“BABEŞ-BOLYAI” UNIVERSITY CLUJ-NAPOCA

FACULTY OF PHYSICAL EDUCATION AND SPORT

DOCTORAL SCHOOL OF PHYSICAL EDUCATION AND SPORT

IMPROVING SPORTS PERFORMANCE BY DEVELOPING SPEED AND COORDINATION IN JUNIOR FOOTBALLERS AGED 14-16

Doctoral thesis summary

Scientific advisor:

Prof. univ. dr. Emilia Florina GROSU

Candidate:

Radu Adrian ROZSNYAI

PART I

THEORETICAL-SCIENTIFIC FOUNDATION OF THE WORK

CHAPTER 1. INTRODUCTION AND ARGUMENT OF THE TOPIC

CHAPTER II. DEFINITION OF MOTOR QUALITY - SPEED

CHAPTER III. DEFINITION OF MOTOR QUALITY - COORDINATION

CHAPTER IV. BIO-PSYCHO-MOTOR EVOLUTION OF 14-16 YEAR OLD FOOTBALL PLAYERS

PART II

CHAPTER V. PRELIMINARY STUDY ON THE EVALUATION OF MOTOR AND PSYCHIC INDICES IN ORDER TO DETERMINE THE LEVEL OF SPORTS TRAINING

CHAPTER IX. GENERAL CONCLUSIONS OF THE EXPERIMENTAL RESEARCH

Keywords: football, junior, speed, coordination, improving performance, increasing speed, updating football training, psychological aspects in football, combined training

PART I

THEORETICAL-SCIENTIFIC FOUNDATION OF THE WORK
CHAPTER 1. INTRODUCTION AND ARGUMENT OF THE TOPIC

The importance and motivation of the topic

The nature of competition in sports games is inherently chaotic. Often, sports such as football, rugby, and field hockey have a fast-paced style of play, consisting of fast turns and frequent changes of direction (Duthie, Pyne, Marsh, & Hooper, 2006; Gregson, Drust, Atkinson, & Salvo, 2010; Jovanovic, Sporis, Omrcen, & Fiorentini, 2011; Murphy, Lockie, & Coutts, 2003). Because of this intermittent type of competitive effort, players in these sports rarely reach maximum running speed during the game (Cronin and Hansen, 2006; Murphy et al., 2003). Consequently, the ability to accelerate is a coveted skill in this segment of the sport.

Sports performance at this time can no longer be complete without an analysis of the entire training process, in accordance with the rigorous requirements in the field. Achieving sports performance is influenced and can take different forms, mostly depending on the nature of the means and methods used, the abilities of athletes, the material and financial resources available, the level of knowledge of the topic studied. The growing sports performances have managed to attract researchers in the field of sports, but also in other fields, bringing a visible contribution to athletes, who can have a complete, complex and optimal training to achieve the ideal in sports.

Even if the countless interdisciplinary "parts" intervene in the evolution of football players, we must not forget the quality of the act of sports training, which must be at an optimal level, allowing to achieve maximum performance in a relatively short time.

Updating the training program is an important objective of our scientific approach, the pedagogical tools we will use in training have the role of improving the performance of athletes and their mental state, as well as the role of increasing the level of attraction of training.

Motivation of the chosen topic

The personal interest, regarding this research topic, comes from the knowledge of the “Football” phenomenon and from the finding of some problems that start from the children's and junior centers in Romania, this junior period being the foundation of the evolution of football players.

The importance of the topic and its representation in the specialized literature

Research in the field of football shows that physical training has a fundamental role in achieving performance. Training planning and coordination is vital to achieving performance; all this planning must include the competitive schedule, the composition and level of the team, the objectives of the club, the game system and the level of opponents (Lopez et al., 2011).

CHAPTER II. DEFINITION OF MOTOR QUALITY - SPEED

Defining the concept of speed

Speed is a complex and complete action of the capacity of neuro-mechanical conditioning of the locomotor-neuro-mechanical system in solving a task that requires rapid resolution through a rapid response from the athlete (Platonov, 2013).

Speed is characterized by the way some limbs move (the legs of a runner or the arm of a hammer thrower). Speed is an integral part of every sport and can be expressed as one of the following: maximum speed, elastic endurance (strength) and endurance at speed (sustained speed) (Nesen, Pomeshchikova, Druz, Pasko & Chervona, 2018).

Increasing the speed of movement can be achieved by repeated sprints in short intervals. This will ultimately ensure the proper formation of neuromuscular pathways and the use of appropriate energy sources (Rearick, Creasy & Buriak, 2011; McKinlay, Wallace, Dotan, Long, Tokuno, Gabriel, et al., 2018).

Speed categorization

The speed of reaction is considered the speed of the body to respond to commands or the speed of action to various stimuli. (Gregson, Drust, Atkinson & Salvo, 2010; Jones, Bampouras & Marrin, 2009).
Execution speed: forms of manifestation of speed - if the number of repetitions always increases within the same unit of time or is maintained constantly reducing the overall execution time (Florescu et al., 1969)
The repetition speed is a variant of the execution speed, the movements (the same) are performed in a predetermined unit or time interval ”(Sandor, 2008)
Moving speed. It is a variant of the execution speed or of the repetition speed and this form of manifestation of speed is found in cyclic movements (Cronin & Hansen, 2006; Little & Williams, 2005; Lockie, Murphy, Schultz, Jeffriess & Callaghan, 2013). .
Acceleration and deceleration speed. Considered a variant of the repetition speed, it represents “the ability of the individual to accelerate to reach a maximum speed as quickly as possible” (Sandor, 2008; Kawamori, Newton, Hori & Nosaka, 2014). Deceleration in these sports can occur in response to the movements of other players or to stay in the playing area.

Uniform and uneven speed

According to Cârstea Gheorghe (2000), uniform and non-uniform speed has manifestations on the background of other forms such as the speed of repetition and movement. Very rarely can we speak of uniform speed in the execution of movements, because the execution of movements is kept very difficult to keep constant.

The importance of speed in sports games

Speed achieved during the sprint is perhaps the most coveted skill in the world of athletics. Sprinting has an obvious value in the world of track and field, but is at the same time a critical component in the whole variety of team sports. Sprint speed has been shown to differentiate ability levels to play in team sports, such as football (Black & Elmo, 1994; Fry & Kraemer, 1991), rugby (Gabbett, 2009; Gabbett et al., 2008), football. (Bangsbo et al., 1991; Cometti et al., 2001; Eniseler, Camliyer, & Gode, 1996; Gissis et al., 2006; Reilly, Williams, Nevill, & Franks, 2000), baseball (Hoffman, Vazquez, Pichardo , & Tenenbaum, 2009), basketball (Hoare, 2000; Hoffman, Tenenbaum, Maresh, & Kraemer, 1996; Shalfawi, Sabbah, Kailani, Tonnessen, & Enoksen, 2011), even ice hockey (Farlinger, Kruisselbrink, & Fowles, 2007; Krause et al., 2012; Peyer, Pivarnik, Eisenmann, & Vorkapich, 2011).

The concept of acceleration in sports games

Acceleration is the rate of change of speed that allows a player to reach maximum speed in a minimum amount of time (Little & Williams, 2005; Lockie, Murphy, Schultz, Jeffriess & Callaghan, 2013).

Despite the many methods of increasing acceleration, the most commonly used typical modalities include resistance training, plyometrics, weight sprints and sprints with changes of direction (Cronin, Hansen, 2006; Delecluse, 1997; Martinez-Valencia et al., 2015)

The role of speed in football

The current football game, compared to the classic one, is more complex, because it is characterized by speed, high intensity, game speed, dynamism, the players having more and more tasks during the game. In order to raise the players' abilities to the current requirements of the football game, it is necessary for them to receive appropriate training, training to comply with current requirements, using modern methods, but also in other fields such as physiology, biomechanics, psychology, biochemistry. (Abrantes et. Al., 2004, Baechle et. Al., 2008).

The whole process of learning, improving the game of football must be done at the age of junior, so this paper is focused on football players aged 14-16. Even if speed depends largely on hereditary baggage, winning a football game has as its main cause the athlete's ability to make specific speed efforts throughout the game. It is attested that the highest performances in football are obtained only by multilaterally developed players, fast,, skillful, strong, who have a good vision of the game and a quick thinking in the complicated moments during the football game (Ferro et. al., 2014, Köklü, Alemdaroglu, Özkan, Koz & Ersöz G., 2015).

Speed training in football

The goal of coaches, in most cases, is to accelerate the movement of the ball, increase the speed of movement of players, improve the speed of execution of various procedures and technical elements, a fact confirmed by the attacks in the game of football that have become much faster. speed of the ball from different areas of the field in others, at high speed, more and more frequent gaps resulting from counterattacks, more mobile defense, with tasks that require good training in terms of speed.

Investigations have confirmed that the dynamic force is correlated with a certain speed of movement. It has the maximum expression when the speed of movement is approx. 5 meters / sec. and can be maintained up to about 7 meters / sec. above this value, the influence of dynamic forces decomposes (Morente et al., 2003).

Following all these aspects, from the point of view of specialists in the field, speed can be improved, developed in training. The points mentioned above are just some of the peculiarities that the coach must take into account when planning the training program.

How fast a football player can move on the field depends on several factors, the way he trains, but also the hereditary factor, which makes its mark on his achievements (Jones, Bampouras & Marrin K, 2009).

Endurance and speed training

Although many trainers consider plyometrics and various running exercises to be the most effective methods of developing speed and sprinting, perhaps the most effective tool is endurance training. According to the Explanatory Dictionary of the Romanian language, sprinting is "acceleration of speed by a competitor (usually in the last phase of the course) at some sports competitions" (https://dexonline.ro/definitie/sprint). Therefore, the endurance of an athlete plays an important role in the sprint. There is a wealth of evidence showing a close relationship between maximum power and speed performance, especially sprinting (Baker, Nance, 1999; Barr, Sheppard, Agar-Newman, & Newton, 2013; Comfort, Bullock, & Pearson, 2012; Cunningham et al., 2013; Delecluse, 1997; Gissis et al., 2006; McBride et al., 2009; Seitz, Reyes, Tran, Saez de Villarreal, & Haff, 2014; Sleivert & Taingahue, 2004; Thomas, Confort, Chiang , & Jones, 2015). Consequently, the principle of progressive overload is often used as the main method of improving sprinting. In 2014, various meta-analyzes

conducted by Seitz et al. (2014) show that there is a link between lower body strength training and sprinting abilities.

CHAPTER III. DEFINITION OF MOTOR QUALITY - COORDINATION

Defining the concept of coordination

Coordination is "the ability of the human body to perform motor acts and actions, especially in various and unusual conditions, with maximum efficiency and minimum energy consumption by the performer" (Cârstea, 1999).

Tudor (2008) defines the ability to coordinate as "a psychomotor quality based on the correlation between the central nervous system and skeletal muscles during a movement."

Coordination, in its various forms of manifestation, is present in all acts and motor actions in the stages of learning, consolidation, improvement, as well as in their application in unusual conditions. (Dragnea, 1996).

Coordination categorization

According to Șandor (2008) the components of coordination are:

- 'Coordination capabilities;
- The capacity of spatio-temporary differentiation;
- Rhythmic capacity;
- Balance capacity;
- Motor learning ability;
- Ability to spatial orientation;
- Ability to lead movements;
- Ability to adapt and readjust motor skills;
- Ability to differentiate movements, etc. "

Coordination develops intensely due to the excitation process. In order to have a high efficiency in the development of coordination, it is necessary to focus on mastering as many motor skills as possible, the degree of difficulty of the exercises to be high, and the difficulty of the exercises to increase gradually. As methodological indications, according to the authors in the field, the rest between exercises must be large enough so that the recovery of athletes is complete, the workload, relatively small, childhood, puberty, adolescence being favorable periods for the development of coordination (Gil, Gil, Ruiz, Irazusta, & Irazusta, 2007).

Methodical procedures for development / education:

„- Performing motor acts and actions in constant conditions, obviously in a large number of repetitions and in a long time. Multiple "repetition" removes unnecessary muscle contractions and reaches the conditions involved in coordination;

- Carrying out motor acts and actions in complex conditions, in the sense of increasing the execution difficulties compared to the normal conditions;
- Performing motor acts and actions in variable conditions, to prevent any possible future situation, for example: practicing on different work surfaces (grass, slag, synthetic), practicing in normal and unfavorable atmospheric conditions, etc. " (Cârstea, 2000).

The mastery of coordination skills generates the intrinsic motivation of athletes.

According to Smith (1976), each action of the players on the field goes through three stages:
- Perceptual mechanism - the player collects information;
- Decision-making mechanism - the player decides how to act based on experience and knowledge;
- Execution mechanism - the ability to coordinate, to execute the action.

A well-developed coordination means better accuracy in the game, better orientation on the field, lucidity in the actions taken, this being the basic motor quality with the highest degree of complexity, without which you can not play football. At the basis of training and the development of coordination is speed, strength and endurance (Riera, 2001).

With the development of motor qualities, the body's capacity for effort increases. The ability acquired, in particular, in a training process, which aims to develop motor skills, improving them and determining the adaptation of the body's organs, functions and systems to a higher level of demand.

Defining agility

Walker and Turner's (2009) definition of agility is the ability to change direction quickly without losing balance, using a combination of power, strength and neuromuscular coordination. Given this aspect, agility was considered to be dependent on two sub-components, namely: perceptual and decision-making factors; as well as factors related to the mechanics of change of direction (Jones, Bampouras and Marrin, 2009).

The importance of agility in football is given by the fact that a sprint, regardless of distance, in a football match is rarely executed in a straight line. Depending on where the ball lands or the locations of opponents, changes of direction are a common variable in football (Balsom, 2007).

Growth, development, motor skills at the age of 14-16

The best method used for proper biological development of juniors is physical exercise, a fact confirmed by specialists in the field. Singer (1981), but also other specialists mention the stages of human life, in terms of the concept of age, as follows:
- chronological age: means the calendar date of human birth;
- biological age: represents the age of the human body and expresses the ratio of the functional capacities of the devices and systems with the normal static values;

- psychological age: represents the capacity of the individual's adaptability completed with self-image but also with the subjectivism of one's own reactions;
- social age: it is considered the relationship of the individual with peers, the structure of society having a determined influence in establishing its ranking;
- functional age: is the sum of the other previous classifications and is considered to be the actual age of the individual.

The effort in the game of football is a mixed one, the athlete during a match goes through aerobic and anaerobic efforts, the morphological characteristics, but also the psychological and physiological variables represent important landmarks in identifying the future practitioners of the game of football. (Croitoru & Șerban 2002).

Physiological and anatomical-morphological aspects of young football players

The period between 10 and 16 years is characterized by variations in the biological maturation of children and young people, which have repercussions on morphology and functional performance (Malina, 2004). In fact, during puberty, various morphological and physiological transformations improve performance and sports training. During this period of growth and development, the performance achieved is often limited by the state of biological maturity (Figueiredo, Gonçalves, Silva & Malina, 2009; Malina, Reyes, Eisenmann & Horta, 2000; Matthys & Craen, 2006). Studies indicate that young people in an advanced stage of maturation tend to achieve better functional performance and, as a result, are chosen by stakeholders during the process of selection and development of football players (Seabra, Maia, Garganta Crescimento, 2001, Malina, 2003).

The assessment of football-specific competencies has been important in the scientific research of the authors (Malina, Cumming, A. P. Kontos, Eisenmann, Ribeiro & Aroso, 2005). However, despite the use of different methods and protocols, studies have not been able to identify an association between football-specific skills and maturation (Malina, Cumming, AP Kontos, Eisenmann, Ribeiro & Aroso, 2005; Seabra, Maia, Garganta Crescimento , 2001; Figueiredo, Gonçalves, Silva & Malina, 2009; Malina, Reyes, Eisenmann & Horta, 2000).

From the literature, the available information focuses on the 11-14 age group (Malina, Cumming, AP Kontos, Eisenmann, Ribeiro & Aroso, 2005; Figueiredo, Gonçalves, Silva & Malina, 2009; Vaeyens, Malina, Janssens, Renterghem, Bourgois & Vrijens, 2006) and little is known about football players in the final period of puberty and their formal training for high sports performance (14-16 years).

The psychological profile of young football players in different game functions

In sports psychology, a mental ability is identified as a skill that regulates thoughts, feelings, and behaviors. It is a resource developed "in a specific task or a narrow class of tasks" (Famose & Durand, 1988). Various skills are needed to apply tactics and strategies learned during training and competitions, and athletes do not always have the tools to use and control their potential (Demontrond et al., 2006). In addition, these abilities can be modulated by different variables. One of the important variables that can be related to mental skills in football is the "game function". Each function has its own mental requirements. Few studies have examined players in different functions of the same sport and found links with mental abilities (Cox & Yoo, 1995). This will seem to be an important area of research, as the challenges of athletes differ from the position held in the team.

PART II

CHAPTER V. PRELIMINARY STUDY ON THE EVALUATION OF MOTOR AND PSYCHIC INDICES IN ORDER TO DETERMINE THE LEVEL OF SPORTS TRAINING

Prerequisites for preliminary research

Our concern was focused on improving sports performance in football players aged 14-16, by identifying opportunities to increase speed and coordination, as well as improve mental state. Also, the need to know the level of the subjects according to which training programs can be designed is a premise of our scientific approach.

The purpose of the preliminary research

Our concern is to check the working tools and present the quantifiable results regarding the level of motor skills and mental state of athletes, checking the potential for their improvement, in order to finally compose a program of exercises aimed at developing speed. and coordination skills, but also an improvement in mental state.

Preliminary research hypotheses

Our hypothesis assumes that by modifying the professional training plan of the juniors - by introducing various specific exercises - we will be able to increase their sports performance and, implicitly, will increase the competitive results.

Research methods

Method of studying the specialized bibliography (documentation method), Observation method, Experimental method, Test method, Questionnaire method, Statistical-mathematical method.

Research organization

Our preliminary study was conducted over a period of three months (September 2018-November 2018) and consisted of reviewing an intervention plan and applying tests to assess motor skills speed and coordination, as well as applying questionnaires to assess stress levels. of athletes. The tests were performed both at the beginning of the study period and at the end of it

The preliminary research was attended by athletes, legitimate football players of the clubs: "Football Academy Cluj-Luceafărul University", Cluj-Napoca, and football players of the Club "Sticla Arieșul Turda", from Turda.

To determine the level of coordination and speed, as well as to determine the mental level, we used three physical tests and a psychological questionnaire (The description of these tests can be found in subchapter 5.5.)

- Arrowhead Agility Drill test;
- Long jump from the spot;
- Running in sprint, in a straight line 30m;
- Stress scale (DASS).

Preliminary study intervention plan

In order to develop the speed of movement, we chose to introduce specific plyometric exercises, as well as sprints applied over different predefined distances, in order to develop the

sprint in endurance regime. These exercises are beneficial in developing not only speed but also endurance. To develop coordination and agility, we have chosen to introduce games and exercises specially created for this purpose.

CHAPTER VI. STATISTICAL PROCESSING OF PRELIMINARY RESEARCH RESULTS

1. Arrowhead Agility Drill test results

Arrow I - the route without ball (to the right)
Arrow II - the route without ball (to the left)
Arrow III - technical test with the ball at foot (to the right)
Arrow IV - technical test with the ball at foot (to the left)

Arrowhead Agility Drill at T1 (initial testing)

Table 1. Descriptive analysis of Arrowhead test scores and comparison of means (T1)

Ind	Gr	Average	ES	Mean	DS	Min	Max	*Statistical significance (p)*		Gr I – Gr II
Arrow I	**I**	8,76	0,1421	8,68	0,4493	8,21	9,63	**Lot I, I-II**	0,5423	I
	II	8,28	0,0787	8,38	0,2489	7,65	8,50	**Lot I, III-IV**	0,9838	0,0029
Arrow II	**I**	8,82	0,1449	8,80	0,4583	8,17	9,66	**Lot I, I-III**	< **0,0001**	II
	II	8,17	0,0786	8,23	0,2486	7,55	8,42	**Lot I, II-IV**	< **0,0001**	**0,001**
Arrow III	**I**	11,53	0,3706	11,48	1,1721	10,21	13,53	**Lot II, I-II**	0,1277	III
	II	10,33	0,1133	10,30	0,3582	9,69	10,81	**Lot II, III-IV**	0,8276	**0,0108**
Arrow IV	**I**	11,52	0,3147	11,41	0,9950	9,91	13,40	**Lot II, I-III**	< **0,0001**	IV
	II	10,28	0,2166	10,13	0,6848	9,21	11,54	**Lot II, II-IV**	< **0,0001**	**0,0045**

The results show that the two groups started from an almost identical level, in terms of agility and coordination with or without a ball at the foot. This is desirable, in that it gives us a chance to better observe the differences that may occur in the final test and thus helps us to validate the conclusions.

Arrowhead Agility Drill test at T2 (final test)

Table 2. Arrowhead Agility Drill test in the studied groups and statistical significance (T2)

Ind	Gr	Average	ES	Mean	DS	Min	Max	*Statistical signifacnce (p)*		Gr I – Gr II
Arrow I	**I**	8,90	0,1130	8,76	0,5055	8,19	9,92	**Lot I, I-II**	0,7754	**I**
	II	8,33	0,0786	8,36	0,3513	7,56	8,90	**Lot I, III-IV**	0,4249	**0,0002**
Arrow II	**I**	8,95	0,1206	8,84	0,5393	8,19	9,88	**Lot I, I-III**	**< 0,0001**	**II**
	II	8,31	0,0773	8,30	0,3455	7,60	8,99	**Lot I, II-IV**	**< 0,0001**	**< 0,0001**
Arrow III	**I**	10,91	0,1673	10,81	0,7481	9,30	12,44	**Lot II, I-II**	0,8147	**III**
	II	10,21	0,0868	10,22	0,3881	9,36	10,85	**Lot II, III-IV**	0,8253	**0,0008**
Arrow IV	**I**	11,09	0,1505	10,98	0,6729	9,97	12,40	**Lot II, I-III**	**< 0,0001**	**IV**
	II	10,30	0,1515	10,17	0,6777	9,18	12,20	**Lot II, II-IV**	**< 0,0001**	**0,0001**

There are statistically significant differences between the two groups (p <0.001) for all samples: no ball to the right (Arrow I), where p is equal to 0.0002; without ball to the left (Arrow II), where p <0.0001; with the ball at the right foot (Arrow III), where p is equal to 0.0008; and with the ball at the left foot (Arrow IV), where p is equal to 0.0001.

These results, as can be seen from the figure above (Fig. 21.), show us in fact that compared to the initial test there was a significant improvement of the experimental group compared to the control group, in all 4 samples of the Arrowhead Agility Drill test (left, right, with ball, without ball).

The importance of these results is considerable as our study focuses on both increasing travel speed and improving coordination, and the figures presented above show that subjects have increased their coordination skills and this result motivates us to continue experimental research.

Speed test on the distance of 30m - running in a straight line

At the statistical analysis of the speed values over the distance of 30m (30m) for unpaired samples no statistically significant differences were observed between the two groups at the first repetition (T1) (p> 0.05) but statistically significant differences were observed between the two batches at the second repetition (T2) (p <0.05).

These figures show that the subjects of the experimental group, following the submission to the intervention plan, significantly increased their speed compared to the control group, the maximum speed at the initial test being 4.90, and at the final test 4.63, value marked in green.

Table 3. Speed testing on the distance of 30m for the studied lots and statistical significance

Ind	Gr	Average	ES	Mean	DS	Min	Max	*Statistical significance (p)*	T1 - T2
30m T1	**I**	4,62	0,0853	4,61	0,2699	4,25	5,15	0,1834	**Gr I**
	II	4,44	0,0992	4,42	0,3136	3,99	**4,90**		0,973
30m T2	**I**	4,62	0,0664	4,63	0,2099	4,26	4,92	**0,0177**	**Gr II**
	II	4,38	0,0647	4,39	0,2045	3,96	**4,63**		0,3947

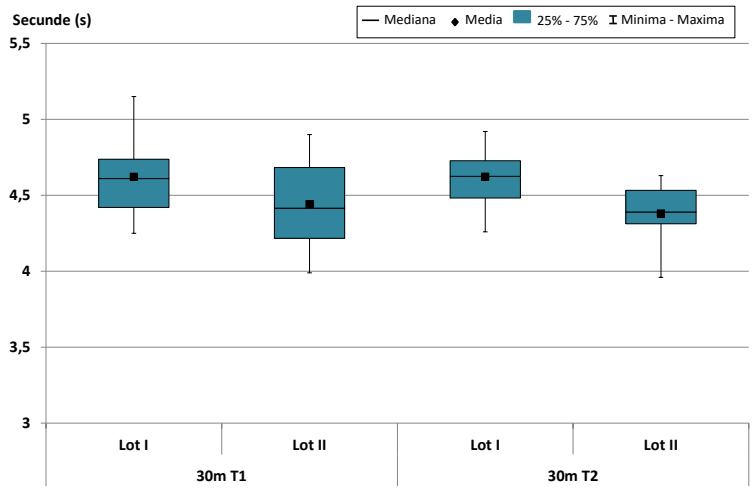

Fig. 1. Speed on the distance of 30m - sprint in a straight line to the studied groups

Long jump from the spot

In the statistical analysis of the long jump values (SLL) for unpaired samples, ie between the control group and the experimental group no statistically significant differences were observed between them, neither at the first repetition (T1) nor at the second repetition (T2) ($p > 0.05$).

The figures show that, in terms of long jumps, the intervention plan did not have a significant impact on their development. We consider that this aspect is caused either by the fact that the exercises performed were not specifically focused on it, or that the duration of the study was too short for these elements of intervention in the sports training program to achieve the desired effect. We will get more details about this aspect in experimental research

DASS Questionnaire Results - (Depression, Anxiety and Stress)

In the statistical analysis of the values for the DASS stress scale for unpaired samples, statistically significant differences were observed between the two groups at the time of T2 (p <0.001), the statistical significance being 0.0005, marked in yellow in Table 14.
In the statistical analysis of the values for paired samples, statistically significant differences were observed between the two time points in group II (p <0.001)

Tabel.4. Descriptive analysis of stress scores and comparison of averages

Time	Gr	Average	ES	Mean	DS	Min	Max	*Statistical significance (p)*	T1 - T2
T1	**I**	1,88	0,1644	1,76	0,7352	0,87	3,4	0,2173	**Gr I**
	II	1,55	0,1850	1,44	0,8273	0,37	3,02		0,2455
T2	**I**	1,77	0,1690	1,82	0,7558	0,62	3,15	0,0005	**Gr II**
	II	1,00	0,0958	1	0,4286	0,37	2,01		**0,0008**

We can observe, from the analysis of the obtained values, the fact that the negative psychological aspects, such as stress, depression and anxiety were intensely reduced in the experimental group, both in the unpaired samples (ie compared to the control group) and in the paired samples. experimentally they intensely improved their mental state and towards themselves at the final test compared to the initial test).

Discussions

Some studies have found greater improvements by applying combined training (Adams et al., 1992; Fatouros et al., 2000), other studies have concluded that training has been equally effective using both training methods (Ford et al., 1983). ; Bauer et al., 1990; Lyttle et al., 1996; Arabatzi et al., 2010; McKinlay et al., 2018).

In our research, we tried to combine all three elements (plyometry + sprint + endurance) and modify them according to our goal (increasing speed) and according to the characteristics and limitations of the target group (juniors 14-16 years).

Conclusions of the preliminary study

The first hypothesis of our experimental research (pilot hypothesis) is confirmed. These results further motivate us to expand the research, as they serve us as the most important basis of personal research.

There were statistically significant improvements in most of the items studied: Arrowhead Agility Drill test - in all four forms (with ball, without ball, left, right), speed test on the distance of 30 m - sprint in a straight line, DASS Questionnaire (Depression , Anxiety and Stress).

PART III

CHAPTER VII. PERSONAL RESEARCH ON THE DEVELOPMENT OF SPORTS PSYCHOMOTOR SKILLS TO IMPROVE SPORTS PERFORMANCE

The purpose of experimental research

The aim of our research is to compile an intervention plan through the application of which we will be able to increase the speed of movement and the level of coordination of athletes. We want to test and analyze the results obtained, after which we can present the conclusions of football coaches and all those interested in streamlining and updating the methods of sports training in junior football.

Research hypotheses

Our hypothesis assumes that the implementation of a special intervention program in the professional training of athletes results in increased speed and coordination, as well as improved psychological aspects.

Research objectives

- Building an intervention program focused on achieving the proposed goals (namely: increasing speed, developing coordination, improving mental state);
- Implementation of this program within the annual training plan for athletes, with a maximum possible positive impact;

- Obtaining improved results following the implementation of the intervention plan, results that will allow us to formulate more efficient alternatives for the components of the sports training program for football players.

Subjects

The experimental research was attended by a number of 40 male subjects born in 2004, 20 athletes belonging to the control group (from the Club "Sticla Arieșul" Turda) and 20 from the experimental group (from the Academy Football University "University of Cluj-Luceafărul").

Research organization

We conducted a longitudinal study, the experimental research was carried out over a period of 12 months and consisted of:
- Carrying out the intervention program;
- Initial and final measurements of physical tests and application of psychological questionnaires (presented in Chapter VIII);
- Supervision of training in compliance with the requirements of the intervention plan;
- Monitoring physical or moral changes and reactions along the way from athletes;
- Data collection and interpretation;
- Formulation of conclusions;

The intervention plan within the experimental research

The elements of the training plan proposed in the experimental research are a complement to the initial plan (from the pilot study). This plan has a higher complexity, in order to increase the speed, in terms of coordination skills, as well as a more varied and focused range of exercises suitable for achieving technical combinations, in order to achieve better sports performance:

1. Exercises, coordination games, agility: Shuttle in X, Square (30 x 12 m + corridor-2 m), 7x1 Attack (Group I), Attack from the 2nd line, Game 7x5, Game in 3 zones - 10x10 + 2 gates

In building our plan we tried to take these aspects into account. Considering the fact that the best workouts for increasing speed are endurance training, plyometrics, sprints with difficulties and sprints with changes of direction (Cronin, Hansen, 2006; Delecluse, 1997; Martinez-Valencia et al., 2015), we adapted these exercises to the needs of the target group, namely, those of athletes aged between 14 and 16 years.

2. Pliometric exercises to increase the speed of movement

3. Sprint exercises to increase speed and endurance in speed

4. Exercises to improve the psychological aspects involved in performance: mediation, controlled imaginative visualization, imaging and mental repetition of tasks

Training methods applied in the annual training plan

In pre-competition periods, we will use the traditional method of training, which involves the separate training of physical, technical and tactical parts.

In the competitive periods, we will progressively introduce the integrated method, that is, we will insist on training the physical part by specific means, but we will not completely abandon the traditional method. In this development phase, it is essential to form a solid base in both the physical and technical training of future footballers.

The tests will allow us to detect the deficiencies of each individual, and the traditional method gives us the opportunity to remedy, through training, these shortcomings and to monitor more accurately the progress of the players. Due to the fact that players, at this age, are prone to the accumulation of chronic fatigue, which leads to overtraining, we will alternate the **micro cycles of accumulation**, **development, with those of discharge**, to give time for overcompensation to take effect.

Physical tests and measuring instruments used in experimental research

Test 1. Speed test over a distance of 30 m - sprint in a straight line. The testing was performed with the Micogate Witty Manager System tool (the full description of the equipment can be found in the preliminary study).

Test 2. Long jump (SLL) The measurement was performed with Micogate Witty Manager System.

Test 3. Computerized analysis of movements by Run, Jump, Walk tests, measurements that were made using the BTS G-Walk assessment tool

a. Run - was done by sprinting 10 m, in a straight line, and were measured: energy consumption, average speed, step length, support phase, propulsion speed. The measurement was performed with the BTS G-Walk device,

b. High jump (Jump) - was achieved by measuring a single high jump, with both feet, following the following aspects: height, maximum speed, detachment speed. The measurement was performed with the BTS G-Walk device,

c. Walking (Walk) - was done by walking, 10 m, on foot, and were measured: walking speed and support phase. The measurement was performed with the BTS P-Walk

BTS G-Walk evaluation equipment

The BTS G-Walk system is a wireless system, consisting of an inertial sensor, consisting of a triaxial accelerometer, a magnetic sensor and a triaxial gyroscope, which is positioned on the L5 vertebra, allowing a functional analysis of gait.

Fig.2. Inertial sensor BTS G-Walk

BTS P-Walk evaluation equipment

The BTS P-Walk system is composed of a single sensory platform, which consists of 2300 resistive type sensors, which allow the evaluation of how the pressures and plantar forces are distributed, both in the static phase and in the dynamic phase (in walking time). The system allows obtaining quantitative information about static and dynamic plantar support, information that helps us identify plantar overloads, rotations and postural asymmetries.

Fig.3. Sensorial platform BTS P-Walk

Psychological tests applied in experimental research

Psychological evaluation SPM (Scale of Motivational Persistence)

The psychological evaluation of PMS consists of 3 factors: long-term pursuit of goals (LTPP - Long Term Purposes Pursuing); tracking of current tasks (CPP - Current Purposes Pursuing) and recurrence of unattained purposes (RUP).

ASSI questionnaire: self-depreciation (A), infatuation (I) and normal self-esteem (SN)

ASSI The questionnaire (self-depreciation, self-esteem, infatuation) is a standardized test for assessing self-esteem as an individual trait. If there is evidence, a "normal self" can be established (with lower or higher values), the dimensions can be accentuated and defined: self-depreciation and infatuation.

CHAPTER VIII. STATISTICAL PROCESSING OF EXPERIMENTAL RESEARCH RESULTS

Descriptive analysis of anthropometric indicators

Body mass index is an official indicator for calculating the ideal body weight for a given height. Because the body mass index helps to determine the weight group in which a person falls.

From the results obtained by us, we notice that this maximum (BMI) was almost the same in all subjects measured, so they all fall into the same weight category.

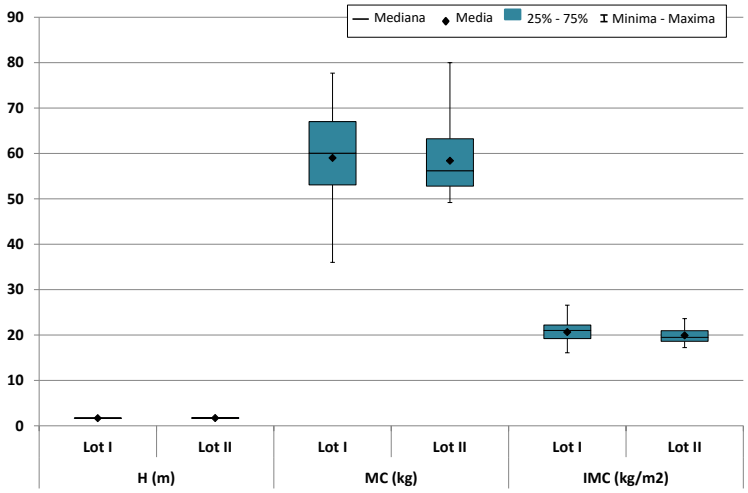

Fig. 4. Anthropometric indicators for the studied groups - final testing

These results assure us that the two groups were identical (or without significant differences) in terms of anthropometric indices, which is a very important and desirable aspect in the process and arguments for validating the results obtained in physical tests.

Physical test results and statistical analysis

Test results Run, Jump, Walk (Running, High jump, Walking)

Physical tests performed and indicators studied:

• Running - energy consumption, average speed, step size, support phase: left leg and right leg, propulsion: left leg and right leg (T1 and T2);

• Jump - height, maximum speed, detachment speed (T1 and T2);

• Walking - support phase: left leg and right leg, walking speed (T1 and T2);

• Dynamic - maximum pressure: left foot and right foot, ground contact time: left foot and right foot (T1 and T2).

1. Analiza statistică a rezultatelor la testul: Alergare (Run)

Table 6. Running test - energy consumption (horse) for the studied groups and statistical significance

Time	Gr	Average	ES	Mean	DS	Min	Max	*Statistical significance (p)*	
T1	**I**	583,75	4,719	583,50	21,103	540	615	0,0558	**I, T1-T2**
	II	**594,35**	12,699	585,00	56,793	486	684		0,4205
T2	**I**	607,75	11,012	606,50	49,247	495	693	**< 0,0001**	**II, T1-T2**
	II	**505,50**	15,389	508,50	68,823	410	630		**< 0,0001**

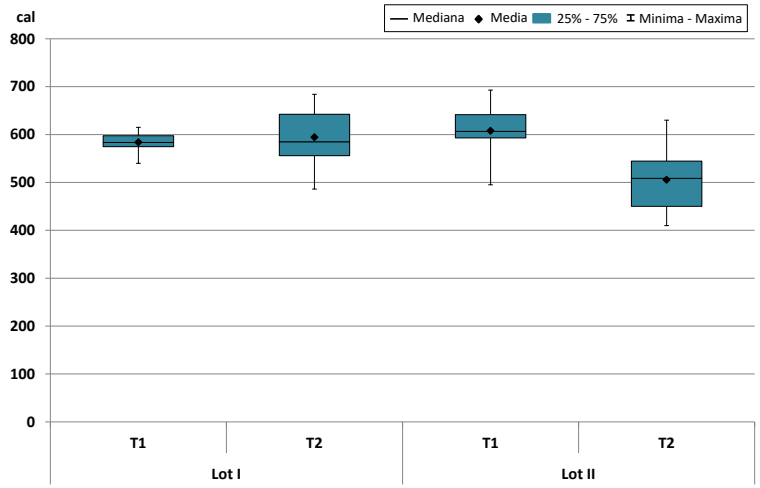

Fig. 5. Running - energy consumption in the studied groups

We observe in the figure above, the statistically significant reduction of energy consumption. This means that athletes can perform the same exercises with less effort than before the intervention. This can mean not only better endurance training, but also better performance in competitive situations, as performing various motor actions (acceleration, changes of direction, coordination, etc.) will be less affected by athlete fatigue.

Regarding the statistical analysis of mean velocity (Vm) values for unpaired samples, at T1 no statistically significant differences were observed between the two groups (p> 0.05). At the time of T2, however, higher values were observed, statistically significantly significant (p <0.01) in group II, statistical value being 0.0005

Table 7. Running test - average speed (km / h) for the studied groups and statistical significance

Time	Gr	Media	ES	Mean	DS	Min	Max	*Statistical significance (p)*	
T1	**I**	8,03	0,726	8,34	3,247	3,03	13,33	0,3583	**I, T1-T2**
	II	8,75	0,557	9,28	2,491	3,07	12,02		0,0891
T2	**I**	9,46	0,633	10,07	2,832	4,44	14,29	**0,0005**	**II, T1-T2**
	II	12,04	0,281	11,54	1,258	10,40	15,72		**< 0,0001**

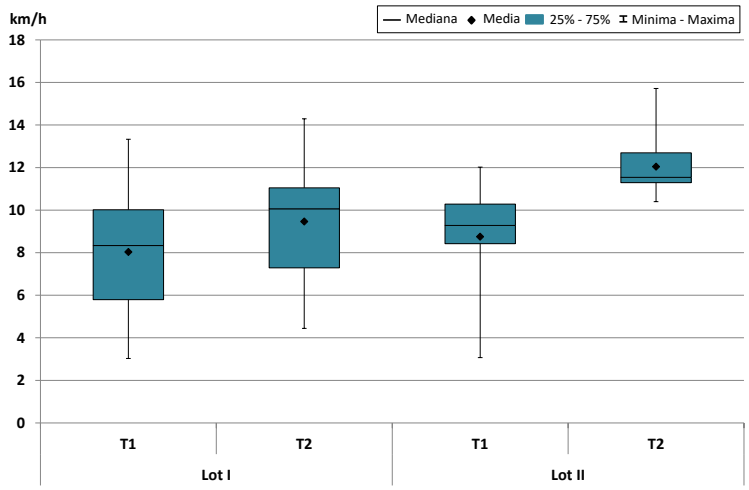

Fig. 6. Running test - average speed in the studied groups

We notice here the same trend: the members of the experimental group significantly increased their speed, including individually, in the final test compared to the initial test.

In the statistical analysis of the step size values (MP) for unpaired samples, at the time of T1 no statistically significant differences were observed between the two groups ($p > 0.05$). At the time of T2, higher values were observed, statistically very significant ($p < 0.01$) in group II, the statistical value being less than 0.0001.

Table 8. Running Proda - step size (m) for the studied groups and statistical significance

Time	Gr	Average	ES	Mean	DS	Min	Max	*Statistical significance (p)*	
T1	**I**	1,26	0,076	1,24	0,339	0,49	1,82	0,2805	**I, T1-T2**
	II	1,29	0,056	1,30	0,249	0,90	1,82		0,8164
T2	**I**	1,38	0,085	1,29	0,382	0,77	2,00	**< 0,0001**	**II, T1-T2**
	II	1,85	0,050	1,86	0,225	1,54	2,22		**< 0,0001**

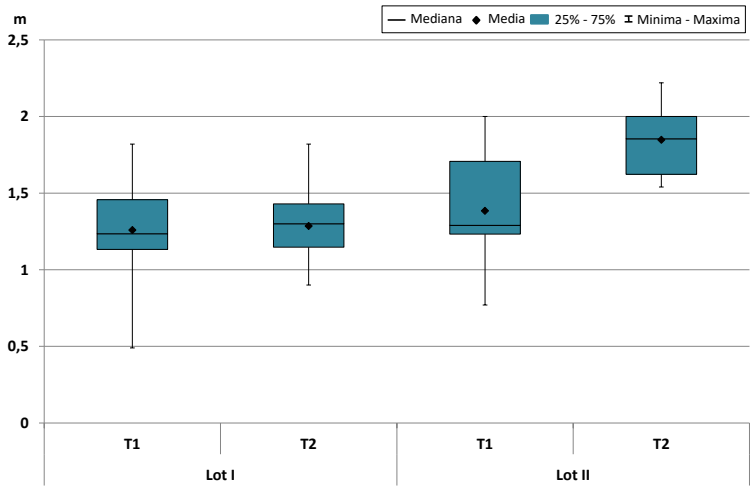

Fig. 7. Running Test - the size of the step in the studied groups

The fact that the experimental group increased its step length in both paired samples (p <0.001) and non-paired samples (p <0.01) is a gratifying aspect, and may have the direct consequence of increasing the travel speed provided that it is maintained. initial cadence.

At the statistical analysis of the support phase values (right leg - Sd and left leg - Ss) for unpaired samples:

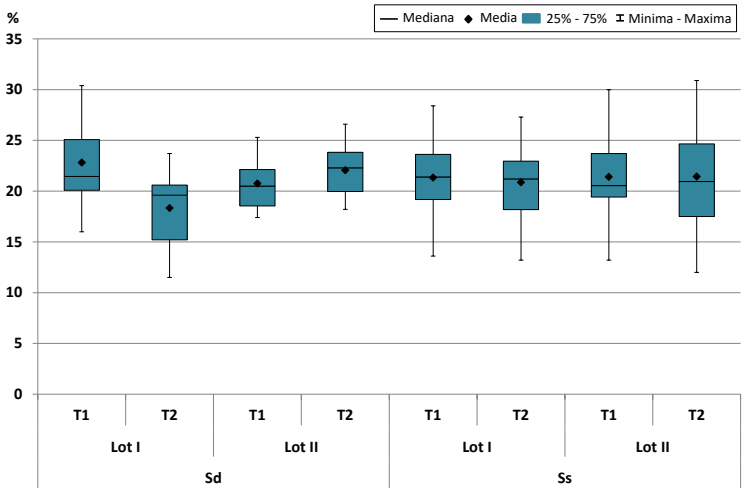

Fig. 8. Running - the support phase for the studied groups

For the right leg (Sd) - at the time of T1 no statistically significant differences were observed between the two groups (p> 0.05); p = 0.0657, at T2 time higher values were observed, statistically very significant (p <0.01) in group II., p = 0.0007for left leg (Ss) - no statistically significant differences were observed between the two lots (p> 0.05) neither at time

T1, the value of statistical significance being 0.9542 nor at time T2 when the value p rose to 0.7009, above the significance threshold.

2. Statistical analysis of test results: Jump

In the statistical analysis of height values (H) for unpaired samples, at T1 no statistically significant differences were observed between the two groups (p> 0.05), p = 0.5688. At the time of T2, higher values were observed, statistically very significant (p <0.01) in group II, p = 0.005. This result shows us that the experimental group following the application plan of intervention evolved better than the control group, registering at the final test a higher value at the high jump, the average of these values being 34.34

Table 9. Jump - height (cm) for the studied groups and statistical significance

Time	Gr	Average	ES	Mean	DS	Min	Max	*Statistical significance (p)*	
T1	**I**	29,81	1,102	28,50	4,928	20,60	39,10	0,5688	**I, T1-T2**
	II	30,82	1,148	32,60	5,133	21,60	38,40		0,5087
T2	**I**	30,54	1,034	29,90	4,623	23,70	39,80	**0,005**	**II, T1-T2**
	II	34,34	0,742	33,50	3,320	30,50	42,70		**0,0258**

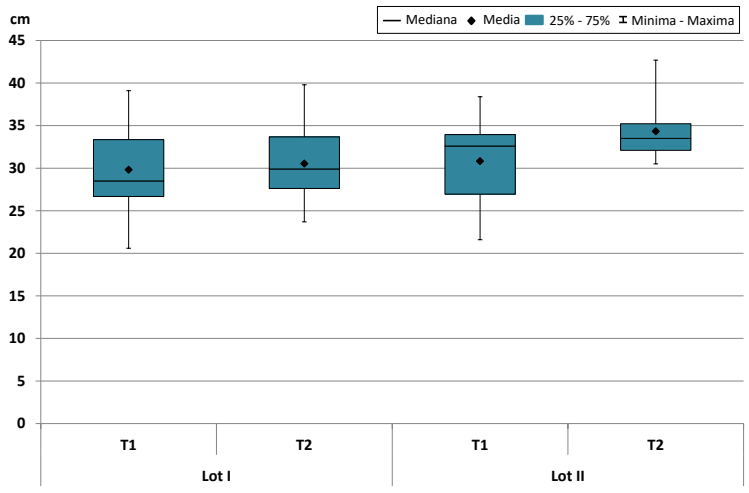

Fig. 9 Jump - height at the studied groups

At the statistical analysis of the maximum speed values (Vmax) for unpaired samples, at time T1 no statistically significant differences were observed between the two groups (p>

0.05), p = 0.0951. At the time of T2, higher values were observed, statistically significantly significant (p <0.001) in group II. Therefore, the experimental group significantly increased its travel speed compared to the control group; p = 0.0006, see Table 26, value marked in green.

I n the statistical analysis of detachment velocity (RV) values for unpaired samples, statistically significant differences were observed between the two time points (p <0.05) at both T1 and T2 time. P value at the initial test being 0.0298, and at the final test being 0.0184, values marked in blue.

An improvement in detachment speed may mean greater propulsive force during running.

3. Statistical analysis of test results: Walk

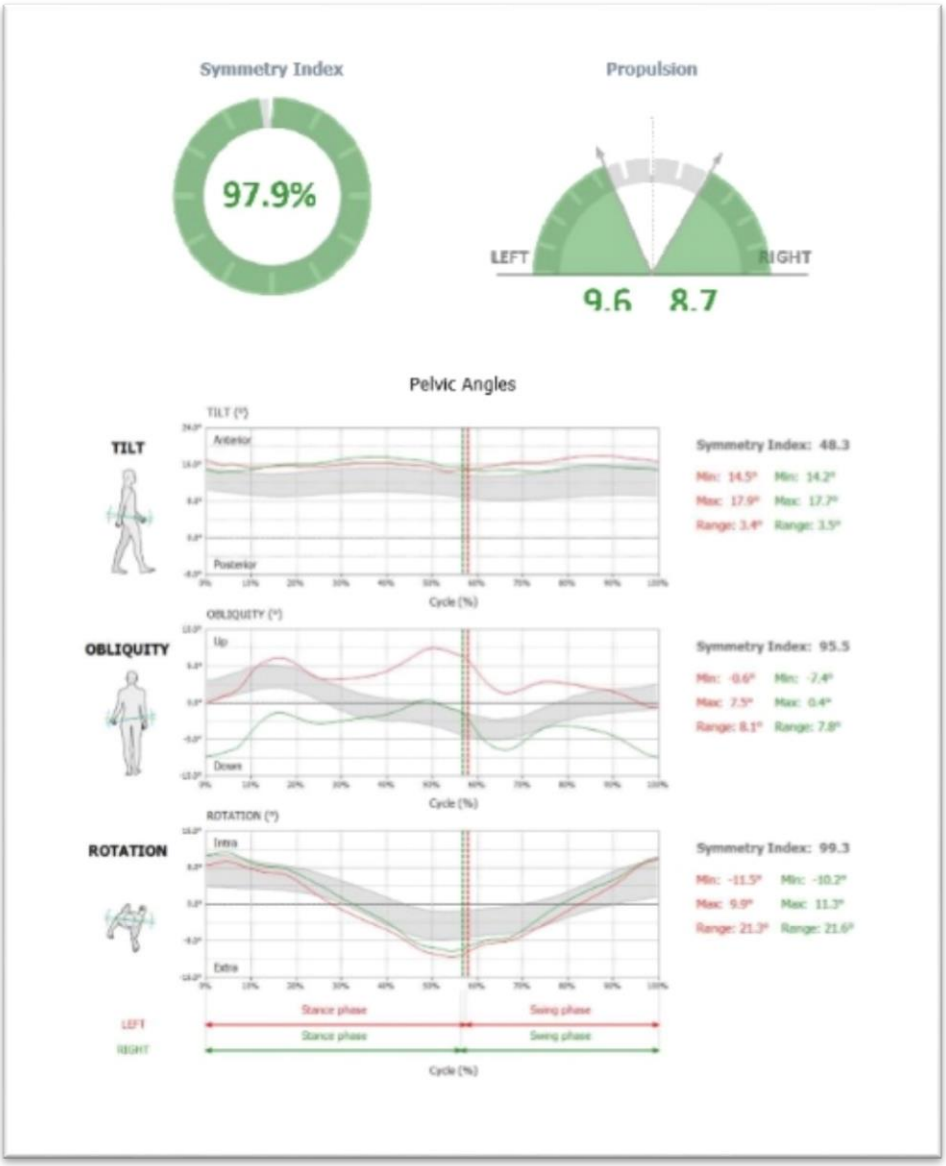

Fig. 10. Symmetry and propulsion - BTS G-Walk images

At the statistical analysis of the support phase values (right leg - SPd and left leg - SPs) for unpaired samples:

• for the right leg (SPd) - at the time of T1 no statistically significant differences were observed between the two groups (p> 0.05); at the time of T2, lower values were observed, statistically significant (p <0.05) in group II, p = 0.0139.

• for the left leg (SPs) - at the time of T1 higher values were observed, statistically significantly significant (p <0.001) in group II; at T2, lower values were observed, statistically significant (p <0.05) in group II, p = 0.0164

We consider that these results are due to the intervention plan and these aspects contribute to the increase of stability and balance during movement (walking).

At the statistical analysis of the speed values (V) for unpaired samples, at the time of T1 were observed lower values, statistically significant (p <0.05) in group II, p = 0.0272. At time T2, higher statistically significant values were observed (p <0.05) in group II, p = 0.0151. This means that in the final test we could see that the experimental group increased its walking speed compared to the control group.

Table 10. Walking - speed (m / s) at the studied groups and statistical significance

Time	Gr	Average	ES	Mean	DS	Min	Max	*Statistical significance (p)*	
T1	**I**	1,16	0,020	1,17	0,091	1,01	1,33	**0,0272**	**I, T1-T2**
	II	1,08	0,028	1,07	0,126	0,86	1,44		0,7344
T2	**I**	1,14	0,030	1,13	0,136	0,83	1,38	**0,0151**	**II, T1-T2**
	II	1,30	0,051	1,28	0,230	0,97	1,85		**0,0012**

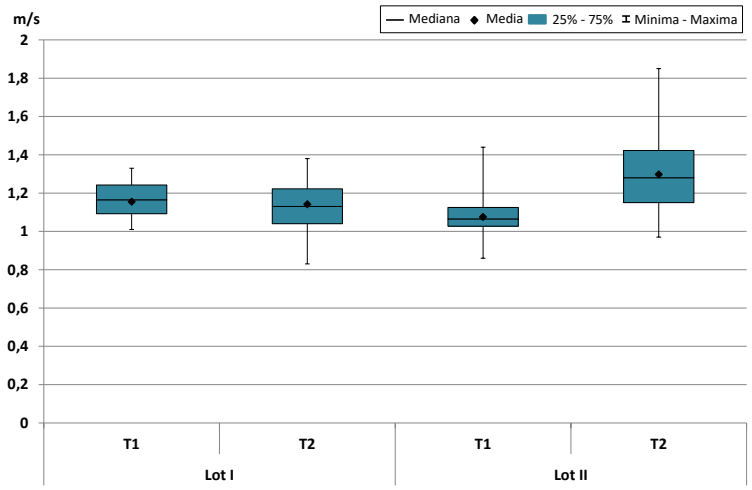

Fig.11. Walking - speed in the studied groups

Step dynamics analysis

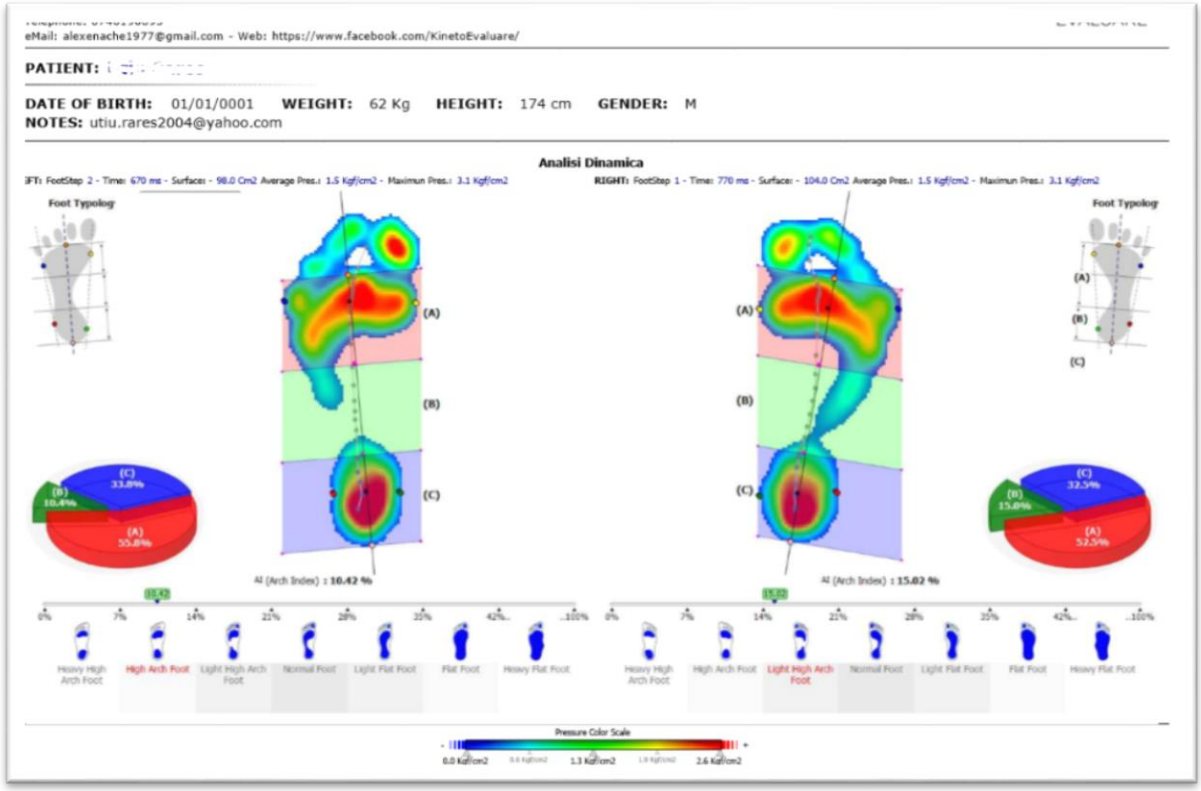

Fig. 12. Pressure on the right and left foot - BTS P-Walk images

At the statistical analysis of the values the maximum pressure (right foot - PMd and left foot - PMs) for unpaired samples:

• for the right leg (PMd) - no statistically significant differences were observed between the two groups ($p > 0.05$) in either of the two time points

• for the left leg (PMs) - no statistically significant differences were observed between the two groups (p> 0.05) in either moment.

In the statistical analysis of the values of the contact time with the ground (right foot - Td and left foot - Ts) for unpaired samples:

• for the right leg (Td) - at the moment T1 higher values were observed, statistically very significant (p <0.01) in group II; at T2 no statistically significant differences (p> 0.05) were observed between the two groups

for the left leg (Ts) - at the time of T1 higher values were observed, very statistically significant (p <0.01) in group II; at time T2 no statistically significant differences (p> 0.05) were observed between the two groups, p = 0.1427

Table 11. Step dynamics - soil contact time (ms) in the studied lots and statistical significance

Time		Gr	Average	ES	Mean	DS	Min	Max	*Statistical significance (p)*			
Td	T1	I	760	10,563	765	47,240	640	850	0,0032	I, T1-T2	Td – Ts	I, T1
		II	804,50	7,344	800	32,843	740	880		0,1893		0,9578
	T2	I	791	12,245	785	54,763	670	880	0,1427	II, T1-T2		I, T2
		II	775	8,959	770	40,066	700	850		0,0017		0,5226
Ts	T1	I	761	15,077	770	67,426	590	880	0,0014	I, T1-T2		II, T1
		II	819	10,283	820	45,986	710	880		0,0759		0,0797
	T2	I	783	11,989	780	53,617	670	870	0,2983	II, T1-T2		II, T2
		II	765	11,687	770	52,265	700	850		0,018		0,4015

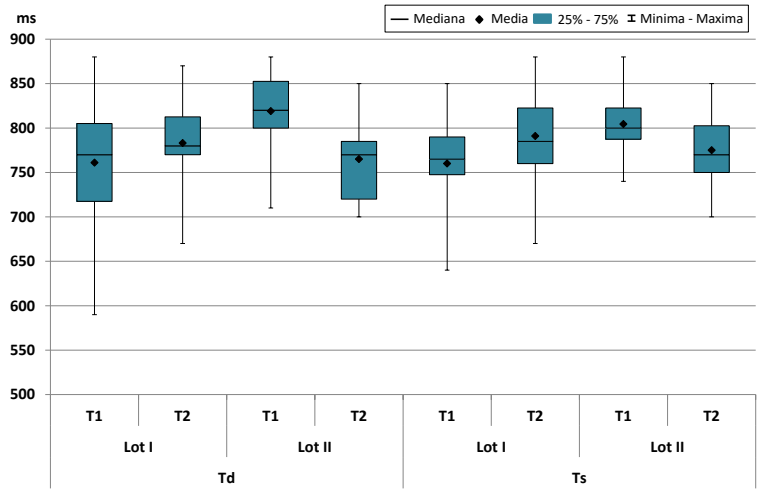

Fig. 13. Step dynamics - soil contact time (ms) in the studied lots

The measurements show that not in all cases statistically significant differences were observed in these indicators. It would have been expected to notice a decrease in soil contact time at all samples. However, as we could see in the statistical analysis of the indicators Phase

of Support and Speed, the good results obtained are in favor of the experimental team, the degree of improvement of these values thus compensating for the indicator with poorer results (time of ground contact).

30m speed test results - straight line sprint

At the statistical analysis of the speed values over the distance of 30m (30m) for unpaired samples, statistically significant differences were observed between the two groups at the first repetition (T1), when the pa was 0.0183, but also at the second repetition (T2). ($p < 0.05$), where pa recorded a value of 0.01

This result is another very important argument in formulating our conclusions and in validating the intervention plan, because increasing speed is one of the main objectives of our research.

Long Jump (SLL)

In the statistical analysis of the long jump values (SLL) for unpaired samples no statistically significant differences were observed between the two groups, neither at the first repetition (T1), where p is equal to 0.2614, nor at the second repeat (T2) ($p > 0.05$), where p is equal to 0.6323.

The fact that there were no differences in the long jump, although other tests showed improvements in dynamic forces, may mean that athletes did not use their arms properly during the long jump, and this could have impacted the final result. negatively.

Statistical analysis of psychological test results

ASSI questionnaire (self-depreciation, infatuation, normal self-esteem)

In the statistical analysis of the values for self-assessment (A) for unpaired samples, statistically significant differences were observed between the two groups at time T2 ($p < 0.05$), the value of statistical significance being 0.0177, which means that the experimental group and-significantly reduced the level of self-depreciation.

In the statistical analysis of the values for infatuation (I) for unpaired samples no statistically significant differences were observed between the two groups neither at time T1 nor at time T2

(p> 0.05), at the final test the statistical significance being 0, 2966, which means that the intervention plan did not induce changes in the level of infatuation of athletes.

In the statistical analysis of the values for normal self-esteem (SN) for unpaired samples, statistically significant differences were observed between the two groups at time T2 (p <0.05), at the final test the statistical significance being 0.0229c which means that the experimental group significantly increased their self-esteem following the intervention.

Table 12. Descriptive analysis of ASSI questionnaire scores and comparison of averages

Time	Gr	Average	ES	Mean	DS	Min	Max	*Statistical significance (p)*	Time	Gr	
T1	A	I	5,90	0,5277	5,5	2,3598	1	9	0,9737	A	**Lot I**
		II	5,90	0,5799	5,5	2,5935	1	10			0,791
	I	I	6,50	0,3591	6	1,6059	4	10	0,876		**Lot II**
		II	6,40	0,3584	6	1,6026	3	10			**0,002**
	SN	I	6,60	0,4724	6,5	2,1126	3	10	0,9873	I	**Lot I**
		II	6,55	0,5051	6,5	2,2589	3	10			0,2324
T2	A	I	5,60	0,5252	5	2,3486	2	9	**0,0177**		**Lot II**
		II	3,85	0,3346	3,5	1,4965	1	6			0,3484
	I	I	6,25	0,3618	6	1,6182	3	10	0,2966	SN	**Lot I**
		II	6,90	0,3472	6,5	1,5526	5	9			0,8438
	SN	I	6,55	0,4946	6,5	2,2118	3	10	**0,0229**		**Lot II**
		II	8,05	0,1983	8	0,8870	7	10			**0,0079**

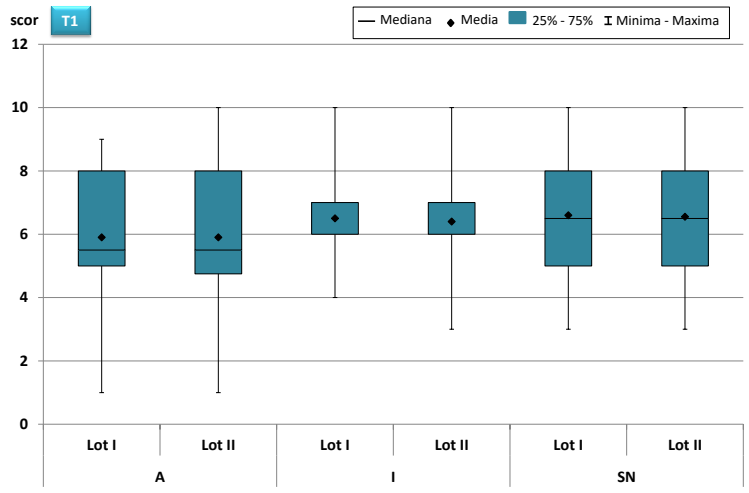

Fig. 14. Items of the ASSI questionnaire for the lots studied at the initial testing

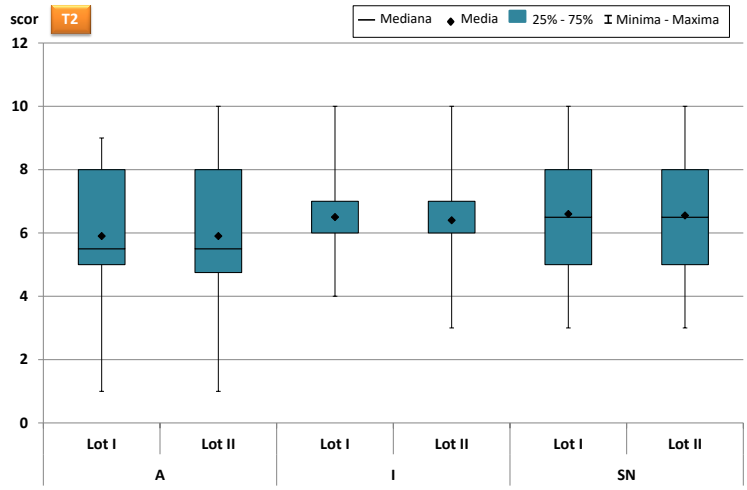

Fig. 15. Items of the ASSI questionnaire for the lots studied at the final testing

Scale of Motivational Persistence (SPM)

In the statistical analysis of the values for long-term pursuit of goals (LTPP - Long Term Purposes Pursuing) for unpaired samples were observed statistically significant differences between the two groups at time T2 ($p < 0.001$), the statistical value being 0.0001 .

In the statistical analysis of the values for tracking current tasks (CPP - Current Purposes Pursuing) for unpaired samples were observed statistically very significant differences between the two groups at time T2 ($p < 0.01$), the statistical significance being 0.0016.

In the statistical analysis of the values for recurrence of unattained purposes (RUP) for statistically uneven samples were observed statistically significant differences between the two groups at the time of T2 ($p < 0.001$), the calculated value of statistical significance being 0.0001

In the statistical analysis of the values of the motivational persistence score (PM) given based on the three previous items, for unpaired samples very statistically significant differences were observed between the two groups at time T2 ($p < 0.01$), the statistical significance being 0, 0039

In the statistical analysis of the values for paired samples, very statistically significant differences were observed between the two time points in group II ($p < 0.001$), the statistical significance at the final testing being 0.002

Table 13. Descriptive analysis of SPM questionnaire scores and comparison of averages

Time	Ind	Gr	Average	ES	Mean	DS	Min	Max	*Statistical significance (p)*	T1 - T2	
T1	PM	I	3,50	0,3940	3	1,7622	1	8	0,1404	PM	Lot I 0,2958
		II	4,50	0,5052	4	2,2595	1	9			Lot II 0,002
	LTPP	I	3,40	0,4554	2	2,0365	1	8	0,4091	LTPP	Lot I > 0,9999
		II	3,70	0,3980	3	1,7800	2	8			Lot II < 0,0001
	CPP	I	4,80	0,4449	4,5	1,9894	2	8	0,9387	CPP	Lot I > 0,9999
		II	4,80	0,3947	5	1,7652	2	8			Lot II 0,0004
	RUP	I	2,90	0,4286	2	1,9167	1	8	0,3318	RUP	Lot I 0,3125
		II	3,60	0,5099	3,5	2,2804	1	8			Lot II < 0,0001
T2	PM	I	4,50	0,4894	4	2,1885	1	9	0,0039		
		II	6,35	0,3015	6	1,3485	4	8			
	LTPP	I	3,40	0,4065	2,5	1,8180	1	7	0,0001		
		II	6,45	0,3202	6	1,4318	3	9			
	CPP	I	4,85	0,4369	5	1,9541	2	8	0,0016		
		II	6,80	0,3044	7	1,3611	4	9			
	RUP	I	3,50	0,5306	2	2,3731	1	8	0,0001		
		II	6,85	0,2927	7	1,3089	4	9			

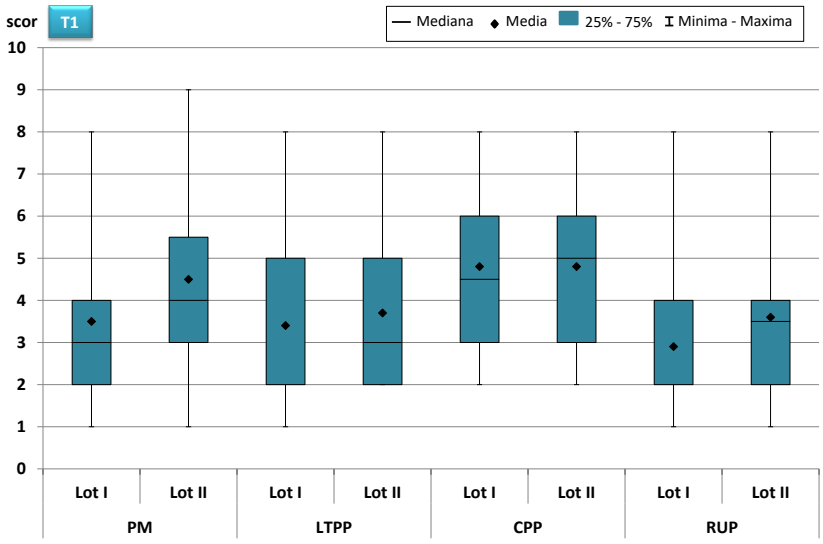

Fig. 16 SPM items for the groups studied at the initial testing

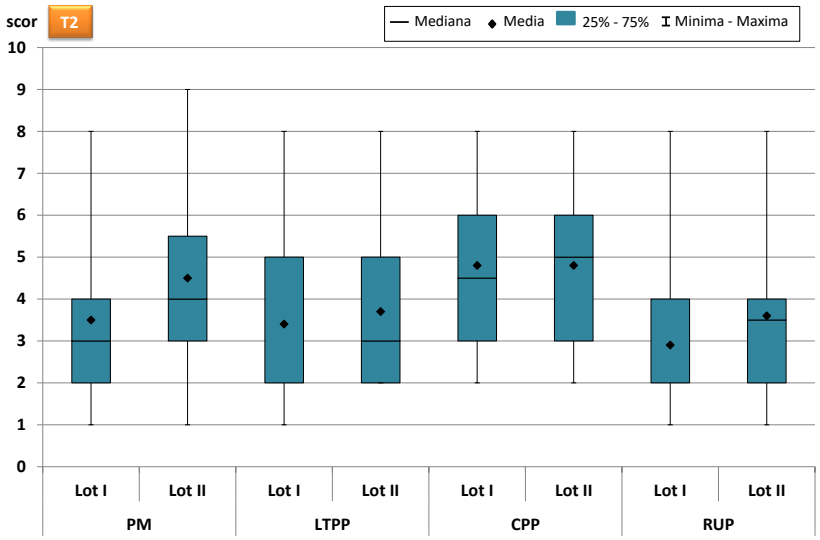

Fig. 17. SPM items for the groups studied at the final testing

Discussions

In addition to football-specific technical skills, individual and team tactical knowledge and particularly adequate levels of physical fitness are important prerequisites for success in football (Stolen et al., 2005). Typical football movements, such as jumping, sprinting, shooting, or rapid change of direction, require a high level of physical training (Meylan and Malatesta, 2009). These actions are crucial for optimal performance, not only in adults (Faude et al., 2013), but also in youth football (Thomas et al., 2009; Marques et al., 2013; Michailidis et al., 2013; Sohnlein et al., 2014), even if it represents only a small, but often decisive, percentage of the total time of the match. Therefore, identifying effective training methods to optimize performance is vital, especially for junior football players.

The conclusions of the experimental research

Considering the increasing degree of complexity of the increasingly pronounced football game, as well as the technical-tactical diversity in continuous development, we believe that attention should be paid to the instructive-educational training process of children and juniors, in order to adapt as much as possible. more optimal of their development peculiarities to the current requirements of the game and, in this way, to the creation of better future footballers.

Our longitudinal research was carried out over a period of 12 months, during which time we introduced specific elements of sports training in the training plan of football athletes,

in order to increase speed, improve coordination skills and improve psychological aspects. To measure the results we used physical tests such as Jumping, Running, Walking, Step Dynamics Analysis, Sprint and Long Jump.

Computer analysis of the data was performed with BTS G-Walk and BTS-P Walk equipment. The psychological questionnaire used was the Motivational Persistence Scale, the SPM test.

The experiment was carried out largely according to predefined research stages, and there were no major incidents during this year that endangered the intervention process or the performance of physical tests.

Considering that at the end of the experiment the figures and the statistical analysis showed us that the athletes increased their speed, improved their coordination skills, improved their walking and running cycle, increased their dynamic strength, they reduced their stress and increased their motivational persistence, we can conclude that our experiment achieved its goal and our hypotheses were confirmed by improving most of the items studied.

CHAPTER IX. GENERAL CONCLUSIONS OF THE EXPERIMENTAL RESEARCH

As we could observe in the preliminary study groups, in our experimental research on the statistical analysis of anthropometric indicators (height, body mass and body mass index) no statistically significant differences were observed. We are happy with this aspect, as it is considered that the measured results are all the more valid the more similar the characteristics of the members of the studied groups.

For computerized analysis of items maximum speed, detachment speed, power consumption, average speed, step size, support phases (walking and running), propulsion, maximum speed and ground contact, measured with BTS G-Walk and BTS P devices -Walk, we obtained statistically significant improvements in almost all the values studied.

Considering all these results (both those from the preliminary study and those from the experimental study), we can conclude that our hypotheses are confirmed - the athletes managed, with the help of the intervention plan, to improve both their motor skills and the psychological ones.

Although the intervention plan contained elements to improve psychological aspects (meditation, imaging, etc.), we consider that the observed mental improvements are also due to the fact that athletes have improved their motor skills, thus being more confident and having a professional satisfaction. bigger. With better speed, increased agility, improved coordination,

and a stable and more balanced psychological state, athletes can become much more efficient and professional players, which increases the chance of achieving better competitive results. The results of this study showed that a combined training program (sprint + endurance speed + plyometrics) was effective in improving speed, coordination and explosive force. Therefore, football coaches could apply this type of training, combined with conventional football training, to optimize its benefits and transfer them into specific football skills to increase the explosive force performance of football players.

References

Abdelkrim B., Castagna N., Jabri C., Battikh I., El Fazaa T., & El Ati, J. (2010). Activity profile and physiological requirements of junior elite basketball players in relation to aerobic anaerobic fitness. *Journal of strength and conditioning research / National Strength & Conditioning Association, 24(9), 2330-2342. doi: 10.1519/JSC.0b013e3181e381c1*

Abrantes C., Macas, V., & Sampaio, J. (2004). Variation in football players' sprint test performance across different ages and levels of competition. *Journal of sports science & medicine, 3(1), 44-49.*

Adams, K., O'shea, J. P., O'shea, K. L., and Climstein, M. (1992). The effect of six weeks of squat, plyometric and squat-plyometric training on power production. *J. Strength Cond. Res.* 6, 36–41. doi: 10.1519/00124278-199202000-00006

Arabatzi, F., Kellis, E., and Saez De Villarreal, E. (2010). Vertical jump biomechanics after plyometric, weightlifting, and combined (weightlifting + plyometric) training. *J. Strength Cond. Res.* 24, 2440–2448. doi: 10.1519/JSC.0b013e3181e274ab

Baechle T. R., Earle R. W. (2008). *Essentials of strength training and conditioning.* Champaign, IL: Human Kinetics.

Baker D, Nance S. (1999). The relation between running speed and measures of strength and power in professional rugby league players. *J Strength Cond Res 13: 230-235*

Balsom P. (2007). *Fotbollens träningslära – Med nya praktiska övningar*. Solna: Svenska fotbollförlaget.

Bangsbo J., Norregaard L., and Thorso F. (1991). Activity profile of competition soccer. *Can J Sport Sci 16: 110-116*

Bangsbo J., Norregaard L., and Thorso F. (1991). Activity profile of competition soccer. *Can J Sport Sci 16: 110-116*

Barboş P.I., Ciocoi-Pop R., D., Cherzoi D. (2017). *Ways of improving physical qualities in judo* by Uchi Komi. Studia Ubb Educatio Artis Gymn., Lxii,1, Pp. 67-73.

Barr M.J., Sheppard J.M., and Newton R.U. (2013). Sprinting kinematics of elite rugby players. *Journal of austrailian strength and conditioning 21: 14-20*

Bauer, T., Thayer, R. E., and Baras, G. (1990). Comparison of training modalities for power development in the lower extremity. *J. Strength Cond. Res.* 4, 115–121. doi: 10.1519/00124278-199011000-00001

Black W., and Elmo R. (1994). Comparisons of size, strength, speed, and power in NCAA division 1-A football players. *Journal of strength and conditioning research, 8(2), 80- 85*

Bloomfield J., Polman R., & O´Donoghue P. (2007). Physical demands of different positions in FA Premier League soccer. *Journal of Sports Science and Medicine, 6(1), 63-70.*

Bompa T.O. (2002). *Teoria şi metodologia antrenamentului*. București: Editura ExPunto

Cappadona J. (2013). *Kinematic and spatiotemporal analysis between sprint drills and maximal sprinting, in: Physical Therapy & Human Movement Science*. Fairfield University: Sacred Heart University, p 52.

Cappellini G., Ivanenko Y.P., Poppele R.E., Lacquaniti F. (2006). Motor patterns in human walking and running. *J Neurophysiol. 2006 Jun; 95(6):3426-37.*

Cârstea G. (1999). *Educaţia fizică - fundamente teoretice şi metodice*. București: Casa de editură Petru Maior

Causer J., McRobert A. P., & Williams A. M. (2013). The effect of stimulus intensity on response time and accuracy in dynamic, temporally constrained environments. *Scandinavian Journal of Medicine & Science in Sports, 23(5), 627-634. doi:10.1111/j.1600- 0838.2011.01440.x*

Clark K.P., Stearne D.J., Walts C.T., and Miller A.D. (2010). The longitudinal effects of resisted sprint training using weighted sleds vs. weighted vests. J Strength Cond Res 24: 3287- 3295

Cometti G., Maffiuletti N.A., Pousson M., Chatard J.C., and Maffulli N. (2001). Isokinetic strength and anaerobic power of elite, subelite and amateur French soccer players. *Int J Sports Med 22: 45-51*

Comfort P., Bullock N., and Pearson S.J. (2012). A comparison of maximal squat strength and 5-, 10-, and 20-meter sprint times, in athletes and recreationally trained men. *J Strength Cond Res 26: 937-940*

Constantin T. (2012). *Pregatirea si realizarea evaluarii psihologice individuale: norme, metodologie si proceduri* Editura: Polirom. ISBN: 978-973-46-2271-9

Constantin, T., Iarcuczewicz, I., Constantin, L., Fodorea, A., Căldare, A., (2007). *Persistenţa motivaţională şi operaţionalizarea ei în vederea evaluării potenţialului motivaţional individual, în Analele de Psihologie şi Ştiinţe ale Educaţiei*, Editura Universităţii „Al I. Cuza", nr 1.

Cox, R. H., & Liu, Z. (1993). Psychological Skills: A Cross-Cultural Investigation. *International Journal of Sport Psychology, 24, 326-340.*

Cox, R. H., & Yoo, H. S. (1995). Playing Positions and Psychological Skill in American Football. *Journal of Sport Behaviour, 18, 183-194*.

Croitoru D., Şerban M. (2002). *Volei în şcoală*. București: Editura Semne. ISBN 973-624-021-5

Cronin J., Hansen K. (2006). Resisted sprint training for the acceleration phase of sprinting. *Strength & conditioning Journal 28*

Cunniffe B., Proctor W., Baker J. S., & Davies, B. (2009). An evaluation of the physiological demands of elite rugby union using Global Positioning System tracking software. *Journal of strength and conditioning research / National Strength & Conditioning Association, 23(4), 1195-1203. doi: 10.1519/JSC.0b013e3181a3928b*

Cunningham D.J., West D.J., Owen N.J., Shearer D.A., Finn C.V., Bracken R.M., Crewther B.T., Scott P, Cook C.J, and Kilduff L.P. (2013). Strength and power predictors of sprinting performance in professional rugby players. *J Sports Med Phys Fitness 53: 105-111*

de Villarreal, E. S., Suarez-Arrones, L., Requena, B., Haff, G. G., and Ferrete, C. (2015). Effects of plyometric and sprint training on physical and technical skill performance in adolescent soccer players. *J. Strength Cond. Res.* 29, 1894–1903. doi: 10.1519/JSC.0000000000000838

Delecluse C. (1997). Influence of strength training on sprint running performance. Current findings and implications for training. *Sports Med 24: 147-156*

Demontrond, P., Fournier, J., & Vaire-Douret, L. (2006). Optimal Psychological States in French Sport Settings: Flow in Sports. *In J. Mohan, & M. Sehgal (Eds.), Health Psychology: Recent Perspectives (pp. 125-129). New Delhi: Abijheet Publications.*

Desmedt, J. E., & Godaux, E. (1977). Ballistic contractions in man: characteristic recruitment pattern of single motor units of the tibialis anterior muscle. *The Journal of physiology, 264(3), 673-693.*

DeWeese B.H, Sams M.L, and Serrano A.J. (2014). Sliding toward Sochi–part1: a review of programming tactics used during the 2010–2014 quadrennial. *Natl Strength Cond Assoc Coach 1: 30-42*

DeWeese B.H, Sams M.L, Williams J.H, and Bellon CR. (2015). The nature of speed: Enhancing sprint abilities through a short to long training approach, in: *Techniques in Track & Field and Cross Country.*

DeWeese B.H, Sams M.L., and Serrano A.J. (2014). Sliding towards Sochi–part II: a review of programming tactics used during the 2010–2014 quadrennial. *Natl Strength Cond Assoc Coach 1: 4-7*

DeWeese, B. H., Bellon, C. R., Magrum, E., Taber, C., and Suchomel, T. J. (2016). Strengthening the springs: How the inclusion of properly sequenced weightlifting derivatives into the strength-training program can improve sprint performance. *Techniques in track & field and cross-country, 9(3), 9-20.*

Diallo, O., Dore, E., Duche, P., and Van Praagh, E. (2001). Effects of plyometric training followed by a reduced training programme on physical performance in prepubescent soccer players. *J. Sports Med. Phys. Fit.* 41, 342–348.

Dodd D. J., & Alvar B. A. (2007). Analysis of acute explosive training modalities to improve lower-body power in baseball players. *Journal of strength and conditioning research / National Strength & Conditioning Association, 21(4), 1177-1182. doi: 10.1519/R21306.1*

Dragnea A. (1996). *Antrenamentul Sportiv.* București: Editura Didactică și Pedagogică R.A.

Dungaciu P. (1967). *Probleme de antrenament în gimnastică*. București: Editura Uniunii de Cultură fizică și Sport

Duthie G.M., Pyne D.B., Marsh D.J., and Hooper S.L. (2006). Sprint patterns in rugby union players during competition. *J Strength Cond Res 20: 208-214*

Eniseler N., Camliyer H., & Gode O. (1996). A comparison of 30-meter sprint values with respect to various leage levels and positions of the soccer players playing in these leagues. *J Soccer Sci Technol, 3, 3-8.*

Epuran M. (2005). *Metodologia cercetării activităţilor corporale*. București: ed. a II-a, Ed. FEST

Faigenbaum A. D., McFarland J. E., Keiper F. B., Tevlin W., Ratamess N. A., Kang J., & Hoffman J. R. (2007). Effects of a short-term plyometric and resistance training program on fitness performance in boys age 12 to 15 years. *Journal of sports science & medicine, 6(4), 519-525.*

Famose, J. P., & Durand, M. (1988). *Aptitudes et acquisition des habiletés motrices. Aptitudes et performance motrice*. Paris: Editions revue EPS

Farlinger, C. M., Kruisselbrink, L. D., & Fowles, J. R., (2007). Relationships to skating performance in competitive hockey players. *Journal of strength and conditioning research / National Strength & Conditioning Association, 21(3), 915-922. doi: 10.1519/R-19155.1*

Fatouros, I. G., Jamurtas, A. Z., Leontsini, D., Taxildaris, K., Aggelousis, N., Kostopoulos, N., et al. (2000). Evaluation of plyometric exercise training, weight training, and their combination on vertical jumping performance and leg strength. *J. Strength Cond. Res.* 14, 470–476. doi: 10.1519/00124278-200011000-00016

Faude O., Koch T., and Meyer T. (2012). Straight sprinting is the most frequent action in goal situations in professional football. *J Sports Sci 30: 625-631*

Faude, O., Roth, R., Di Giovine, D., Zahner, L., and Donath, L. (2013). Combined strength and power training in high-level amateur football during the competitive season: a randomised-controlled trial. *J. Sports Sci.* 31, 1460–1467

Feltz, D. L., & Ewing, M. E. (1987). Psychological Characteristics of Elite Young Athletes. *Medicine and Science in Sports and Exercise, 19, 98-105.* *http://dx.doi.org/10.1249/00005768-198710001-00002*

Ferro A., Villacieros J., Floria P., and Graupera J.L. (2014). Analysis of speed performance in soccer by a playing position and a sports level using a laser system. *J Hum Kinet 44: 143- 153*

Figueiredo AJ, Gonçalves CE, Silva MJC, Malina RM. Characteristics of youth soccer players who drop out, persist or move up. *J Sports Sci 2009; 27(9):883-91*

Figueiredo AJ, Gonçalves CE, Silva MJC, Malina RM. (2009). Youth soccer players, 11-14 years: maturity, size, function, skill and goal orientation. *Ann Hum Biol ; 36(1):60-73.*

Florescu C., Dumitresu V., Predescu A. (1969). *Metodica dezvoltării calităţilor fizice*. Bucureşti : Editura Consiliului Naţional pentru Educaţie Fizică şi Sport

Ford, H. T. Jr., Puckett, J. R., Drummond, J. P., Sawyer, K., Gantt, K., and Fussell, C. (1983). Effects of three combinations of plyometric and weight training programs on selected physical fitness test items. *Percept. Mot. Skills* 56, 919–922. doi: 10.2466/pms.1983.56.3.919

Ford, H. T. Jr., Puckett, J. R., Drummond, J. P., Sawyer, K., Gantt, K., and Fussell, C. (1983). Effects of three combinations of plyometric and weight training programs on selected physical fitness test items. Percept. Mot. Skills 56, 919–922. doi: 10.2466/pms.1983.56.3.919

Ford, H. T., Jr., Puckett, J. R., Drummond, J. P., Sawyer, K., Gantt, K., & Fussell, C. (1983). Effects of three combinations of plyometric and weight training programs on selected physical fitness test items. *Percept Mot Skills, 56(3), 919-922. doi: 10.2466/pms.1983.56.3.919*

Franchini E., Artioli G.G. & Brito C.J. (2013). Judo combat: Time-motion analysis and physiology. *Int J Performance Analysis in Sport 13: 626–643*

Franco-Marquez, F., Rodriguez-Rosell, D., Gonzalez-Suarez, J. M., Pareja-Blanco, F., Mora-Custodio, R., Yanez-Garcia, J. M., et al. (2015). Effects of combined resistance training and plyometrics on physical performance in young soccer players. *Int. J. Sports Med.* 36, 906–914. doi: 10.1055/s-0035-1548890

Fry A. C., and Kraemer W. J. (1991). Physical performance characteristics of american collegiate football players. *Journal of strength and conditioning research, 5(3), 110-171*

Gabbett T. J. (2010). GPS analysis of elite women's field hockey training and competition. *Journal of strength and conditioning research / National Strength & Conditioning Association, 24(5), 1321-1324. doi: 10.1519/JSC.0b013e3181ceebbb*

Gabbett T., Kelly J., Ralph S., and Driscoll D. (2009). Physiological and anthropometric characteristics of junior elite and sub-elite rugby league players, with special reference to starters and non-starters. *Journal of science and medicine in sport 12: 215-222*

Gabbett T.J., Kelly J.N., and Sheppard J.M. (2008). Speed, change of direction speed, and reactive agility of rugby league players. *J Strength Cond Res 22: 174-181*

Gall Fl, Carling C, Williams M, Reilly T. (2010) Anthropometric and fitness characteristics of international, professional and amateur male graduate soccer players from an elite youth academy. *J Sci Med Sport 2010;13(1):90-5.*

Garcia Manso J. M. (1997). *Entrenamiento de la velocidad*, ed. S.L. Editorial Gymnos. ISBN: 9788480131155

Gheorghe B. (2002). *Bazele jocului de fotbal*. Bacău: Editura Alma mater

Gheorghe B. (2008). *Bazele teoretice și mijloace de acționare pentru pregătirea fizică specifică a jucătorilor de fotbal*. Iași: Editura Pim

Gheorghe, C. (2000). *Teoria și metodica educației fizice și sportului.* București, Ed. AN-DA;

Ghițescu I. G. (2007). *Aspecte teoretice și conceptuale ale pregătirii juniorilor în baschet.* București: Ed. Matrixrom

Gil S. M., Gil J., Ruiz F., Irazusta A., & Irazusta J. (2007). Physiological and Anthropometric Characteristics of Young Soccer Players According to Their Playing Position: Relevance for the Selection Process. *Journal of Strength and Conditioning Research, 21(2), 438-445. doi:10.1519/00124278-200705000-00026*

Gissis I., Papadopoulos C., Kalapotharakos V.I., Sotiropoulos A., Komsis G., and Manolopoulos E. (2006). Strength and speed characteristics of elite, sub elite, and recreational young soccer players. *Res Sports Med 14: 205-214*

Gregson W., Drust B., Atkinson G., and Salvo V.D. (2010). Match-to-match variability of highspeed activities in premier league soccer. *Int J Sports Med 31: 237-242*

gy, 24, 326-340

Hanţiu I. (2013). *Kinesologie Știința Mișcării* – note de curs. Oradea

Hardy, L., Jones, G., & Gould, D. (1996). *Understanding Psychological Preparation for Sport: Theory and Practice of Elite Performers*. Wiley, Chichester.

Harre D. (1987) . *Teoria antrenamentului sportiv*. Bucureşti: Editura Stadion

Harrison A. J., Keane S. P., & Coglan J. (2004). Force-velocity relationship and stretchshortening cycle function in sprint and endurance athletes. *Journal of strength and conditioning research / National Strength & Conditioning Association, 18(3), 473-479. doi: 10.1519/13163.1*

Heyman, S. (1992). Comparisons of Successful and Unsuccessful Competitors: A Reconsideration of Methodological Questions and Data. *Journal of Sport Psychology, 4, 295-300.*

Hoare D. G. (2000). Predicting success in junior elite basketball players--the contribution of anthropometic and physiological attributes. *Journal of science and medicine in sport / Sports Medicine Australia, 3(4), 391-405.*

Hoff J. (2007). Training and testing physical capacities for elite soccer players. *Journal of Sports Sciences, 23(6), 573-582. doi: 10.1080/02640410400021252*

Hoffman J. H. (2014). *An investigation of the sled push exercise: Quantification of work, kinematics, and related physical characteristics.* (Doctor of Philosophy in Sport Physiology and Performance), East Tennessee State University, Johnson City, TN.

Hoffman J.R., Vazquez J., Pichardo N, and Tenenbaum G. (2009). Anthropometric and performance comparisons in professional baseball players. *J Strength Cond Res 23: 2173- 2178*

Hoffman, J. R., Tenenbaum, G., Maresh, C. M., & Kraemer, W. J. (1996). Relationship between athletic performance tests and playing time in elite college basketball players. *Journal of strength and conditioning research, 10(2), 67-71.*

Hrysomallis C. (2012). The effectiveness of resisted movement training on sprinting and jumping performance. *Journal of strength and conditioning research / National Strength & Conditioning Association, 26(1), 299-306. doi: 10.1519/JSC.0b013e3182185186*

Ingle, L., Sleap, M., and Tolfrey, K. (2006). The effect of a complex training and detraining programme on selected strength and power variables in early pubertal boys. *J. Sports Sci.* 24, 987–997. doi: 10.1080/02640410500457117

Jaric S, Ristanovic D, and Corcos DM. (1989) The relationship between muscle kinetic parameters and kinematic variables in a complex movement. *Eur J Appl Physiol Occup Physiol 59: 370-376, 1989.*

Jones P., Bampouras T., & Marrin K. (2009). An investigation into the physical determinants of change of direction speed. *J Sports Med Phys Fitness, 49(1), 97-104.*

Jooste, J., Steyn, B. J. M., & Vandenberg, L. (2014). Psychological Skills, Playing Positions and Performance of African Youth Soccer Teams. South African *Journal for Research in Sport, Physical Education and Recreation, 36, 85-100.*

Jovanovic M., Sporis G., Omrcen D., and Fiorentini F. (2011). Effects of speed, agility, quickness training method on power performance in elite soccer players. *J Strength Cond Res 25: 1285-1292*

Kawamori N., Newton R.U., Hori N., and Nosaka K. (2014). Effects of weighted sled towing with heavy versus light load on sprint acceleration ability. *J Strength Cond Res 28: 2738-2745*

Kivi D. and Alexander M. (1997*). A kinematic comparison of the running A and B drills with sprinting, in: Physical Education and Recreation Studies*. Manitoba, Canada: University of Manitoba, p 198

Köklü Y., Alemdaroglu U., Özkan A., Koz M., & Ersöz G. (2015). The relationship between sprint ability, agility and vertical jump performance in young soccer players. *Science & Sports, 30(1), 1-5. doi: 10.1016/j.scispo.2013.04.006*

Kotzamanidis, C. (2006). Effect of plyometric training on running performance and vertical jumping in prepubertal boys. *J. Strength Cond. Res.* 20, 441–445. doi: 10.1519/00124278-200605000-00034

Krause, D. A., Smith, A. M., Holmes, L. C., Klebe, C. R., Lee, J. B., Lundquist, K. M., Hollman, J. H. (2012). Relationship of off-ice and on-ice performance measures in high school male hockey players. *Journal of strength and conditioning research / National Strength & Conditioning Association, 26(5), 1423-1430. doi: 10.1519/JSC.0b013e318251072d*

Little T., & Williams A. G. (2005). Specificity of Acceleration, Maximum Speed and Agility in Professional Soccer Players. *National Strength & Conditioning Association, 19(1), 76-78.*

Lockie R.G., Murphy A.J., Schultz A.B., Jeffriess M.D., and Callaghan S.J. (2013). Influence of sprint acceleration stance kinetics on velocity and step kinematics in field sport athletes. *J Strength Cond Res 27: 2494-2503*

Lopez-Segovia, M., Marques, M. C., van den Tillaar, R., & Gonzalez-Badillo, J. J. (2011). Relationships between vertical jump and full squat power outputs with sprint times in u21 soccer players. *Journal of human kinetics, 30, 135-144. doi: 10.2478/v10078-011-0081-2*

Luebbers P. E., Potteige J. A., Hulver, M. W., Thyfault J. P., Carper M. J., & Lockwood R. H. (2003). Effects of plyometric training and recovery on vertical jump performance and anaerobic power. *Journal of strength and conditioning research / National Strength & Conditioning Association, 17(4), 704-709.*

Lyttle, A. D., Wilson, G. J., and Ostrowski, K. J. (1996). Enhancing performance: maximal power versus combined weights and plyometrics training. *J. Strength Cond. Res.* 10, 173–179. doi: 10.1519/00124278-199608000-00008

Mackala K., Fostiak M., and Kowalski K. (2015). Selected determinants of acceleration in the 100m sprint. *J Hum Kinet 45: 135-148*

Mahoney, M. J., Gabriel, T. J., & Perkins, T. S. (1987). Psychological Skills and Exceptional Athletic Performance. *The Sport Psychologist, 1, 181-199*

Malina RM, Cumming SP, A. P. Kontos A, Eisenmann JC, Ribeiro B, Aroso J. Maturity-associated variation in sport-specific skills of youth soccer players aged 13 - 15 years. *J Sports Sci 2005; 23(5):515-22.*

Malina RM, Eisenmann JC, Cumming SP, Ribeiro B, Aroso J. (2004). Maturity-associated variation in the growth and functional capacities of youth football (soccer) players 13-15 years. *Eur J Appl Physiol 2004;91;555-62.*

Malina RM, Reyes MEP, Eisenmann JC, Horta L. (2000). Height, mass and skeletal maturity of elite Portuguese. *J Sports Sci 2000; 18:685-93.*

Malina RM. (2004). *Growth and maturation: basic principles and effects of training*. Silva MJC, Malina RM, editors. Children and Youth in Organized Sports. Coimbra: Imprensa da Universidade

Malina RM. (2003). *Growth and maturity status of young soccer players*. Reilly T, Williams AM, editors. Science and Soccer. London: Routledge;

Marques M.C, Gil H., Ramos R.J, Costa A.M, and Marinho D.A. (2011). Relationships between vertical jump strength metrics and 5 meters sprint time. *J Hum Kinet 29: 115-122*

Marques M.C. and Izquierdo M. (2014). Kinetic and kinematic associations between vertical jump performance and 10-m sprint time. *J Strength Cond Res 28: 2366-2371*

Marques, M. C., Pereira, A., Reis, I. G., and Tillaar, R. V. D. (2013). Does an in-season 6-week combined sprint and jump training program improve strength-speed abilities and kicking performance in young soccer players? *J. Hum. Kinet.* 39, 157–166. doi: 10.2478/hukin-2013-0078

Martinez-Valencia M.A., Romero-Arenas S., Elvira J.L., Gonzalez-Rave J.M, Navarro Valdivielso F., and Alcaraz P.E. (2015). Effects of Sled Towing on Peak Force, the Rate of Force Development and Sprint Performance During the Acceleration Phase. J Hum Kinet 46: 139-148

McBride J.M., Blow D., Kirby T.J., Haines T.L., Dayne A.M., and Triplett N.T. (2009). Relationship between maximal squat strength and five, ten, and forty-yard sprint times. *J Strength Cond Res 23: 1633-1636*

McFarlane, B. (1993). A basic and advanced techical model for speed. *National strength and conditioning association journal, 15(5), 57-61.*

McKinlay, B. J., Wallace, P., Dotan, R., Long, D., Tokuno, C., Gabriel, D. A., et al. (2018). Effects of plyometric and resistance training on muscle strength, explosiveness, and neuromuscular function in young adolescent soccer players. *J. Strength Cond. Res.* 32, 3039–3050. doi: 10.1519/JSC.0000000000002428

Meir R., Colla P., & Milligan C. (2001). Impact of the 10-metre rule change on professional rugby league: Implications for training. *Strength & conditioning Journal, 23(6), 42-46.*

Meylan, C., and Malatesta, D. (2009). Effects of in-season plyometric training within soccer practice on explosive actions of young players. *J. Strength Cond. Res.* 23, 2605–2613. doi: 10.1519/JSC.0b013e3181b1f330

Michailidis, Y., Fatouros, I. G., Primpa, E., Michailidis, C., Avloniti, A., Chatzinikolaou, A., et al. (2013). Plyometrics' trainability in preadolescent soccer athletes. *J. Strength Cond. Res.* 27, 38–49. doi: 10.1519/JSC.0b013e3182541ec6

Moanță A.D. (2009). *Baschet. Pregătirea copiilor şi juniorilor*. Bucuresti: Editura Moroşan pag. 234 ISBN 978-973-8986-84-8

Murphy A.J., Lockie R.G., and Coutts A.J. (2003). Kinematic determinants of early acceleration in field sport athletes. *J Sports Sci Med 2: 144-150*

Nesen O., Pomeshchikova I., Druz V., Pasko V. & Chervona S., (2018). Changes of technical preparedness of 13-14-year-old handball players to develop high-speed and power abilities. *Journal of Physical Education and Sport, 18(2), 878-884*

Ozolin N. G. (1972). *Metodica antrenamentului sportiv*. București: Editura Stadion

Perez-Gomez, J., Olmedillas, H., Delgado-Guerra, S., Ara, I., Vicente-Rodriguez, G., Ortiz, R. A., Calbet, J. A. (2008). Effects of weightlifting training combined with plyometric exercises on physical fitness, body composition, and knee extension velocity during kicking in football. *Applied physiology, nutrition, and metabolism = Physiologie appliquee, nutrition et metabolisme, 33(3), 501-510. doi: 10.1139/H08-026*

Peterson K. (2009). *Overtraining: Balancing practice and performance*. The sport psych handbook, Human Kinetics, Champaign, IL, pp. 49-70

Peyer K. L., Pivarnik J. M., Eisenmann, J. C., & Vorkapich M. (2011). Physiological characteristics of National Collegiate Athletic Association Division I ice hockey players and their relation to game performance. *Journal of strength and conditioning research /National Strength & Conditioning Association, 25(5), 1183-1192. doi: 10.1519/JSC.0b013e318217650a*

Philippaerts R, Vaeyens R, Janssens M, Renterghem BV, Matthys D, Craen R., (2006). The relationship between peak height velocity and physical performance in youth soccer players. *J Sports Sci 2006;24(3):221-30.*

Platonov, V.N., (2013). *Periodization of sports training. General theory and its practical application.* Ed. Olympic Literature., 624

Poplu G., Ripoll, H., Mavromatis S., & Baratgain J. (2013). How do expert soccer players encode visual information to make decisions in simulated game situations? *Research Quarterly for Exercise and Sport, 17(3), 392-398. http://dx.doi.org/10.1080/02701367.2008.10599503*

Predescu C. (2011). *Fiziologia și biochimia efortului sportiv.* București: Discobolul

Raglin J.S. (1993). *Overtraining and staleness: Psychometric monitoring of endurance athletes.* R.B. Singer, M. Murphey, L.K. Tennant (Eds.), Handbook of research on sport psychology, New York, NY: Macmillan, pp. 840-850

Raglin, J. S., Morgan, W. P., & Luchsinger, A. E. (1990). Mood and Self-Motivation in Successful and Unsuccessful Female Rowers. *Medicine and Science in Sports and Exercise, 22, 849-853.*

Rearick M., Creasy J. & Buriak J. (2011). Avoid overtraining in young athletes. *Journal of Physical Education, Recreation & Dance, 82 (5) (2011), pp. 25-36*

Reilly T, Bangsbo J, Franks A. Anthropometric and physiological predispositions for elite soccer. *J Sports Sci.2000;18(9):669-83*

Reilly T. (2007). *The science of training – soccer*. London: Routledge.

Rienzi E., Drust B., Reilly T., Carter J.E., and Martin A. (2000). Investigation of anthropometric and work-rate profiles of elite South American international soccer players. *J Sports Med Phys Fitness 40: 162-169*
Rienzi E., Drust B., Reilly T., Carter J.E., and Martin A. (2000). Investigation of anthropometric and work-rate profiles of elite South American international soccer players. *J Sports Med Phys Fitness 40: 162-169*
Riera, Riera J. (2001). *Habilidades deportivas, habilidades humanas*. Institut Nacional d'Educaci6 Física de Calalunya. Universitat de Barcelona

Rimmer E. and Sleivert G. (2000). Effects of a plyometrics intervention program on sprint performance. *Journal of strength and conditioning research 14: 295-301*

Ronnestad B. R., Kvamme N. H., Sunde A., & Raastad T. (2008). Short-term effects of strength and plyometric training on sprint and jump performance in professional soccer players. *Journal of strength and conditioning research / National Strength & Conditioning Association, 22(3), 773-780. doi: 10.1519/JSC.0b013e31816a5e86*

Rumpf M. C., Lockie R. G., Cronin, J. B., & Jalilvand, F. (2015). The effect of different sprint training methods on sprint performance over various distances: a brief review. *Journal of 169 strength and conditioning research / National Strength & Conditioning Association. doi: 10.1519/JSC.0000000000001245*

Sandor I. (2008). *Bazele generale ale teoriei educatiei fizice și sportului*. Suport de curs Cluj-Napoca

Saunders T. (1973). *Spela fotboll*. Västerås: ICA-förlaget AB.

Șchiopu U., Verza E. (1995). *Psihologia Vârstelor: ciclurile vieții.* București: Ed. Didactică și Pedagogică

Seabra A, Maia JA, Garganta R. (2001). Crescimento, maturação, aptidão física, força explosiva e habilidades motoras específicas. Estudo em jovens futebolistas e não futebolistas do sexo masculino dos 12 aos 16 anos de idade. *Rev Port Cien Desp 2001;1(2):22-35.*

Seitz L.B., Reyes A., Tran T.T., Saez de Villarreal E.., and Haff G.G. (2014). Increases in lower-body strength transfer positively to sprint performance: a systematic review with metaanalysis. *Sports Med 44: 1693-1702*

Sekulic D., Krolo A., Spasic M., Uljevic O., & Peric M. (2014). The Development of a New Stop´n´go Reactive-Agility Test. *Journal of Strength and Conditioning Research, 28(11), 3306-3312. DOI: 10.1519/JSC.0000000000000515*

Șerbănoiu S. (2004). *Metodica Educaţiei fizice*. București: Cartea Universitară

Sha, Z. (2014). *Kinetic and kinematic properties of D-I male sprinters*. (Doctor of Philosophy in Sport Physiology and Performance), East Tennessee State University, Johnson City, TN.

Shalfawi, S. A., Sabbah, A., Kailani, G., Tonnessen, E., & Enoksen, E. (2011). The relationship between running speed and measures of vertical jump in professional basketball players: A field-test approach. *Journal of strength and conditioning research, 25(11), 3088-3092.*

Sheppard J. M., & Young W. B. (2006). Agility literature review: Classifications, training and testing. *Journal of Sports Sciences, 24(9), 919-932. doi: 10.1080/02640410500457109*

Sion G. (2003). *Psihologia Vârstelor*. București: Editura fundației România de mâine.

Sleivert G. and Taingahue M. (2004). The relationship between maximal jump-squat power and sprint acceleration in athletes. *Eur J Appl Physiol 91: 46-52*

Sohnlein, Q., Muller, E., and Stoggl, T. L. (2014). The effect of 16-week plyometric training on explosive actions in early to mid-puberty elite soccer players. *J. Strength Cond. Res.* 28, 2105–2114. doi: 10.1519/JSC.0000000000000387

Spinks C.D., Murphy A.J, Spinks W.L., and Lockie R.G. (2007). The effects of resisted sprint training on acceleration performance and kinematics in soccer, rugby union, and Australian football players. *J Strength Cond Res 21: 77-85*

Stojanovi, M. D., & Ostojic S. M. (2011). Stretching and injury prevention in football: current perspectives. *Research in sports medicine, 19(2), 73-91*.

Stølen T., Chamari K., Castagna C., & Wisøff U. (2005). Physiology of Soccer. *Journal of Sports Medicine, 35(6), 501-536. DOI 10.2165/00007256-200535060-00004*

Stolen, T., Chamari, K., Castagna, C., and Wisloff, U. (2005). Physiology of soccer: an update. *Sports Med.* 35, 501–536. doi: 10.2165/00007256-200535060-00004

Stone M.H., Stone M., Sands, W. A. (2007). Principles and Practice of Strength Training. Champaign. *IL: Human Kinetics*

Tanner R. K., & Gore C. J. (2013). *Physiological tests for elite athletes (2nd ed.)*. Champaign, IL: Human Kinetics, Australian Institute of Sport.

Taylor, J., & Wilson, G. (2005). *Applying Sport Psychology: Four Perspectives*. Champaign, IL: Human Kinetics

Thelwell, R. C., Greenlees, I. A., & Weston, N. J. V. (2006). Using Psychological Skills Training to Develop Soccer Performance. *Journal of Applied Sport Psychology, 18, 254-270.* *http://dx.doi.org/10.1080/10413200600830323*

Thomas C., Comfort P., Chiang C.Y., and Jones P.A. (2015). Relationship between isometric midthigh pull variables and sprint change of direction in collegiate athletes. *Journal of trainology 4: 6-10*

Thomas, K., French, D., and Hayes, P. R. (2009). The effect of two plyometric training techniques on muscular power and agility in youth soccer players. *J. Strength Cond. Res.* 23, 332–335. doi: 10.1519/JSC.0b013e318183a01a

Tsos A., Pasko V., Rovniy A., Nesen O., Pomeshchikova I. & Volodymyr M., (2018). The improvement of the technical preparedness of 16-18-year-old rugby players with the use of the computer program "Rugby-13". Physical Activity Review, 6, 257-265.

Vaeyens R, Malina RM, Janssens M, Renterghem BV, Bourgois J, Vrijens J, et al. A multidisciplinary selection model for youth soccer: the Ghent Youth Soccer Project. *Br J Sports Med 2006;40(11):928-34.*

Verkhoshansky Y. (2011). *Special Strength Training Manual for Coaches*", Rome, Italy: C Verkhoshansky SSTM. ISBN: 978-88-904038-2-8.

Verza E.,Verza F.E. (2000). *Psihologia Vârstelor.* București: Ed: PRO Humanitate

Vestberg T., Gustafsson R., Maurex L., Ingvar M., & Petrovic P. (2012). *Executive Functions Predict the Success of Top-Soccer Players*. PLoS ONE, 7(4), e34731.

Vigne G., Gaudino C., Rogowski I., Alloatti G., and Hautier C. (2010). Activity profile in elite Italian soccer team. *Int J Sports Med 31: 304-310*

Walker S., & Turner A. (2009). A One-Day Field Test Battery for the Assessment of Aerobic Capacity, Anaerobic Capacity, Speed and Agility of Soccer Players. *Strength and Conditioning Journal, 31(6), 52-60.*

Walsh, M., Arampatzis, A., Schade, F., & Bruggemann, G. P. (2004). The effect of drop jump starting height and contact time on power, work performed, and moment of force. *Journal of strength and conditioning research / National Strength & Conditioning Association, 18(3), 561-566. doi: 10.1519/1533-4287(2004)182.0.CO;2*

Wang X. and Wang Y. (2012). Gait analysis of children with spastic hemiplegic cerebral palsy. *Neural Regeneration Research Journal*, vol. 7, pp. 1578–1584

Wang, Y. C., and Zhang, N. (2016). Effects of plyometric training on soccer players. Exp. Ther. Med. 12, 550–554. doi: 10.3892/etm.2016.3419

Young W. B. (2006). Transfer of strength and power training to sports performance. *International journal of sports physiology and performance, 1(2), 74-83.*

Young W., McLean B., and Ardagna J. (1995). Relationship between strength qualities and sprinting performance. *J Sports Med Phys Fitness 35: 13-19*

Young, W. (1992). Plyometrics: Sprint bounding and the sprint bound index. *Strength & conditioning Journal, 14(4), 18-21.*

Zafeiridis A., Saraslanidis P., Manou V., Ioakimidis P., Dipla K., & Kellis S. (2005). The effects of resisted sled-pulling sprint training on acceleration and maximum speed performance. *The Journal of sports medicine and physical fitness, 45(3), 284-290.*

Zemková E., & Hamar D. (2014). Agility performance in athletes of different sport specializations. *Acta Gymnica, 44(3), 133-140. doi: 10.5507/ag.2014.013*