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**Abstract of the doctoral thesis:  
BUILDING EFFORT CAPACITY BY FUNCTIONAL  
TRAINING AND METABOLIC METHODS TO  
FOOTBALL PLAYERS, JUNIOR II (AGE 14 – 16)**

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**Introduction**

Football is a sport that requires a strenuous exercise, frequently alternating between effort and recovery phases on a variable time basis.

In football performance, the intensity of the physical effort has increased and it must be maintained for a longer period of time, depending on the target.

The physical training has a very important role for the football players, as it determines the performance of the players both in training and in competitions. Physical preparation is the starting point for the whole process of training, the central point/pivot for all the other components of the training.

Depending on the requirements and characteristics of the actual football, physical training interact and influences directly the preparation of technical, tactical, physical and psychological. A tactical concept is achieved only if there is a basis for optimal physical training together with an appropriate emotional and intellectual capacity.

During a football game, the distances can vary, as well as the intensity of running, which proves that a football player must train with all three types of exercise (aerobic, anaerobic lactic acid, anaerobic alactic acid).

The modern football game requires players to engage in all phases of the game, there is a tendency to "close down" the positions and to develop the universal player who can practice a complete football game, based on his physical qualities and tactical skills.

**Part I: THEORETICAL RESEARCH**, which includes 6 chapters.

**Chapter.1.** Motivation for choosing the theme, current situation, research stages, **Chapter.2.** Evolution of the football game, **Chapter.3.** General and specific issues on the effort and performance capacity during the football game, **Chapter.4.** Morphological and functional features, physical and mental characteristics for the Junior II (age 14-16), **Chapter.5.** The specific functional and metabolic training , **Chapter.6.** Conclusions and novelty items drawn from the theoretical part

### **Motivation for choosing the theme**

Considering the international results obtained by the national teams, as well as those gained by the clubs in Romania, there is a sharp decrease compared to the performance of the last 15 - 25 years. Low individual value of the players beginning from junior level is the result of the current Romanian football.

It is known that the junior groups focus less on the general physical preparation than the other components of the training. This leads to inadequate physical development of the future seniors.

Currently, during a football game, a field player runs on an average of 10 and 13 kilometres. This demonstrates how much the football game has evolved physically lately.

### **The ergogenesis of the football game**

The energy sources used by a football player, during a game, are found, in various degrees ,in the three energy systems: alactacid, lactacid, aerobic.

Stored in the muscle cell, the most important four compounds containing energy and involved in the effort energogenesis are:

- ✓ adenosine triphosphate;
- ✓ creatinphosphate;
- ✓ glycogen;
- ✓ lipids;
- ✓ and protein metabolism.

The ergogenesis of the football game:

- ✓ alactacid sistem – 15%;
- ✓ lactacid sistem– 15%;
- ✓ aerobicsistem– 70%.

### **Novelty items/originality and its impact**

- ✓ The concept of functional training;
- ✓ The use of TRX in training children and teenagers;
- ✓ Generalising the exercise areas across all sports;
- ✓ The concept of VO<sub>2</sub> DRIFT is a slow component of VO<sub>2</sub>. Coaches should

- avoid exercise training in this area;
- ✓ Children and teenagers can tolerate lactate doses as adults;
  - ✓ Strength training for children and juniors will be scheduled and guided by principles similar to adults.

**Part II: TESTING THE EFFORT CAPACITY OF FOOTBALL PLAYERS**  
**JUNIOR II - Preliminary research**, which includes 3 chapters.

**Chapter.7.** Organize and conduct preliminary research, **Chapter.8.** Preliminary research results and their interpretation, **Chapter.9.** Preliminary findings

**The premises of the preliminary research**

The need to know the effort capacity in junior II football players and, depending on it, establishing training programs to improve the effort capacity.

**The objectives of the preliminary research**

The objective of the preliminary research is getting to know aerobic and mixed effort capacity for the junior II football players.

**The purpose of the preliminary research**

The purpose of the research is to complete a comparative analysis of the dynamics of the effort following the application tests to the members of two football clubs and to verify our proposed means for achieving the objectives.

**The tasks of the preliminary research**

- ✓ Selecting the groups to be tested;
- ✓ Establishing the necessary context to carry on the testing;
- ✓ Selecting the tests;
- ✓ Applying the established tests;
- ✓ Selecting the statistical parameters necessary for the analysis and interpretation of results;
- ✓ Drawing up the preliminary conclusions and proposals.

**The theory of the preliminary research**

Testing the superior aerobic effort capacity can provide information on sports performance.

**Time, place and subjects of the preliminary research**

During the preliminary research, the members of 2 football clubs from the community championship were tested. Moreover, initial testing of the experimental and control groups has been done.

- ✓ **Sport Club no 1**, Group 1998, Professor Dulceața Victor, 4<sup>th</sup> place in the community championship. Experimental group with 18 athletes.
- ✓ **FC Dinamo 1948 Club**, Group 1998, Coach Prioteasa Gabriel. 1<sup>st</sup> place in the community championship. Control group with 18 athletes.

Following the preliminary research, we came to the following conclusions:

- ✓ The results obtained from the analysis of data collected in the field reveals that, in the initial testing, FC Dinamo's athletes are better physically prepared than the athletes from CSS1;
- ✓ A quality workout in the upper aerobic part is recommended to be associated with a speed workout for children and peripubertal adolescents;
- ✓ As for the football game, ergophysiological experts recommend that upper endurance training to be mixed: VO<sub>2</sub> max at the central level and peripheral AA (amino acids - Anaerobic Alactacid) by means of intensity 1.2 - 1.4 of VAM and for AA 5-15 sec;
- ✓ The maximal aerobic speed measurement (VMA) achieved corresponding to a PMA (VAM's slightly higher and lower for a running race) is assumed from VO<sub>2</sub> max;
- ✓ The level of superior aerobic effort capacity can provide information/predictions on the performance of the team, during a game, to football coaches;
- ✓ From a methodical point of view, after the measurement day of the maximum consumption of O<sub>2</sub> (VO<sub>2</sub> max) and the calculation of the maximum aerobic power (MAP) or the correspondent maximum aerobic speed(VAM),athletes must use means of 80, 85, or 90% intensity of VAM, during the next training sessions;
- ✓ Attention must be paid to the fact that a small error for VO<sub>2</sub> max or PMA or VAM for a scheduled power will induce a significant error in the maximal aerobic endurance as 10 times higher in percentages;
- ✓ To be noted that improving endurance upper zone (anaerobic threshold, VO<sub>2</sub> max) would improve the tolerance to lactic acid (strength-speed);
- ✓ A 5-min running test shows that the results from FC Dinamo athletes are superior to the results from CSS1 athletes;
- ✓ As for the shuttle run test, the results lead us to the conclusion that the speed of the athletes under stress from FC Dinamo is better than those from CSS1. The graph indicates an average time 2 seconds better for Dinamo (45'61") than the one recorded by CSS1 (47'61");
- ✓ Analysing the average VAM recorded by a player from both teams, we can note a maximum aerobic speed better for Dinamo, that recorded an average of 16.17, compared with those from CSS1, which reached an average of 15.73;
- ✓ The results gathered from testing the effort capacity with GP SPORTS indicate us that athletes from FC Dinamo 1948 have a higher aerobic

effort capacity, during the games, than those of CSS1. The effort capacity is correlated with a higher performance. From the preliminary research, we can conclude that, on an average basis, a player from Dinamo runs faster than a player from CSS1, reaching the max speed of 7.39 m/s. The player from Dinamo runs by 0.63 m/s fastest than the player from CSS1. Looking at CV, the results achieved by Dinamo team are more homogeneous (7.21%) compared with those of the School Sport Club nr 1 (9.49%);

- ✓ The maximum heart pulse rate compared to the running distance indicate us that players from Dinamo have a lower heart pulse rate, which shows a better physical preparation compared to those from CSS1;
- ✓ Analysing the data gathered from the experiment, we can conclude that testing the effort capacity can provide information on sport's performance –Thus, **the theory of the preliminary research is confirmed.**

All this information has led to an objective assessment of the effort capacity of athletes.

***Part III: IMPLEMENTATION OF FUNCTIONAL TRAINING AND ORGANIZATION OF PHYSICAL TRAINING TO THE FOOTBALL PLAYERS CSS 1 TEAM (experimental group) - FINAL RESEARCH,***  
which includes 3 chapters.

**Chapter.10.** The methodological approach of the final research, **Chapter.11.** Presentation, analysis and interpretation of results, **Chapter.12.** Conclusions and original elements from the final research

**The theories of the final research**

1. Using TRX in the functional training will help optimize the effort capacity;
2. Using the methods of metabolic workout  $VO_2$  max, VAM, in training, will result in an increase of sport performance.

**Conclusions of the final research**

- ✓ Children can work with TRX, for improving coordination capacity, but not for muscle growth;
- ✓ The resistance training under high intensity and volume is efficient and effective for increasing resistance to pubertal children;
- ✓ A great importance must be paid to educating the sense of rhythm and timing, without which the athletes cannot perform variations of intensity required by the effort areas;

The lack of specific training for the metabolic effort areas leads to the football players being unable to effectively support the effort during the game, and thus the technical and tactical benefits have large fluctuations.

Following the research, which basically consisted in functional training of the football players, we have reached the following conclusions:

- ✓ During the shuttle speed test, the average speed of the athletes from CSS1 (experimental group) is higher than the average rate of the athletes from Dinamo (control group) by 0.16 m/s, the average is 5.44 m/s for the experimental group, respectively 5.28 m/s for the control group. The speed varies between 5.00 and 5.71 m/s for the experimental group and between 4.89 and 5.71 m/s in the control group. The coefficient of variability in testing indicates that both groups are homogeneous 3.7% for the experimental group and 4.2% for the control group;
- ✓ During the 5-minute running test, the average distance competed by the subjects from the experimental group (CSS1) is longer than the one corresponding to the control group (Dinamo) with 41.11 m, the average distance for the experimental group is 1406.67 m and 1365.56 m for the control group. The distance varies between 1270 and 1520 m in the control group and between 1330 and 1500 m in the experimental group. The coefficient of variability in testing indicates that both groups are homogeneous group 3.3% for the experimental group and 6.2% for the control group;
- ✓ During the maximal aerobic speed test, we can notice a better aerobic speed for the CSS1 players compared with those from Dinamo. The average maximal aerobic speed for the CSS1 experimental group is higher by 0.49 km/h than the control group Dinamo, averaging 16.88 km/h respectively 16.39 km/h. The speed varies between 15.24 and 18.24 km/h in the control group and between 15.95 and 18.00 km/h in the experimental group. The coefficient of variability in testing indicates that both groups are homogeneous 8.2% for the experimental group and 6.1% for the control group.
- ✓ Following the analysis of the results from the tests, we can conclude that "using TRX in the functional training will help optimize the effort capacity" – **1<sup>st</sup> theory of the final research is confirmed.**
- ✓ The results from testing effort capacity assessed by GP SPORTS shows that players from CSS1 have a higher aerobic effort capacity during the games, than the players of FC Dinamo 1948. The effort capacity is correlated with higher performance. The research shows that, on average, a player from CSS1 runs faster than a player from Dinamo, with a speed of 7.39 m/s;
- ✓ The value of the maximum heart pulse rate compared to the run distance indicate us that the players from CSS1 have a lower heart pulse rate, which shows a better physical preparation compared to those from Dinamo. The difference of the averages for the experimental - control groups equals -2.12 bpm, the averages are 196.07 bpm for the

experimental group and 198.19 bpm for the control group. The index of effect size (0.12) shows a low to medium difference between the two groups;

- ✓ On average, the maximum volume of oxygen is higher for the experimental group than for the control group with 3.25%, the averages being equal 61.90% for the experimental group and 58.65% for the control group. The maximum amount of oxygen varies between 61% and 63% in the experimental group, and between 57.5% and 61.2% in the control group;
- ✓ Analysing the data resulting from the experiment, we can conclude that: "Using the methods of metabolic workout (VO<sub>2</sub> max, VAM), in training, will result in an increase of sport performance" –**the 2<sup>nd</sup> theory of the final research is confirmed.**

All this information has led to an objective assessment of the effort capacity of athletes.

### **Original elements:**

Any research has elements of originality. As regards this research, we consider to be original the followings:

- ✓ The concept of functional training in children and teenagers;
- ✓ TRX's use in training children and teenagers;
- ✓ Testing Juniors with GP Sports;
- ✓ The use of GP Sports in testing can offer coaches the following information:
  - metabolic cost;
  - Zoning effort;
  - Leading the effort dynamics;
  - Distances covered, etc.
- ✓ The attempt to establish a correlation between effort capacity and the metabolic workouts on exercise areas at football players.

### **Research limits:**

- ✓ Lack of trained specialists working with TRX;
- ✓ The data gathered using GP Sports, for this research, is an effective diagnostic for the effort parameters, but unfortunately the higher costs involved will prevent the continuous use of these methods; lack of trained specialists to work and interpret data gathered with GP Sports equipment.