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DOCTORAL THESIS

-SUMMARY-

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USING PROPRIOCEPTIVE STRUCTURES IN OPTIMIZING THE TRAINING OF FEMALE HANDBALL PLAYERS

Keywords: proprioception, women's handball, six-metre line, agility, balance, coordinative abilities, sports training

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CUPRINS

INTRODUCTION

The interest for achieving short term, high efficiency sport performances with minimal biological risks has led to a boom of scientific research in sports and also to an increased receptiveness to the transfer of knowledge and applications from other areas (Gagea, A., 2007, p. 7).

"High performance sport is not an alternative but a reality, a social phenomenon anchored in our present life and surely in a close perspective" (Baştiura, E., 2001, p.1).

Due to its particularities high performance sport is a trial area of new things and of creativity. The novelty factor needs to be raised with every leap in performance.

High performance sport today seems to be subject to a neverending progress. Day by day, sports media presents achievements and records that were hardly anticipated a while ago. It is on a steady climb, keeping pace with science's triumphs, sometimes even anticipating their scientific justification. However, one has to acknowledge that for the majority of these great accomplishments in sports science has had a substantial contribution.

Modern handball is a dynamic sport characterised by highly developed motor skills: speed, agility, reaction speed, explosiveness, power mode stamina and coordination (Hatzimanouil, D.,et.al., 2004, 46, pp. 125-140).

At present high performance handball has reached a new level of performance which calls for a scientific approach in all its aspects. The constant development of the game leads theorists and practitioners to continuously investigate and update the issue of the game's contents and directions of the training process (Foretić, N.,et.al., 2011, pp. 243-247; Táborský, F., 2011, pp. 7-13).

The dynamic nature of handball captures viewers by combining technical brilliance and grace with bravery and stamina.

Training is based on modern methods which seek optimization in three directions: running, jumping and shooting, and demands a complete and well rounded physical development.

Today, more than ever, the game requires players to be highly sophisticated in every aspect, especially young players oriented and trained for high performance.

Cojocaru, A., et.al., (2013, p. 4) claim that "presently great accomplishments are no longer objectively possible without carrying a vast, multi- and intterdisciplinary, informational baggage and possessing a high efficiency training technology, of which the most effective solutions can be selected in view of achieving the set goals, against the context of the clear-cut conditions of the activity performed".

When the ability to practice a sport becomes art, the protagonists become genii; when team spirit is subdued by every individual highlight and the will to succeed overcomes all physical and mental pain, it is then when one becomes one of the best of the best in sport (Vlak, T.,et.al., 2004, pp.526-530).

We think it is safe to conclude that one of the current tendencies necessary to obtain high performances in modern handball is the perfection of specialized training.

Importance and purpose of paper

From a theoretical point of view this paper focuses on the proprioceptive methods used for optimizing the training of U16 female six-metre line players. The research conducted uses a large quantity of data concerning the use of certain training programmes to harness the motor skills of wing players and pivots.

The main aim of this research is an experimantal compilation and implementation of a training programme that contains proprioceptive methods in view of optimizing the training of U16 female six-metre line players and maximizing the use of performance skills.

The target of the training programme proposed is to better coordinative, psycho-motor, sensory and perceptive skills of handball players using proprioceptive methods according to possibilities and adapted to individual characteristics.

Reason for choice of topic

Our own view of high performance sport and especially of handball has been shaped by the years spent as a professional athlete then as a teacher and coach, the establishment of our own children and youth sports association, cooperation with coaches, physical coaches, methodologists from high performance handball, as well as the informational explosion of the media and internet.

The tean years spent as a player and teacher have led to our own way of approach in preparing competitions. The work done during these years required intensive preparation and work, theoretical documentation, thorough planning and analysis, the finding and examination of errors. A differential approach in training the same group of players, moreover, tackling the same idea with different characteristics for different individual characteristics and experience of players, helped me to understand that without an exact knowledge of the particularities of

each player training methods are less efficient. Individualization is a modern principle in training.

An insufficient training of coordiantive abilities leads to the lessening of performance skills, especially in high performance handball.

Our interest in all aspects of the game, mainly Nordic handball, where players starting at early age, have superior basic and motor abilities converted into game time coordination most notably, speed and all of its aspects, force, stamina, agility, balance, sustained playing and passing rhythm, rapid succession of offence and defence, technical finesse and precision, and most importantly the joy of the game, determined us to find new methods in searching to optimize the training of female handball players.

The main reason for choosing this topic is the current trend of introducing specific, proprioceptive means into training programmes, with the aim of improving the specific indices of neuromuscular coordination as well as static and dynamic balance, from an early age.

After studying writings on this topic we noticed a limited approach towards proprioceptive methods in optimizing player performance both in national and international handball. This is not the case for using proprioception as a means of prevention or post-traumatic recovery. In this respect one can find various approaches and numerous research studies.

Another reason for choosing this topic is a lack of utilisation of the potential of six-metre line players by handball teams in our country compared to European handball where the best results in greater competitions are attributed to the utilisation of high potential line players.

It is worth mentioning that this research concerning the optimizing the training of six-metre line players in U16 women's handball by means of proprioceptive methods is the first of its kind in our country, with objectified, rationalized and standardized methods of training young handball players and not as methods of preventing or recovery from injuries.

PART I
THEORETICAL AND SCIENTIFIC SUBSTANTIATION

1 CHAPTER 1. ASPECTS OF PROPRIOCEPTION IN HIGH PERFORMANCE SPORTS

1.1 *The definition of proprioception and proprioceptive sense*

Acsinte, A., (2011, pp. 116-120) defines proprioception as "the body's ability to receive information from the brain as a response to stimulus appeared in the body"; he also refers to "the body's ability to notice the position of its members at any given moment".

Proprioception is an innate "talent" of the body of becoming aware and of its position in space. Thissense is closely related to muscle tone sense and the perception of effort and balance (Ljubojević, A., et.al., 2012, pp. 257 - 266).

Proprioception has been defined as the ability to integrate sensorysignals from different mechanoreceptors to determine the position of the body and movement in (Han, J., et.al., 2015, pp. 1-11; Goble, D.J., 2010, pp. 1176–1184), and plays a vital role in balance control (Röijezon, U., et.al., 2015, pp. 368–377; Pasma, J.H., et.al., 2012, pp. 1138–1148; Clark, N.C., et.al., 2015, pp. 378–387). Theoretically, proprioceptive information from each part of the body contributes to balance control. As it has been demonstrated, this includes visual proprioception, although in sports the visual channe is often busy processing information about opponents or ball movement, thus other proprioceptive sources become necessary (Han, J., et.al., 2015, pp. 1-8).

1.2 *Responsiveness*

Sherrington's contributions are fundamental as a result of his classification of responsiveness (Iturri, J.J.G., 2003, pp. 274-284).

Exteroceptive senses

Interoceptive senses

Proprioceptive senses

In sports, for a proper functioning of the joints, conscious proprioception is essential. Propriocetive/kinesthetic sense is supplied especially through the neuromuscular junction, with the contribution of skin and joint receptors. The feeling of force is ensured by the Golgi apparatus while the sense of balance by the vestibular system.

1.3 *The physiological mechanism of proprioception*

Proprioception is transmitted to all levels of the central nervous system when it offers a unique sensory component of optimizing the motor control. In addition, proprioceptive information are necessary for neuromuscular control as regards dynamic restrictions. Joint receptors, which are often affected to a certain extent during a joint damage, seem to be an important element of proprioception. While their role in the triggering of muscular reflexes is still controversial, their influence on γ motor neurons and supraspinal motor pathways seems to be more well-grounded (Riemann, B.L., et.al. 2002, pp. 80-84).

1.4 *Motor learning*

Motor learning is an innate motor response which accompanies man from his initial stage of development and is activated by environmental stimuli.

Pedagogy scholars seem to think that learning is process of acquiring knowledge and of developing abilities and skills for future activity.

Mihăilescu, L., et.al., (2002, p.14) thinks that "motor learning is a type of learning that differs from others where every intentional motor gesture from the person's motor stock is a subject of the learning process".

Thus we can conclude that motor learning resides in the continuous search for optimal motor solutions by way of changing and perfecting techniques through training.

1.5 *The role and importance of proprioceptive training in high performance sports*

After carefully examining literature in this domain I concluded that there is hardly enough focus on proprioceptive training, both nationally and internationally, as regards optimizing handball performances. The same is not true to approaching proprioception as a

means of prevention or post-traumatic recovery. In this respect one can find various approaches and numerous research studies.

In sport training neuromuscular training programmes that include balance exercises are oftn applied in order to optimize performance, prevent or recover from injuries. It seems that these exercises have a certain amount of influence over neuromuscular control and functional performance (Zoltan, P., 2004, pp. 139-172).

One of the current trends is to introduce specific elements of proprioceptive development into training programmes, that are meant to improve the specific static and dynamic balance indicators as well as neuromuscular coordination from an early age (Acsinte, A., et.al., 2012, pp. 28-32).

Some studies show that the most successful athletes are those who manage to control their body and its parts with the best coordination possible (Acsinte, A., et.al., 2012, pp. 28-32).

If similar, complete neuromuscular training programmes were implemented on a wide scale, handball players could reach higher levels of performance by combining improved power, force, speed, pelvic area stability, fnctional biomechanics and a reduced injury proneness. Moreover, if used for muscle development and movement control at the correct time, event greater effect coulb be obtained both in performance and reducing injury proneness (Myer, G.D., et.al.,2005, pp.51-60).

Performance decline owing to lack of neuromuscular stability brings about modification between length and tension, force and couple, and in joint kinematics. It is imperative to encourage activities of stabilising joint reflex introducing these into training programmes, by means of unstable surfaces, utilising functional movement structures.

All these exercises (proprioceptive stimulation in special conditions, on mobile surfaces, balance fits, Wobble boards, Balance Boards etc.) done in a certain way (eyes closed) can contribute to the qualitative improvement of athletic performance, especially in high-stress sporting situations, as well as in situations of technical performance demands in unnatural body positions (off-ground imbalance, passing, shooting etc.) (Acsinte, A., 2004, pp. 58-62; Acsinte, A., et.al., 2007, p. 10) .

2 CHAPTER 2. COORDINATIVE ABILITY – A COMPONENT OF MOTOR ABILITY

2.1 *The concept of coordinative ability in the game of handball*

In literature coordinative ability can be associated with the term dexterity, adroitness, skill, and is conditioned by gesture guiding and adjusting processes.

In defining coordinative ability a great many opinions have been put forward. What transcends is that, regardless of their wording, specialists emphasize the psycho-motor component being conditioned by the quality of the central nervous system.

Coordinative abilities contribute to the forming of a general movement from partial movements in a consistent and coordinated way. When these movements are coordinated, we can reach a high level overall coordination (Esfahankalati, A., et.al., 2013, pp. 42-46).

Blumenstein, B., et.al., (2007, pp. 62-67) thinks that "these are important during the handball game and their development is necessary from an early age. Especially coaches who work with young players will have to include coordination development in their daily training programme".

A high level of "coordinative abilities specific to handball" allow the player to execute complex actions at higher and higher speed and can apply them, for example, in cases where their movements are restricted by opposing playersț actions (Starosta,W., 2006, pp. 9-23).

It is believed that a high level mastery of basic situational, cognitive and functional motor skills is of utmost importance for the efficient learning, perfecting and successful implementation of new motor structures (Hirtz, P., et.al., 2002, pp. 19-28).

2.2 ***Components of coordinative abilities***
2.3 ***Conditioning factors of coordinative abilities***
2.4 ***Coordinative abilities in the game of handball***

2.4.1 The ability to coordinate. The role and importance of coordination in the game of handball

A precise execution of a motor skill training programme requires good coordination which in turn depends on the precision of information received from the analysers (whose role and integrity are decisive).

Starosta, W., (2006, pp. 9-23) states: "coordination, or the ability of executing movements correctly and in a correct sequence in influenced by various neuromuscular processes which control and regulate movement, allowing the player to execute both planned and unplanned actions".

A maximum development intensity of motor skills, especially those of coordination, can be reached at the ages of 7-11 and 14-18. The execution of certain exercises contributes to developing the efficiency of the central nervous system and, indirectly, increases the level of coordination which in turn allows a better movement execution (Cojocari, D., 2014, pp. 14-29; Starosta,W., 2006, pp. 9-23).

Due to the charasteristics of movements in handball, the importance of basic and specific coordination has been stressed for the successful execution of almost all technical and tactical tasks during the game (Srhoj, V., et.al., 2006, pp. 601-605; Bojic, I., 2008). These results prove that a successful execution of all tasks in modern high performance handball, from all, situational and motor, factors involved, technical and tactical skills all rely on good coordination (Bojić, I., et.al.,2014, pp.405-410; Starosta, W.,2006, pp.9-23).

Young handball players who possess solid coordination will be more successful in executing situational and motoric tasks.

2.4.2 Balance ability

Balance or posture control represents the ability to maintain a foothold with minimal movement, as well as the ability of executing a task while preserving a stable position. It is

maintained. This is maintained by way of a dynamic integration of forces and both internal and external factors involving the environment (Lee, A., et.al., 2006, pp. 117–125; Bressel, E., et.al., 2007, pp. 42–46). Adjusting balance depends on visual, vestibular and proprioceptive stimuli (Subasi, S.S., et.al., 2008 , pp. 186–205; Gribble, P.A., et.al., 2007, pp. 35–41).

The vestibular analyser ensures maintaining and controlling the static and dynamic balance of the body. It provides information on the body's movements and position in space and develops reflexes which help in keeping balance and body position (Duca, M., et.al.,2014, p. 37).

Authors Freiwald, J., et.al., (2006, pp. 140-150) and Gstöttner, M., et.al., (2009, pp. 218-231) underline the importance of developing balance based on scientific programmes for coordination training to prevent injuries and improve performance.

It is recommended for young athletes that training balance start with exercises for static balance and then move on to more complex one for dynamic balance.

Balance training is recommended to begin on a stable surface with a wide base for foothold and visual feedback. For increased efficiency the difficulty level of execution can be raised: narrow base for foothold with eyes open; wide base for foothold with eyes closed; narrow base for foothold with eyes closed. The complexity of movements involved as well as the execution of exercises on different types of surfaces (sand, lawn, grass, various devices etc.) lead to the facilitation of the balance training process.

The role of unstable surfaces is to intensify muscular activity at the expense of mechanical load. By introducing unstable surfaces the proprioceptive feedback is unreliable due to the fact that the control mechanism responsible for maintaining balance is being permanently stimulated, its task thus becoming more difficult.

2.4.3 Agility

Agility is the ability to change directions or body orientation based on quick and precise processing of internal and external information without significant loss of speed or execution.

When speaking of agility Gajanana, P.B., (2013, pp. 621-624) says that "it is the ability to quickly change body position and this, apart from speed, requires a combination of different attributes like good balance, coordination, reactions, muscle power, force and stamina".

It must be included in the anual training plan as a primary component offering athletes the possibility of making use of force improving and physical training programmes during competitions.

Specialists consider that a comprehensive agility development programme will tackle the following elements: power, force, acceleration, deceleration, coordination, balance and dynamic flexibility. When female athletes use agility exercises, they develop neuromuscular awareness and, as a result, are more capable to understand the movements of their own body.

Agility helps players perform in activities that need quick change of direction while maintaining balance, force, speed and boy control. Yet it is also defined by flexibility and fluency of movement (Gajanana, P.B., 2013, pp. 621-624).

Although it plays an essential part in the majority of sports, there is hardly enough focus on developing this ability during various stages of training.

2.4.4 The ability to combine and link movements
2.4.5 The ability of orientation in space and time
2.4.6 The ability of kinesthetic differentiation
2.4.7 The ability of motor reaction
2.4.8 The ability of movement transformation
2.4.9 Rhythmic ability

3 CHAPTER 3. PARTICULARITIES OF PUBERTY (AGE 15-16)

3.1 *The concept of growth and development*

The notion of age has multiple meanings: chronological age; biological age; age; Social age; functional age.

The growth and development of the human body is influenced by a series of exogenous and endogenous factors, by the intensity and durationof these factors. The exogenous factors are diet; geographical environment; socioeconomic factors; physical exercise; emotional educational factors; in toxic environments children show limited development.

Endofgenous factors that play a role in body growth and development are:

- Hereditary factors;
- Hormonal factors.

3.2 *Stages of human development*

Human development takes place throughout life, with various growth rate from birth to maturity, conditioned by the hereditary model, environmental, social and cultural factors.

Throughout life and his existence a person is subject to quantitative and qualitative transformations that encompasses three types of development:

- biological: physical (anatomical and physiological) changes of the body;
- mental: generating, maintaining and modifying functions, processes and mental traits of the individual;
- social: dynamic structuring and change of behaviour according to norms, values and requirements of educational, cultural and social environment.

In conclusion, human development is a biological, mental and social evolution from physical, somatic, organic, functional, sensory, perceptive, attitudinal, behavioral, motivational, emotional and intellectual points of view. As a complex and contradictory phenomenon, development has a major role in man’s personality achieving maturity and fulfilment as a self-determined biological, mental, social and cultural system.

3.3 *General characteristics of puberty (age 15-16)*

Post-puberty, also known as adolescence, in girls begins at the age of 14 and ends at 18.

During this period the indices of bodily development gradually slow down to a halt. The increase in height gives way to the development of certain parts of the body.

Musculature is well developed and is accompanied by good neuromuscular coordination. Learning and assimilation capacities are well-developed, offering ground for increased performance ability.

Professor Demeter, A., (1974, pp.92-93) claims that "during puberty we witness a difference in growth rate between girls (who develop more quickly) and boys. At the end of pubertal transformations the two sexes become completely different, each with his own morphological particularities preserved for the rest of life".

3.4 *Particularitties of somatic development in puberty*

During this period there is a slowdown of somatic development while from a biological standpoint body dimensions of adulthood are reached.

Gradually the adolescent comes close to being an adult as regards maturing and general hormonal balance, posture and general, gender-specific guise stabilise. Girls acquire feminine body shape: a more prominent bust, specific conformation of the pelvic region, clear facial features with fine contour.

Skeletal system

Muscular system

3.5 *Morpho-functional particularities of puberty*

Nervous system

Analysers

Cardiovascular system

Respiratory tract

Endocrine system

Gonads

3.6 *Psychological particularies of puberty*

Thinking

Memory and attention

Language

Imagination and representations

Motivation

Emotionality

Personality

3.7 *Particularities of motor development in puberty*

The concept of motricity is defined as an innate as well as acquired ability of the human being to react with a movement to internal and external stimuli by means of the musculoskeletal system.

Puberty, from a motoric point of view, favours a logical development of motor skills, with the purpose of fulfilling motoric tasks with high value motor skills.

The young player's body needs to meet the demands of training, to show optimal growth and maturity values in order to achieve higher and higher levels of performance. Thus its metabolism must work at an adequate level, as well as its respiratory and circulatory functions. All physiological changes brought about by growing up must be taken into consideration (Manole, V., 2008, p. 22).

This stage is charaterised by the stability of psychophysiological and neural processes which influences young people's performance (Bon, M., 2000, pp. 35-40; Katzamanidis, Ch., et.al., 2000, pp. 49-55; Taborski, F., et.al., 2000, pp. 18-24).

Alexandru, E., (2004, p. 54) claims that "the optimization of sport training of young athletes requires knowledge of their growth particularities through different stages. Only based on this can one devise a training process suitable for their age and level of development, their needs and wishes".

4 CHAPTER 4. PARTICULARITIES OF U16 FEMALE HANDBALL PLAYERS TRAINING PROCESS

4.1 *Current international trends in the development of the game of handball*

During several decades a lot of studies were made that focus on ways of achieving performances in handball. Based on these studies a series of recommendations was made aiming at improving the technical and tactical behaviour of athletes and the training process.

In the game of handball the anthropometric characteristics of athletes can determine performances to a certain extent by differentiating players who play on different competition levels (Milanese, C., et.al., 2011, pp. 1301-1309; Chaouachi, A., et.al., pp. 151-157).

Vila, H., et.al., (2012, pp.2146-2155) and Chaouachi, A., et.al., (2009, pp.151-157), claim that each specific position requires unique physiological and physical features determined by the technical and tactical requirements of these positions, the goal being maximizing performances on the court.

The research conducted by Gorostiaga, E.M., et.al., (2005, pp. 225-232) and Ziv, G., Lidor, R. (2009, pp. 375-386) shows that high level performances areconditioned by some physical characteristics. Studies find that lately top players have shown an increase in physical features, both in body mass and height.

4.2 *Current national trends in the development of the game of handball*

At present hig performance Romanian handball is no longer on the same level as in its golden years in the years 1961-1976, when they won titles of world champions and olympic champions, completed by winning European cups, making the Romanian handball school an example to follow by most teams and clubs throughout the world. Their own understanding of the game, internationally considered as one of the best, emphasises the importance of Romanian handball.

4.3 *General characteristics of today's game of handball*

The game of handball calls on all motor skills, bot general and specific: speed (of reaction, execution, movement, combined); stamina (general, specific, combined); force (general, specific, combined), vertical jump; coordinating ability which, in combination with the kinesthetic analyser, has an important role in developing ball-sense; in combination with the olfactory analyser in developing the sense for distance; with the auditory analyser in shaping balance and orientation in space; general mobility and articular flexibility.

Playersare expected to have remarkable both physical qualities (speed, reaction, force, endurance, vertical jump) and mental qualities (good focus, resistence to stress, good visual-motor coordination, perseverence, boldness, anticipation, composure, quick decision-making and high efficiency in unforeseen situations, mental-emotional and social team skills) (Doboşi, Ş., 2009, p. 35).

Lately the importance of women's handball has made quite a leap, as underlined in a series of studies (Barut, C., et.al., 2008, pp. 55–59; Gholami, M., et.al., 2010, p. 119; Granados, C., et.al., 2007, pp. 860–867; Granados, C., et.al., 2008, pp. 351–361; Hasan, A.A., et.al., 2007, pp. 197-202).

4.4 *Stadial nature of handball training (stage III)*

"Sport training as a long term process demands a phased preparation of athletes, with several stages determined by characteristics of age and general inclinations of adjustment of the body"(Teodorescu, S., 2009, p.77).

Teodorescu, S., (2009, p.25), when talking about handball training's stadial nature, enumerates four stages:

- stage I – selection, initiation
- stage II – early specialization
- stage III – thorough specialization
- stage IV – high performance

The chronological sequence of these stages requires one to acknowledge their limitations, especially that of the content of training, but also of the effort demanded.

4.4.1 Stage III - specialized training

The transition from the early stage to the training for high performance, but also the achievement of world class recognition is conditioned by this stage.

"This stage of training sees a constant and balanced progress of performance and without forcing any single aspect of training. Also, there is an obvious progress and a complex dynamic of motor maturation, although this is not a factor of stability and complex study" (Simion, G.,et.al., 2011, p.50).

As sports games require specific, complex skills, there are certain age limitations for each training stage. Specialists consider that the age of 16 is crucial in the selection of female handball players.

In the game of handball the third stage corresponds to the U16 category (age 15-16 athletes). In the first part of this stage there is a marked preference for general training, while in its last part specialized training is more pronounced. As a result of an increase in the

number of competitions and performance objectives in the stages final two years, the balance between general and specialized training will be of 55-60 % and 40-45 % respectively.

4.5 *Particularities of training U16 female players*

4.6 *Anthropometric characteristics of female handball players*

Anthropometric data offer quantitative information for each body part (Riegerová, J., et.al., 2006, p. 262) morphological phenotype of players and are useful in anticipating physical abilities of athletes.

The evolution of handball demands that players have an adequately built body. The quality of movements of players is greatly affected by somatotype and body proportions.

When defining the modern handball player one has to identify specific anthropometric characteristics which in the conditons of real competition play a role in improving sport performance. When selecting athletes for different positions one needs to take into account a series of criteria which enhance their performance: height, body mass, hand length and span. These last ones influence motor skills like dribbling, passing, catching and throwing the ball while maximizing its speed.

Anthropometric characteristics offer useful information on body height, mass, limb and bone circumference. They are affected by hereditary factors in various ways (Noutsos, K., et.al., 2004, pp. 177-192). Thus body height may be an uncertain predictor when estimating future performance potential as during puberty variables are high (Perš, J., et.al., 2002, pp. 295-311). This is why it is not recommended to underestimate the anthropometric profile of youth players.

4.7 *Wing player type*

In the game of handball anthropometric characteristics of players vary significantly due to their various tasks and the requirements of the game.

Wing players are smaller and lighter because the index of fat content of their body is lower as their game tasks require them to act in limited space. Movement dynamism and agility with or without the ball are basic characteristics which means that their centre of mass is lower and their body length is reduced. As they play in the vicinity of the six-metre line, the length of their upper limbs is not particularly important, unlike hand span, which is a fundamental criterium in the selection of talents as it plays an important role in ball control and shooting force.

Fro a wing player speed is paramount. This position requires continuous repeated quick movements, both on offence and on defence. These players represent the vanguard most of the time, often performing counterattacks or preventing the other team from doing the same, which calls for covering the largest stretch of the court.

4.7.1 Somatic, motor, technical and tactical, mental and functional model of wing players

4.7.1.1 *The somatic model of wing player*
4.7.1.2 *The motor model of wing player*
4.7.1.3 *The psychological model – sensory skills of a wing player*
4.7.1.4 *Neural and psychomotor skills of a wing player*
4.7.1.5 *Intellectual skills of a wing player*
4.7.1.6 *The technical-tactical model of wing player*

4.8 *Line player type*

Pivots present high values of height, weight, arm spread and upper body length which allow her good ball control and force when collecting the ball during body contact with the opposition. Higher body volume and force are necessary in permanently maintaining contact with the defenders and securing a favourable position.

These are robust players with the highest body volume index (Srhoj, V., et.al., 2002, pp. 219-227; Táborský, F., 2007, pp. 1-6). Muscle mass in combination with low centre of mass, strong upper body and relatively heavy mass help the line player in keeping a balanced position and resisting pressure from the defenders in the form of pushes and bumps, and in successfully fulfilling her role (Christodoulidis, T., et.al., 2009, pp. 53-60).

4.8.1 Somatic, motor, technical and tactical, mental and functional model of line players

4.8.1.1 *The somatic model of line player*
4.8.1.2 *The motor model of line player*
4.8.1.3 *The psychological model – sensory skills of a line player*
4.8.1.4 *Neural and psychomotor skills of a line player*
4.8.1.5 *Intellectual skills of a line player*
4.8.1.6 *The technical-tactical model of line player*

4.1 *Individualization during training of U16 female handball players*

The constant technical and tactical advances of the game, and the ever-increasing demands of effort ask for thorough preparation and training in all their aspects.

As regards age, sex, level of training, purpose etc, specialists estimate that individualizaton may begin with stage III training (U16) by means of specific methods and means.

A paramount component of training youth players is the importance attributed to individualization (Hantău, C., 2004, p. 76). The more time is allocated to indiviualized training the less hiatus will appear in the player's physical, technical and tactical training (Gomboș, L., 2012, p. 77).

Individualized training needs to be made according to individual sheets, a personalized training plan and programmes etc around clearly set objectives.

In today's handball, on high performance level, individualization has become an existing training principle and is based on individual, physical characteristics of the players and their positions within the team.

PART II

PRELIMINARY RESEARCH INTO TRAINING U16 FEMALE HANDBALL PLAYERS BY MEANS OF PROPRIOCEPTIVE METHODS

5 CHAPTER 5. PRELIMINARY RESEARCH INTO TRAINING U16 FEMALE HANDBALL PLAYERS BY MEANS OF PROPRIOCEPTIVE METHODS

5.1 *Preliminary research background*

The starting point of this paper was the idea that using proprioceptive methods can have a positive influence on indices of coordinative ability. Accordingly, the premises we have set could be summed up in the following way:

- The morpho-functional and motor particularities specific to the experimental group match the requirements of this scientific study;
- The experimental group on which the preliminary study was made is homogenous as regards specific motor experience;
- The experimental group was open to cooperate and was involved in the practical activity during this entire research;
- Due to this activity the rate of progress registered with this group can be maintained.

5.2 *Goal of preliminary research*

The desired effect in executing this preliminary research is validating tests and methods used in the research proper. It also wishes to set a number of stuctures of methods that will be applied to the experimental group, a battery of tests that will be used in the research proper and the design of a coherent training programme.

5.3 *Aim and mission of preliminary research*

During the preliminary research the following stages were followed:

- Creating an organizational plan of the research and the lot of subjects of the preliminary research;
- Selecting specific bibliographical sources on the topic chosen in view of adapting current data to the research's goal and prmises;
- Setting the goal and hypotheses of the research;
- Creating a training plan tobe applied during the preliminary research that includes proprioceptive methods;
- Selecting the battery of tests to start the preliminary research as well as the player subjects;
- Centralizing and interpreting the data collected and making a comparativ analysis;
- Formulating conclusions that emerge from the preliminary research.

5.4 *Preliminary research hypothesis*

To set the preliminary research hypothesis we started from the premise that the selection and application of proprioceptive methods in the training programme proposed by us, revealed by the tests wu used, will help improve coordinative abilities.

Specific preliminary research hypothesis:

- *The use of proprioceptive methods, based on movements on unstable surfaces, the use of elastic bands and gym balls, determines an increase of specific indicators of speed, agility, coordination, orientation in space and time and static and dynamic balance.*

5.5 *Preliminary research process*

The preliminary research was conducted during a six months period when training methods to be used during the research proper were applied. During these six months we tried to observe whether the selected methods influence the specific training parametres of the experimental group..

The preliminary research started on January 10. The selected methods were applied until June 15, 2013. The preliminary research began with an initial test. The final test was conducted on June 12-13, under the same conditions and executing the same tests as in the initial test.

The subjects who took part in the preliminary research were a number of 13 female athletes of 15-16 years of age, U16 handball player of Arena Sport Club Tîrgu Mureş. The number of training sessions scheduled per week was 6 of an hour and half each, from Monday to Friday at 17.30-19.00, 10.00-11.30 on Saturdays. Besides the training programme including traditional methods specific to the handball training, they were subjected three times a week, for a twenty-minute period each time at the beginnig of the training session, to a training programme designed by us, containing proprioceptive methods.

5.6 *Research stages*

September – October 2012: bibliographic study.

November – December 2012: selection of training methods, evaluation items, planification of preliminary research training sessions.

January – June 2013: initial testing, application of selected methods on experimental group, final testing.

July 2013: Interpretation of data collected from the two tests and drawing conclusions from preliminary research.

5.7 *Research methods application*

5.7.1 Observation

5.7.2 Pedagogical experiment

5.7.3 Test method

5.7.4 Statistical and mathematical method

5.7.5 Graphical representations

5.8 *Battery of tests*

Both in Part II and in Part III the battery of tests was selected from the work of Reiman, M., P.,et.al., (2009, pp. 115-116; 160; 192;196; 199, 201).

By applying these tests we sought to evaluate the level of certain indices: speed, lower limb force, agility, body position and balance control, coordination, multi-diretional body control.

5.8.1 Stability test with multiple single leg jumps

5.8.2 Figure 8 drill test

5.8.3 'T' drill test

5.8.4 Zigzag drill test

5.8.5 3-cone drill test

5.8.6 Illinois agility test

5.9 *Research equipment and materials*

Unstable surfaces (balance fits); gym balls; elastic bands; climbing frame; cones; stopwatch; whistle;

5.10 *Anual general training plan*

5.11 *Training programme including proprioceptive methods implemented during the preliminary research*

Methods were applied from 7.01.2013 to 23.06.2013, three times a week for 20 minutes at the beginning of each training session.

6 CHAPTER 6. PRELIMINARY RESEARCH RESULTS

6.1 *Graphical representation, data analysis and interpretation*

7 CHAPTER 7. PRELIMINARY RESEARCH CONCLUSIONS

Due to the variety of methods and materials specific to proprioceptive training, the training of six-metre line players from U16 women's handball can be optimized through education of motor and coordinative abilities.

Adapted proprioceptive programmes can determine a much more active participation of handball players, as the various training methods and their atractiveness stimulate their attention, awareness and implication in the training process.

After conducting the practical activities the first conclusion that emerged was that the preliminary hypothesis was confirmed, meaning that selecting and applying proprioceptive methods within the proposed programme will help improve the level of coordinative abilities as revealed by the tests.

Based on the data analysis after the prliminary tests, the specific hypothesis was also confirmed, therefore *using proprioceptive methods, by means of movements on unstable surfaces, the use of elastic bands and gym balls, will determine an increase of specific indices of speed, agility, coordination, orientation in space and time and static and dynamic balance.*

The results from this preliminary research support us in answering the preliminary hypothesis submitted within this paper and establish the ground for setting the premises of the experimental research from Part III of the paper.

8 PART III
CHAPTER 8. PERSONAL RESEARCH ON USING PROPRIOCEPTIVE STRUCTURES IN OPTIMIZING THE TRAINING OF FEMALE HANDBALL PLAYERS

8.1 *Aim of research*

In spite of the great number of works published concerning education and development of coordinative abilities necessary to practice the game of handball, they fail to outline a concrete work method. The wide array of methods used to form and develop coordinative skills has not been organised to meet the specifics of puberty nor the specific requierements of player positions.

As a result, in this work, we will try to elaborate a system of methods and a methodology of teaching and developing age-specific coordinative abilities. At the same time we will try to demonstrate that the use of proprioceptive methods has a greater impact on teaching and developing coordinative abilities in comparison with the use of traditional methods used in handball training.

In conclusion, the aim of this paper is to elaborate a methodology of teaching and developing coordinative abilities, to elaborate a system of methods of teaching and developing coordinative abilities, as well as to designate a battery of tests in view of the evaluation of said abilities.

8.2 *Research background*

From the beginning we started from the idea that using proprioceptive methods can improve the specific indices for teaching and developing coordinative abilities. Thus the premises of this paper can be stated in the folowing way:

- Quantitative and qualitative optimization of the training process in accordance with current international training trends;
- In order to achieve a competitive performance potential, an amelioration of the training process is necessary by introducing individualized training, applying valuable methodic experience and the latest research results;
- Programming and planning of training content according to morpho-functional particularities of the experimental group;
- Establishing the entire training process by using the most adequate work methods;
- The optimization of trining six-metre line players by a rational application of drive systems.

8.3 *Research objectives*

- Data selection from the literature that relates to this study and to youth women's handball both national and international, adapted to the topic of this paper;
- In accordance with the aforementioned we tried to establish a strategy for the execution of this study;

- Devising the content of training programmes as well as the drive siystems of the training process of six-metre line players in U16 women's handball;
- Applying certain objective evaluation instruments in order to appreciate the level of indices for coordinative and psychomotor abilities;
- Selection of tems and research subjects / U16 female handball players who play on wing and pivot positions and who will undergo the training programmes implemented during the main research;
- Particularization of the conducted experimentin correation with the sample lot;
- Collecting, processing and interpreting the resulting data in order to design a differentiated practical line of method to be applied during training sessions;
- Formulating conclusions and recommendations.

8.4 *Research tasks*

- Selection of topic-related bibliographic material;
- Elaboration of research strategy and training plans;
- Establishing the premises and hypotheses of the research;
- Establishing the groups to undergo this research;
- Selection of initial test elements;
- Variable customization for the experiment group;
- Selection of final test elements;
- Statistical-mathematical processing of data resulting from the two testings;
- Interpreting the results of the statistical-mathematical interpretation of data;
- Forulating the concusions of the research;
- Making recommendations for a large scale application of the methods proposed.

8.5 *Research hypotheses*

Although in the context of any physical activity coordinative abilities play an essential role, one can notice a neglect of teaching and developing these by means of proprioceptive methods. Teaching and developing these abilities is done through handball-specific training methods. The reason for this is the short time allocated during training for the teaching and development of coordinative abilities as coaches are more preoccupied by getting fast results than by the age-specific formation and training of young players. As a result coaches prefer utilising methods specific to the game of handball to achieve several objectives at the same time.

Thus, in this research, we proposed the introduction of proprioceptive methods into the training sessions and to demonstrate that teaching and developing coordinative abilities through this type of methods is achieved more quickly and more thoroughly than by means of handball specific training methods.

The hypotheses we started from to realise this research are:

1. The correct and timely application of proprioceptive methods during training sessions contributes significantlyto the teaching and development of coordinative abilities in comparison with handball specific training methods.

2. Incorporating proprioceptive structures into training improves psychomotor ability indices.

3. The systematic use of proprioceptive methods in the development of specific indices of coordinative abilities determines the improvement of offensive technical parametres;

4. The introduction of proprioceptive methods into the training programme leads to the improvement of efficiency indicators of wing and line players in official games;

5. By using proprioceptive methods one can observe the correlation between test results and offensive technical parametres of wing and line players

8.6 ***Research structure***

The experiment was conducted within Arena Sport Club from Tîrgu Mureş, where a number of 10 athletes were selected into the experimental group, and "Ioan Vlăduţiu" Secondary School from Luduş where a number of 10 athletes were selected to form the control group.

The experiment was carried out during a sport season, starting on July 22, 2013, while the final testing took place on June 20, 2014.

The training programme of both groups, the experimental and the control group, was made up of the same number of training sessions per day after the following schedule:

- Training period: - two training sessions/day – 10.00 – 11.30 and 17.00-18.30;
  - one training session/day – 10.00 – 12.00;
- Preseason, season and transition period: - one training session/day, daily from 17.00 – 18.30.

Initial testing was conducted during the peiod of July 24-25, 2013. During the experiment proprioceptive methods were applied three times per week for thirty minutes each, while the control group benefited from the same type of training as the experimental group, minus the proprioceptive methods. Planning and scheduling of these activities were done in mutual agreement with the teaching coach from the institution of the control group.

The final testing was conducted on June 17-18, 2014. At both testings (initial and final one) both groups took part.

8.7 ***Research stages***

The entire research, starting from the bibliographic study and until the implementation of the results, implies going through a sequence of stages. These stages are:

- Stage I. Its main objective is familiarization with the topic and field, gathering the necessary information and knowledge in view of easing the work done during research.

The time interval allocated to this stage was September 2011 - February 2012;

- Stage II represent the emergence of the problem and of the intention to solve it by wording it in terms as clear and adequate as possible. Other tasks of this stage are:
  - Finding a suitable location to conduct the research;
  - Stating the preliminary hypotheses which will be improved based on tackling reality in the field;
  - Preparation for the preliminary research.

The time interval of this stage was March 2012 - December 2012.

- Stage III corresponded to the preliminary research which aimed at:
  - Validation of methods to be used during research;
  - Validating the battery of tests to be used during research.

Time interval January 2013 - June 2013.

- Stage IV. This was the stage when the research on which this paper is based on was conducted

  Time interval July 2013 - June 2014
- Stage V. This stage saw several tasks fulfilled:
  - Interpretation of data resulted from the experiment;
  - Drawing conclusions;
  - Writing of doctorl thesis based on th bibliographic material, the experiment itself and the conclusions which emerged

  Time interval July 2014 - June 2015
- Etapa a-VI-a. Implementation of research results

  Ongoing process.

8.8 *Research equipment and materials*

To fulfil the objectives and tasks set within the preliminary research and the experiment proper, we used an array of materials whose utilisation influences the expected results. In addition to material used for the preliminary research, force platforms and TRXs were used.

8.9 *Research methods*

8.9.1 Bibliographic study

8.9.2 Statistical-mathematical method

8.10 *Battery of tests*

In addition to the tests applied during the preliminary research, in this third part of the paper two additional tests were added.

8.10.1 Two-leg balance with legs close together, eyes open (15-second recording time)

8.10.2 Two-leg balance with legs close together, eyes closed (15-second recording time)

These two measurements, aided by force platform AMTI BP400600, will help determine average displacement along the X-axis.

8.11 *Anual general training plan*

8.12 *Training programme including proprioceptive methods implemented during main research*

The programme was implemented during a sport season, from July 22, 2013 to June 20, 2014, three times a week, for thirty minutes during individualization training, before each training session.

9 CHAPTER 9. DATA COLLECTION AND INTERPRETATION

9.1 *Shooting on goal efficiency - experimental group vs. control group*

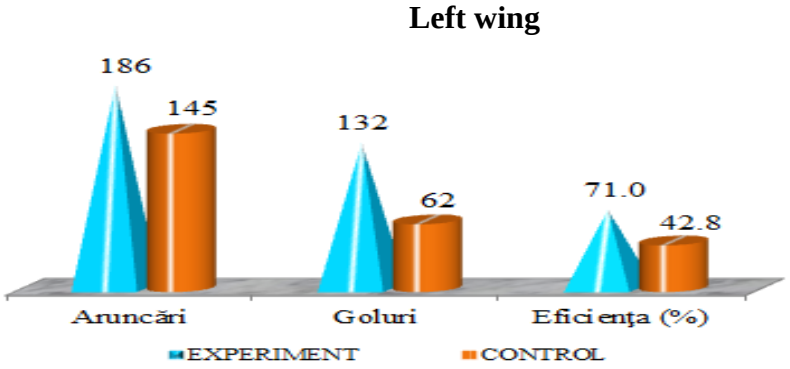

Chart 1. Left wing shooting efficiency – experimental group – control group

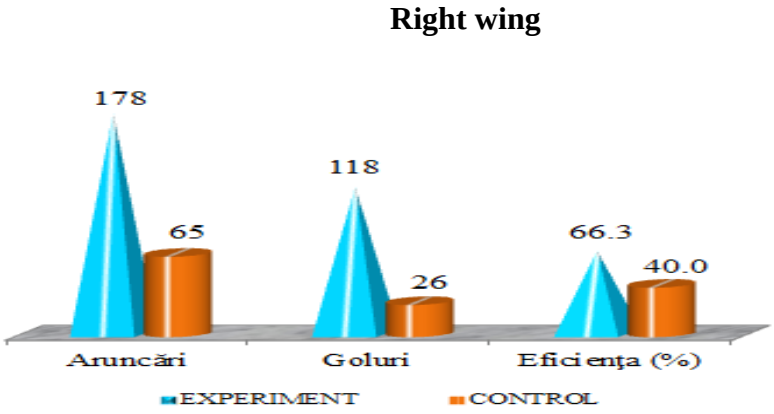

Chart 2. Right wing shooting efficiency – experimental group – control group

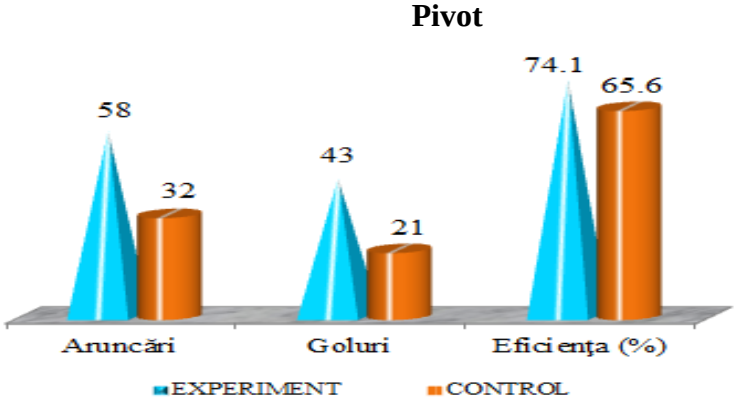

Chart 3. Pivot shooting efficiency – experimental group – control group

9.2 *Total goals scored/game parametres*

Table 1. Total goals scored/game parametres

Team	C.S. Arena Tîrgu Mureș (experimental group)			"Ioan Vlăduțiu" School Luduș (control group)		
Offence parametres	Left wing	Right wing	Pivot	Left wing	Right wing	Pivot

	Goals scored	Goals scored	Goals scored	Goals scored	Goals scored	Goals scored
A. 7 m.	36	-	-	13	-	-
A. Extr.	44	40	-	35	17	-
A.Contr.	32	43	19	2	1	-
A. 6 m	7	13	24	16	8	26
A. 9 m	13	22	-	-	-	-

Left wing

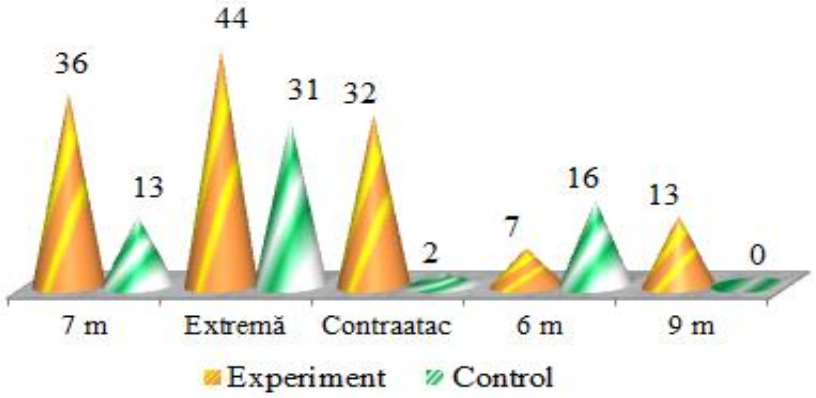

Chart 4. Comparison of goals scored by left wing experimental group vs. Control group /game parametres

Right wing

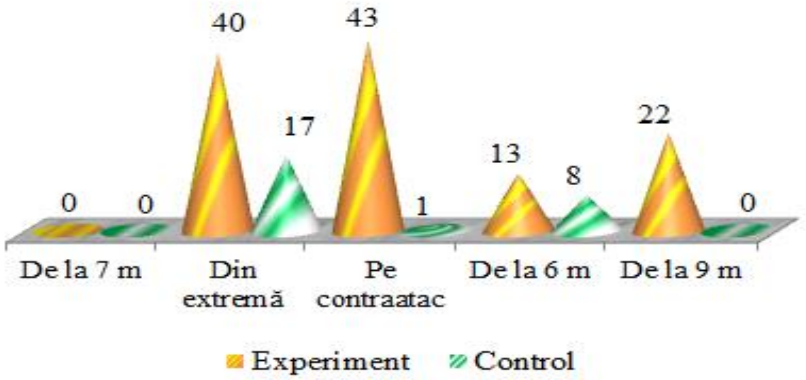

Chart 5. Comparison of goals scored by right wing experimental group vs. Control group /game parametres

Pivot

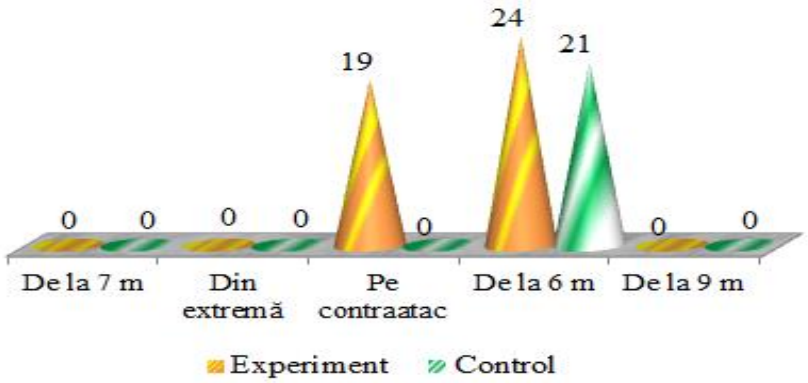

Chart 6. Comparison of goals scored by pivot experimental group vs. Control group /game parametres

9.3 *Correlations between control sample results and handball parametres for the experimental group by positions*

9.3.1 Left wing - Pearson Correlation

Table 2. Correlations between control sample results and game parametres - experimental – left wing

CONTROL SAMPLES		GAME PARAMETRES						
		Shots on goal	Total goals scored	Goals scored				
				From 7m	From wing	Counter attack	From 6m	From 9m
Multiple jumps on right leg	r	0.321	0.173	0.012	-0.090	0.277	0.274	0.339
	p	0.365	0.632	0.973	0.805	0.439	0.444	0.338
Multiple jumps on left leg	r	**-.828****	**-.868****	**-.918****	-0.108	**-.767****	-0.363	-0.161
	p	***0.003***	***0.001***	***0.000***	0.767	0.010	0.302	0.657
Two-leg balance with eyes open	r	-0.257	-0.416	-0.396	**-.749***	-0.221	0.418	0.404
	p	0.473	0.232	0.258	***0.013***	0.540	0.229	0.247
Two-leg balance with eyes closed	r	-0.357	-0.215	-0.021	-0.048	-0.244	-0.210	-0.388
	p	0.312	0.550	0.954	0.895	0.497	0.561	0.267
"T" drill	r	-0.263	-0.228	-0.026	-0.536	0.054	0.092	-0.290
	p	0.462	0.526	0.942	0.110	0.883	0.800	0.416
Zigzag drill	r	0.369	0.357	0.384	0.032	0.298	0.189	0.069
	p	0.294	0.311	0.273	0.930	0.403	0.601	0.850
3-cone drill	r	-0.082	-0.084	-0.014	-0.240	0.065	0.238	-0.299
	p	0.822	0.817	0.969	0.505	0.858	0.508	0.402
Illinois agility test	r	0.450	0.376	0.333	0.004	0.477	0.240	-0.014
	p	0.192	0.284	0.347	0.991	0.164	0.505	0.970

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

We notice that there are statistically significant correlations with a significance threshold of $p < 0.01$, between *Multiple jumps on left leg* and game parametres: *shots on goal*; *total goals scored*; *goals scored from 7m.*; *goals scored on counterattack.*

Correlations are negative as the reduction of points as a result of the reduction in execution errors for *multiple jumps on left foot* imply an improvement of the game parametres enumerated above.

Also, *Two-leg balance with eyes open* has a negative and statistically significant correlation, with a statistic threshold of 0.01. The decrease in displacement leads to the *increase of static balance* which positively influences the *goals scored from wing* parametre.

There are also correlations with coefficients that have considerable, positive or negative, values but which are not statistically significant.

9.3.2 Right wing - Pearson Correlation

Table 3. Correlations between control sample results and game parametres - experimental – right wing

CONTROL SAMPLES		**GAME PARAMETRES**					
		Shots on goal	Total goals scored	**Goals scored**			
				From wing	Counter attack	From 6m	From 9m
Multiple jumps on right leg	r	0.162	0.067	0.251	-0.340	0.318	-0.144
	p	*0.654*	*0.855*	*0.484*	*0.336*	*0.371*	*0.691*
Multiple jumps on left leg	r	-0.037	-0.319	-0.301	-0.215	0.002	-0.393
	p	*0.920*	*0.369*	*0.398*	*0.550*	*0.995*	*0.261*
Two-leg balance with eyes open	r	0.304	-0.233	-0.327	-0.399	0.471	-0.437
	p	*0.394*	*0.517*	*0.356*	*0.254*	*0.170*	*0.206*
Two-leg balance with eyes closed	r	-0.436	0.050	-0.301	0.492	0.145	-0.073
	p	*0.208*	*0.890*	*0.398*	*0.149*	*0.689*	*0.841*
"T" drill	r	0.493	0.143	-0.055	-0.191	0.420	0.224
	p	*0.148*	*0.693*	*0.879*	*0.597*	*0.227*	*0.533*
Zigzag drill	r	0.422	0.149	0.325	-0.187	0.011	0.203
	p	*0.225*	*0.680*	*0.359*	*0.605*	*0.977*	*0.574*
3-cone drill	r	0.121	-0.033	0.237	-0.574	-0.097	0.228
	p	*0.739*	*0.928*	*0.509*	*0.083*	*0.790*	*0.527*
Illinois agility test	r	**.882****	0.604	**.637***	-0.098	**.714***	0.352
	p	***0.001***	*0.064*	***0.048***	*0.787*	***0.020***	*0.318*

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

For the right wing thereare statistically significant correlations with a significance threshold of $p < 0.01$, between the results of *Illinois agility test* and *Shots on goal*. Also, there are statistically significant correlations between results of *Illinois agility test* and game parametres *Goals scored from wing* and *Goals scored from 6m*, but with a significance threshold of $p < 0.05$.

Correlations are positive as decline in time means increase in speed, agility and multi-directional body control, which correlate with an increase of game parametre values mentioned above.

The right wing also presents correlations whose coefficients have considerable, positive or negative yet statistically insignificant, values.

9.3.3 Pivot - Pearson Correlation

Table 4. Correlations between control sample results and game parametres - experimental – pivot

CONTROL SAMPLES		GAME PARAMETRES			
		Shots on goal	Total goals scored	Goals scored	
				Counter attack	From 6m
Multiple jumps on right leg	r	**-.755***	-0.575	**-.820****	-0.297
	p	***0.012***	0.082	***0.004***	0.404
Multiple jumps on left leg	r	0.099	0.250	0.254	0.194
	p	0.786	0.486	0.479	0.591
Two-leg balance with eyes open	r	-0.030	0.034	-0.043	0.077
	p	0.934	0.925	0.906	0.833
Two-leg balance with eyes closed	r	0.076	-0.056	0.421	-0.350
	p	0.834	0.877	0.226	0.322
"T" drill	r	-0.025	-0.142	0.023	-0.218
	p	0.945	0.695	0.949	0.546
Zigzag drill	r	-0.282	-0.307	-0.161	-0.336
	p	0.430	0.388	0.656	0.343
3-cone drill	r	**-.685***	-0.628	-0.569	-0.533
	p	***0.029***	0.052	0.086	0.112
Illinois agility test	r	-0.544	-0.480	-0.432	-0.409
	p	0.104	0.160	0.212	0.240

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

For pivots there are statistically significant correlations with a significance threshold of $p < 0.01$, between the results of *Multiple jumps on right leg* test and *Goals scored from counterattack.* Statistically significant correlations with a significance threshold of $p < 0.05$

appear between results for *Multiple jumps on right leg* and *Shots on goal* and also between the *3-cone test* and game parametre *Shots on goal*.

Correlations are negative for the values measured for *Multiple jumps on right leg* test and the two game parametres as a drop in points as a results of a reduction in error count for *Multiple jumps on right leg* leads to the increase in value of the *Shots on goal* parametre and of *Goals scored from counterattack*. The decline in time for the *3-cone drill test* means improvement of speed, agility and multi-directional body control which determines the increase in the number of *shots on goal* by the pivot. As for otherpositions, the pivot exhibits correlations whose coefficients have considerable, positive or negative values, with no statistical significance.

10 CHAPTER 10. CONCLUSIONS AND RECOMMENDATIONS

10.1 *Discussion on the results*

10.2 *Theoretical conclusions*

This research allows us to put forth a series of conclusions and recommendations, presented in the order in which the scientific investigations were conducted: theoretical (general) conclusions, study results, as well as practical (specific) conclusions, which refer to the hypotheses proposed for evaluation in this paper.

The theoretical novelty of this paper stands in its proposing a new orientation of th training process by means of implementing a programme containing proprioceptive methods which will have a significant contribution to the education and development of coordinative abilities, in comparison with handball-specific training methods.

A current trend is the introduction of specific proprioceptive methods into training programmes in order to improve specific neuromuscular coordination indices, as well as static and dynamic balance from an early age..

This scientific approach contains a set of novel, original elements as regards optimizing training for six-metre line players in U16 women's handball, by means of proprioceptive strutures, and aiming at maximized capitalization of wing and line players' potential.

In this paper we set out to improve the efficiency of six-metre line players in U16 women's handball, positions which have not been emphasized lately during training and have not been capitalized entirely.

The variety of methods included in the programme proposal, based on utilising various devices and materials: balance fits, TRXs, elastic bands etc., contributed to the optimization of training U16 wing players and pivots, in agreement with modern trends in handball training.

The current trend in modern handball is standardizing all components, and this research highlights a new orientation of the training process towards implementing an adapted proprioceptive training programme which improve the specific indices of speed, agility, coordination, orientation in space and time, and static and dynamic balance of U16 female handball players.

Organizing individualized training adapted to each athlete's possibilities has contributed, apart from the better neuromuscular coordination indices, to great results in

official competitions by improving the efficiency of wing players and line players, and their contribution to the game.

It is worth mentioning that within this research that targets the optimization of six-metre line players' training by means of proprioceptive structures, methods are objectivised, rationalised and standardised as methods for the optimization of training young handball players and not as methods used to prevent or recover from injuries.

In our country, and also on youth level, there is a lack of thorough exploitation of the potential of six-metre line players when compared to European handball, where great results in big competitions are attributed to the use of high potential line players.

This fact was proven by the Romanian national side, too, whaen they came away with the bronze medals from the World Championship in Denmark, in December 2015. In games where the contribution of the six-metre line was negligeable, the Romanian team lost, winning the games which saw good performances from wing players and pivots.

10.3 *Specific conclusions of experimental research*

The conclusions that emerge from this scientific enterprise refer to the hypotheses regarding teaching and developing coordinative abilities, improving indices of certain psycho-motor abilities, improving the efficiency of six-metre line players in official games as a result of applying proprioceptive training adapted to handball.

During the study modern, innovative teaching materials were used, having the purpose of modernization of the training of U16 handball players.

■ Following the study conducted on teaching and developing coordinative abilities we can conclude the following:

- All tests show that research subjects presented higher numerical values at the final test than at the initial one, after the application of the programme proposed by us;
- The analysis of the results of Multiple jumps on single foot (left and right) tests make us claim that the progress of the experimental group are superior to that of the control group because of the influence of the variable introduced by us (proprioceptive methods) into the research.
- The difference in results registered by the two groups (experimental and control) at the final testing of two-leg balance with legs close together, eyes open, shows an improvement in static balance for the experimental group.
- The results registered by the two groups (experimental and control) at the final testing of two-leg balance with legs close together, eyes closed, show that the variable introduced by us induces progress as there is better static balance registered by the experimental group.
- The importance of applying proprioceptive methods is demonstrated by the progress registered by the experimental group during the "T" drill test as compared to the control group.
- The results registered during the Zigzag drill test entitle us to say that the progress of the experimental group are superior to that of the control group due to the influence of the variable (proprioceptive methods) introduced by us into the research.

➢ The importance of applying proprioceptive methods is demonstrated by the progress registered by the experimental group when evaluating speed, agility and multi-directional body control was demonstrated by theresults registered during the 3-cone drill test.

➢ We can ascertain that the progress of the experimental group in the Illinois agility test of speed, agility and multi-directional body control, are superior to that of the control group due to the influence of the variable (proprioceptive methods) introduced by us into the research.

The results that came from the statistical processing of data are significant, which confirms hypothesis (I1) which states: *The correct and timely application of proprioceptive methods during training sessions contributes significantlyto the teaching and development of coordinative abilities in comparison with handball specific training methods*.

The second hypothesis (I2) is also confirmed: *Incorporating proprioceptive structures into training improves psychomotor ability indices.*

■ As regards the results registered by six-metre line players, from the offensive parametres of the 20 official games we can conclude the following:

➢ ***Total goals scored***

➢ The results registered entitle us to claim that the variable introduced by us has had a positive effect on the number of goals scored by the left wing of the experimental group in the 20 official games, in comparison to the control group.

➢ After analysing the data we can conclude that the difference between the average number of goals scored in the 20 official games by the right wing of the two groups (experimental and control) can be attributed to the variable introduced by us.

➢ The difference between the average number of goals scored in the 20 official games by the pivots is statistically significant between the two groups (experimental and control) and entitles us to claim that it can be attributed to the variable introduced into this research.

➢ ***Goals scored from the 7 m line***

➢ The greater difference of goals scored from 7 m throws in the 20 games by the left wing players of the experimental group (1.80) compared to the control group (0.65) shows us that the variable introduced by us has had a beneficial influence on this game parametre.

➢ ***Goals scored from the wing***

➢ Following the analysis of statistical data we notice that the difference between the two groups in goals scored during the 20 games by left wing players from wing shots is not statistically significant (2.20 for the experimental group and 1.55 for the control group respectively, $p=0.065 > 0.05$ and $z = -1.846$).

➢ As for goals scored from the wing by right wing players of the two groups, the difference is statistically significant (the average of the experimental is 2 while the control group registered 0.85, while $p=0.002<0.05$ and $z = -3.161$) and can be attributed to the variable introduced by us.

➢ ***Goals scored from counterattacks***

➢ The average value of goals scored by left wing players on counterattacks is 1.60 goals for the experimental group and 0.10 for the control group, while $p<0.001<0.05$ and $z = -4.962$, which shows a statistically significant difference between the two groups.

- The average value of goals scored by right wing players on counterattacks is 2.15 goals for the experimental group and 0.05 for the control group, the difference being 2.10 goals, while $p<0.001<0.05$ and $z = -5.727$, which testifies to a statistically significant difference between the two groups.
- The average value of goals scored during the 20 games by the pivots on counterattacks is 0.95 for the experimental group and 0.00 for the control group where no goals were scored by pivots on counterattacks. $p<0.001<0.05$ while $z = -4.252$ showing, in this case, a statistically significant difference btween the two groups.

- ***Goals scored from the 6m line***
- From 6 m shots during the 20 official games left wing players of the two groups scored 0.35 goals for the experimental group and 0.80 for the control group, resulting in a lower value for the experimental group by 0.45 goals. The significance threshold calculated with the Mann-Whitney test is $p=0.05$ while $z =-1.932$;
- The average number of goals scores in the 20 games by the right wing players from the 6m line is equal to 0.65 for the experimental group and 0.40 for the control group, resulting a bigger difference for the experimental group by 0.25 goals. The Mann-Whitney test with $p=0.275>0.05$ and $z=-1.091$ testifies to a statistically insignificant difference between the two groups;
- As for the pivots, the averag number of goals scored in the 20 games from the 6m line is 1.20 for the experimental group and 1.05 for the control group, the difference being 0.15 goals in favour of the experimental group, while $p=0.921>0.05$ and $z =-0.100$ showing a statistically insignificant difference in this case.

- ***Goals scored from shots form 9 m***
- The data analysis of goals scored in 20 games by left wing players from 9m revelas the fact that there is a statistically significant difference between the two groups (0.65 for the experimental and 0.00 for the control group, with $p<0.001<0.05$ and $z=-4.333$) and is the result of the variable introduced by us.
- In the case of right wings the same statistically significant difference can be observed (1.10 goals for the experimental group and 0.00 for the control group, while $p<0.001<0.05$ and $z = -5.222$), owing to the positive influence of proprioceptive methods introduced into the research.

The statistical analysis of data registered by six-metre line players for all five offence parametres analysed, show statistically significant results which determine us to accept work hypothesis I3.

- After the study conducted on the efficiency improvement of shots on goal of wing players and pivots throughout the 20 official games, we can conclude the following:
- As regards the efficiency of shots on goal from the left wing side, there were a total of 186 shots with 132 goals scored by the experimental group, the efficiency being 71,0%, while for the control group from a total of 145 shots there were 62 goals scored, the efficiency being 42,8%. We can safely state that the progress registered by the experimental group are superior

to that of the control group due to the influence of the variable (proprioceptive methods) introduced by us.

- On the right wing of the experimental group 118 goals were scored from a total number of 178 shots, the efficiency being 66,3%, while the control group registered 65 shots on goal and scored 26 times, the efficiency being 40,0%. We can conclude that the superior progress shown by the experimental group as compared to the control group is the result of the introduced variable (proprioceptive methods).
- From pivot position one can observe that from a total of 58 shots on goal 43 goals were scored by the experimental group, the efficiency of this position being 74,1%, while for the control group from a number of 32 shots 21 goals were scored, with 65,6% efficiency. This too makes us claim that the superior progress of the experimental group compared to the control group are to be attributed to the variable introduced by us into the research.

These being presented we can assess that work hypothesis I4 has been confirmed, which says: *The introduction of proprioceptive methods into the training programme leads to the improvement of efficiency indicators of wing and line players in official games.*

■ The study conducted on the correlation between the results of the control samples and game parametres of the experimental group by positions we can ascertain the following:

- On the left wing side there are statistically significant correlations with a significance threshold of $p < 0.01$, between *Multiple jumps on left leg* and game parametres: *shots on goal*; *total goals scored*; *goals scored from 7m*; *goals scored from counterattack.* Also, *Two-leg balance with eyes open* correlates negatively and statistically significantly, with a significance threshold of 0.01. The decrease in displacement along the X-axis leads to an increase of static balance which in turn influences in a good way goals scored from wing parametre.
- On the right wing there are statistically significant correlations with a significance threshold of $p < 0.01$, between the results of *Illinois agility test* and *shots on goal*. There are also statistically significant correlations between the results of *Illinois agility test* and the *goals scored from the wing* and *gols scored from 6m* prametres, but with a significance threshold of $p < 0.05$. The correlations are positive as the decline in time leads to an increase of speed, agility and multi-directional body control with correlates with a value increase of game parametres mentioned above.
- There are statistically significant correlations on the pivot position with a significance threshold of $p < 0.01$, between the results of the *Multiple jumps on right leg* test and *goals scored from counterattack.* Statistically significant correlations, but with a significance threshold of $p < 0.05$ were registered between the results of *Multiple jumps on right leg* and *shots on goal*, and also between test results of the *3-cone drill test* and game parametre *shots on goal*. Correlations between values measured at the *Multiple jumps on right leg* and the two game parametres are negative as the decline in the number of points as a result of the decline of execution error when when doing multiple jumps on right leg leads to an increase in shots on goal and goals scored from counterattack values. The decline in time in the *3-cone drill test* means an increase of speed, agility and multi-directional body control which determines a higher number of shots on goal by the line player.

In accordance with the fact presented above we accept the validity of work hypothesis I5 which states: *By using proprioceptive methods one can observe the correlation between test results and offensive technical parametres of wing and line players.*

10.4 Elements of novelty and methodological recommendations

Based on the results registered by this research, on the conclusions emerging from Part II and those from the experimental research we can state the following:

- The element of novelty of this paper is the implementation of a programme which contains objectified, rationalized and standardized proprioceptive methods for the optimization of training and increased efficiency of wing and line players in U16 women's handball and not as methods of preventing or recovery from injuries;
- The use of unstable surfaces has positive effects on developing coordinative and handball specific abilities as the utilised programmes exceed the traditional methods of training and learning basic handball skills for female U16 players.

We also would like to make a series of recommendations regarding the application of the programme proposed in this paper:

- the programme should be introduced for the duration of a training macrocycle;
- it should last for 20-30 minutes, for a minimum of 3 three times a week, at the beginning of practice sessions;
- it should be introduced as part of individualized training;
- introducing proprioceptive methods from an early age;
- methods should be adapted according to age and individual particularities of players;
- methods should be applied to all players of a team and particularized for each position;
- methods should be applied according to the easier towards difficult principle, from simple to complex;
- Structure of methods should be applied for periods of 4-6 weeks depending on the feedback from athletes;

Accordingly, together with the Technical-Methodical Comission of the Romanian Handball Federation we shall try to popularize this proprioceptive training programme, adapted to children and youth level, at the refresher courses for coaches.

Until now the introduction of proprioceptive methods training programme was attempted at a training camp for youth players of the national side in the summer of 2014 and at the 2002-2003 age group's training camp, organized by the Romanian Handball Federation in August-September 2015.

BIBLIOGRAPHY

1. Abdolvahabi, Z., Nemati, N., Salehian, M.H., Majidi, M., (2012) The Influence of Handball Simulated Competition Induced Fatigue on Functional Stability, Annals of Biological Research, , 3 (5), pp. 2533-2537;
2. Acevedo, R., J., Rivera-Vega, A., Miranda, G., Micheo, W., (2014), Anterior Cruciate Ligament Injury: Identification of Risk Factors and Prevention Strategies, *Current Sports Medicine Reports*, 13(3), pp. 186-191;
3. Acsinte, A., (2004), Biochemical and physiological changes in handball players during a specific high intensity training programme, *EHF Periodical, 1 /2004,* pp. 58-62;
4. Acsinte, A. Eftene, A., (2007), Physical condition in high performance team handball (requirements), *Vienna / Austria, EHF Web Periodicals*, pp. 1-10;

5. Acsinte, A., Alexandru, E., Milon, A., Lupescu, L., (2010), *Improving ankle and knee joint stability proprioceptive balancefit discsdrills*, Xlibris Corporation, pp.185-186;
6. Acsinte, A., Alexandru, E., (2007), Physical condition in high performance team handball (requirements), *Vienna/ Austria - Publisher: EHF Web Periodical*, 10, p. 4;
7. Acsinte, A., Alexandru, E., (2007), Physical Condition in High Performance Team Handball, *Viena-Austria, EHF Web Periodical*, pp.1-10;
8. Acsinte, A., (2011), Proprioceptive training în handball, *EHF Scientific Conference, Science and Analytical Expertise in Handball*, Viena, Austria, pp. 116-120;
9. Acsinte, A., Alexandru, E., Costea, L. M., (2015), Power and strength training in team handball, *EHF Web Periodical*, pp.1-7;
10. Acsinte, A., Alexandru, E., Guiterrez a Quilar, O., (2012), Neuro-musculartcoordinatioa and balance skills development in young female handball players, *2nd EHF Scientific conference women and handball scientific and practical Approaches*, pp. 28-32;
11. Albu, E., (2007), *Psihologia vârstelor. Curs pentru uzul studenţilor*, Universitatea „Petru Maior", Tîrgu Mureș, p.69;
12. Alexandru, E., (2004), *Modelarea conţinutului antrenamentului sportiv în perioada pregătitoare la handbaliste juniaore I din cadrul stadiului despecializare, Rezumat teză doctorat*, Chişinău, p. 54;
13. Badr, N., (2013), The effects of bosu ball training on teaching and improving the performance of certain handball basic skills, *Science, Movement and Health,* 13 (2), pp. 498-505;
14. Baker, D., (1999a), A comparison of running speed and quickness between elite professional and young rugby league players, *Strength and Conditioning Coach*, 7(3), pp. 3-7;
15. Balint, E., (2004), *Instruirea în jocul de handbal.Conţinut tehnic*, Editura Universităţii Transilvania Braşov, pp .5; 33-35;
16. Balint, E., Curiţianu, I., (2012), The Importance Of Anticipation In Increasing The Defense Efficiency In High Performance Handball, *Bulletin of the Transilvania University of Braşov,* 5 (54) No. 1, pp. 103-112;
17. Balint, G., Ganzenhuber, P., Balint, T., Spulbel, F.,(2013), *Metode de evaluare a potenţialului biometric şi somato-funcţional pentru selecţia copiilor în vederea practicării sărituri lor cu schiurile*, Editura Inocenţiu Voinea, Bucureşti, pp.37-38;
18. Barati, A., Safarcherati, A., Aghayari, A., Azizi, F., Abbasi, H., (2013) , Evaluation of relationship between trunk muscle endurance and static balance in male students, *Asian J Sports Med 4*, pp. 289-294;
19. Barut, C., Demirel, P., Kiram, S., (2008), Evaluation of hand anthropometric measurements and grip strength in basketball, volleyball and handball players, *International Journal of Experimental and Clinical Anatomy*, 2, pp. 55–59;
20. Baştiura, E. (2001), *Forma sportivă şi periodizarea antrenamentului*, Analele UVT-Seria EFS, 3(1), p.1;
21. Bayios, I.A., Bergeles, N.K., Apostolidis, N.G., Noutsos, K.S., Koskolou, M.D., (2006), Anthropometric, Body Composition And Somatotype Differences Of Greek Elite Female Basketball, Volleyball And Handball Players, *J Sports Med Phys Fitness*, 46(2), pp. 271–280;
22. Bilge, M., Sevim, Y., Ersöz, G., (2010), An Investigation Of The Relationship Between Peak Anaerobic Power-Capacity, Body Composition And Heart Rate In

Turkish National Senior Handball Players, *Dirim Medical Journal*, 85(4), pp. 152-165;
23. Blanco, F.M., (2004), *Balonmano. Detección, Selección y Rendimiento de Talentos*. Editorial Gymnos, Madrid, p. 66;
24. Blumenstein,B., Lidor, R., Tenenbaum,G.,(2007), Perspective on sport and exercise psychology, *Psychology of sport training*, Vol 2, pp. 62-77;
25. Bochiş, E., (2000), *Dezvoltarea umană*, Editura Imprimăria de Vest, Oradea, p. 153
26. Bojić, I., (2008), *The effect of the specially programmed training process on the basic coordination and specific motor abilities of young female handball players*, PhD thesis, Skoplje: Fakultet fizičke kulture;
27. Bojić,I., Petković,D., Kocić,M., (2010), Influence of different training programmes on basic coordination of female handball palyers, *Acta Kinesiologica*, 4(1), pp. 71-74;
28. Bojić,I., Pavlović, L., (2014), Coordination between coordination and situational-motor abilities of young female handball, *1ST International scientific conference, Research in Physical Education, Sport and Health, Ohrid*, pp. 405-410;
29. Bon, M., (2000), Measurement of the cyclic movements of the handball players during the game by computer vision system, *Web: EHF Periodicals – Viena,* pp. 35-40;
30. Bota, C., Prodescu, B., (1997), *Fiziologia educaţiei fizice şi sportului – ergofiziologie,* Editura Antim Ivireanu, Rm. Vâlcea, p. 135;
31. Bota, I., (1984), *Handbal – modele de joc şi pregătire*, Editura Sport-Turism, Bucureşti, pp. 18-41;
32. Brand, H., (2008), *Handball -Mein Spiel, mein Stil*, Philippka Verlag, Deutschland, pp. 67-68;
33. Bressel, E., Yonker, J.C., Kras, J., Heath, E.M., (2007), Comparison of static and dynamic balance in female collegiate soccer, basketball, and gymnastics athletes, *Journal of Athletic Training*, 42, pp. 42-46, [Abstract];
34. Brittenham, G., (1996), *Athleticism for Basketball (Chapter 5)*. Complete Conditioning for Basketball, Human Kinetics: Champaign, IL, pp. 69-87;
35. Brumagne, S., Lotte, J.,Claeys, K., Pijnenburg, M., (2013), *Altered variability in proprioceptive postural strategy in people with recurrent low back pain*, In: PW Hodges, Cholewcki J, VanDieen JH, (eds.). Spinal Control:The Rehabilitation of Back Pain, Churchill Livingstone Elsevier: Edinburg, London, pp. 135-144;
36. Buchheit, M., Laursen, P.B., Kuhnle, J., Ruch, D., Renaud, C., Ahmaidi, S., (2009), Game Based Training In Young Elite Handball Players, *Int. J. Sports Med.*, 30, pp. 251-258;
37. Buchheit, M., Lepretre, P.M., Behaegel, A.L., Millet, G.P., Cuvelier, G., Ahmaidi, S., (2009), Cardiorespiratory Responses During Running And Sport Specific Exercises In Handball Players, *J. Sci.Med. Sport*, 12(3),
pp. 399-405;
38. Bulava,B., Rodić, S., Gruić, I.,(2011), The effect of basic and specific motor abilitieson the shooting precision in handball, *6th Fiep European Congress, Physical Education*, Croaţia, pp. 558-563;
39. Camliguney, F. A.,Ramazanoglu, N., Atilgan, O.E., Yilmaz, S., Uzun, S., (2012), The effects of intensive ski training on postural balance of athletes, *International Journal Of Humanities and Social Science*, 2(2), pp. 71-79;
40. Can, F., Yilmaz, I., Erden, Z., (2004), Morphological Characteristics And Performance Variables of Women Soccer Players, *J Strength Cond Res*, 18(3), pp. 480–485;
41. Čavala, M., Katić, R.,(2010), Morphological, Motor and Situation-motor Characteristics of Elite Female Handball Players According to playing performance and position, *Coll. Antropol.*, 32(4), pp. 1355-1361;

42. Cărăbaş, I., (2013), Study Regarding the Play of the wing player at the World Handball Championship-Serbia 2013, *Timişoara Physical Education and Rehabilitation Journal,* 6(11), pp. 61-64;
43. Ceylan H., I., Saygin, O., (2015), Examining the Effects of Proprioceptive Training on Coincidence Anticipation Timing, *Reaction Time and Hand-Eye Coordination, Anthropologist*, 20(3), pp.437-445;
44. Chaouachi, A., Brughelli, M., Levin, G., Boudhina, N., Cronin, J., Chamari, K. (2009), Anthropometric, physiological and performance characteristics of elite team-handball players, *Journal of Sports Sciences*, 27(2), pp. 151-157;
45. Chaouachi, A., Brughelli, M., Levin, G., Boudhina, N.B., Cronin, J., Chamari, K., (2009), Anthropometric, Physiological And Perfor-Mance Characteristics Of Elite Team-Handball Players, *J Sports Sci*, 27(2), pp. 151–157;
46. Chelly, M.S., Hermassi, S., Aouadi, R., Khalifa, R., Van den Tillaar, R., Chamari, K., Shephard, R.J., (2011), Match Analysis Of Elite Adolescent Team Handball Players, *J. Strength Con. Res.*, 25(9), pp. 2410-2417;
47. Cherif, M., Gomri, D., Aouidet, A., Mohamed, S., (2011), The offensive efficiency of the high-level handball players of the front and the rear lines, *Asian Journal of Sports Medicine*, 2(24), pp. 241-248;
48. Christodoulidis, T., Karras, D., Kororos, P., Skoufas, D., Toganidis, T., Vareltzis, I., Zapartidis, I.(2009), Profile Of Young Female Handball Players By Playing Position, *Serbian Journal of Sports Sciences*,2, pp. 53-60;
49. Ciulea, L, E.,(2015), *Optimizarea fitness-ului la jucătoarele de volei, junioare I, prin implementarea unui program adaptat de gimnastică aerobică şi functional training*, Teză doctorat, Braşov, p. 79;
50. Čižmek, A., Ohnjec, K., Vučetić, V., Gruić , I., (2010), Morphological differences of elite Croatian women's handball players according to their game position, *Hrvat Sportskomed Vjesn*, 25, pp. 122–127;
51. Claparide, E.D. citat de Epuran, M., (1976), *Psihologia Educaţiei fizice*, Editura Sport-Turism, p. 41;
52. Clark, M., (2008) *Integrated balance training, national academy of sports medicine*, Printed in the United States of America, pp. 3-37;
53. Cojocari,D., (2014), *Recuperarea coordonării şi a echilibrului în activităţile pihomotrice de bază la persoanele după accident vascular cerebral prin tehnici de biofeedback stabilografic*,Teză de doctorat, Chişinău, p. 14-29;
54. Cojocaru A., Cojocaru M.,(2006), *Studiu asupra evoluţiei caracteristicilor sportivilor voleibalişti cu vârste cuprinse între 15-18 ani*, Analele Universităţii Spiru Haret Seria Educaţie Fizică, Sport şi Kinetoterapie, Anul III, nr. 3, Editura Fundaţiei România de Mâine, Bucureşti , p. 17;
55. Cojocaru, A., Lăzărescu, D., Ştefănescu, A.,(2013), *Ghid orientativ al antrenorului de volei*, Bucureşti, p. 4;
56. Colibaba, E.D., (2005*), Note de curs, specializare baschet, anul III,* p. 198;
57. Colibaba, E.D., Bota, I. (1998), *Jocuri sportive. Teorie şi metodică,* Editura Aldin, p. 99;
58. Colibaba, E.D., Mihăilă, I., (2004), Regândirea şi reactualizarea conceptului de antrenament individual în pregătirea echipelor de jocuri sportive colective, *Vol. Sesiunii Internaţionale, Cominicări Ştiinţifice*, Galaţi;
59. Cordun, M., (1999), *Kinetologie medicală*. Editura Axa, Bucureşti, p. 413;
60. Cote, L., Crutcher, M. D., (1991), The basal ganglia, In: Kandel E R, Schwartz J H, Jessell T M, editors, *Principles of Neural Science*. 3rd ed. Elsevier Science; New York, NY, pp. 647–659;

61. Creţu, T., (2001), *Psihologia vârstelor*, Editura Departamentului de Învăţământ deschis la distanţă, Universitatea Bucureşti, p. 238; 273; 274; 305; 274-275; 317;
62. Creţu, T., (2009), *Psihologia vârstelor, Ediţia a III a revizuită şi adăugită*, Editura Polirom Iaşi, p. 274; 276; 278; 281; 282; 283; 290; 292;
63. Curiţianu, I., Neamţu M., (2014), Compared Study Concerning The Evolution Of Left Wings, Right Wings And Pivots At Male Handball Teams H.C.M. Constanta And F.C. Barcelona In "Champions League" 2011-2012, *5th World Conference on Educational Sciences,University of Rome, Italy, Procedia -Social and Behavioral Sciences, 116*, pp. 3859-3863;
64. Curiţeanu, I.M.,(2014), *Contribuţii privind ameliorarea performanţelor motrice şi a comportamentului tehnico-tactic pe posturile de extreme şi pivot în jocul de handbal la echipele de seniori din România*, Teză de Doctorat, Braşov, p.1;
65. Davlin, C.D., (2004), *Dynamic balance in high level athletes*. Perceptual and Motor Skills, 98, pp. 1171-1176;
66. Demeter, A., (1974), *Bazele fiziologice ale educaţiei fizice şi sportului*, Editura Stadion, Bucureşti, p. 10; 98;
67. Demeter, A., (1974), *Bazele fiziologice ale educaţiei fizice şcolare*, Editura Stadion, Bucureşti, pp. 92-93;
68. *Dicţionarul Explicativ al Limbii Române*, (1984), Editura Poligrafică, Sibiu, p. 80;
69. Dijkerman, H.C., de Haan, E.H., (2007), Somatosensory processes subserving perception and action, *Behav Brain Sci*, 30(2), pp. 189-201;
70. Doboşi, Ş. (2009), *Refacerea şi recuperarea după efortul din antrenament şi competiţie,* Editura,,Napoca Star", Cluj Napoca, p. 35
71. Dragnea, A., (1996), *Antrenamentul sportiv*, Editura Didactică şi Pedagogică, Bucureşti, p. 61; 62;
72. Dragnea, A., Bota, A., (1999), *Teoria activităţilor motrice,* Editura Didactică şi Pedagogică, Bucureşti, p. 44; 149; 151;
73. Dragnea, A., Bota, A., Stănescu, M., Şerbănoiu, S., Teodorescu, S., Virgil, T., (2006), *Educaţie fizică şi sport – Teorie şi Didactică*, Editura FEST, Bucureşti, p.124;
74. Dragu, A., Cristea, S., (2003), *Psihologie şi pedagogie şcolară*, Ovidius University Pres, Constanţa, p. 51;
75. Drăgan, I.,(1994), *Medicina sportivă in "Medicina sportivă aplicată'*. Editura Editis, Bucuresti, p. 43;
76. Duca, M., Dencicov-Cristea, L, (2014), *Biologie. Procese şi sisteme vitale*, Manual pentru clasa a XI-a, Editura Krim, Chişinău, p. 37; 38;
77. Dumitrescu, G., (2011), *Antrenament sportiv fotbal. Curs master, Semestrul II*, Oradea, p. 50; 60;
78. Dumitru, G., (2011), *Antrenamentul sportive*, Curs master, Semestrul II, Oradea, p. 8;
79. Dye, S. F., (2000), The functional anatomy of the cerebellum: an overview, In: Lephart S M, Fu F H, editors. *Proprioception and Neuromuscular Control in Joint Stability*. Human Kinetics; Champaign, IL, pp. 31–35;
80. Epuran, M., (1976), *Psihologia educaţiei fizice*, Editura Sport – Turism, Bucureşti, p. 31;
81. Epuran, M., (1984), *Reglarea psihică*, Institutul de Educaţie fizică şi sport, Bucureşti, p. 121
82. Epuran, M., (2005), *Metodologia cercetării activităţilor corporale,* Editura FEST, Bucureşti, p. 131; 246; 379;
83. Epuran, M., Stănescu, M., (2010), *Învăţarea motrică: aplicaţii în activităţile corporale*, Discobolul, Bucureşti, p. 206

84. Ergen, E., Ulkar, B., (2008), Proprioception and Ankle Injuries in Soccer, *Clin Sport Med*, 27, pp. 195-217;
85. Esfahankalati,A., Venkatesh, C.,(2013), Relationship between coordinative abilities and performance in elite female handball players, *Asian Journal of Multidisciplinary Studies*, 1(5), pp. 42-46;
86. Faur, M., Aftimiuc, O., (2002), Probleme actuale privind dezvoltarea capacităţii coordinative la studenţii facultăţii de educaţie fizică-anul I, *Analele UVT-Seria EFS*, 4, pp. 93-97;
87. Filipovic, V., Ciliga, D., (2010), Postural adaptation of idiopathic adolescents scolioses (IAS), *Kinesiology*, 42, pp. 16-27;
88. Finichiu, M. (2009), *Educarea şi dezvoltarea capacităţilor coordinative în lecţia de educaţie fizică*, Maraton, 1(2), pp. 178-184;
89. Fleancu J., L., (2004), Teză de doctorat, p. 60l;
90. Flisk, S.S. (2000), *Speed, agility, and speed endurance development*. In T.R. Beachle & R.W. Earle (Eds.), Essentials of Strength Training and Conditioning (2nd ed.), Champaign, IL, Human Kinetics, pp. 471-491;
91. Foretić, N., Rogulj, N., Srhoj,V., Burger, A., Rakovic, K., (2011), Differences in situation efficiecy parameters between top men and women handball teams, *EHF Scientific Conference*, Vienna, 18-19 November, pp. 243-247;
92. Fradet, L., Botcazou, M., Durocher, C., Cretual, A., Multon, F., Prioux, J., Delamarche P., (2004), Do handball throws always exhibit a proximal-to-distal segment sequence?, *Journal of Sport Science*, 22(5), pp. 439-447;
93. Freiwald, J., Papadopoulus, C., Slomka, M., Bizzini, M., Baumgart, C., (2006), Prävention im fußballsport*, Sportorthopädie Sporttraumatologie*, 22, pp. 140–150;
94. Fulton, K. T. , (1992), Off season strength training for basketball, *National Strength and Conditioning Association Journal*, 14(1), pp. 31-33;
95. Gagea, A. (2007), *Aplicaţii ale ştiinţei avansate în sportul de performanţă, Cercetări interdisciplinare în sportul de performanţă*, Editura Ministerului şi Reformei Administrative, p. 7;
96. Gajanana, P. B., Swamy, S.N., (2013), An appraisal of agility in athletes engaged in indigenous and non-indigenous games of India, *Journal of Physical Education and Sport*, 13(4), pp. 621- 624;
97. Gambetta, V., (1996), How to develop sport specific speed, *Sports Coach*, 19(3), pp. 22-24;
98. Gauchard, G.C., Gangloff, P., Jeandel, C., Perrin, P.P., (2003), Physical activity improves gaze and posture control in the elderly, *Neurosci Res* 45, pp. 409-417;
99. Găişteanu, M., (2004), *Psihologia copilului* Edited by Foxit PDF Editor Copyright (c) by Foxit Software Company, p. 73;
100. Ghez, C., (1991) The control of movement, In: Kandel E R, Schwartz J H, Jessell T M, editors. *Principles of Neural Science*. 3rd ed. Elsevier Science, New York, NY, pp. 533–547;
101. Ghez, C., (1991), Voluntary movement, In: Kandel E R, Schwartz J H, Jessell T M, editors, *Principles of Neural Science*. 3rd ed. Elsevier Science, New York, NY, pp. 533–547;
102. Gholami, M., Sabbaghian Rad, L., (2010), Anthropometric, bodycomposition and somatotype differences of Iranian elite women's basketball and handball players, *Br J Sports Med*, 44, p. 119;
103. Gioftsidou, A., Malliou, P., Sofokleous, P., Pafis, G., Beneka,A., Godolias, G., (2012) THE EFFECTS OF BALANCE TRAINING ON BALANCE ABILITY IN HANDBALL PLAYERS, *EXERCISE AND QUALITY OF LIFE* , 4 (2), pp. 15-22;

104. Giummarra, M.J., Gibson, S.J., Georgiou-Karistianis, N., Bradshaw, J.L., (2007), Central mechanisms in phantom limb perception: the past, present and future, *Brain Res Rev* 54, pp. 219-232;
105. Gomboş, L., (2012), *Tehnica şi metodica pregătirii portarului în jocul de handbal*, Editura Casa de Ştiinţă, Cluj-Napoca, p. 77;
106. Gorostiaga, E.M., Granados, C., Ibáñez, J., González-Badillo, J.J., Izquierdo, M., (2006), Effect of an entire season on physical fitness changes in elite male handball players, *Medicine and Science in Sports and Exercise,* 38(2), pp. 357–366;
107. Gorostiaga, E.M., Granados, C., Ibáñez, J., Izquierdo, M., (2005), Differences in physical fitness and throwing velocity among elite and amateur male handball players, *Journal of Sports Medicine,* 26(3), pp. 225–232;
108. Granados, C., Izquierdo, M., Ibáñez, J., Bonnabau, H., Gorostiaga, E.M., (2007), Differences In Physical Fitness And Throwing Velocity Among Elite And Amateur Female Handball Players, *Int J Sports Med,* 28(10), pp. 860–867;
109. Granados, C., Izquierdo, M. Ibáñez, J, Bonnabu, H., Gorostiaga, E.M.,(2008), Effects of an entire season on physical fitness in ellite women's handball players, *Med Sci Sports Exerc,* 40(2), pp. 351–361;
110. Gribble, H., (2004), Effect of Lower-Extremity Fatigue on Postural Control, *Archives of Physical Medicine and Rehabilitation,* 85(4), pp. 589-592;
111. Gribble, P.A., Tucke,r W.S., Whit, P.A., (2007), Time-of-day influences on static and dynamic postural control, *J Athl Train* 42, pp. 35–41;
112. Gruić, I., Vuleta, D., Milanović, D., (2006), Performance indicators of teams at the 2003 men´s world handball championship in Portugal, *Kinesiology*, 38(2), pp. 164-175;
113. Gstöttner, M., Neher, A., Scholtz, A., Millonig, M., Lembert, S., Raschner,C., (2009), Balance ability and muscle response of the preferred and nonpreferred leg in soccer players,motor control, *Human Kinetics*,13, pp. 218-231;
114. Guskiewicz, K.M., (2011), *Regaining postural stability and balance in rehabilitation technique for sports medicine and athletic training*. In WE? Prentice, Mc Graw-Hill, New York, pp. 144-173;
115. Gutierrez, A.O., Ruiz Gomez, J.L., Ramis, J., (2011), Claverising DEA to assess the efficiency of handball teams, *EHF Scientific Conference,* Vienna, 18-19 November, pp. 248-25;
116. Haibach, P.S., Reid, G., Collier, D.H., (2011), *Motor Learning and Development,* Human Kinetics, pp. 6-7;
117. Hantău, C., (2000), Handbal, Editura Alphina, Bucureşti, pp. 76; 78; 79; 52;
118. Hantău, C., (2004), *Handbal. Antrenamentul copiilor şi juniorilor*, Editura Printech, Bucureşti, pp. 52; 76; 78; 79;
119. Hantău, C., (2011), Evaluating the maximum instantaneous anaerobic power (miap) and the maximum anaerobic power (map) in handball players, *EHF Web Periodicals*, pp. 1-7;
120. Hasan, A.A., Reilly, T., Cable, N.T., Ramadan, J., (2007), Anthropometric profiles of elite Asian women's handball players, *J Sport Med Phys Fitness,* 47(2), pp. 197-202;
121. Hasan, A.A.A., Rahaman, J.A., Cable, N.T., Reilly, T., (2007), Anthropometric profile of elite male handball players in Asia, *Biology Sport,* 24, pp. 3–12;
122. Hatzimanouil, D., Oxizoglou, N., (2004), Evaluation of the morphological characteristics and motor skills in the national junior handball teams of Greece and Yugoslavia, *Journal of Human Movements Studies*, 46, pp. 125-140
123. Hianik, J., (2011), The team mach performance indicators and there evolution in handball, *EHF Scientific Conference*, Vienna, 18-19 November, pp. 252-256;

124. Hill-Haas, S.V., Dawson, B., Impellizzeri, F.M., Coutts, A.J., (2011), Physiology of small-sided games training in football: a systematic review, *Sports Medicine* 41(3), pp. 199-220;
125. Hirtz, P., Starosta, W. ,(2002), Sensitive and critical periods of motor co-ordination development and its relation to motor learning, *Journal of Human Kinetics*, 7, pp. 19 – 28;
126. Horghidan, V., (2000), *Problematica psihomotricităţii*, Editura Globus, Bucureşti, pp. 143; 146;
127. Igorov-Boşi, M., (2009), *Handbal. Metodica antrenamentului. Curs universitar*, A.N.E.F.S., Bucureşti, p. 119;
128. Ilić, D., Drašković, V., Marković, S. (2009). *Selection of students for handball gifted teaching physical education*, In Book of Abstracts 5-th FIEP Euoropean congress, 2-nd Serbian congress of P.E. Teachers (52). Niš: Ministry of youth and sport, Minisrty of science and technological development ministry of education;
129. Impellizzeri, F.M., Marcora, S.M., Castagna, C., Reilly T., Sassi, A., Iaia, F.M., (2006), Physiological and performance effects of generic versus specific aerobic training in soccer players, *International Journal of Sports Medicine*, 27(6), pp. 483-492;
130. Iturii, J.J.G., (2003), *Proprioception and coordination in rehabilitation of sports injuries*, In WR Frontera(ed.), Rehabilitation of sports injuries: scientific basis, Blackwell Science, pp. 274-284;
131. Johnson, E.O., Zoubos, A.B., Soucaco, P.N., (2005), Regeneration and repair of peripheral nerves, *Injury, Int. J. Care Injured*, 36(4), pp. S24-S29;
132. Johnson, E.O., Vekris, M.D., Zoubos, A.B., Soucacos, P.N., (2006), Neuranatomy of the brachial plexus: the missing link in the continuity between the central and peripheral nervous systems, *Microsurgery, Pub Med,* 26(4), pp. 218-29;
133. Jullien H., Bisch C., Largouet N., Manovrier C., Carling C.J., et al. (2008), Does a short period of lower limb strength training improve performance in field-based tests of running and agility in young professional soccer players?, *J Strength Cond Res*, 22(2), pp. 404-411;
134. Karras, D., MihăilăI., Ghervan P., (2007), Orientations, current and long-term tendencies in the handball of high performance, *Citius Altius Fortius -Journal of Physical Education and Sport*, 7(4), pp. 24-25;
135. Katic, R., Cavala, M., Srhoj, V., (2007), Biomotor Structures in Elite Female Handball Players, *Coll. Antropol.*, 3, pp. 795–801;
136. Katzamanidis, Ch., Chatsikotoulas, K., Giannakos, A.,(2000), Optimisation of the training plan of the handball game, *Web: EHF Periodicals – Viena* , pp. 49-55;
137. Kendall, F.P, Mc Creary, E.K., Provance, P.G., Rodger, M.M., Romani, W.A., (2005), *Posture în muscles testing and function with posture and pain,* William & Wilkins: Baltimore, pp. 51-105;
138. Koga, H., Nakamae, A., Shima, Y., Iwasa, J., Myklebust, G., Engebretsen, L., Bahr, R., Krosshaug, T., (2010), Mechanisms for Noncontact Anterior Cruciate Ligament Injuries, *The American journal of Sports Medicine*, 20(10), pp. 1-9;
139. Kumar, P., (2014), A Comparative study of agility among handball and basketball male player, *International Journal Of Science And Research*, 3(2), pp. 256-257;
140. Laguna, M. and Torrecusa, L., (2000), La detección y seguimiento de jugadores en balonmano, *Revista de la asociación de entrenadores de balonmano,* p. 14;
141. Lee, A., Lin, W., Huang, C., (2006) Impaired proprioception and poor static postural control in subjects with functional instability of the ankle, *J Exerc Sci Fit 4*, pp. 117–125;

142. Lică, M.E., 2011*, Strategii de optimizare a prregătirii fizice a voleibaliştilor juniori bazate pe evaluări neuromusculare*, Teză de doctorat, Piteşti, p. 36;
143. Lephard, S., Swanik, C.B., Fu, F., Huxel, K., (2011), *Reestablishing Neuromuscular Control*. In: WE Prentice(ed.). Rehabilitation Technique for Sports Medicine and Athletic Training, McGraw-Hill, New-York, pp. 122-143;
144. Lidor, R., Falk, B., Arnon, M., Cohen ,Y., Segal, G., Lander, Y., (2005), Measurement of talent in team handball: The questionable use of motor and physical tests, *J Strength Cond Res.*, 19, pp. 318–325;
145. Lihalle, H., (1998), *Psychologie des adolescents*, PUF, Paris, p. 41;
146. Little, T., Williams, A.G., (2005), Specificity of acceleration, maximum speed, and agility in professional soccer players, *J Strength Cond Res*, 19(1), pp. 76-78;
147. Luigi, P., Manchado-Lopez, C., Perse, M., Kristan, M., Schander, I., Zimmermann, M. (2008), *Motion characteristics according to playing position in international men's team handball*, 13th Annual Congress of the European College of Sports Science, Portugal-Estoril, Book of Abstract, p. 255;
148. Malina, R.M., Ribeiro, B., Aroso,J., Cumming, S.P., (2007), Characteristics of youth soccer Players aged 13-15 years classified by skill level, *British Journal of Sports Medicine*, 41(5), pp. 290-295;
149. Malinzak, R.A., Colby, S.M., Kirkendall, D.T., Yu, B., Garrett, W.E., (2001*)*, A comparison of knee joint motion patterns between men and women in selected athletic tasks, *Clin. Biomech*. (Bristol, Avon), 16(5), pp. 438-445;
150. Manchado, C., Hoffmann, E. Valdivieso, F., Platen, P., (2007), Beanspruchungsprofil im Frauenhandball—Belastungsdauer und Herzfrequenzverhalten bei Spielen der Nationalmannschaft, *Deuts Zeitschr Sportmed* 58(10), pp. 368–373;
151. Manchado, C., Vila, H., Rodriguez, N., Abraldes, J.A., Ferragut, C., (2012), Anthropometric Profiles of the Different Spanish Women's National Teams, *In EHF Web Periodical*, pp 1-6;
152. Manno, R., (1996), *Bazele teoretice ale antrenamentului sportiv*, Editura Revue E.P.S., 1992, tradusă de C.C.P.S., S.D.P. 371-374, Bucureşti;
153. Manole, V., (2008), *Condiţia fizică în handbalul feminin*, Editura Pim, Iaşi, p. 22;
154. Marczinka, Z., (2011), What's the difference? Coaching femmale and male handball players, *EHF Scientific Conference*, Vienna, 18-19 November, pp. 89-93;
155. Marques, M.C., van den Tilaar, R., Vescovi, J.D., Gonzalez-Badillo, J.J., (2007), Relationship Between Throwing Velocity, Muscle Power, And Bar Velocity During Bench Press In Elite Handball Players, *Int J Sports Physiol Perform*, 2, pp. 414–422;
156. Massuça, L., Fragoso, I., (2011), Do coaches from different handball contexts assume the same success criteria to identify high potential handball athletes?, *EHF Web Periodical*, pp. 1-28;
157. Massuça, L.M., (2011), Expertise evolution of technical and tactical proficiency in handball: differences between playing status, *EHF Scientific Conference*, Vienna, 18-19 November, pp. 282-286;
158. Matthew, G.G., (1997), Brain motor mechanisms, In: Matthews G G, editor, *Neurobiology: Molecules, Cells & Systems*, Blackwell Science Inc; Malden, MA, p. 234;
159. Matsuda, S., Demura, S., Nagasawa, Y., (2010), Static one-legged balance in soccer players during use of a lifted leg, *Perceptual and Motor Skills*, 111, pp. 167-177;
160. Michalsik, L.B., Madsen, K., Aagaard, P., (2011), Activity Match Profile and Physiological Demands in Female Elite Team Handball, *EHF Scientific Conference*, Vienna, Austria, 18-19 November, pp. 162-167;

161. Mihăilescu, L., Mihăilescu, N., (2002), *Instruirea programată în atletism,* Editura Universității din Pitești, Pitești, p. 14;
162. Mihăilă, I., (2005), *Profilul jucătorilor pe posture şi implicaţiile lui în realizarea condiţiei fizice specific la handbaliştii junior, Teză de doctorat*, Piteşti, p. 47;
163. Mihăilă, I., Creţu M., Popescu D., Gionea, B., (2014), The role of athletics specific means in sports team training, *4th World Conference on Educational Sciences, 02-05 February , Barcelona, Spain, Procedia -Social and Behavioral Sciences,* 46, pp. 4151 –4153;
164. Mihailoff, G. A., Haines, D. E., (1997), Motor system I: peripheral sensory, brainstem and spinal influence on ventral horn neurons, In: Haines D E, Ard M D, editors. *Fundamental Neuroscience*, Churchill Livingstone Inc, New York, NY, . pp. 335–346;
165. Milanese, C., Piscitelli, F., Lampis, C., Zancanaro, C, (2012), Effect of Competitive Season on Anthropometry and Body Composition in Female Handball Players**,** *Biol. Sport,* 29, pp. 199-204;
166. Milanese, C., Piscitelli, F., Lampis, C., Zancanaro, C., (2011), Anthropometry and body composition of female handball players according to competitive level or the playing position, *Journal of Sports Sciences,* 29(12). pp. 1301–1309;
167. Milanović, D. (2007), *Training theory*, Zagreb: Faculty of Kinesiology;
168. Mohamed, H.,Vaeyens R., Matthys S., Multael M., Lefevre J., Lenoir M., Philppaerts R., (2009), Anthromopetric and Performance Measures for the Development of A Talent Detection and Indification Model in Youth Handball, *In Journal of Sport Sciences,* 27(3), pp. 257-266;
169. Moncef, C., Dagbaji,G., Abdallah, A., Mohaamed, S., (2011), The Offensive Efficiency of the High-Level Handball Players of the Front and the Rear Lines**,** *Asian J Sports Med*., 2(4), pp. 241–248;
170. Monea, G, Monea, D., (2010), *Selecţia şi orientarea în sportul de performanţă*, Editura Mido Print, Cluj-Napoca, p. 110;
171. Moreno, E., (1995), Developing quickness part 2, Strength and Conditioning, 17, pp. 38-39;
172. Munteanu, A., (2003), *Psihologia copilului şi adolescentului*, Editura Augusta, Timişoara, p. 94;
173. Munteanu, A., (2003), *Psihologia copilului şi adolescentului*, Editura Augusta, Timişoara p. 234; 238; 242; 243; 245; 248; 246-251;
174. Murray, P. F., (1996), *Psychology and speed,* New Studies in Athletics, 11(2 3), pp.115-120;
175. Myer, G.D., Ford, K.R., Palumbo, J.P., Hewett, T.E., (2005) Neuromuscular training improves performance and lower-extremity biomechanics in female athletes, *Journal of Strength and Conditioning Research,* 19(1), pp. 51–60;
176. Myklebust, G., Engebretsen, L., Brækken, I., H., Skjølberg, A., Olsen, O.,E., Bahr, R., (2003), Prevention of Anterior Cruciate Ligament Injuries in Female Team Handball Players: A Prospective Intervention Study Over Three Seasons, *Clinical Journal of Sport Medicine*, 13, pp. 71–78;
177. Neagu, N., (2010), *Teoria și practica activităților motrice umane,* Editura University Press, Tîrgu Mureș, p. 57;
178. Neagu, V., Mihăilă, I., Drăgan, A., Smerea, M., (2011), Study of the individualisation players în performance handball, *Scientific Report Series Phisycal Education and Sport, Piteşti,* 15(1), pp. 1025-1027;
179. Nicu, A. (coordonator), (2002), *Enciclopedia educaţiei fizice şi sportului*, Editura Aramis, Bucureşti, p. 95; 121;

180. Niederseer, D., Mörtl, H., Liebensteiner, M.C., Egger, A., Thaler, C.W., Plöderl, M., Niebauer, J., Raschner, C., (2014) General Fatigue and Joint Position Sense in Male Elite Handball Players, *DEUTSCHE ZEITSCHRIFT FÜR SPORTMEDIZIN*, 65(6), pp. 149-153;
181. Norton, K., Olds, T., (2001), Morphological Evolution Of Athletes Over The 20th Century: Causes And Consequences, *Sports Med*, 31(11), pp. 763–783;
182. Noutsos, K., Koutouloulis, A., Kororos, P., Bayios, I., (2004), Morphological Characteristics Of Greek Female Handball Players, *Health and Sport Performance*, 3(3), pp. 177-192;
183. Ochiană G., (2006), *Ludoterapie în recuperarea dizabilităţilor psihoneuromotorii ale copiilor*, EdituraPerformantica, Iaşi , p. 62;
184. Ohnjec, K, Vuleta, D, Milanović, D, Gruić, I., (2008), Performance indicators of teams at the 2003 world handball championship for women in Croatia, *Kinesiology*, 40(1), p. 69-79;
185. Paillard, T., Noé, F., Rivière, T., Marion, V., Montoya, R., Dupui, P.,(2006), Postural performance and strategy in the unipedal stance of soccer players at different levels of competition, *Journal of Athletic Training*, 41, pp. 172-176;
186. Palmieri, R.M., Ingersoll, C.D., Stone, M.B., Krause, B.A., (2002), Center-of-pressure parameters used in the assessment of postural control. *Journal of Sports and Rehabilitation*, pp. 51-66;
187. Pánics, G., Tállay, A., Pavlik, A., Berkes, I., (2008), Effect of proprioception training on knee joint position sense in female team handball players, *Br. J. Sports Med*, 42, PP. 472-476;
188. Perš, J., Bon, M., Kovayiy,S., Šibila, M., Dežman, B., (2002), Observation And Analysis Of Large-Scale Human Motion, *Hum Mov Sci.*, 21(2), pp. 295-311;
189. Petković, D., (2008), *Sports training. In Serbian*, Nis, University of Nis.;
190. Pezerat-Correia, P., Valamantos, M., Francisco, A., Santos, P., (2007), Influence of position roles on upper limb force parameters in young male handball players, *Journal of Sports Medicine and Exercise Science.*, 39(suppl.), p. 216;
191. Piţigoi, G., (2010), Coordonatele metodologice de elaborare a proiectelor individuale de pregătire, *Discobolul-Revista UNEFS de Cultură, Educaţie, Sport şi Kinetoterapie,* 4(22), pp. 80-88;
192. Platonov, N.V., (1996), *Allenamento sportivo. Teoria e metodologia*. Calzetti Mariucci Editori, Perugia, p. 197;
193. Pokrajac, B., (2008), EHF Men's Euro 2008 Analysis, discussion, comparison, tendencies in modern Handball., *Publisher: EHF Web Periodical,* pp.1-15;
194. Popa, G., (1999), *Metodologia cercetării ştiinţifice în domeniul educaţiei fizice şi sportului*, Editura Orizonturi Universitare, Braşov, p. 126;
195. Popescu-Neveanu, P. (1978), *Dicţionar de psihologie*, Editura Albatros, Bucureşti, p. 26;
196. Pori, P., Bon, M., Sibila, M., (2005), Jump shot performance in team handball. A kinematic model evaluated on the basis of expert modeling, *International Journal of Fundamental and Applied Kinesiology*, 37(1). pp. 40-49;
197. Pramanick, P., (2011), *Determine the relationship of selected coordinative abilities to the performance in badminton;*
198. Prisăcaru I. R., Marinescu Gh., (2010), Analysis of tactics and offensive playing systems in elite European teams, in vue of optimizing attack for Romanian -top handball male teams, *Discobolul –Revista UNEFS de cultură, educaţie, sport şi kinetoterapie*, Anul VI, 4 (22), pp. 30-40;

199. Proske, U., Gandevia, S.C., (2012), The proprioceptive senses: their roles in signaling body shape,body position and movement,and muscle force, *Physiol Rev 92,* pp. 1651-1697;
200. Punnoose, A., Gallagher, C., Matthews, J., Khanduja, V., (2015), Rehabilitation of a National Taekwondo Player Following Arthroscopic Hip Surgery: Successfully Achieving a Return to Gold Medal Winning Performance Levels, *J Nov Physiother*, 5(2), pp. 1-5;
201. Reiman, M., P., Manske, R.C., (2009), *Functional testing în human performance* , Human Kinetics, pp. 115-116; 160; 192; 196; 199, 201;
202. Ricotti,L., (2011), Static and dynamic balance in young athletes, *Journal Of Human Sport & Exercise* ,6(4), pp. 616-628;
203. Riva, D., Rocca, R., B., F., Mamo, C., (2015), Proprioceptive training and injury prevention in a professional men's basketball team: a six-year prospective study, *The Journal Of Strength And Conditioning Research*, pp. 1-23;
204. Riegerová, J., Přidalová, M., Ulbrichová, M. (2006), *Aplikace fyzické antropologie v tělesné výchově sportu (příručka funkční antropologie)*. Olomouc: HANEX, p.262;
205. Riemann, B.L., Lephart, S.M., (2002) The Sensorimotor System, Part II: The Role of Proprioception in Motor Control and Functional Joint Stability, *Journal of Athletic Training*, 37(1), pp. 80–84;
206. Rogulj, N., (2000), Differences in situation-related indicators of handball game in relation to the achieved competitive results of the teams at 1999 World Championship in Egypt, *Kinesiology*, 32(2), pp. 63-74;
207. Rogulj, N., Srhoj, V., (2009), Influence of the collective attack tactics on handball match outcome, *Fizička kultura*, 37, pp. 15-20;
208. Rogulj, N., Srhoj, V., Nazor, M., Srhoj, L., Čavala, M., (2005), Some Anthropologic Characteristics of Elite Female Handball Players at Different Playing Positions, *Coll. Antropol*, 29 (2), pp. 705–709;
209. Rogulj, N., Srhoj, V., Srhoj, L., (2004), The contribution of collective attack tactics in differentiating handball score efficiency, *Collegium Antropologicum,* 28(2), pp. 739-746;
210. Romero-Franco, N., Gallego-Izquierdo, T., Martinez-López, E., J., Hita-Contreras, F., Catalina, O., P., M., Martinez-Amat, A., (2014), Postural Stability and Subsequent Sports Injuries during Indoor Season of Athletes, *J Phys Ther Sci.*, 26(5), pp.683-687;
211. Röijezon, U., Clark, N.,C., Treleaven, J., (2015), Proprioception in musculoskeletal rehabilitation. Part 2: Clinical assessment and intervention, *Manual Therapy*, 20(3), pp.378–387;
212. Saeterbakken, A.H., van den Tillaar, R., Seiler, S., (2011), Effect of corestability training on throwing velocity in women's handball players, J *Strenght Cond Res*, 25(3), pp. 712-718;
213. Sassi, R., Reilly, T., Impellizzeri, F., (2004), A comparison of small-sided games and interval training in elite professional soccer players, *Journal of Sports Sciences*, 22, pp. 521-566;
214. Sayers, M., (2000), Running techniques for field sport players, *Sports Coach, Autumn,* 23, pp. 26-27;
215. Sbenghe, T. (2008) , *Kinesiologie. Ştiinţa mişcării*, Bucureşti, Editura Medicală, p. 344; 365; 366; 375;
216. Schiopu U, Verza E, (1989), *Adolescenţă personalitate şi limbaj*, Editura Albatros, Bucureşti p. 99;
217. Schiopu, U., Verza, E., (1997), *Psihologia vârstelor. Ciclurile vieţii. Ediţia a III-a*, Editura Didactică şi pedagogică, Bucureşti, p. 218;

218. Seamon, J.G, Kenrik, D.I., (1992), Psichology Prentice Hall, *Serbian Journal of Sports Sciences,* 3(1-4), pp. 53-60;
219. Sevreza, V., Bourdin, C., (2015), On the Role of Proprioception in Making Free Throws in Basketball, *Research Quarterly for Exercise and Sport*, 86(3), pp. 1-7;
220. Shaw, M.Y., Gribble, P.A., Frye, J.L., (2008), Ankle bracing, fatigue, and time to stabilization in collegiate volleyball athletes, *Journal of Athletic Training*, 43, pp. 164-171;
221. Sherrington, C.S., (1906), On the proprioceptiv system, especially in its reflex aspect, *Brain*, 29, pp 467-482;
222. Sheppard, J.M., Young, W.B., (2006), Agility literature review: Classifications, training and testing, *Journal of Sports Sciences*, 24(9), pp. 919-932;
223. Sheppard, J.M., Young, W.B., Doyle, T.L., Sheppard, T.A., Newton, R.U., (2006), An evaluation of a new test of reactive agility and its relationship to sprint speed and change of direction speed, *J Sci Med Sport*, 9, pp. 342–349;
224. Šibila, M., Pori, P., (2009), Position-Related Differences in Selected Morphological Body Characteristics of Top-Level Handball Players, *Coll. Antropol.*, 33(4), pp. 1079-1086;
225. Šibila, M., Pori, P., Bon, M., (2003), Basic kinematic differences between two types of jump shot techniques in handball, *Acta Univerisita Palacki Olomuc*, 33(1), pp. 19-26;
226. Šibila, M., Vuleta D., Pori, P. (2004), Position-related differences in volume and intensity of large-scale cyclic movements of male players in handball, *Kinesiology*, 36(1), pp. 58-68;
227. Simion G, Amzăr, L., (2009), *Human movement science research*, University of Piteşti Publishing House;
228. Simion, G., Stănescu,G., Mihăilă, I., (2011), *Antrenament sportiv concept sistematic*, Editura Ovidius universityPress, Constanţa, p. 19, 20, 50;
229. Sion, G., (2003), *Psihologia vârstelor*, Editura Fundaţiei României de Mâine, Bucureşti p. 191; 192; 193; 238;
230. Skoufas, D., Kotzamanidis, C., Hatzikotoylas, K., Bebetsos, G., Patikas, D., (2003), The relationship between the anthropometric variables and the throwing performance in handball, *J. Hum. Mov. Stud*., 45, pp. 469-484;
231. Smetacek, V., Mechsner, F., (2004), Making sense, *Nature, Pub Med*, 4, 432(7013), p.21;
232. Smîdu,N., (2014), The importance of coordinative abilities in achieving athletic performance, *Maraton*, 4(1), pp. 91-95;
233. Sotiriu, R., (2000), *Handbal. De la iniţiere – la performanţă*, Bucureşti, p.45, 99;
234. Sporis, G., Jukic, I., Milanovic, L., Vucetic, V., (2010), Reliability and factorial validity of agility tests for soccer players, *J Strength Cond Res*, 24(3), pp. 679–686;
235. Srhoj, V., (2002), Situational Efficacy of Anthropomotor Type of Young Female Handball Plyers, *Coll. Antropol.*, 26(1), pp. 211-218;
236. Srhoj, V., Marinović, M., Rogulj, N., (2002), Position Specific Morphological Characteristics of Top-Level Male Handball Players, *Coll. Antropol*., 26(1), pp. 219-227;
237. Srhoj, V., Rogulj, N., Katić, R., (2001), Influence of the attack end conduction on match result in handball, *Coll. Antropol.*, 25(2), pp. 611-617;
238. Srhoj, V., Rogulj, N., Zagorac, N., Katić, R., (2006), A new model of selection in women's handball, *Coll. Anropol*., 30 (3), pp. 601-605;
239. Stanković, V., Malacko, J., (2011), Effect of morphological characteristics and motor abilities on the development of coordination abilities of boys aged 11-12, *Acta kinesiologica*, 5(1), pp. 12-15;

240. Starosta,W., (2006), The concept of modern training in sport, *Physical Culture And Tourism*, 13(2), pp. 9-23;
241. Stillman, B.C., (2002), Making Sense of proprioception: The meaning of proprioception, kinaesthesia and related terms, *Physioterapy*, 88(11), pp. 667-676;
242. Subasi, S.S., Gelecek, N., Aksakoglu, G., (2008), Effects of different warm-up periods on knee proprioception and balance in healthy young individuals, *J Sport Rehab.*, 17, pp. 186–205;
243. Şchiopu U., Verza E., (1995), *Psihologia vârstelor. Ciclurile vieţii*, Editura Didactică şi Pedagogică, Bucureşti, p. 42; 203;
244. Şiclovan, I., (1972) , *Teoria educaţiei fizice şi sportului,* Editura Stadion, Bucureşti, p. 389;
245. Taborski, F., Pollany, W., (2000), 15th Women's World Championship in Italy, *Web: EHF Periodicals – Viena*, pp. 18-24;
246. Táborský, F. (2007), The body height and top team handball players, *EHF web Periodical, September*, pp. 1-6;
247. Taborsky, F., (2008), Cumulative indicators of team playing performance in handball (Olympic Games Tournaments 2008), *EHF Web Periodical, Viena-Austria*, pp.1-10,
248. Táborský, F., (2011), Competitive Loading in Top Level Handball and the Consequences for Training (Survey Study), *EHF Web Periodical*, pp. 1-11;
249. Taborsky, F., (2011), Phenomenon Handball, *EHF Scientific Conference, Vienna, 18-19 November*, pp. 7-13;
250. Teodorescu, L.,(1975), *Probleme de teorie şi metodică în jocurile sportive*, Editura Sport-Turism, Bucureşti, p. 175;
251. Teodorescu, S., (2009), *Periodizarea şi planificarea în sportul de performanţă*, Editura Alpha MDN, Buzău, p. 25;
252. Teodorescu, S., (2009), *Antrenament şi competiţie*, Editura Alpha MDN, Buzău, p.16, 25, 28, 47, 77, 89, 92;
253. *Terminologia educaţiei fizice şi sportului*,(1974), Editura Stadion, Bucureşti, p. 355;
254. Trofin, E, Grigorovici, S., Leonte, M.,(1979), *Curs de specializare handbal, Probleme de antrenament*, Centrul de Multiplicare al Universităţii din Bucureşti, p. 53;
255. Tsitskarsis, G., Theoharopoulus, A., & Garefis, A. (2003), Speed, speed dribble and agility of male basketball players playing in different positions, *Journal of Human Movement Studies*, 45, pp. 21-30;
256. Tudor, V. (1999), *Capacităţile condiţionale, coordinative şi intermediare-componente ale capacităţii motrice*, Editura RAI, Bcureşti, p. 121; 124; 125;
257. Turcu, F., (2004), *Curs de psihologie şcolară*, Bucureşti, p. 19; 22;
258. Turdean M., Prodan L.,(2012g), *Bazele statisticii. Manual de studiu individual,* Editura Pro Universitaria, Bucureşti, p.15;
259. Urban, F., Róbert Kandráč, R. František Táborský, F.,(2013), Positio-Specific Categorization of somatotypes: 2011 Women's 17 European Handball Championship, EHF Web Periodical Activities, Austria pp. 1-9;
260. Urban, F., Kandráĉ, R., Táborský, F., (2011), Position-Related Changes in Somatotypes of Top Level Male Handball Players: 1980 and 2010, *EHF Scientific Conference: Science and Expertise in Handball (Scientific and practical approaches)*, pp. 214-218;
261. Van den Tillaar, R., Ettema, G., (2003), Influence of instruction on velocity and accuracy of overarm throwing, *Perceptual and Motor Skills*, 96(2), pp. 423-434;
262. Van den Tillaar, R., Ettema, G., (2004), Effect Of Body Size And Gender In Overarm Throwing Performance, *Eur J Appl Physiol*, 91(4), pp. 413–418;

263. Van den Tillar, R., Ettema, G., (2004), A Force-velocity relationship and coordination patterns in overarm throwing, *Journal of Sport Science and Medicine,* 3(4), pp. 211-219;
264. Vargas, R.P., Dick, D.D., de Santi, H., Duarte, M., da Cunha Júnio, A.T., (2008), Evaluation of physiological characteristics of women's handball athletes, *Fitness Perform J (Online Edition),* 7(2), pp. 93–98;
265. Vărzaru, C. G., Igorov, M.A.,(2014), Statistical Model of the Wing Player who Participated in the Women European Handball Championship, Serbia 2012, *Procedia-Social and Behavioral Sciences*,117, pp. 346–351;
266. Velciov, P., (1994), *Psihologia vârstelor. Partea I. Curs*, Tipografia Universităţii din Timişoara, p. 224; 226; 227; 228; 229; 230; 231;
267. Verstegen, M., Marcello, B., (2001), *Agility and coordination*. In: High Performance Sports Conditioning. B. Foran, ed. Champaign IL, Human Kinetics, pp. 139–165;
268. Verza, E., Verza, F.E., (2000), *Psihologia vârstelor,* Editura Pro Humanitate, Bucureşti, pp. 185; 186; 189; 199; 200; 201;
269. Victor, L., (2010), *Dezvoltarea calităţilor motrice cu ajutorul metodelor modern şi a mijloacelor specifice jocului de fotbal în învăţământul liceal*, Editura Sfântul Ierarh Nicolae, ISBN 978-606-577-050-8, p. 49;
270. Vila, H., Manchado, C., abraldes, A., Alcaraz, P., Rodríguez, N., (2011), Anthropometric Profile in Female Elite Handball Players by Playing Positions, *EHF Scientific Conference 2011, Science and Expertise in Handball (Scientific and practical approaches),* Vienna, pp. 219-222;
271. Vila, H., Manchado, C., Rodriguez, N., Abraldes, JA., Alcaraz, PE., Ferragut, C., (2012), Anthropometric profile, vertical jump, and throwing velocity in elite female handball players by playing positions, *Journal of Strength Condition Resistence*, 26(8), pp. 2146–2155;
272. Virgil, T., (1999), *Capacităţile condiţionale, coordinative şi intermediare – componente ale capacităţii motrice,* Editura R.A.I., Bucureşti, pp. 133 – 134;
273. Visnapuu, M., Jürimäe, T., (2009), Relations of anthropometric parameters with scores on basic and specific motor tasks in young handball players, *Percept. Motor Skills*, 108(3), pp. 670-676;
274. Vlak, T., Pivalika, D., (2004), Hanball: The Beauty of the Best, *Croatian Medical Journal,* 45 (5), pp. 526-530;
275. Vlăduţ, R., Pîrvulescu ,V.N., (2001), *Semiologie şi noţiuni de patologie medicală pentru kinetoterapeuţi*, Craiova, Editura Sitech, , pp. 83-84;
276. Vuillerme, N, Nougier, V. ,(2004), Attentional demand for regulating postural sway: The effect of expertise in gymnastics, *Brain Research Bulletin,* 63, pp. 161-165;
277. Vuleta, D., Milanović, D., Sertić, H., (2003), Povezanost varijabli šutiranja na gol s konačnim rezultatom rukometnih utakmica Europskog prvenstva 2000 godine za muškarce, *Kinesiology*, 35(2), pp. 168-183;
278. Wang, Z., (2014), Proprioception influence on rhythmic gymnastics sport skills formation based on physiology theory, *Journal of Chemical and Pharmaceutical Research*, 6(1), pp.57-61;
279. Wagner, H., Müller, E., (2008), Motor learning of complex movements. The effects of applied training methods (differential and variable training) to the quality parameters (ball velocity, accuracy and kinematics) of a handball throw, *Sports Biomechanics*, pp. 54-71;
280. Weinberg, R.S., Gould, D., (1999), *Foundation of sport and exercise psychology, 2end edition*, Human Kinetics Publisher, Champaign, II, p. 538;
281. Weineck, J., (1995) – *Biologie du sport,* SDP, nr. 365-366;

282. Westin, S., D., Hermeto, A., Noyes, F., R., (2015), A Six-Week Neuromuscular and Performance Training Program Improves Speed, Agility, Dynamic Balance, and Core Endurance in Junior Tennis Players, *J Athl Enhancement*, 4(1), pp.1-8;
283. Young, W., Farrow, D., (2006), A review of agility:practical application for strength and conditioning, *Strength and Conditioning Journal*, 28(5), pp. 24-29;
284. Young, W. B., Hawken, M., & McDonald, L. (1996), Relation ship between speed, agility, and strength qualities in Australian rules football, *Strength and Conditioning Coach*, 4(4), pp. 3-6;
285. Young, W., James, R., Mont – Gomery, I., (2002), Is muscle power related to running speed with changes of direction?, *J. Sports Med. Phys. Fitness*, 42(3), pp. 282–288;
286. Young, W.B., McDowell, M.H., & Scarlett, B.J. (2001), Specificity of sprint and agility training methods, *Journal of Strength and Conditioning Research*, 15(3), pp. 315-319;
287. Zapartidis, I., Skoufas, D., Vareltzis, I., Christodoulidis, T., Toganidis, T., Kororos, P., (2009), Factors influencing ball throwing velocity in young women's handball players, *Open Sports Med J.*, 3, pp. 39–43;
288. Zapartidis, I., Toganidis, T., Vareltzis, I., Christodoulidis, T.,Kororos, P., Skoufas, D., (2009), Profile of young women's handball players by playing position, *Serbian J Sports Sci*, 3(1-4), pp. 53-60;
289. Zapartidis, I., Vareltzis, I., Gouvali, M., Kororos, P., (2009), Physical fitness and anthropometric characteristics in different levels of young team handball players, *The Open Sports Sci. J.*, 2, pp. 22-28;
290. Zech, A., Markus Hubscher, M., Vogt, L., Winfried Banzer, W., Hansel, F., Pfeifer, K., (2010), Balance training for neuromuscular control and performance enhancement: a systematic review, *Journal of athletic training*, 45(4), pp. 392–403;
291. Zilescu, Ş., (1968), *Adolescenţa*, Editura Didactică şi Pedagogică Bucureşti, p. 90;
292. Ziv, G., Lidor, R., (2009), Physical characteristics, physiological attributes, and on-court performances of handball players: *European Journal of Sport Science*, 9(6), pp. 375-386;
293. Zoltan, P., (2004), *Kinetoterapie în neuropediatrie*, Editura Arionda, Oradea , pp. 139-172;
294. Zoltan, P., (2009), *Rolul stretchingului în normalizarea funcţiei stato-kinetice*, Editura Corsan Iaşi, pp. 47-48;

WEB BIBLIOGRAPHY

1. http://activities.eurohandball.com, visited, iulie 2013
2. www.AMTI.biz
3. http://www.eurohandball.com/publications, visited, iulie 2013
4. http://www.newworldencyclopedia.org/entry/Proprioception
5. http://www.performbetter.com/webapp/wcs/stores/servlet/PBOnePieceView?storeId=10151&catalogId=10751&pagename=347ș
6. http://www.medtorrents.com/download/Dictionar_de_psihologie-Roland_Doron-Humanitas.pdf