed, Methodology for diagnostics of a personality for motivation to avoid failures).

Results. The results have shown that: the priority of life values of the highly qualified hand-ball players (EG) and reserve handball players (CG) differ, the control and the experimental groups of the interviewed were homogeneous, and considerable differences between them on the temperament properties were not observed, the degree of motivation to succeed and motivation to avoid failures for the interviewed in control and experimental groups differs.

Conclusions. Our research was conducted to establish the interrelation between social and personal factors of play activity of handball players and based on it to determine the most efficient means and methods of forming the sports achievements motivation. The results allow selecting individual methods of motivation that are most effective for the each player.

YOUNG HANDBALL PLAYERS – THE PERCEPTION OF THEIR PARENTS IN SPORT CONTEXT

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In recent years, the deviant and negative behaviors of parents during follow-up in their children's sports practice have reached alarming proportions in various sports. This increase may be associated with greater participation of parents, both in the presence in games and in training. With this study, we intend to assess the perception of the athletes about the behaviour of the parents in the sports context, namely in relation to fair play. The sample consisted of young handball players from the Madeira Handball Association, aged 9-16 years of both genders (n = 284, male n = 122, female n = 162) registered by ten clubs and with a minimum of one year of organized sports practice. For the data collection, a questionnaire previously constructed and duly validated was used. The results confirm that the athletes consider positive the presence of their parents, however, the results point to a perception of inadequate behaviors of the parents regarding the referees, mainly by the boys. It was found that the younger the athletes are the greater is the perception of the enthusiastic support of the parents, the greater the volume of instructions to the field, and the perception of a greater emotional discontent of the parents in relation to the problems and incidents of the game and training.

Keywords: Handball, Parents, Perception, Fair Play, Behaviours.

A PATHBREAKING METHOD IN HANDBALL

The Sport Science group's structure

How an organized team work can correlate with the effectiveness of the club or of the national team

Made by: András László Szabó (Performance Manager)

NEKA (National Handball Academy), Balatonboglár, Hungary

Introduction

At NEKA the infrastructure, the staff and the the players, including the leaders are truly one of a kind. Due to everything being at hand NEKA could take a big step forward in the physical and mental aspects of the game.

My job will be to present the structure and the workflow of the team.

Phases, competencies and departments...

Materials and methods

Team structure and projects

The job as a coordinator is making the right decisions for a more effective way of improving performance.

Performance diagnostics-Guiding and aiding 4 seasonal tests, giving feedback to coaches afterwards for every team.

Having weekly tests (twice a week) to determine overall readiness of the players, wellness questionnaire, HRV(Omegawave, Polar). CMJ, Hamstring- for lower body prevention, as how prepared the players are for the trainings. Establishing a huge database for every player.

Performance monitoring-Monitoring the performance of the players daily using Catapult and Polar. Giving feedback to the coaches based on quality objective data for every team. It is an important aspect about the players and how well they can handle the given load, so the the performance increases and the injury risk decreases. So that the mechanical load is bearable for every player.

This way the players can improve a lot, especially in being explosive and in speed endurance.

Strength and conditioning-Organizing the work in weekly microcycles. Where depending on the schedule there's excentric, isometric, concentric work with deloads. These concepts help improving max strength, power and springiness the best.

The results

Better overall readiness, performance output and decreased risk of injury. Stable, winning attitude and improved weight room culture.

Last year out of 4 championships NEKA got 2 gold and 2 silver

National teams:

M U17 Open European Championship 5th place

W U17 European Championship 1st place

The strength and conditioning field has gotten so big, that there are already different branches inside, where specialists can work better in their own territory.

Key words

Teamwork, Competencies, Preventive performance enhancement, long term athletic player development

PHYSIOLOGICAL PERFORMANCE TEST SYSTEM OF NATIONAL HANDBALL ACADEMY

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Approximately there are 140 athletes in our academic system, they are grouped by age and sex. In every season they have to participate in different medical examinations, anthropometric measurements, and a physiological performance tests.

Our physiological performance test system consists 8 different tests; ankle mobility, jump test, eccentric hamstring strength test, core test, push up test, sprint and agility test and an intermittent fitness test. It measure several physical qualities, which influence the athlete's performance like, ankle dorsiflexion mobility, core muscle strength, hamstring strength and imbalances, jump height, maximal running speed, maximal aerobic power, anaerobic speed reserve and change of direction abilities. The main aim of the system is to reduce the risk of injury, besides it increases the performance.

PERFORMANCE MONITORING IN HANDBALL: A NEW DIRECTION FOR THE SPORT

Martin Szücs

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Monitoring in team sports is an important piece of the performance enhancing model. Lot's of quality data is coming out, which can help practitioners improve their teams overall health, improve performance or aid injury prevention. The presentation will provide information on what do we monitor in handball games, what data do we provide to coaches and other staff about the players or the game. Also how can live monitoring help the flow of the trainings and provide quality data to the coaches, which can also help the trainers in making decisions based on objective data. The presentation will be held with case studies.

EFFECTS OF A 6-WEEK TRANSITION TRAINING ON BEACH HANDBALL PLAYERS' PERFORMANCE ON RIGID AND SAND SURFACE

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INTRODUCTION: Beach handball is played during the summer break of indoor team handball schedules as yet. Information about surface-specific transition phase(s) between indoor and outdoor conditions are limited. Thus, the aim of this study was to examine the effect of a 6-week surface-specific transition training (TT) on physical performance on rigid and sand surface.

METHODS: Twenty-nine beach and indoor team handball players (control: 14; TT: 15) were tested pre and post TT on rigid (r) and sand (s) surface in jump (CMJ, DJ, DJ-RSI), sprint (5-10-20 m), COD, and drop distance jump (DDJ) performance. Individual performance thresholds ($> 2 \times CV$) were set to identify meaningful changes. 2x2x2 repeated measures ANOVAs were used to evaluate differences between factors (time, surface, group; $\alpha = 0.05$).

RESULTS: Significant interaction effects were observed with improvements of 6.0%, 4.2%, 16.3%, 4.8% in CMJ (r), COD (s), DJ-RSI (s) and DDJ (ES 0.75-1.30) for the TT group. For CON, significant decreases of 2.2%, 2.1%, 2.2%, 13.7% in 20 m (r), 10 m (s), 20 m (s), DJ-RSI (s) (ES 0.73-0.83) were detected. Individual responses were 3 times higher in TT group (26 vs. 72).

CONCLUSION: A 6-week transition training (TT) enables enhancement of vertical and horizontal jump performance in the TT group without limiting players' indoor performance. Sprint performance was maintained on individuals' threshold approach ($2 \times CV$) compared to CON. Therefore, a TT is practically relevant in team handball players' preparation for the outdoor beach handball season in the summer break.

ON-COURT GAME-BASED TESTING IN ELITE MALE AND FEMALE TEAM HANDBALL PLAYERS

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Introduction: Biological differences between men and women are well known; however, in team handball exists a lack of knowledge for the link between the physical demands in competition and the physical performance during testing in male and female players. Consequently, the aims of our study were to analyse team handball on-court physical performance in male and female team handball players in different performance levels by use of team handball specific testing.

Methods: Thirty-six elite, sub-elite and non-elite male as well as thirty-two elite, top-elite and world-class female indoor court players performed a game based performance test (GBPT). The oxygen uptake, heart rate, blood lactate concentration, ball velocity and jump height in the jump shots as well as running time (in offence, defence, fast break and retreat) were measured.

Results and Discussion: Significant differences in peak oxygen uptake, heart rate, ball velocity, defence, offence and fast break time were found between male elite, sub-elite and non-elite as well as between female world-class, top-elite and elite players. Between elite male and female team handball players significant differences were found in offence and defence time, jump height and ball velocity in the jump shot but not in the peak oxygen uptake and heart rate. In the pauses between the high-intensity movements in the game-based performance test, a female world-class player was able to increase oxygen uptake more compared to an elite player. The results of the present study clearly indicated the importance of specific agility both in offence and defence, in throwing velocity in the jump shot as well as in aerobic performance in elite male and female team handball. The present observations suggest using on-court anaerobic and high-intensity aerobic training in elite male and female team handball additional to commonly used physical training such as strength and power training.

FOULS IN WOMEN'S TEAM HANDBALL - THE EFFECT OF A PERMITTED FOUL ON DEFENSE PERFORMANCE

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The primary aim of the defense in team handball is to prevent the opponent's team from scoring. In order to achieve that, defensive players are allowed to use body contact to stay in an optimal defending position. However, if this contact is made in a way that is not in accordance with the rules the referee calls a foul. A lack of research exists concerning the question whether a permitted foul (without personal sanction) is an adequate way to prevent the offensive team from scoring. In this study, the effectiveness of fouls, used in defense situations to prevent successful shots on the goal in team handball, is investigated. A video analysis of 20 female amateur and 30 female professional handball matches was conducted. The number of fouls and the success of scoring were measured in regular defense situations ($N=3.950$). The effectiveness of fouls in preventing the scoring of goals was compared between both groups. In the professional league, it was found that when the attacking situation was disrupted by a permitted foul the probability of scoring a goal was at 46,64% while the probability of scoring without a permitted foul was at 48,05%. However, the analysis revealed that the results were not significant. In the amateur league, it was found that an interference with the attacking situation through a permitted foul lead to a higher probability of scoring (43,39%) than the probability of scoring without an interruption of the attacking team (36,90%), a difference which was significant ($p=.01$). Therefore, in professional leagues it's questionable if an interruption through a foul by the defense is an effective way to stop the offensive team from scoring. On the contrary, in amateur leagues a foul seems an inadequate way to reduce the effectiveness of the opponent's attack. It seems that the difference between the leagues requires different tactics in defensive strategy.

POSTER

INJURY PREVENTION POLICIES IN DUTCH HANDBALL CLUBS

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Background: Injury incidence in team handball is high but many of these injuries can be prevented by implementing preventive measures. In Dutch handball clubs, many youth teams are trained and coached by volunteers. Higher qualified trainers at senior level come and go. Therefore, club policies are necessary to implement preventive practices on club level.

Purpose: To investigate current preventive policies in Dutch handball clubs.

Methods: An online survey was sent to all (371) Dutch handball clubs in February 2018. Technical committee members/head coaches were asked about club policies regarding injury prevention as well as barriers and facilitators for implementation on club level.

Results: Sixty-seven clubs (18%), covering all competition levels, answered the questionnaire. The mean number of trainers per club was 18 of which on average 30% had a trainer's licence of any level. Of all clubs, 20% had a club policy on injury prevention, in 51% the choice was up to trainers themselves and the other 29% had no clear knowledge of a policy on injury prevention. Only 14% of all clubs had a long-term policy on maintenance of preventive measures. Important barriers for implementation were insufficient knowledge on injury prevention in trainers and/or within the club, as well as lack of implementation competencies within the club. Other barriers were financial, organisational and the high number of volunteers within the club. Important facilitators for implementation were insight in the contents and effectiveness of preventive measures by means of an app and/or yearly in-company workshops. Furthermore, external support from the Dutch Handball Association and support for the implementation process in the club as well as incorporating prevention within athlete development were mentioned.

Conclusion: Injury prevention policies seem to be scarcely implemented in Dutch handball clubs. Externally supported knowledge transfer and implementation management on club level are needed to facilitate the implementation of injury prevention policies in Dutch handball clubs.

THE AMID PROJECT – ATHLETIC MIGRATION AND DUAL CAREER: A CASE FROM HANDBALL

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Introduction: Long-term planning of athletes' career is one of the characteristics of modern sport, including education, migrations etc. The EHF is a partner in Handball 4 Dual Careers, supporting players on their academic and professional paths. Among other dual career projects in elite sport in Europe is also the AMID project. **Methods:** Descriptive and qualitative research methods are combined. The paper presents the structure, methods and aims of the AMID project, as well as a case study (based on a semi-structured interview) of a top elite female handball player. **Results and Discussion:** The AMID project aims to raise awareness and knowledge of the phenomenon of dual career and athletic migration, and to build a network and develop applicable support structures for migrating athletes within the EU including evaluation and implementation of best practices. The overall objective is to support good governance in sport and dual career by tackling the challenges of new economic and social conditions in the EU. Finally, the project will provide practical tools to stakeholders and feed good practices into governance. By expanding the network, exchanging the identified best practices across European policies, and involving national authorities in the process, the AMID project will contribute to the standardisation of European education and sport measures beyond its time frame and also outside of the participating organisations. We checked the aims of AMID through a case study of an outstanding Slovenian female handball player, who has migrated seven times, with different educational experiences parallel to her sports career. **Conclusion:** The AMID project provides one of the models for a dual career of migrating athletes. Migration across borders in the EU is a requirement in many elite sports, also in handball, and a crucial challenge for dual career athletes. The case study of an elite female handball player, who combined her sports career with academic education, can help identify the needs and obstacles in the life of migrating athletes. Due to specific conditions and demands of elite sport, a systematic and well-organized system of support for migrating athletes is needed, especially in the field of education.

IMPLICATIONS OF A LINEAR FORCE-VELOCITY RELATION ON COMPLEX MOVEMENTS. A PRELIMINAR STUDY WITH THROWING

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Handball, like many other sports nowadays, routinely includes intense weight training sessions. If not done carefully, one may ask if we are not exchanging agility and speed by brute force. This balance is important to several abilities including the throwing capacity/speed.

We have organized a simple (field implementable) protocol to evaluate this dichotomy with respect to the throwing capacity and applied it to ten adult male players of a secondary Portuguese national division.

The protocol uses a set of six balls with official sizes (1, 2 and 3) but with weights ranging from 298g to 818g. Each player performed several 7-metre throws to the goal with these balls (in randomized order) and the ball speed was measured with a handheld radar.

The preliminary results show a classical power-force-velocity relation from which an optimal ball weight can be computed with a simple spreadsheet.

Results also show that all players would produce higher throw power if the ball was heavier than the official size 3, meaning that they have a speed deficit. They need to improve speed more than they need to improve shear force. This information is important to the design of adequate training sessions, adjusted to individual needs.

EFFECT OF ANKLE TAPING ON KNEE AND HIP JOINT ANGLES DURING JUMP LANDING TASKS

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Anterior cruciate ligament (ACL) injury causes serious problems for both competitive athletes and recreational athletes. Landing with less knee and hip flexion has been identified as one of the risk situations that contribute to ACL injuries. The purpose of this study was to investigate the effect of ankle taping on knee and hip joint angles during landing from three step run-up followed by jumping. Seventeen female collegiate athletes volunteered to participated in this study. The subjects performed two jump landing tasks, single-leg and double-leg landings from vertically jumping after taking three step run-up, and a stopping task, double-leg stopping from horizontally jumping after taking three step run-up, with maximal effort. The peak angles of knee flexion angle, hip flexion angle, knee valgus angle and tibial rotation angle during those tasks were measured. The sum of knee and hip sagittal plane angles of the ankle-taped leg was significantly greater than the sum of those angles of the untaped leg. The results showed the ankle taping could lead athlete to more proper landing posture to prevent ACL injuries.

CONFLICTOMETRIC ANALYSIS OF INTERPERSONAL RELATIONS IN WOMEN'S HANDBALL TEAM

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Abstract

Cohesion and a favorable socio-psychological climate contribute to the improvement of sports results in a team. In this work, the level of conflict in the interpersonal relationships of athletes was studied for an adequate analysis of the psychosocial climate in the women's handball team.

One of the most important characteristics of relationships in a sports team is the level (or degree) of conflict, both of an individual athlete and in the sports group as a whole.

The indicator of group conflict (J I.K) of the women's handball team (calculated according to the method of B. A. Babayan) was -0.42 (with a range of J I.K from -1.0 to 1.0), which indicates the level of group conflict is above average. The average Conflict Index of each player in the group $Me(J I.K.) = 0.2$, indicates that the values of the individual conflict coefficient of the players as a whole are at the average value.

However, the players of the team coefficient of individual conflict ranges from -0.66 to 0.85, therefore - the conflict of players varies significantly within the same group. In this regard, we divided the players according to the level of individual conflict into 3 subgroups: athletes with conflict slightly higher than the average - 3 athletes (16.66% of all group members); athletes with a conflict level of significantly average level - 10 players (55.55% of the members of the whole group); athletes with low conflict - 5 players (27.77%).

You can also notice that the Index of positive conflict expansiveness for all players in the first subgroup is 0.24, which is higher than the index for the second subgroup, equal to 0. Thus, there is a high level of group cohesion in the first subgroup and a low level in the second subgroup.

DIFFERENCES IN ATTENTION ATTRIBUTES FOR FEMALE HANDBALL PLAYERS

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Abstract

Increased competition among women's handball teams at major international competitions and the domestic Championship of Russia among super league teams dictates the need to further improve the training system for highly qualified handball players. In this regard, the study of the characteristics of the attention properties of handball players of different roles becomes relevant, as it creates the possibility of a directed increase in their individual manifestations.

A preliminary analysis of the effectiveness of the game activity of the team of handball players demonstrates the presence of certain dynamics of indicators of erroneous actions in the conditions of competition - loss of the ball during dribbling, passing and catching, other errors.

The study of the volume of attention of handball players of different position in the test with proof-reading breakdown showed that the best indicators, as expected, were the center back and left wings players. The smallest value of the volume of attention is identified and handball players function the right wings.

Accounting for errors made by handball players allowed us to calculate the accuracy coefficient of attention. In this indicator, the best results are the back court players (0.92) and the left wings (0.88). Linear players (pivots) showed the lowest results (0.79).

The highest speed of information processing, was shown by center back players - 6.58 characters per second. The most important thing is that this speed was shown at the 4th, last minute of the test, which characterizes the high productivity of the attention of this position players.

PLAYING LEVEL AND POSITION DIFFERENCES IN BODY CHARACTERISTICS AND PHYSICAL FITNESS PERFORMANCE AMONG MALE TEAM HANDBALL PLAYERS.

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ABSTRACT

The primary aim of this study was to examine the anthropometric characteristics, as well as the physical performance of professional handball players classified by playing position and competition level. 20 male players (age: 20.4 ± 0.88 years) from the first handball league and 18 male players (age: 21.3 ± 1.61 years) from the second handball league were categorized as backs (8/8), pivots (5/4), and wings (7/6). The following variables were measured in both groups: peak power; vertical squat jump (SJ); countermovement jump (CMJ); sprint times over 15 and 30 m; handball throwing velocity during the jump shot (JS) and 3 step shot (T3 step); upper and lower limb muscle volumes; Yo-Yo Intermittent Recovery Test. Anthropometric data revealed significantly less muscle volume ($p=0.003$, $\eta^2=0.248$) for second league players (3.13 ± 0.29 l) than for first league (3.71 ± 0.82 l). The cross-sectional area for the first league players was also larger ($p=0.010$, $\eta^2=0.192$). Regarding performance parameters, we found significant league differences in 5/15 (33%) performance parameters ($p<0.05$ and $\eta^2>0.20$): running throw ($\eta^2=0.285$), SJ power ($\eta^2=0.670$), SJ velocity ($\eta^2=0.900$), peak upper limb power ($\eta^2=0.231$) and Yo-Yo-IR 1 ($\eta^2=0.348$). The second league players showed higher SJ velocity than the first league players ($\eta^2=0.900$). In contrast, we detected a greater difference in SJ power ($\eta^2=0.670$), but in favor of the first league players. Pivots had the highest throwing velocity and wings were the fastest (15 m, 30 m sprint), strongest (countermovement jump) and most enduring (Yo-Yo-IR 1) athletes. Backs consistently showed the lowest level throwing velocity and sprint performance. The anthropometric differences between playing levels and playing positions may indicate the advantageous characteristics that the respective positions demand, whereas the playing position differences in physical fitness characteristics may indicate training specificity issues that must be addressed strategically.

PHYSIOTHERAPY AND REHABILITATION IN PROFESSIONAL SPORTS

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In professional sports, athletes achieve top results and move their physical and psychological boundaries. Being a professional athlete nowadays requires a lot of discipline, sacrifice, and mental stability. The life and work of a professional athlete are increasingly being disturbed by injuries.

The goal of sports rehabilitation is a fast, targeted and individualized approach when dealing with injuries. Sports rehabilitation unites the athlete and the medical team. The combined efforts of athletes and the entire medical team result in great recovery results in the shortest time possible. The rehabilitation process begins immediately after the injury or surgery, and is divided into several phases. The success and speed of rehabilitation of each injury depend on the personal knowledge and skills of the physical therapist, as well as innovative medical devices.

In sports physiotherapy, it is preferable that the physiotherapist knows and apply specific techniques and concepts of physiotherapy, in addition to expert knowledge in musculoskeletal physiotherapy. In terms of new techniques in physiotherapy rehabilitation, in addition to manual techniques, these techniques are applied as well: Dynamic Neuromuscular Stabilization (DNS), Kaltenborn/Evventh Approach Manual Therapy, McKenzie Concept, Yumeiho Therapy, Myofascial Release (MFR), Emmett Technique, Nerve Neurodynamics (NDS), Proprioceptive Neuromuscular Facilitation (PNF), Instrument Mobilization (IST)) technique, Neurokinetic Therapy (NKT), Dry needling, Medical Flossing, Cupping and others. Nowadays, physiotherapists have at their disposal many new innovative medical devices, besides the classic ones. The new devices include Game Ready or NormaTec recovery systems - cryotherapy, shockwave therapy - shock wave, Interx - interactive stimulation, Tecar therapy, Ergon IASTM Technique, electro-stimulators. Cupping physiotherapy is a branch of medicine that is constantly advancing in professional sport and follows the needs of every top athlete in his work, recovery, and rehabilitation after each injury.

Keywords: physiotherapy, sports rehabilitation, medical therapeutic apparatus, physiotherapy techniques, professional sport

THE MOST COMMON INJURIES IN TEAM SPORTS AND THEIR EARLY REHABILITATION WITH THE USE OF ORTHOPEDIC SPORT SUPPORTS

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Team sports, such as handball, basketball, volleyball, football, all contain numerous changes of direction, jumps, landings in which acute traumatic injuries are frequent. The most common injuries are ankle distortion and dislocation, with the younger age groups and female athletes at risk. With the senior population, acute knee ligament injuries are common; anterior cruciate ligament (lat. ligamentum cruciatum anterius - ACL), posterior cruciate ligament (lat. posterior cruciatum ligament - PCL), medial collateral ligament (lat. medial colletaral ligament - MCL). The cause of acute injuries may be trauma, resulting from the athlete's contact with a teammate during competition and training, contact with the base, contact with the ball, fence or on-field advertising. When sports field injuries occur, proper decision-making in a short period of time and providing physiotherapy intervention is essential. In the first phase, the protocol, containing protection, rest, ice, compression and elevation (PRICE), is respected. After a medical examination and specialist's treatment, a doctor gives the diagnosis and continues to an early sports physical therapy rehabilitation. In the second phase, the rehabilitation is adjusted to the degree of the strain, partial or complete rupture of the ligament system, and addresses the individual needs of the athlete. The new advances in the domain of sports medicine and rehabilitation accelerate the recovery of the athlete and his/her return to the sports field. During the gradual return of an athlete to the field, in addition to the physiotherapy treatments, physical therapies and exercise programs, bandages, active orthoses and braces are also given. The orthopedic supplies used for injuries in team sports are: sports ankle and elbow support, sports wrist strap, dynamic sport ankle support and sport support for the knee. They are used in the rehabilitation phase, recovery, training and sports activities, and can be used in the prevention of the occurrence of injuries. Their benefit is that they increase endurance and enable faster recovery, and do not interfere with the biomechanics of joint movement.

Keywords: team sport, acute sports injuries, physiotherapy, sport rehabilitation, orthopedic sports orthoses

DEVELOPMENT OF STATISTICAL DATA INDEX FOR EVALUATING THE TACTICAL ASPECTS OF ATTACK AND DEFENSE IN HANDBALL

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Dean Oliver shows in basketball four important factors in the match of the statistical indexes to winning. In fact, these four factors of statistical index are also used in NBA and NCAA. We demonstrated the rates of expected goals against the possessions and expected conceded goals against opposing possessions to qualify for the preliminary round in World Handball Championship in previous study. As far as we know, however, there is no such useful statistical index to win in handball as like a basketball. Therefore, the purpose of this study was to develop the useful statistical data indexes to win the Handball match. We analyzed 216 men's matches of Japan Handball League between the regular season 2017-2018 and 2018-2019. We have counted the number of goal, missed shot and saved shot, technical foul, technical miss, free throw and assist play in attacking phase in both teams. The ratios of goal (xG), no goal (xNG), turnover (xTO) and free throw (xRF) against attacking possessions and the shooting efficiency (%G) and assist efficiency (%AST) were calculated. In defending possession, also, those data were calculated (xL, xSG, xETO, xEF, %L, %OAST). Those data were calculated the value of average and standard deviation for all matches. The histograms was created for each data and classified into five levels (Excellent, Good, Average, Poor, Terrible) using 68-95-99.7 rules. Our results indicate that the higher rank teams had a higher percentage of Excellent and Good than the lower rank teams did, and lower rank teams had a higher percentage of Poor and Terrible than the higher rank teams in all statistical indexes. In conclusion, this study provides that the statistical indexes calculated in this study were found to be a useful index related to win.

KINEMATIC ANALYSIS OF THROWING FOR HANDBALL PLAYER THE DIFFERENCE BETWEEN USING STICKING TAPE AND THE STICKING GEL

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Men's Japanese team ended up as the lowest rank among participated 24 countries at the 2019 Handball World Cup in Germany and Denmark. As the reason, it was indicated that Japanese players had less experience playing at international games, and there were physical and technical, differences between the Japanese team and the other national teams. On the other hand, there is the original culture in Japan regarding the training environments. It is that players whose ages are between elementary school(U12) and university(U22) are allowed only to use the sticking tape instead of the sticking gel in their competitions.

Because of that, the purpose of this study was to reveal the effect for using the sticking tape instead of the sticking gel while throwing from the perspective of kinematic analysis and to provide the latest information for coaching young generations. The motions of throwing were analyzed by the three-dimensional motion capture system.

As the result, it was cleared that there were different ranges of motions for the flexion of the wrist and the external rotation of the shoulder among two conditions, and it caused the differences of the throwing mechanism between two conditions.

GAZE BEHAVIOUR AND SHOOTING STRATEGIES IN HANDBALL PENALTY THROWS

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Aim: The choice of an appropriate gaze strategy in sport can lead to more efficient information processing and thus improved motor performance. The aim of this study was to analyze the relationship between sporting expertise and gaze behavior strategies in penalty throws taken by handball players. **Methods:** 19 expert handball players from the top professional league in Poland and 19 novice players from a junior high school took a total of 190 penalty throws. Eye movements were recorded binocularly using a mobile eye tracking system. The number of fixations, fixation duration, number of fixation in maintaining visual stability in relation to fixation location (goalkeeper, goal sectors) were analyzed. **Results:** There were significant differences between experts and novice players in fixation duration in relation to the location of the goalkeeper ($p=0.010$) and location of goal sectors ($p=0.039$), and in the number of fixations in maintaining visual stability during the proper phase of penalty throw ($p=0.004$). Moreover, during the preparatory phase of the throw, expert handball players had a greater number of fixations located in the areas of the goalkeeper's head ($p=0.001$) and right arm ($p=0.033$). A correlation analysis showed a positive link between throw efficiency and total time of fixation in the proper phase of the throw ($R=0.28$, $p=0.005$). **Conclusions:** The strategy of visual behaviors during the performance of penalty throws in handball differed between experts and novice players in terms of visual localization and the duration and number of fixations. The experts' gaze behavior was more associated with the fixation on the goalkeeper, whereas in novices with the fixation on goal sectors. Finally, the observed longer duration of fixation before the initiation of movement in experts indicates that this strategy may have a positive effect on penalty throw accuracy.

INJURY, PREVENTION AND RECOVERY – PSYCHOLOGICAL BACKGROUND AND APPROACH

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The intervention aimed to provide the perspective on the sports injury psychology through an analysis of recent literature and research done in this domain. The main objective is to raise awareness and develop an insight into the significance of psychological interventions on athletes during the training and competition period as pre-injury mental states, and the effects psychological interventions have on the recovery, post-injury, process.

An electronic search of the Web of Science, Scopus, KoBSON, PsycINFO and Cambridge Journals Online databases was used.

Injuries in sport are found to be a considerable issue within the domain of sport participation, especially on the competitive level. The requirements athletes have to face are demanding and create a stressful psychological environment. Stress has been detected as a variable associated with an increased risk of injury, related to both interpersonal and intrapersonal aspects. Stressors could be connected with the personal, leadership, team and environmental issues of an athlete.

Psychological intervention strategies such as Psychological Skills Training and cognitive-behavioural therapy were efficiently demonstrated and shown to be successful in reducing injury rates by improving stress management skills and reducing stress manifested response.

In conclusion, some variations in the current literature have been highlighted and directions for future research have been provided.

Keywords: psychology, sports injury, prevention, recovery, psychological interventions

SHOT FREQUENCY AND SUCCESS RATE OF VARIOUS TYPES OF THROWS FROM BACKCOURT POSITIONS

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In sporting competitions, success depends on many different criteria. One of these criteria is the goal throwing efficiency from the backcourt players, which is influenced by the position of the player as well as the distance between the player and the goal. Previous studies have found that approximately half of the throws at the goal are performed from the left and right backcourt positions and that jump throws occur more often than other types of shots. Therefore we decided to compare the efficiency of goal-attempts following 1 vs. 1 situations and breakthroughs with throws from the back court, including jump shots and set shots. Twelve games of the World Championship 2019 and 15 total teams were analyzed. Variables considered included the frequency of the different types of throws and their scoring rate. The data were statistically analyzed via χ^2 -test. The results reveal that differences in the frequency of the various types of throws as well as in the efficiency of the throws were significant notable between the two groups. Results confirmed that throws following 1 vs. 1 situations or break-throughs are more efficient than throws from the backcourt, either via jump throws or by set throws. Nevertheless in absolute terms, goals are more frequently scored from the backline. These findings should be considered for fitness program planning, as well as for offense and defense tactics.

MOTOR AND MORPHOLOGICAL DIFFERENCES BETWEEN YOUNG FEMALE HANDBALL PLAYERS FROM THREE AGE GROUPS

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ABSTRACT

The study aimed to establish whether any statistically significant differences exist between three age categories of elite young Slovenian female handball players in terms of the results achieved in some motor and morphological parameters. For this purpose, members of the Slovenian national team born in 1998/99 and 2000/2001 were selected so that their average respective age was 15, 17 and 19 years. The set of motor measures included 12 parameters covering various motor areas relevant to handball. The measures defining the subjects' morphological status included 8 parameters or appropriately calculated indices (Šibila and Pori, 2009). The number of subjects differed each year, although all three measurements were carried out with the 29 subjects included in our study. All measurements were conducted by the same people, using the same measurement technology. The results were processed with descriptive statistics methods and the differences between the groups were established using a Kruskal-Wallis test. The results showed that statistically significant differences between young female handball players aged 15, 17 and 19 could not be confirmed in the most of the studied parameters. Obviously, 15 is the age at which those female players who were included by their coaches among the ranks of talented national team players have reached their biological maturity in morphological and motor terms. The majority of morphological characteristics and motor abilities are highly genetically conditioned. Thus, only statistically significant differences were established between players older than 15 years in terms of amount of muscle mass, somatotype, 5 m and 10 m sprint time and 30-15IFT test. Evidently, the training factors do not provide a sufficiently strong stimulus for the development of other motor abilities.

Key words: elite handball, motoric, morphology

ELECTROACUPUNCTURE (EA) TREATMENT FOR TOP ATHLETES IN JAPAN A CASE OF TREATMENT OF STRAINED CALF MUSCLE IN HANDBALL PLAYER

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In Japan, physical therapy, including acupuncture, is occasionally used for the management of subacute to chronic sports injuries. The purpose is to regulate the autonomic nervous system without the use of drugs by improving the blood flow to the affected area, and by suppressing pain and excessive sympathetic nerve activity.

In 2018, the Fukuoka University (FU) Sports Clinic used acupuncture as a treatment method in handball players. In 2018, among all FU handball players (men, n = 42; women, n = 27), 27 men (64.3%) and 21 women (77.7%) were injured. Among the injured players, 15 men and 9 women underwent the acupuncture treatment, which was applied to the periarticular muscles and tendons of the four limbs, and the lumbar region. In all cases, needles appropriate for the muscles, tendons, and nerves that innervate them were either inserted for mechanical stimulation, or the electroacupuncture stimulation treatment (EA) was performed directly. In one case, acupuncture was used for moderate muscle strain in the lower thigh and calf areas. Two weeks of physical therapy with EA and athletic training of the lower limbs resulted in early recovery from pain and improvement in the range of motion and muscle strength.

WHAT MAKES YOU WIN? – THE PERCEPTION OF HANDBALL SPECIFIC MATCH SITUATIONS

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Since attacking phases in team handball are a highly dynamic, the defense of the opposing team is encouraged to use body contact to disrupt the dynamic of the attacking team and to protect their own goal. Such a defense behavior often leads to foul situations sanctioned with a free throw. Objective video analysis has shown that a permitted foul (a foul without personal sanction) does not increase the success-rate of defending their own goal. However, other studies that used statistic sheets, assume that the committing of permitted fouls, which result in a game interruption, is positively related to game success. Facing these mixed and murky results, we took another view on this topic by investigating the players' subjective perception of permitted fouls on the likelihood of winning a handball match. Furthermore, the players' subjective perception of other significant handball specific match situations (e.g. goals, missed shots, or technical mistakes), were investigated to be able to better classify and evaluate the results of the permitted fouls. Questionnaires will be filled in by 100 female handball players. The results might disentangle the contradictory results regarding the effect of permitted fouls on the likelihood of winning a game and might give an insight into the players' perception of the game. Any difference between the subjective perception and the objective evaluations of handball specific match situations might be a good starting point to bring both perspectives together. Taking the subjective perception into account for objective data analysis and using objective data in practice and coaching to develop the subjective perception of handball specific situations could have a positive impact on the overall performance in handball.

MULTIPLE INVESTIGATIONS OF COPING STRATEGIES AND NEUROMUSCULAR SYSTEM FUNCTIONAL STATE IN THE FEMALE HANDBALL JUNIOR NATIONAL TEAM ATHLETES

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Ensuring of high performance in various sports, individualization of the training process is impossible without taking into account the individual and personal characteristics of athletes. The influence of the properties of the basic nervous processes is manifested in all the mental and physiological components of human behaviour, such as the adaptation and stability of emotional states, the pattern of the sensorimotor response to mental load while processing information of various degrees of complexity, electrical activity of the brain and cardiovascular system, muscular coordination and, in general, in the success of sports activities. The study involved 16 female handball athletes aged 17-19. To determine individual differences in the properties of the main nervous processes (strength, mobility, balance) and individual differences in sensorimotor response a system of psychophysiological diagnostics "Diagnost-1" (MV Makarenko, VS Lizogub) was used. The study of attention, fatigue level, the degree of female athletes training was carried out with the use of mobile electroencephalographic device "Smarting". To identify strategies for coping with stress, the questionnaire "Identifying individual coping strategies" (E. Heim) was used. The E. Heim's technique for revealing individual coping strategies allowed determining the preferred adaptive and non-adaptive styles of coping with stressful situations. Stabilometric study was performed using "Wii balance board". The methods of vectorcardiogram and heart rate variability were also applied. Recommendations based on the testing results were used to individualize the female athletes training during the team formation process for participation in the Euro 2019 Championship.

APPLICATION OF ONE-HANDED CATCHES IN ELITE MEN'S TEAM HANDBALL

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Recent evidence suggests that the grip and the size of a ball have an effect on the movement pattern (of throwing motions) and the throwing velocity (Fasold et al., 2019). This study examined the use of one-handed catches in handball games. Twelve different teams were analyzed throughout 24 matches of the 2019 world cup. The quantitative game observation focused on OHCs in five categories: low intense actions, high intense actions, fast break actions, pivot catches and interceptions. In total, 4547 OHCs were counted. The average application of OHCs per game was 94.73 ± 30.99 in total, 58.48 ± 21.76 for low intense actions, 22.40 ± 9.80 for high intense actions, 7.10 ± 5.11 for fast break actions, 3.52 ± 1.83 for pivot catches, and 3.23 ± 2.19 for interceptions. Significant differences were observed in the total number of OHCs ($F(11,36) = 5.84$, $P < 0.001$) and in the categories low intense actions ($F(11,36) = 5.67$, $p < 0.001$) and fast break actions ($F(11,36) = 3.29$, $p = 0.003$) between the countries. Applying a post-hoc test, it was found that Egypt performed significantly more OHCs in total compared to Sweden, Hungary, France, Iceland, Norway and Denmark ($p < 0.05$). Additionally, Egypt was found to perform significantly more OHCs in low intense actions compared to Sweden, Hungary, France, Iceland, Norway and Denmark ($p < 0.05$). Furthermore, France applied significantly less OHCs in total than Germany, Denmark and Egypt ($p < 0.05$). Post-hoc analyses for fast break actions showed that Sweden performed significantly more OHCs than France and Croatia ($p < 0.05$). The results show differences in the application of the OHC between different countries in two categories (i.e. low intense actions, fast break actions), which could be explained by different teaching methods used in the different countries (e.g. Germany, France, Egypt).

References:

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QUANTIFICATION OF MONOTONY, WEEKLY LOAD AND STRAIN AN ENTIRE COMPETITIVE PERIOD IN SEMI-PROFESSIONAL FEMALE HANDBALL

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In nowadays competitive period of entire season in handball takes 7–8 months. The problem is how to manage detraining and retraining of handball players fitness which occurred during the very long period. The aim of this research was to quantify monotony, weekly load and strain during competitive period in semi-professional female handball (field players).

Twelve female handball players (champions of Lithuania and winner of Lithuanian Cup) during the competitive period (duration 36 weeks) of the season 2018/2019 were monitored. Duration of every training session in minutes, rating of perceived exertion (RPE, scale 0–10) were checked (Foster et al., 2001). Training load (TL), monotony (M), weekly load (WL), strain (S), a ratio of acute:chronic (RAC) training was calculated by dividing 1-week load by the 3-week rolling mean (McGuigan, 2017).

Indices varied in such a way (arbitrary units – AU): RPE (6.33–7.55), TL (sRPE) 689.2–723.3, monotony 1.259–1.517, RAC 0.92–1.11, weekly load (3097.2–3586.3), strain (4265.8–5451.9). Nearly perfect correlation was found between duration of training minutes to sRPE ($r=0.916$), to monotony ($r=0.905$), very high – to strain ($r=0.846$), and high to weekly load ($r=0.590$), to ratio of RAC ($r=0.590$), but trivial to RPE of training session ($r=-0.12$). Very high correlation was found between of sRPE to monotony ($r=0.855$), to strain ($r=0.848$), high correlation to RAC ($r=0.685$) and to weekly loads ($r=0.596$), but trivial to monotony ($r=-0.074$).

Such kind of monitoring allow to understand players' responses to their training program, need for recovery or retraining in order to minimize the risk of nonfunctional overreaching during long competitive period and avoid the risk of injuries.

THE EFFECT OF PLYOMETRIC TRAINING ON ANTERIOR CRUCIATE LIGAMENT INJURY PREVENTION AND LEG MUSCLE STRENGTH IN FEMALE JUNIOR HANDBALL PLAYERS.

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Plyometric training programs have been implemented in anterior cruciate ligament (ACL) injury prevention programs. Plyometric exercises are designed to aid in the improvement of muscle strength and neuromuscular control. The objective of this study was to investigate the effect of plyometric training on ACL injury prevention and leg muscle strength in female junior handball players. The subjects were 12 female junior handball players aged 15 to 17 years who were members of teams that participated in the Kyusyu high school handball championships. We conducted 12 weeks of plyometric training (double-leg hop, split squat jump, standing triple jump, single leg hop, box jump, bounding and hurdle jump, etc.) twice a week. The isokinetic peak torque during concentric (CON) and eccentric (ECC) knee joint flexors (H: hamstring) and extensors (Q: quadriceps) before and after the intervention was measured at angular velocities of 60°/sec and 180°/sec (CON) and 60°/sec (ECC). Peak torque hamstring /quadriceps (H/Q) strength ratio was also calculated. T-test was used to compare before and after values and P-value lower than 5% was considered as statistically significant. The peak torque significantly increased ($p < 0.05$) during 60°/sec and 180°/sec (CON) in the hamstrings, respectively while maintaining quadriceps strength (CON), thereby improving the H/Q strength ratio. In addition, knee extension muscle strength (ECC) showed a 10% improvement in muscle strength after the training. These results show that plyometric training has an effect of preventing ACL injury in female junior handball players.