Victor Dulceață

Football **TALENT** or work?

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Editura RISOPRINT
Cluj-Napoca 2024

*Editura **RISOPRINT** este recunoscută de **C.N.C.S.***
***(Consiliul Național al Cercetării Științifice)**.*
www.risoprint.ro ***www.cncs-uefiscdi.ro***

ISBN 978-973-53-3265-5

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AUTOR
VICTOR DULCEAȚĂ

Director editură: GHEORGHE POP

Preface

Football is a sport that requires intense physical effort, the alternation between the phases of demand and recovery being repeated at variable intervals. In performance football, the intensity of physical effort has increased and must be maintained for as long as possible, depending on the proposed objective. The physical training of footballers has a particularly important role, which determines the performance of athletes both in training and in competitions. Physical training is the very starting point for the entire training process, being the pivot for all the other components of training.

Depending on the requirements and characteristics of today's football, physical training interacts and directly influences technical-tactical, biological and psychological training. A tactical concept is realized only if there is a base of optimal physical training doubled by adequate volitional-intellectual capacities. During a football game, the distances and the intensity with which they run differ, which shows us that a football player must train with all three types of effort (aerobic, lactace anaerobic, alactacid anaerobic).

Modern football requires players to engage in all phases of the game, with a tendency to "abolish" positions and the emergence of the universal player who, through his motor qualities and tactical ability, practices total football. Depending on the requirements and characteristics of today's football, physical training interacts and directly influences technical-tactical, biological and psychological training. A tactical concept is achieved only if there is a base of optimal physical training doubled by adequate volitional-intellectual capacities, all of which lead to functional training.

Achieving functional training is a very ambitious goal because in practice it is much more difficult to conceive than the traditional method in which all the elements that are part of the football game are trained separately. Functional training requires fantasy and creativity. In performance football, the concept of functional training is used more and more often. Functional training is not a new, revolutionary concept, but it is a reinterpretation of traditional training methods in the current context. Functional training involves simple, natural movements, movements that we make during the game without realizing how much it would help us if we used it in training.

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CHAPTER 1
THE EVOLUTION OF THE GAME OF FOOTBALL AT NATIONAL AND INTERNATIONAL LEVEL FROM A PHYSICAL POINT OF VIEW

People have always wanted ways of relaxation, recreation, competition and this is how games appeared, individual or collective competitions, which engaged both competitors and spectators.

The ball game, or in the beginning, appeared from the primitive populations of Alaska, Mexico, Greenland, by the ancient peoples of Egypt, China, Greece, Japan, where the game was very close in image to the football of the modern or contemporary era

In China, 2000 years ago, it was played with an object filled with hair and feathers called Tsu-Chu, in ancient Greece, a blister filled with air, called aporaxis or episkiros, was used in the game. "They cultivated games and physical exercise with the conviction that a harmonious development of the human personality is not possible without the development of its physical capacities; physical education was seen as an integral part of general education and was addressed especially to the younger generation" (Cojocaru, V. 2001).

In the Middle Ages, the game was played in Italy under the name of "gioco del calcio", which had its origin in the similar games of Greek and Roman antiquity, and in

France, under the name of "la soule" or la choule, it was played between two localities, in city squares or even on the streets. Regarding the ancestor of football, there are still controversies but England is entitled to consider itself at the origin of this game, in the form we know it today.

In England, the game appeared under the name of harpastum brought with the Roman occupation, apparently the first ball used was the head of a Roman soldier who died in the battle of conquest of Brittany. Various historical documents attest that the English ancestor of football was brutal. There were also periods when the game was forbidden due to violence from both players and spectators or admitted with restrictions, due to accidents or social conflicts.

In the mid-nineteenth century, the game appeared in schools in England, where in its practice, both feet and hands were used to handle the game ball.

Two games are required: *football-rugby and dribbling game*. In 1845 some safe laws were established, the dimensions of the playing field, the number of players and the duration of the game. The separation of the two games is attributed to a student named William Webb Ellis who, while playing football with his classmates, took the ball in his arms and ran away with it, thus determining the origin of the essential characteristics of the game of rugby. (Cojocaru, V., 2001).

The first public schools to adopt these rules were Eton and Harrow, which forbade the use of hands and their clinging. Dribbling game was officially born in October 1848 at Trinity College in Cambridge.

On October 26, 1863, the two forms of play were definitively separated, the English federation (Football Association) was born, on the same day the so-called "Cambridge rules" were adopted. The only one who refuses to accept the new regulations is the official of the Rugby College, who prefers to keep the game "by hand" by forming a separate football-rugby federation.

In 1866 the first cup between English cities called the Challenge Cup was organized, in 1882, the English federation counted over 1000 clubs, and in 1883 the International Board was created.

After England, new federations began to appear in Switzerland – 1869, Scotland and Northern Ireland – 1873, in Germany – 1874, Belgium – 1880, Holland and Denmark – 1889, France – 1908, Brazil and Portugal – 1914.

The first football game between two women's teams took place in London in 1898.

In 1899 – 1900, seven European federations founded the F.I.F.A. (International Federation of Association Football), and Guerin was elected the first president of FIFA, and on April 4, 1905, England also became a member of FIFA.

Today, FIFA has more members than the UN, with more than 200 countries registered, and the World Cup is an event that, together with the Olympic Games, attracts the largest number of spectators.

In Romania, football is brought by students who were studying abroad. From the known data, the first organized match was played in Arad in 1899 on the occasion of a school celebration, between teams made up of locals and students studying in Budapest. In 1904, the

first football team, Olimpia, was founded in Bucharest, and in 1912, the first official championship took place.
The Romanian Football Federation was founded on February 16, 1930, being the year of its first participation in the inaugural edition of the World Cup in Montevideo, and since 1931 it has been affiliated to FIFA. The rules of the game were introduced over a long period of time.
These rules form the legal picture of current football as demonstrated by these data:

- ✓ 1872 – the rectangular land with a length between 90 – 120m and a width between 45 – 90m;
- ✓ 1875 – the gate must have a length of 8 yards (7.32 m) and a height of 8 feet (2.44 m);
- ✓ 1886 – the existence of an arbitrator is provided;
- ✓ 1890 – the diameter of the bars and the width of the marking are 12cm;
- ✓ 1891 – penalty rule and goal nets;
- ✓ 1896 – duration of the match – 90 minutes, half-time 15 minutes;
- ✓ 1899 – number of players – 11 of which one goalkeeper;
- ✓ 1902 – the appearance of the punishment surface;
- ✓ 1913 – the goalkeeper may not touch the ball with his hand except in the penalty area;
- ✓ 1925 – the off-side rule appears;
- ✓ 1926 – the ball should have a circumference of 68 – 71cm and a weight of 396 – 453g;
- ✓ 1927 – allowing a goal to be scored directly from a corner;

- ✓ 1967 – the goalkeeper no longer has the right to kick the ball and hold it in his hands several times before clearing;
- ✓ 1992 – the goalkeeper is no longer allowed to catch the ball in his hands after a voluntary foot pass from a teammate;
- ✓ 1997 – the goalkeeper is no longer allowed to stop the ball in his arms after a throw-in by a teammate;
- ✓ 2000 – the goalkeeper has 6 seconds to put the ball back in play.

"We notice that since its inception until now, the game of football has undergone a multitude of transformations, going through a long period of development and progress, which has led to the creation of a responsible activity with a high-class competitive spirit. The problems raised by contemporary football, perfected in all its departments, are much more complex than in the past, the game itself being completely different from the one practiced in previous decades." (Motroc, I., Cojocaru, V., 1991)

Football is considered to be the sports discipline with the largest area of diffusion, being practiced by millions of people and to include in its nets more and more followers of all nationalities and races from all areas of the globe, in various competitions.

In high-performance football, the limits of all the factors that contribute to mastery are pushed further and further: the biological capacity of the players for effort, the preparation time, the intellectual and professional

capacity of the coach, the administrative-organizational possibilities and facilities, the research and application of science data in the preparation of players, as well as the moral motivation, but especially the material motivation of the players.

The evolution of football from a physical point of view has its origin with the development of the first games. We can say that it began with the advent of football and has continued until today, when contemporary football is carried out under the sign of total physical commitment. This has led to an increasing importance being given to the physical preparation of the players.

In the first decades after playing the game, there could be no talk of physical training, players relied only on the physical qualities they were endowed with by nature and on a certain training of them during the games.

Physical training was and is the starting point that provides support for all the other components of sports training, while ensuring the evolution of the football game, although it has not always been given due attention.

Over the years, the physical training of football players has improved, being taken to the upper limits of the biological potential, reaching the point that, at present, the development of motor skills is a real obsession of all those who work in performance football. In today's football, when the dynamism of the game has increased considerably, the player is pressured by the lack of space and time, by the opponent's hard marking, the players can cope with the demands only by possessing speed, strength, skill and endurance of a higher level.

In the game of football, the physical training directly influences and interferes with the game tactics, as the physical capacity develops, the tactical act acquires new possibilities of execution. Today's football requires players to engage in all phases of the game, with a tendency to "abolish" positions and the emergence of the universal player who, through his motor qualities and tactical ability, practices total football.

The players represent "dynamic complexes" who, at every moment of the game, must act physically, make some quick and efficient decisions, but who, in order to take action, must benefit from adequate motor support.

"Increasing the quality of the game can be achieved first of all by developing motor skills and coordinating collective actions. The soloists of a team are indispensable and invaluable, but decisive in achieving victory is the joint effort and the spirit of sacrifice of the entire team" (Mombaerts E., 1991).

In the context of contemporary football, in which players engage in all phases of the game, the speed of the game has an important tactical content, through the advantages created by the alternations of rhythm, the changes of the direction of attack and the rapid initiation of the counterattack; But at the same time, strength should not be neglected, as most actions require increased strength indices from footballers for, making jumps and tackles, recovering the ball, overtaking the opponent.

Technique is a basic component of training for children and juniors and directly influences the other component factors, but especially the tactical factor. The acquisition of a defective technique has irreversible effects on the evolution of the football player.

The progress of the technique over the years came, not as a tendency towards spectacularity, but as a response of the strikers to the excessive development of the technical and tactical procedures of the defenders. Obviously, the action can also be interpreted in the opposite direction, by the fact that the defenders have also widened the range of their technical procedures. It can be said that this battle between attack and defense, specific to each of them, was and is the main factor that led to the impulse, the evolution and the new features of the technique. In the evolution of the game of football, the perfection of the existing technical procedures and actions, as well as the appearance and development of new ones, did not lead to an anarchic use of them, but on the contrary, they forced an intelligent, rational, effective and safe use of technical means.

The exceptional players who have an above-average refined technical baggage in which the technical actions of effect predominate, with a touch of special virtuosity that delights the eyes and captivates, have been subjected to a restructuring of their own technique, according to the essential technical-competitive requirements.

The acquisition of a technical background as complete as possible becomes a permanent necessity both from the desire to make a show, and from the need for the variety of procedures, precision actions because effectiveness is achieved through the last movements in front of the goal, where the lack of space and the time crisis are increasingly accentuated due to aggressive and overcrowded defenses.

The evolution of the technique took place simultaneously with the development of the players' mental and

intellectual capacities. The technical act has become intellectualized, this is expressed in practice through precise, opportune, subtle passes and the launch of the partner free of marking, through successive and spectacular dribbles, various takeovers, deceptive movements and acrobatic completions, etc. The emergence and improvement of crowded defenses, strict marking, reduced spaces, play in all areas, determined the development of players' thinking.

In the game of football, the tactics began their evolution with the discovery of the "pass"; This tactical procedure led to the alternation of dribbling with passing, which led to the distribution of players on positions. With the realization that it is more advantageous to pass to a teammate, the frequency of shots on goal has also increased, which has led to a more careful organization of the defense. The first tactical position was 1 – 10, which was composed of a goalkeeper and ten strikers. We gradually switched to the formula 1 – 1 – 9 and then 1 – 1 – 1 – 8.

A tactical settlement that lasted almost a decade in the British Isles was represented by the "Scottish game formula" (1873 – 1882). Wales was the first team to abandon this system and impose a new settlement. This tactical arrangement was evidenced by the withdrawal of a central striker on the midfielders' line, the game formula turning into 1 – 2 – 3 – 5, thus the defenders and midfielders equaled the number of attackers. This pyramid-shaped tactical arrangement began to dominate British football, being quickly adopted by the European countries where the game of football was played, being used for several decades in a row.

A revolutionary vision regarding the placement of the team on the field and the tasks of the players from a tactical point of view, was of the famous English coach Herbert Chapman, who created the famous WM settlement and who between 1930 and 1938, managed with Arsenal London, to win the championship and the FA Cup several times. He withdrew 2 players to the side to ensure the marking on the opposing wingers and in front of his own goal he placed the central midfielder, giving him defensive tasks; He kept 2 midfielders with both offensive and defensive tasks and another 2 midfielders with game coordination tasks, who made the connection between attack and defense. The attack was provided by 3 advanced players, whose game tasks were to score as many goals as possible.

This settlement will dominate world football until the period 1950 – 1956, when the tactics of the football game were again revolutionized by the remarkable results of the Hungarian representative, who in 1953 beat England 7 – 1 in Budapest and 6 – 3 in London. This disaster practically meant the end of the WM system. The new game concept of the Hungarian team stood out for its more offensive character, for the increase of speed and individual technique, for the mobility of the players, the exchange of places between them who, through short passes, made some spectacular combinations with increased efficiency.

A strict and very well organized defensive system, used at Internazionale Milano in the '60s by Helenio Herrera, was the famous "catenaccio" He managed to win 2 Italian championships and 2 European Cups. The game system involved a placement on 3 lines, with a defensive

compartment with 4 defenders, 2 midfielders and 4 forwards.
Among the most important features of Hererra's system, the most important aspects should be noted:

- ✓ increased attention paid to the opponent;
- ✓ strict marking on opponents;
- ✓ the extremely important role of set pieces, around the goal area and the role of offside play;
- ✓ The midfielders' play ensures the connection between the attacking and defending compartments.

In the 70s, the 1 – 4 – 3 – 3 system became famous, in which a third player appeared in the midfield, a change that had the role of balancing the tactical responsibilities in the midfield. This system of play had a relatively balanced distribution on the field, both of the players and in terms of tactical tasks for the two phases of the game: offensive and defensive.
In the '80s, the technicians' demands and conceptions take on another meaning, more and more professional, evolving towards the improvement of any physical, technical, tactical and psychological moment.
The extremely elaborate and well-organized game stands out, the ball circulation and the mobility of the players were much more accurate, and when the ball was with the opponent, by pressing and groping, they blocked the opponent's actions away from their own goal.
In recent years, football is best characterized by 3 aspects:

1. it concerns the variant in which two players appear acting on the flanks, with many offensive tasks, but also with exceptional resources and physical training, doubled by a collective tactical discipline;
2. refers to the line of defenders; the winner of the 1994 World Cup in the USA, Brazil, came up with a new system of play, with a defensive line made up of 4 defenders, very technical and mobile, who no longer used the libero position and played in line, bringing serious changes to the construction and offside game;
3. refers to the latest regulations on the goalkeeper's game:
    a. the obligation not to be able to play the ball with his hand if it is intentionally sent to him by a teammate with his foot or from a throw-in;
    b. The 6-second rule, during which the goalkeeper must put the ball back in play.

These things have transformed the goalkeeper's game, giving him the duties of a central defender in the new version of the game. At the last World Cup, Brazil 2014, most teams used the 4 – 4 – 2 system, with flexibility and mobility depending on the phase of the game and the opponent, being able to turn into 4 – 3 – 3 or 4 – 5 – 1.Other teams used derivatives of these systems: 4 – 4 – 1 – 1 or 4 – 2 – 3 – 1.Whatever the system chosen by the

coach, the mobility and complexity of the players led to the creation of total football.

"As today's football is more and more tacticized, a decisive role is represented, according to the latest theories, by the relationships between players, if until recently these relationships were manifested through concrete and direct actions, currently the scope of the notion is enriched with new components:

- ✓ Anticipating the partner's intention with the ball;
- ✓ Directing the partner without the ball to the one who holds it;
- ✓ The support of the partner who plays;
- ✓ The false demarcation" (Cojocaru, V. 2001).

CHAPTER 2
GENERAL AND SPECIFIC ASPECTS REGARDING THE CAPACITY FOR EFFORT AND PERFORMANCE IN THE GAME OF FOOTBALL

2.1. Physical effort and effort capacity

The body of the athlete, in general, and of the footballer, in particular, is a hyper-complex dynamic system fully engaged from a physical, functional and mental point of view, in the effort in the preparation process.

"Physical exertion means a voluntary or involuntary activation of an organ, segment or organism, in order to exceed the usual performance. From an energetic point of view, the effort is a transformation of chemical energy into mechanical energy, which causes a series of disturbances in the body that affect the major functions, the adaptation of the apparatus and systems being dependent on its nature". (Bota C., 2000).

"Physical effort consists of soliciting, tensing, straining the organs, apparatuses and systems of the body's functions, with energy expenditure and fatigue accumulations, involving special psychic processes, in order to achieve a superior work capacity, therefore an improvement in the training state". (Marinescu, Gh., 1998)

From a complementary psychological perspective, Popesu Neveanu quoted by Marinescu, Gh., 1998

considers effort as a behavior of mobilization, concentration, acceleration of physical and mental forces within a system with conscious and unconscious self-regulation; The effort implies a certain finality and therefore is characterized by focus, adequacy to the obstacle, tension and unification of physical, psychic, intellectual resources.

The repeated efforts during training represent permanent requests for adaptation, at an always higher level, which will lead to the training state and to the achievement of sports form.

During the effort, the body undergoes a double demand:

- ✓ on the one hand, the physical stress, respectively of the somatic sphere – the somatic component of stress;
- ✓ on the other hand, the psychic, emotional demand, in which the body makes the effort – called the psychological component of stress.

The adaptive reactions of the body induced by the effort made in training are the basis for the increase of the effort capacity, a component of the ability to performance on which the remarkable progress achieved by contemporary sport depends.

The effort capacity according to Demeter, A., quoted by Dragnea, A., and Bota, A., 1999 represents the body's ability to carry out a motor activity, a mechanical work with different intensities and durations.

"The effort capacity represents the maximum amount of mechanical work performed in the unit of time. Its limits are very wide and depend on age, gender, state of health, degree of training, etc.". (Cordun, M., 2011).

Training is the basis for increasing the capacity for effort. The effort capacity represents the body's effort to carry out a motor activity with different intensity and duration, representing the maximum amount of mechanical work performed in the unit of time.
Depending on the full or partial presence of oxygen in the production of the energy necessary for contraction, the effort capacity can be considered to be aerobic and anaerobic.

2.2. Performance capacity

Performance capacity represents the set of factors that lead to obtaining a maximum result, with the exhaustion of all the body's reserves, in a given sport or sports discipline.
"Performance capacity is defined as the result of the operational interaction of bio-psycho-educogenic systems materialized in recognized and classified values based on social-historical criteria" (Dragnea A., et al., 2006).
"Performance capacity is determined by four global, synthetic factors: aptitudes, attitudes, training and ambience, conceived in a functional interrelation". (Teodorescu S., 2009)
"The training process in performance sports aims to continuously increase the effort capacity in order to ensure, on the one hand, the possibility of supporting a large amount of work in training in good conditions and, on the other hand, to allow the achievement and maintenance of the highest possible level of effort during competitions". (Marinescu, Gh., 1998).

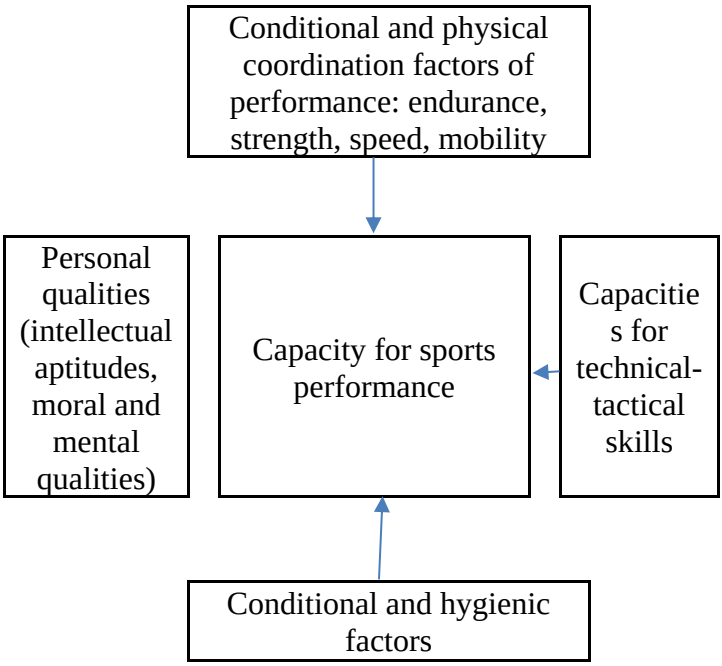

Figure 1. Performance Capacity Factors (Epuran M., 2001 after Weineck J.)

The main goal of sports training is to develop performance capacity. It has a complex structure in which biological and psychological factors are present, socially integrated, in order to obtain sports performances. In order to capture and highlight the systemic interactions of the factors involved in its structure, the study of the performance capacity must be carried out from an operational perspective. (Figure 1).

"The performance capacity can be considered the result of the operational interaction of bio-psycho-educogenic systems materialized in recognized and classified values based on social-historical criteria. It is the complex manifestation of the individual's availability, materialized in objective values or objectified in points, places,

rankings, goals scored, kilos raised, rights won, etc." (Dragnea A.C., Teodorescu S.M., 2002).

2.3. Systematization of efforts

"Training effort is the process of consciously overcoming, by the athlete, the demands of training for physical improvement, for reaching a higher technical and tactical level, as well as for emphasizing mental and intellectual factors, the results of which deliberately produce changes in the performance capacity and adaptation of the organs and systems involved" (Dragnea A. et al., 2006)

Systematization of efforts, according to oxygen supply and energy sources:

1. According to the criterion of oxygen supply to the body during effort, we distinguish:
    a. aerobic efforts: in which the oxygen requirement is in a real balance with the oxygen supply, and the intensity of the effort can be small, submaximal.

Adaptation phase, at the beginning of the effort:

- ✓ imbalance between O2 consumption and needs (O2 deficiency);
- ✓ the necessary energy comes from O2 contained as a reserve in muscle fibers (myoglobin) and in the blood;
- ✓ degradation of ATP – muscle CP;
- ✓ anaerobic use of glycogen with lactate production.

The equilibrium phase, during the effort with the true steady state:

- ✓ balance between O2 consumption and needs;
- ✓ it is installed at an intensity of effort of approximately 50% of VO2max;
- ✓ the necessary energy is released through oxidative processes of glycogen and free fatty acids;
- ✓ duration of more than one hour.

Equilibrium phase, during exercise with an apparent stable state (ergostasis):

- ✓ O2 consumption increases slowly throughout the effort;
- ✓ the body works with an O2 deficiency;
- ✓ energy is mostly released through the oxidation of carbohydrates;
- ✓ The duration of the effort does not exceed one hour.

Recovery phase, recovery from the end of the effort:

- ✓ high consumption of O2 compared to resting consumption;
- ✓ the O2 debt is paid;
- ✓ the restoration of phosphagagens represents the alactacid debt;
- ✓ the oxidation of the lactic acid produced in excess is the lactacid debt;
- ✓ O2 debt = alactacid debt + lactacid debt.

The body is in a balance between the demands and supply of oxygen (steady – states). Two phases are distinguished:

- ✓ The steady state – true states, the equilibrium phase, occurs during exercise with the true stable state and there is a balance between the consumption and the need for O2. It lasts more than an hour.
- ✓ The steady state – relative states, the equilibrium phase, occurs during exercise with the apparent stable state (ergostasis), and the body works with an O2 deficiency. The duration of the effort does not exceed one hour.

b. anaerobic efforts: they are carried out in the conditions of working in apnea, they are characterized by a high intensity (100%), energogenesis takes place in the absence of oxygen. Anaerobic efforts are divided into:

- ✓ alactacid anaerobic efforts. They are very short and maximum intensity efforts, it has phosphagens as an energy substrate. ATP runs out in 7 – 10 sec.;
- ✓ anaerobic lactacid efforts: the efforts are short, of maximum 60 sec. in which the ATP resthesis is obtained from anaerobic glycolysis, with the massive formation of lactic acid.

c. Mixed efforts: the intensity is submaximal and allows the body to be supplied with oxygen.

2. According to the energy sources starting from the restoration of ATP, (Mathews, D.K., and Fox, E.L., 1976 cited by Marinescu Gh., 1998):
    a. the ATP-CP system (phosphagen – anaerobic alactacid) is the simplest system and the fastest source of energy and the system does not depend on a long series of reactions. The intensity of the effort is 100% and higher and does not depend on O2, ATP and CP are stored directly in the muscle cell. This system releases energy to replenish 0.570 mMolli ATP.
    b. the anaerobic glycolysis system (lactic acid system) does not require the presence of O2 and is the second anaerobic system through which ATP is resynthesized. Anaerobic glycolysis it involves the partial degradation of carbohydrates to lactic acid. The cycle is called EMBDEN – MEYERHOFF. This system releases energy to replenish 1 – 1.2 mMolli ATP.

Characteristics:

- ✓ anaerobic glycolysis leads to the formation of lactic acid;
- ✓ does not require the presence of O2;

- ✓ uses only carbohydrates;
- ✓ releases a sufficient amount of energy to replenish 1 Moll of ATP;
- ✓ intervention time: 15 – 20sec;
- ✓ it takes about 40 – 50sec;
- ✓ Maximum intensity moment: 90 – 150sec;
- ✓ payment interval of DO2: in 15 minutes 50% is paid and in the next few tens of minutes it is paid in full;
- ✓ Motor quality concerned: resistance in force mode or resistance in speed mode.x`x`

Limiting factors of the reaction:

- ✓ muscle ability to develop intense glycolysis and depends on the proportion of fast fibers and the intensity of the activity of glycolytic enzymes;
- ✓ the ability of the muscle to withstand acidosis and work at low pH values.

c. The aerobic ATP production system, this system is carried out in the presence of oxygen and includes three reactions:

- ✓ aerobic glycolysis;
- ✓ the Krebs cycle;
- ✓ electron transport system.

This system releases energy for the replenishment of 38 – 39 mMolli ATP.

d. The lipid system of ATP production. It is important for preventing glycogen

depletion in the muscles from one day to the next, and athletes can work twice a day for several days at a submaximal intensity. This system releases energy for the replenishment of 129 mMolli ATP.

2.4. Physical effort in the game of football In the game of football,

In the movement on the field is discontinuous and acyclic, the movement of the players is not uniform but alternative, and the effort falls into the category of the submaximal to the maximum.

The effort in the game of football is mixed, aerobic – anaerobic. In this mixed effort, the three energy release processes are involved: aerobic, lactacid anaerobic, alactacid anaerobic.

Effort in the game of football is a long-term effort with irregular interruptions and a very varied range of actions that is characterized by the complex manifestation of all motor qualities: speed, strength, relaxation, coordination and endurance.

As far as motor qualities are concerned, in the game of football the speed of movement, execution, reaction, circulation, birding, ball handling, etc., predominates, but speed is carried out in resistance and force, i.e. in close correlation with the other motor qualities. Endurance manifests itself in relation to the duration of the game to cope with several chained speed actions, or the demands of a prolonged phase. Strength is especially evident in the dispute with the opponents, in the repeated, precise and adequate hitting of the ball, in overcoming obstacles

outside the game such as the quality of the field, the weather, etc. (Cojocaru, V., 2001).

The ability to sprint over distances of 20 – 40 – 60m with maximum speed and repeating them whenever the game requires it, requires from the players an excellent preparation of speed – endurance and power – endurance.

At the same high level must be placed in terms of aerobic endurance, the player being obliged to perform the same good game both at the beginning of the match and at the end of it, decreasing the possibility of committing technical or tactical mistakes amid fatigue. At the same time, a high level of aerobic endurance also ensures a good recovery rate between matches and training.

Power is another particularly important factor in football, highlighted in game situations involving sprints, changes of direction, jumps and physical contact with the opponent, and due to the fact that these actions are repeated during the match, strength – endurance must also be trained.

The most important physical capacity that a footballer must have is strength, without strength it is impossible to have speed and power, it is impossible to grow physically.

The current football has experienced an extraordinary development in all aspects, the extremely large and varied number of specific motor skills represent elements that not every player can reach, therefore, in the total physical commitment during the game, the effort made up to the upper limits of the biological potential, requires the existence of skills and motor qualities at a very high level.

Effort in the game of football – presents a series of characteristics imposed by

1. *Competition program:*

- ✓ the long duration of the competition program that extends over a period of 9 – 10 months;
- ✓ the variability of the sports form that must ensure maximum efficiency of the players on the dates and periods provided in perfect correlation with the calendar of the representatives;
- ✓ the regularity of the matches that produces a rhythmic demand;

2. *The game itself*

- ✓ long duration of playing time plus possible overtime;
- ✓ the large dimensions of the playing field and its quality;
- ✓ large number of players;
- ✓ the development of the game outdoors regardless of the climatic conditions;
- ✓ The activity throughout the game is carried out in conditions of total commitment, with a sustained rhythm, alternating the compartments and lines of players according to the applied game system.

3. *Players*

- ✓ need to keep the rhythm and total commitment until the last second of the game;

- ✓ technical executions and tactical actions carried out in fatigue conditions;
- ✓ the complexity of the tactical component considering the size of the field and the number of players;
- ✓ the player's participation in the attack and defense phases determines repeated changes in the structure of his movements and the rhythm of his movement;
- ✓ direct combat with the opponent requires a high capacity for effort to cope with the rhythm imposed by the opponent and his actions, but especially to be able to trigger vigorous actions throughout the game;
- ✓ the entire effort made by the player during the game is ultimately an effort of resistance that results in physical and mental fatigue, which recovers faster or slower, depending on the degree of preparation of each player;
- ✓ the football game becomes faster and faster, more aggressive, demanding each player very complexly, regardless of the position occupied on the field (Motroc, I., Cojocaru, V., 1991)

2.5. Ergogenesis in the game of football

The energy sources used by a football player during a game are found in the 3 energy systems: alactacid, lactacid, aerobic, in different proportions.

In the muscle cell are stored the four most important compounds that contain energy and interest the energogenesis of effort:

- ✓ adenosine
- ✓ triphosphate;
- ✓ creatinfotip;
- ✓ glycogen;
- ✓ Lipids;
- ✓ Protein metabolism is also added to these. Ergonomics of the football game:
  - o alactacid system – 15%;
  - o lactacid system – 15%;
  - o aerobic system – 70%.

Phosphagen-anaerobic alactacid system

This system is the simplest, does not depend on oxygen and does not produce lactic acid. It is the fastest source of energy and has immediate intervention time. It occurs at the beginning of the effort or in the sprint effort The enzyme equipment, creatine kinase (CK) is 95% in the muscles, cells and heart cell about 5%, in the nerve cell and at the level of nerve tissue it is almost absent. In children, this enzyme is inferior. This path intervenes at the beginning of the effort or in the sprint effort." (Guedj B.E., et al., 2006) (Table 2).

"Maximum anaerobic alactacid strength (PMAA) is the flow rate of mechanical energy per unit time (in watts), in reality it is the result of the simultaneous use of the alactic anaerobic process at a very high level and the

lactacid and aerobic anaerobic processes with low participation." (Marinescu Gh., 2003)
"Development (PMAA) is primarily aimed at intervening on the biological factor, namely functional reserves, dimensional factors, functional capacities.
As for the training methodology, maximum efforts are recommended, lasting 15 – 20 seconds, which ensure the improvement of the strength of the phosphagen system". (Dragnea A.C., Teodorescu S.M., 2002)
"Anaerobic power is the speed of execution of an effort based on the energy resulting from metabolic processes carried out in anaerobics." (Cordun M., 2011) PMAA cannot be sustained for more than 6 – 10 seconds, after which the power decreases and the ATP resynthesis is progressively performed on the basis of anaerobic gricolisis.

Limiting factors: (Guedj B.E., et al., 2006)

- ✓ at the central level depends on motor control with temporal and spatial recruitment of a large number of muscle fibers at the same time and successively;
- ✓ at the peripheral level, it depends on the muscle volume engaged in movement.

"The maximum anaerobic alactacid capacity" (CMAA) is the total amount of energy available depending on the reserves of ATP and CP. CMAA can be sustained between 20 – 40sec. After performing a maximum effort, the recovery has a new time greater than or equal to 6 minutes." (Guedj B.E., et al., 2006)
"Use: this system (allactic anaerobic pathway) integrates strength, power, speed exercises and is found in

weightlifters, jumpers, throwers and sprinters." (Guedj B.E., et al., 2006).

Table 2: Characteristics of the phosphagen system

Characteristics	Phosphagen System
Energy(Kcal)	5,7-6,9
Capacity (KJ)	15 to 30
Power (KW)	4 to 12
Maximum intervention time	6-7sec
Sonda	Jumps, throws, sprints
Triggering	Immediate
Type of fiber	Fast fibers
Energy substrates	ATP and CP
Intensity of effort	Maximal (100%)
Chemical reactions	creatine kinase
Volume	Unimportant
Energy balance	1 Moll ATP
Motor quality concerned	F,V,F-V
O2 Debt Payment	45sec, 50%
Full Restore Limit	2 – 3min (hp) and > 6min for Motor Control
Recovery	Short Between Reps

Anaerobic glycolysis system

"The anaerobic glycolysis system is the second anaerobic system through which the A.T.P. is resynthesized in the muscles. Anaerobic glycolysis involves the partial degradation of carbohydrates in the absence of oxygen to lactic acid." (Marinescu, Gh., 1998).

This system has an intervention time of 15 – 20 sec. and covers efforts of maximum 40 – 50 sec, from 50 sec to 1.30 min, the power is submaximal anaerobic and covers intense efforts (table 3).

"The maximum anaerobic lactacid power (PMAL) corresponds to the maximum flow rate of glycolysis and is the mechanical expression during a maximum power exercise of an effort of about 30 seconds. The lactic anaerobic power is twice as low as the power alactic anaerobes." (Guedj B.E., et al., 2006)

"The maximum lactaceous anaerobic capacity (CMAL) represents the maximum amount of energy available from anaerobic glycolysis. CMAL is low in prepubertal children and develops especially in athletes who possess a higher proportion of IIA and IIB fibers in their muscles, through training with short intervals and repetitions between 30sec and 1.5min." (Guedj B.E., et al., 2006).

Table 3: Characteristics of the lactacid anaerobic pathway

Characteristics	**Lactacid anaerobic pathway-anaerobic glycolysis system**
Energy (Kcal)	10-12
Capacity (KJ)	100 to 200
Power (KW)	3 to 8
Maximum intervention time	20sec to 1.30min
Sample examples	400 – 800m flat,
Type of fibers	Fast fibers
Developed motor	R-F,R-V

quality	
Energy substrates	Glucose
Trigger	In a few sec
Chemical reactions	Anaerobic glycolysis
Intensity	Close to maximum
Energy balance	2 – 3 Molli ATP starting from glycogen
Presence of O2 for ATP resynthesis	No
Payment of O2 debt	15min-50%
Recovery	Complete ≥ 1h
Volume	Medium

Aerobic system

"The reactions of anaerobic metabolism take place in the cytoplasm of the cell, the reactions of aerobic metabolism take place in a specialized unit closed in the cell called mitochondria, which would also be one of the main limiting factors of aerobic capacity." (Marinescu Gh., 1998)

Aerobic reactions are divided into: aerobic glycolysis, the Krebs cycle, the electron transport system. In the presence of oxygen, lactic acid does not appear (Table 4). The aerobic system leads to an increase in the level of the lactic threshold, which means the possibility of making a more intense effort, at a higher percentage of VO2max, without lactate increasing above resting values." (Dragnea A. C., Teodorescu S. M., 2002)

Maximum aerobic power (PMA) is the maximum amount of oxygen during intense exertion that the body can use, being the maximum volume of oxygen (VO2max). At the end of puberty it has a high value, then

it progressively decreases in parallel with the flow and FCmax.

"Maximum aerobic power is the biological equivalent of maximum oxygen volume (VO2max) and represents the maximum consumption of O2 taken from the lungs, transported to the cardiovascular level under the influence of cardiac output through hemoglobin and used in muscle mitochondrial oxidative phosphorylations during exercise in relation to the unit of time". (Guedj B.E., et al., 2006).

Table 4: Characteristics of the aerobic system

Characteristics	**Aerobic pathway-production ATP**
Energy (Kcal)	39 Molli ATP
Capacity (KJ)	1 to 400
Power (KW)	0,8 to 1,7
Maximum intervention time	> 1.30min
Sample examples	1500m – 5000m flat
Volume	Very important
Energy reserves	Muscle and other tissues
Energy substrates	Glucose, fatty acids
Intensity	2/3 of maximum power
Chemical reactions	Glycolysis and aerobic lipolysis
Triggering	In a few minutes
Motor quality developed	All
Presence of O2 for ATP Synthesis	Yes (mandatory: A.G.)
Payment of the O2 debt	No, but the resurgence of reserves

Full recovery limit	from a few hours to 2 – 6 weeks
Recovery	Short, active

Maximum aerobic capacity

"Aerobic capacity is the amount of energy available based on the oxidation of energy substrates. It is dependent on the availability of lipid reserves stored by the body. Hepatic neoglucogenesis is equally involved as lipids. The main limiting factor is muscle glycogen. During exercise, the athlete oxidizes his own liver and muscle amino acids. Insufficient glycogen stores are a strength depleting factor and lead to premature depletion with very prolonged protein recovery delays.

By developing the upper aerobic capacity – the anaerobic threshold and VO2max, we must make an adaptation of the vascularization system and the cardiovascular system, while increasing the enzymatic activity at the level of lipolysis – the phenomenon of CROSS OVER protects carbohydrates and switches to lipid consumption" (Guedj B.E., et al., 2006).

To protect carbohydrates, we use the energy released by the lipid system (CROSS OVER) and perform workouts in the areas of superior aerobiosis (submaximal intensity). Protein and amino acid stores come from the liver and muscles.

In football, VO2max is not a determining factor for success. A minimum VO2max is required for the expression of game-specific qualities to be possible.

Football training should be a mix of VO2max at the central level and anaerobic alactacid at the peripheral level. These repeated exercises (5 – 10 repetitions)

should last 1 – 4 minutes with an intensity of 1.2 – 1.4 of the VAM but submaximal (anaerobic alactacids, from 5 to 15sec). The effort-to-break ratio is 1/1. After the recovery period, the muscle CP is in sufficient quantity to allow the support of a new effort. The intake of nutrients is very important, both in training and in the recovery period.

2.6. Effort – Fatigue – Recovery

Fatigue is a common phenomenon, which occurs after prolonged or excessive activity and represents a temporary decrease in the body's capacity for effort.

"Fatigue as a complex and hypercomplex echo of the effort, breaks the body's homeostasis, through changes in biochemical processes, favoring the body's transition to a new adaptation stage superior to the previous one. Fatigue, if it is at an optimal level, appears as a stimulating factor of functional and mental resources." (Marinescu Gh., 1998).

"Fatigue is a special type of functional state of man, which appears temporarily under the influence of intense or long-term activity and which leads to a decrease in its efficiency." (Platonov V.N., 2015)

Fatigue is of 3 kinds:

- ✓ physical;
- ✓ Sensory;
- ✓ Cerebral.

Gandelsman divides fatigue into two stages:

- ✓ latent fatigue, the one at the beginning of the effort;

- ✓ obvious fatigue, which occurs in the conditions of prolonged effort.

Fatigue can also be:

- ✓ Intellectual;
- ✓ Sensory;
- ✓ Emotional;
- ✓ Physics;

"There are three theories that explain the genesis of fatigue (Marinescu Gh., 1998):

- ✓ the theory of depletion of the energy substrate (the depletion of A.T.P., C.P., glycogen reserves would be the basis of fatigue);
- ✓ the theory of autointoxication (especially muscle with intermediate metabolism products that would block muscle contraction);
- ✓ the theory of heterochronism (consisting in explaining fatigue by neuromuscular synaptic blockade, which induces the blocking of the transmission of the influx from the nerve to the muscles)".

Fatigue as a state of physiological discomfort is combated by the body through recovery.
The relationship between effort and rest, i.e. between energy expenditure with accumulated fatigue and the rest necessary for recovery, is an essential characteristic of training. Training tasks and recovery influence each other and are closely related.

"Recovery is the process that takes place as a reaction to fatigue and is oriented towards the restoration of disordered homeostasis and functional capacity" (Platonov V.N., 2015).
Recovery after a competition is longer than after training, because oxygen transport systems are restored faster than energy resources.
The difference between the terms return and restoration must be made:

- ✓ Return (the phenomenon of establishing the initial homeostatic balance);
- ✓ Recovery (the phenomenon of reorganization and restructuring of the body).

The factors on which the recovery processes depend are:

- ✓ ***The type of tasks***. Return occurs faster after a dynamic muscular effort than after a static one;
- ✓ ***Duration of tasks***. For a hard task, when energy reserves are depleted and it is necessary to compensate for the energy deficit, the liver and muscle intervene;
- ✓ ***The intensity of the tasks***. When the intensity of the load increases, the production of anaerobic energy also increases, with the appearance of lactic acid and oxygen debt;
- ✓ ***Sequence of tasks***. As muscle fatigue can decrease the efficiency of training and deteriorate sports performance, it is necessary to judiciously plan the recovery intervals between different exercises;

- ✓ ***Frequency of tasks***. The optimal frequency results from the recovery time required depending on the duration, intensity and sequence of various stimuli;
- ✓ ***The level of preparation***. The optimization of the training level induces an adaptation to specific and non-specific tasks, the homeostasis disorder constantly decreasing;
- ✓ ***Heredity and environmental factors***." (Dragnea A.C., Teodorescu S.M., 2002).

"Fatigue occurs as a result of the loss of function of a certain component of the complex system of organs and functions of the body or as a result of the disturbance of the interaction between them, and the role of the main link is to take over the activity, as soon as there is a mismatch between the level of effort and the functional reserves.

The causes can be:

- ✓ Decreased energy reserves;
- ✓ Disturbance of the integrity of functional structures;
- ✓ Breaking homeostasis;
- ✓ Disorder of nervous and hormonal regulation." (Marinescu Gh., 1998)

In addition to the forms of manifestation of fatigue, there are also manifestations of chronic fatigue of a local or general type. It occurs as a result of repeated muscle accumulations or solicitations day after day, without

following a correct break schedule. This overload is known by the term overtraining.

Two forms of overtraining are distinguished:

- ✓ Bazedovian type (sympathetic – tonic);
- ✓ Addisonian type (parasympathetic – tonic).

In football training, the effort can be:

- ✓ standard, always the same or uniform;
- ✓ variable, the one that changes in rhythm.

Also, the effort can be continuous or with pauses, intervals at different times.
As for the break, it can be passive, when the body is expected to recover naturally and to programmed values, or active by performing an activity, different from the one that caused the fatigue.
Three types of breaks are known:

- ✓ breaks that ensure the complete recovery of the effort capacity;
- ✓ shorter breaks, which favor the incomplete recovery of the body;
- ✓ longer breaks that allow overcompensation and the performance of the following repetitions against the background of an increased work capacity." (Ciolcă, S., 2015)

2.7. Metabolic areas of effort.

Despite the mistaken opinion of coaches that metabolic stress zones are only valid for cyclic sports, new concepts

and theories show that they are also valid for team sports (martial arts, sports games, contact sports, gymnastics, etc.).
The metabolic support of the effort in the game of football is dominated by the aerobic zones (aerobic threshold, anaerobic threshold and maximum consumption of O2 – VO2 max) on which the breakthroughs of the areas of anaerobic effort (power efforts, lactate peaks and tolerance to lactic acid accumulation) are grafted.

2.7.1. Aerobic threshold (A.P.)

"It is the compensatory effort zone or the lower aerobic effort zone. The amount of effort in this area does not add up to the total workload and is characterized by low work rate, 50% intensity, heart rate 140 beats/min and lactacidemia below 2mMolli." Marinescu, Gh., (1998).
In 1993 Maglischo E.W., named this area as (resistance zone 1), zone R1, where low-intensity aerobic exercises are performed. This area addresses the development of basic resistance.
The aerobic threshold area aims to develop aerobic capacity by using a large volume of effort. This area is approached especially in the preparatory period, and is specific to long and low-intensity efforts.
"A very important aspect is the selective solicitation of fast and slow twitch muscle fibers. Most of the training in this exercise area will be performed by the slow fibers, which provide the time needed to recover the fast ones." (Maglischo E.W., 1993)
In training in this area, both fats and glycogen provide the energy necessary to restore ATP, making it possible

for the athlete to save muscle glycogen, helping him to train for a longer period of time in a more advanced phase of training, which will lead to improved performance in training and competition.
In football, performing exercises in this area of effort is recommended in the first 3 – 6 weeks of each beginning of the preparatory period, and should have a share of more than 50% of the total volume of training performed during this period.
Characteristics:

- ✓ heart rate is below 120beat/min;
- ✓ lactacidemia is 2mMolli;
- ✓ effort intensity 50 – 60%;
- ✓ it addresses the exercises of learning, consolidation and improvement of techniques, in the warm-up part and in the post-exercise recovery part;
- ✓ It is recommended for high-performance athletes to perform about 400 – 800m of effort in this area at the end of the lesson to neutralize the lactic acid accumulated in the muscles.

2.7.2. Anaerobic threshold (P.Ana.)

The anaerobic threshold is the area of medium aerobic effort or the area where the effort is mostly aerobic. Marinescu Gh., 1998, quoting Tocitu, D., divides this area into two,,,stable O2 area" and "relative O2 area".
The first area is characterized by a lower pace than the one in the competition, lasting between 45 – 120min and

an intensity of 55 – 65%. In the "stable O2 zone" lactacidemia is 2 – 3.5mMolli.
In the second area, the pace is lower than the competition rate with a duration of 30 – 90 minutes, having effects of maintaining and developing aerobic capacity, the intensity of 70 – 80% of VO2max, HR – 160-170 beats/min. In the "relative O2 zone" lactacidemia 3.5 – 5.5mMolli (classically the anaerobic threshold has 4mMolli).
In 1993 Maglischo E.W. named this resistance zone 2, zone R2. This area is characterized by aerobic efforts.
"The term anaerobic threshold is misunderstood as a threshold between aerobic and anaerobic metabolism. The anaerobic threshold is actually the intensity at which aerobic metabolism and lactic acid removal mechanisms work close to their maximum capacity, and lactic acid does not accumulate so quickly in the muscles as to cause acidosis. This name is a misnomer because anaerobic metabolism occurs before the anaerobic threshold is reached.' (Maglischo, 1993 quoted by Marinescu Gh., 2003)
"Improving the anaerobic threshold is the most important training adaptation that helps improve performance, perhaps even more important than improving VO2max. An improvement in the anaerobic threshold reflects not only increases in VO2max but also indicates a reduction in lactate production in active muscles and an increase in its elimination rate." (Marinescu Gh. 1998)
The anaerobic threshold is also found in the literature as:

- ✓ Onset Blood Lactate Accumulation (OBLA),
- ✓ Maximum Stable State of Lactic Acid (SMSTL),
- ✓ Individual Anaerobic Threshold (PANI)

In football, training in this area has the role of to improve aerobic capacity. This should be done as quickly as possible without overexerting the athlete.
Characteristics:

- ✓ in P.Ana. the swimming volumes are made
- ✓ link between the anaerobic threshold and sports performance compared to VO2max and sports performance is achieved;
- ✓ working speeds in this area are lower than VO2max speeds;
- ✓ breaks of 5 – 10sec for short repetitions of 25-50-100m, 10 – 30sec for repetitions of 200-400m and 1 – 2min for longer distances 800-1500m;
- ✓ intensity 70 – 85% of VO2max;
- ✓ lactatemia is 4 mMolli;
- ✓ the anaerobic threshold is individual and can have values between 4 – 6.8 – 10mMolli, this emphasizes that sprinters with an individual threshold greater than 4 mMolli can work for a longer time at speeds of 65 – 85% of VO2max at a stable concentration of blood lactate;
- ✓ heart rate between 140 – 150 beats/min;
- ✓ the body reaches a relatively stable state

2.7.3. Maximum oxygen consumption (VO2max).

"The maximum oxygen consumption is measured in the laboratory by calculating the amount of oxygen exhaled in one minute, subtracting this amount from the amount inhaled in the same period of time. The difference is the

oxygen consumption necessary for muscle activity. Each individual possesses a limited capacity to consume O2 called maximum capacity to consume O2 (VO2max)". (Marinescu Gh., 2003).

In 1993 Maglischo E.W. named this resistance zone 3, zone R3. This area is characterized by predominantly aerobic resistance overload exercises.

The efforts in this area are characterized by a slightly lower pace than the competition one, having a duration of 5 – 15min, intensity 85 – 90%, HR – 180 beats/min, lactacidemia 5.5 – 12mMolli. It is an area where superior aerobics predominates.

Another important condition for this area of effort and for training is the observance of the correlation between the maximum oxygen consumption and the respiratory rate. The area of superior aerobics involves an effort that has lipid metabolism as an energy supplier to protect the aerobic glycolysis system. Respiratory quotient (how much respiratory QR is 1.1 for carbohydrates and 0.70 for lipids).

The respiratory quotient is also called non-protein, because it does not take into account the amount of energy brought by protein metabolism. The oxidation of proteins is more complex, because these molecules made up of amino acids contain nitrogen that cannot be oxidized. Proteins contribute relatively little to the supply of energy and their metabolism is neglected.

When we develop the upper aerobiosis zones (R2, R3), in which part of the effort in football, we have to use lipid metabolism.

Training in this effort zone must comply with another methodical condition: throughout the entire evening to

keep the same intensity; that is why this condition is achieved by working with parentheses/series and repetitions. Between repetitions the breaks are small of 10-15-20sec., and between sets the breaks are 3-5-7 min. Athletes work within these brackets with intensities of 85% - 90% of maximum speed. But in assessing the maximum oxygen consumption, it is advisable to work with its relative values and not with absolute values.

VO2max. Relative is the consumption of O2 in l/min divided by the body weight in kg of the subject.

Until the stable state is reached, the maximum consumption of O2 (VO2max) goes through several states. These intermediate stable states are known as VO2 DRIFT. VO2 DRIFT is a slow component of maximum O2 consumption. The attainment of steady state is covered in part by anaerobic metabolisms (oxygen consumed during recovery/COPD also serves to replenish oxygen stores fixed on hemoglobin and myoglbin, which were used at the onset of exercise) (Wilmore J.K., Costill D.L., 1998).

The increase in the supporters of the effort is done progressively according to the muscular energy needs.

Many specialists in the training process confuse the state of VO2 DRIFT with the concept of VO2max, which leads to working in a lower effort zone. An essential condition to achieve maximum oxygen consumption is that at least 3 minutes of effort with intensity specific to the R3 zone must pass, all in close connection with the concept of EPOC (post-exercise oxygen consumption/oxygen debt) (Wilmore J.K., Costill D.L., 1998).

A good indicator of increased oxygen consumption is heart rate. Between variations in heart rate and oxygen consumption there is a slight lag in transient states. Following an exceptionally exhausting effort, oxygen consumption decreases with the duration of the effort. During the break VO2 is not constant, and the first 2-3min VO2 decreases rapidly.

In football, to improve VO2max, the method of intermittent efforts of 5-6 minutes grouped in 4-5 series, with an intensity of 80-90%, is recommended. The effort-rest ratio should be (1/4, 1/2). If the pause is shorter, it does not allow a complete recovery between repetitions, which causes each repetition in a series to start with a higher oxygen consumption than in the previous repetition.

Conditions for achieving VO2max:

- ✓ Stability of VO2max despite increased load (for this we work with parentheses and not with a single series;
- ✓ Reaching the theoretical maximum heart rate. [210 – 0.65 x age] (Spiro S., 1977);
- ✓ Respiratory Coefficient (Respiratory Tract) ⟦QR= ⟧_VO2^VCO2, 1.1 for carbohydrates and 0.70 for lipids;
- ✓ Exhaustion of the subject or inability to maintain constant at 60rpm, pedaling speed;
- ✓ The effort made within the brackets ≥3 minutes depending on the length of the sample;
- ✓ It takes 20 – 30 minutes;
- ✓ After 3 months, progress stops;

- ✓ Intensity 90 – 92%;
- ✓ Lactatemia between 6 – 12 mMolli;
- ✓ Relative stable status;
- ✓ Heart rate ≥ 180beat/min;
- ✓ effort/break ratio = 1:1/2.

2.7.4. Tolerance to the accumulation of lactic acid (T.L.).

In this area, aerobiosis predominates, but anaerobics also occurs in a higher percentage. The exercises have a duration of 1 – 4 minutes, with a 100% intensity and a heart rate – 180 beats/min.

In this area, lactacidemia is 12 – 18 mMolli. The rhythm is equal to that of the competition. In 1993 Maglischo E.W., named this sprint zone 1, zone S1. This area is characterized by exercises to buffer the accumulation of lactic acid.

In order to improve tolerance to lactic acid, the principle of specificity and overload must be observed. The effort-to-break ratio should be 1 to 1. In order to remove a greater amount of lactic acid from the muscles in children and juniors, longer breaks are recommended. Exercise must produce blood lactic acid concentrations greater than 12 mMolli.

Acidosis must provide the necessary stimulus to increase the buffering capacity of the muscles and blood. Also, the pain associated with acidosis should produce the stimulus necessary to improve pain tolerance. Training with lactate tolerance is very stressful. Players who can tolerate acidosis better can perform better and for a

longer period of time, producing more energy at the anaerobic level, which is very important at the end of a test or at certain moments of effort, when the situation requires sustained efforts lasting 30 – 90 seconds. In addition to the physiological effect, the psychological one is also pursued, to cope with the pain caused by training and competition. The pain caused by acidosis makes training with lactic acid tolerance have a higher emotional content than other types of training. Severe acidosis can lead to damage to muscle tissues that will need a long enough time to recover.

The area of lactate tolerance, very important in the game of football although it is often "skipped" in training. Although it has a percentage of participation in the effort of about 14%, many trainers do not train this area, considering that specific resistance training is sufficient, which is misunderstood. This area should not be omitted and must be trained independently, because there are many situations in the game or at the end, when players are forced to make a sustained effort against a background of fatigue. Training this area requires special attention, because too severe acidosis leads to fatigue and ultimately to overtraining. It is recommended to do one, maximum two workouts at this effort zone per week, with a minimum of 72 hours before the competition.

Characteristics:

- ✓ the purpose of lactic acid tolerance training is to help the athlete perform an effort with maximum intensity almost every repetition and to overload the mechanisms that increase lactic acid production and pain tolerance;

- ✓ the frequency of this type of training should be 2-4 times a week;
- ✓ intensity = 95-100% of the competition speed;
- ✓ effort/break ratio = 1:1;
- ✓ lactatemia = 12-20 mMolli.

2.7.5. Lactate production (P.L.)

The efforts in this area have a duration of 30 – 45 seconds and an intensity of 100 – 110%. Lactatemia is obtained in a short time and is 12 – 18 mMolli. The pace is higher than the game. In 1993 Maglischo E.W., named this sprint zone 2, zone S2. This area is characterized by exercises to increase anaerobic metabolic speed.

The exercises are performed at maximum or supramaximal intensity and sets lasting between 25sec – 2min are generally used. Workouts in this area of improving anaerobic metabolism should include the principles: progressivity, overload and specificity.

There is a great similarity between lactic acid production and lactic acid tolerance workouts.

Both develop anaerobic capacity, the difference between them lies in the intensity with which they act. The intensity of anaerobic metabolism is maxim.

The sensation of intense burning in the muscles that is felt after exercise for several hours is given by the increase in the level of lactic acid in the muscles. The burning sensation is the result of the change in muscle PH, which becomes acidic.

Lactic acid is a product of metabolism that occurs in anaerobic glycosis, i.e. the burning of glucose in the absence of oxygen. Lactic acid has an important role in

the appearance and onset of muscle fatigue and is a powerful stimulus for the secretion of anabolic hormones, such as:

- ✓ GLUCOCORTICOID;
- ✓ TESTOSTERONE.

In training, the body uses energy in order to generate muscle contractions and it is necessary regardless of the system in which it is mainly used to produce lactic acid, even at rest.

In football, the moments when lactic acid is produced alternate with those when it is eliminated from the muscles and then from the blood. The lactate level of footballers is directly proportional to their level of preparation.

Lactic acid should not be seen as a product of useless metabolism or as a toxin, it is a source of energy. During training, when VO2 max is reached, the excess accumulated lactic acid can cause muscle fatigue, recovery in this case is done through an active break and a carbohydrate-rich meal. The assessment of lactic acid at the muscle level can be done by muscle biopsy. It can cause muscle trauma and is therefore less and less used. The most common method of measuring lactic acid is by taking venous blood. It is put on a spectrographic device, and within a minute we can find out the value of lactic acid.

2.7.6. Power (P.)

The efforts in this area last up to 15 seconds, and the intensity is 100 – 110%. Lactatemia does not occur in this area. The pace is higher than the game.

In 1993 Maglischo E.W., named this sprint zone 3, zone S3. In this area, exercises are performed to increase muscle strength and work with weights. Training in this area aims to develop strength (speed – strength). The ability to accelerate, decelerate, change the direction of travel, jump, sudden turns, hit the ball, fight with the opponent are expressions of the combined quality of speed and strength, and essential elements of the game of football. The energy sources of this area are ATP – CP. DO2 does not overload the body in anaerobic effort.

The lactate concentration is close to the resting one. Training this area seems relatively simple, if the dosage is followed. The same risk existed in the case of breaks that were too short; The CP needs at least 2 minutes to recover in a proportion of 85%. It is good that the number of repetitions is divided into series by 3 – 4 repetitions, with active breaks of 4 – 5 minutes between sets, thus avoiding the intervention of the anaerobic lactic system. The appearance of any burning in the muscles is proof of the appearance of lactic acid and the effort must be stopped. Training this area uses glycogen and lactic acid more than any form of training. The time allotted to sprints is too short to empty glycogen stores.

The basics of anaerobic power and capacity training:

- ✓ Central and peripheral factors are required;
- ✓ There are repeated exercises between 1.30 – 10 minutes, of the fractional type through long intervals with active breaks;
- ✓ For team sports, combat games are a mixed training of VO2max at the central level and AA at

the peripheral level by recruiting type II muscle fibers;

- ✓ There are intense exercises at 1.2 – 1.4 of the VMA, but submaxims of AA, from 5 to 15sec with active recovery of duration equal to or less than the time of the duration of the exercise;
- ✓ The training lasts half an hour or more with a first warm-up phase from 10 to 30 minutes and a return break at 120 beats/min.;
- ✓ Heart rate and VO2max are almost reached. At the end of each recovery period – muscle creatine information (CP) is sufficient to allow a new exercise at the same intensity;
- ✓ In the prepubertal child or adolescent, a qualitative aerobic training is unconditionally associated with a speed training for the demand of type I, II a and II b fibers and ensures a good cardio-vascular and psychomotor development (anaerobic threshold, VO2max, anaerobic alactacid and lactacid training).

CHAPTER 3
FUNCTIONAL AND METABOLIC TRAINING SPECIFIC TO THE GAME OF FOOTBALL

3.1. Functional training

Functional training is currently a basic means in shaping the athlete. To train functionally we must first of all use functional tools, these are tools that allow our body to move unrestricted, without limits. The key concepts that we should try to achieve in the training of footballers are as follows:

- ✓ the movements must be multiplanes,
- ✓ working on all 3 planes of movement; the movements must be integrated into the specific environment of the sport;
- ✓ The movements have to be complex, so they are a challenge for the brain as much as they are for the whole body when it moves.

Functional training should also have an element of fun included, and the body should be physically and mentally connected when we train. Depending on the chosen exercises, all motor qualities can be developed, thus the specific training objectives of football can be achieved:

a) Power;
b) Speed;

c) Muscular endurance;
d) Improvement of cardio vascular capacity.

"Since the game of football is made up of complex game actions, true functional systems, it is necessary that the physical training is done taking into account the technical-tactical elements of the game; In fact, the components of physical training must be educated and developed to such an extent that they become organic parts of the technical-tactical elements, their support and condition of existence". (Cojocaru, V., 2002)

Specialists have called functional training this type of training so that the general public can learn the benefits of this training method and understand that the fixed machines in classic gyms are not effective. The big professional football clubs have built training halls with large open spaces for functional training and have removed the classic machines to make room for functional equipment. This is the future in the training of footballers that is adopted by all the big clubs.

When we train functionally, it is an attractive way full of mental challenges and physical stimulation. The most common equipment used in functional training are:

- ✓ cable machines and pulleys;
- ✓ medicine ball;
- ✓ gymnastics balls;
- ✓ BOSU ball;
- ✓ elastic bands and tubes;
- ✓ inflatable discs and platforms for balance;
- ✓ benches and boxes for plyometric training;
- ✓ TRX.

The most common equipment used in functional training is TRX Suspension Training.
TRX is a system of levers between gravity and body weight, perfect for anyone due to the fact that the level of resistance and difficulty can be controlled. Depending on the angle of inclination, the level of demand of the muscles directly involved changes, but also the abdominal one, which makes the effort to balance the movement. Nothing happens without strong engagement of the abdomen, its contractions being involuntary. Unlike standard workouts that allow you to use a muscle group, TRX allows you to use a greater number of muscle groups simultaneously, as well as a wider spectrum of multiplane movements. Through these exercises, the following are developed simultaneously: Strength, Balance, Flexibility.
Depending on the intensity and volume of the exercises, TRX workouts can be:

- ✓ Cardio
- ✓ Strength
- ✓ Interval

TRX SUSPANSION TRAINING helps the body's endurance and body shaping without swelling the muscles, but only shaping them; develops muscular endurance, deep muscle activity, posture muscles and joint mobility; It can be a good means of recovery for those with joint and back problems.

Exercise complex with TRX - SUSPENSION TRENING

Warm-up exercises:

Ex no. 1:

Starting position:

- Facing the direction of the TRX attachment point, legs close together, hands extended forward, raised at hip level;
- TRX grabbed by the handles with hands in pronation;

Movement unfolding:

- Bending the trunk forward with the arms outstretched, while lifting one leg and bringing it backwards;
- Hold the position for 5 seconds, then return to the initial position;
- Repeat the exercise with the other leg.

Dosage:

- Five times with each leg;

This exercise aims to warm up the muscles of the thighs, trunk.

Recommendations: in the initial position, the abdominal muscles must be in tension.

Ex no. 2:

Starting position:

- Sitting, with your back to the direction of the TRX attachment point;
- Legs shoulder-width apart, arms by your sides, hands grab the TRX's handles.

Description of the movement:

- A forward lunge is performed, at the same time as raising the arms to the sides to the level of the shoulders;
- Holding the position for 5 seconds;
- Return to the original position;
- Repeat the exercise with the other leg.

Dosage:

- Five times with each leg;

With this exercise, the gluteal, anterior and posterior muscles of the thigh, the median deltoid, are warmed up.
Recommendations: the abdominal muscles must be in tension.

Ex no. 3:

Starting position:

- Facing the direction of the TRX attachment point;
- Feet shoulder-width apart, flexed from the knee joint;
- The upper limbs bent at the elbow joint, the hands grasp the handles of the TRX.

Description of the movement:

- Extension of the lower limbs, at the same time as extension of the upper limbs and bringing them forward, above the head;
- Return to the original position.

Dosage:

- 15 times.

This exercise aims to warm up the posterior and anterior areas of the thigh, buttocks, deltoid.

Ex no. 4:

Starting position:

- Support on the palms, upper limbs suspended in the handles of the TRX;
- One leg flexed at the knee joint, the other stretched.

Description of the movement:

- Alternating flexion and extension of the legs.

Dosage:

- 15 times with each leg.

This exercise helps to warm up the abdominal oblique, deltoid muscles.

Recommendations: the pelvis kept in the same position, through a state of tension in the abdominal muscles.

Exercises for training

Ex no. 1: Flexion-extension in the knee joint

Starting position:

- Sitting, facing in the direction of the TRX attachment point;
- Feet shoulder-width apart;
- Arms bent at the elbow joint, hands grasp the TRX handles at chest level.

Description of movement:

- Flexions-extensions in the knee joint.

Dose:

- 30 times.

This exercise develops the thigh muscles and gluteal muscles.

Recommendations: increase the intensity by increasing the speed and performing the exercise on one leg.

Ex no. 2: Side lunge

Starting position:

- Sitting, facing the TRX attachment point;
- Feet shoulder-width apart;
- Arms bent at the elbow joint, hands grasp the TRX handles at chest level.

Description of the movement:

- Perform a lateral lunge, at the same time as stretching the arms, in order to maintain the handles of the TRX;

- Holding the position for 10 seconds and then returning to the initial position;
- Repeat the exercise with the other leg.

Dose;

- 15 times with each leg.

This exercise develops the anterior and posterior part of the thigh, respectively the gluteal muscles.
Recommendation: the abdominal muscles must be in tension, the trunk kept straight.

Ex no 3: Bridge

Starting position:

- Lying dorsally, arms at your sides;
- Lower limbs flexed, with legs suspended in the TRX handles

Description of the movement:

- Lifting the pelvis from the ground and flexion in the knee joint, bringing them towards the chest;

Dose;

- Repeat the exercise 20 times.

This exercise develops the posterior thigh muscles.
Recommendation: there must be permanent tension exerted from the heels to the TRX handles.

Ex no. 4: Rowing

Starting position:

- Facing the direction of the TRX attachment point;

- Legs shoulder-width apart;
- Upper limbs stretched out, hands grab the TRX handles.

Description of the movement:

- Bending the arms at the elbow joint, bringing them backwards;
- Return to the original position.

Dosage:

- Repeat the exercise 20 times.

This exercise develops the back muscles.
Recommendation: the exercise becomes more difficult if it is performed in one leg.

Ex no. 5: Chest press

Starting position:

- Sitting, with your back to the direction of the TRX attachment point;
- Legs shoulder-width apart, arms raised at head level, flexed at the elbow joint, hands grab the TRX handles.

Description of the movement:

- Extension of the arms;
- Return to the original position.

Dosage:

- Repeat the exercise 20 times

This exercise develops the triceps muscles.
Recommendation: this exercise is more difficult the more inclined the initial position of the body.

Ex no. 6: Crunch

Starting position:

- Support on the palms, upper limbs stretched out and suspended in the handles of the TRX;

Description of the movement:

- Bringing the knees to the chest by flexion;
- Return to the original position.

Dosage:

- Repeat the exercise 20 times

This exercise develops the abdominal muscles.
Recommendation: the exercise can be performed with support on the palms or forearms.

Ex no. 7: Hip lift

Starting position:

- Lying on your back, arms by your sides;
- The lower limbs flexed, with the legs suspended in the handles of the TRX;
- Arms by your sides.

Description of movement:

- Lifting the pelvis from the ground by;
- Lowering the pelvis to close to the ground.

Dosage:

- Repeat the exercise 30 times

This exercise develops the muscles of the buttocks, back of the thigh.
Recommendation: the exercises become more difficult the lower the flexion at the knee joint.

3.2. Total training

Total training is seen as a multidisciplinary and even interdisciplinary approach and takes into account the complete development of the individual and the team.
Maximizing performance cannot be achieved without maximizing the athlete's personality. In this sense, the technicians are obliged to call on other resources for the efficiency of the preparation outside the actual training activity.
In the '70s, the concept of "total training" appeared, which envisaged the complete development of the individual and the team, in the case of sports games. This concept is based on the idea that "maximizing performance cannot be achieved without maximizing the athlete's personality." (Epuran M, 2001)
Total training is a hyper-complex system that includes, in addition to the training itself (physical training, technical training, tactical training, theoretical training, mental training, artistic training and recovery), mental training, psychoregulation training and invisible training.
Then, within each component, a specific activity with a given quality is imposed, such as, for example, the choice of developing strength, speed, endurance, mobilization or addressing the psychic component.

Total training aims to create developmental subclasses such as force-speed, endurance-speed but also reaction speed, the ability to share acyclic or the cyclic frequency of the capacity for the speed factor.
Therefore, in this type of training organization all these components are intertwined.
"Total training is a human activity, carried out by people (coaches, technicians, scientists), at the service of man (athletes, teams) carried out at a maximum level of efficiency." (Epuran M, 2001).

Total training:

- ***a) Actual training***
  - ✓ Physical training
  - ✓ Technical training
  - ✓ Tactical training
  - ✓ Theoretical training
  - ✓ Mental training
  - ✓ Artistic training
  - ✓ Recovery
- ***b) Mental training***
- ***c) Psycho-regulation training***
- ***d) Invisible training***

Man is an inseparable totality, which makes each exercise have a global repercussion on the entire set of components of performance training, something that will be seen later, the notion of cycle implies the inevitable application of the specific activity in a given time.
To better understand what total training is, we can, for example, during a football training session look for an

activity from the tactical component through an opposition exercise: two defenders to a striker; The striker must leave with the ball at his foot from the center of the field, overcome the two defenders and shoot at the goal. The two defenders must block the striker from scoring. What will we find?
As the required task, it aims at the tactical component, but at the same time it also appeals to the following:

- ✓ the physical component concerns all the movements and phases of the game action performed;
- ✓ the technical component targets both the striker (dribbling, ball handling) and the defenders (defensive position, adaptation – choosing the place depending on the situation);
- ✓ the psychological component is given by the opponent's pressure – valid for all attacker/defender, especially if the success of the exercise is under the empire of punishment, 10 push-ups for the loser;
- ✓ and finally, the tactical component, which is the basis of the required game and which consists in the fact that the striker must not let himself be dispossessed of the ball and the defenders must orient themselves and coordinate their places.

3.3. Principles of sports training

"The principles of sports training are general theses or norms that guide the entire sports training activity.

During the development of the athletes' training process, the principles have crystallized better and better, some of them have amplified their role, others have decreased in value and also new principles have appeared, so that in the current stage, in addition to those characteristic of the instructive-educational ones, there are specific principles of training". (Dragnea A.C., Teodorescu S.M., 2002)

In order to achieve these goals, numerous authors have adapted, over time, a series of general norms and theses, gathered in the form of the principles of sports training, as follows:

Manno R. classifies the principles of sports training into:

1) ***General principles:***
   - ✓ the principle of self-awareness;
   - ✓ the principle of reality;
   - ✓ the principle of accessibility;
   - ✓ the principle of successful task solving.

2) ***Principles of effort management:***
   - ✓ the principle of continuity of training;
   - ✓ the principle of progressivity;
   - ✓ the principle of multilaterality.

Matveev L.P. and Novicov A.D.:

1) ***General principles:***
   - ✓ the principle of harmonious development;

- ✓ the principle of linking physical education to work in production and defense;
- ✓ the principle of strengthening health.

2) Methodical principles:

- ✓ the principle of conscious participation;
- ✓ the principle of intuition;
- ✓ the principle of accessibility and individualization;
- ✓ the principle of systematization;
- ✓ the principle of gradually increasing the requirements.

Dragnea A. and Teodorescu S. M:

- ✓ The principle of adaptation to progressive demands (of continuity);
- ✓ The principle of compensation and overcompensation (of restoration);
- ✓ The principle of training cyclicity;
- ✓ The principle of individualization;
- ✓ The principle of motivation;

Epuran M. thus:

1) General principles:

- ✓ the principle of football-scientific orientation;
- ✓ the principle of efficiency and economy;

- ✓ the principle of multilateral development;
- ✓ the principle of complementarity of theory with practice.

2) Principles regarding training objectives:

- ✓ the principle of maximizing performance capacity;
- ✓ the principle of developing motor, cognitive, affective and volitional skills;
- ✓ the principle of control, objectification and evaluation of the activity;
- ✓ the principle of collaboration between coach, athlete and interdisciplinary team.

3) Principles regarding the content of the training:

- ✓ the principle of interdisciplinarity;
- ✓ the principle of rationing;
- ✓ the principle of operationalization.

4) Methodical principles:

- ✓ the principle of individualization;
- ✓ the principle of awareness;
- ✓ the principle of motivation and voluntary effort;
- ✓ the principle of accessibility;
- ✓ the principle of interaction of verbal and non-verbal means;
- ✓ the principle of modeling;

- ✓ the incentive principle;
- ✓ the principle of overlearning;
- ✓ the principle of specialization;
- ✓ the principle of athlete's self-regulation.

3.4. Speed training

Speed training must be carried out by reproducing situations similar to those of the football game. This results in functional speed training. The aim should be to improve the ability to produce force in a rapid manner during an activity carried out at high intensity. It is also necessary to improve the ability to perceive game situations that require immediate action.

In speed training, the players' ability to anticipate and react in different game situations must be improved. It should be provided in the first part of training after a good warm-up. Football players can be involved in maximum efforts for short periods of time, which should not exceed 10 seconds. For a complete recovery, the period must be much longer.

This anaerobic capacity can be improved at puberty. This does not mean that pubertal footballers have to perform more anaerobic training than adults. Training for lactate tolerance and dairy production must be very well programmed and directed to have the same result as in adult footballers, and excess can lead to overtraining.

Footballers should perform series of speed sprints, assisted sprints and endurance sprints at least 3 times a week in training. Sprints in different aspects on distances of 30-150 meters are recommended. Some of them should be with dairy production. A higher number of

repetitions is required for dairy production, and the rest interval between these repetitions should be similar to the rest interval recommended for adult training.
"The development of speed will be provided with priority in the preparatory period, the pre-competition stage and in the competition period. Within these microcycles, 2-4 lessons are scheduled and as many compensatory lessons." (Dragnea A.C., Teodorescu S.M., 2002).
If excessive work is carried out at maximum intensities, the speed barrier may be installed. "The speed barrier is a normal physiological process, based on a stereotype created in the cerebral cortex.
In the specialized training process for speed development, it must be taken into account that the installation of the "speed barrier" should be carried out as late as possible, and not at all during the training period.
Premature installation of the speed barrier is a consequence of early specialist training. The avoidance of premature installation of the speed barrier can be ensured provided that the work at maximum speed is not abused.", (Cojocaru, V. 2002).
After the installation of the speed barrier, it is recommended to use in training lessons the efforts with variable intensities, submaximal up to 85% of the maximum capacity.

3.5. Endurance training

Endurance capacity is conditioned by:

- ✓ the type of muscle fibers included in the activity. It was considered that in a resistance effort almost 90% of the maximum oxygen absorption is carried out by red fibers;

- ✓ energy sources. The resistance capacity is conditioned by the glycogen reserves in the liver. The liver generates the glycogen necessary to ensure effort;
- ✓ cardio-vascular capacity. Maximum oxygen volume (VO2max) is the main criterion for assessment;
- ✓ capillarization and peripheral regulation. Local blood supply increases 10-15 times compared to rest;
- ✓ blood composition. Resistance training has beneficial effects in the growth of red blood cells;
- ✓ lung capacity. Resistance training increases the chest circumference by increasing the volume of the lungs.

By endurance training in speed we mean the ability to produce power and energy quickly through anaerobic systems. It improves the ability to recover after a period of effort carried out at a high intensity.
The ability to produce lactate and perform high-intensity effort in a repeated manner must be trained in one specific manner, and that is speed endurance training.
In speed endurance training we encounter 2 situations:

- ✓ lactic acid production training. Its purpose is to improve the capacity for effort and to achieve maximum efforts in a short period of time;
- ✓ maintenance training (lactate tolerance). It aims to increase the ability to sustain a high-intensity activity over time. The intensity must be almost

maximum. The maximum intensity cannot be maintained throughout the training period.

During puberty, the body's ability to adapt is not called upon to its full potential. At this age, the foundations of the subsequent performance capacity will be laid because during this period the potential to withstand an effort is very high. Resistance training based on the anaerobic threshold is the same in children as it is in adults. No difference was found in the concentration of lactic acid in the blood. In both children and adults, the concentration was between 2.5 – 5 mMolli/l.

3.6. Muscle strength training

Muscle strength also influences speed and endurance. Strength training for children and adolescents will be carried out according to principles similar to adults.
The force can be of several types:

- ✓ Maximum force;
- ✓ Instantaneous force;
- ✓ Resistance in force.

Maximum force is not used in football because it makes movements more difficult, they become slower. Instantaneous strength is the central objective of training, it directly connects the negative dynamic parts with the positive dynamic parts in an explosive way.
Resistance in force is mostly found in the game of football. In football training, strength exercises are mainly used in the preparatory period.
"Strength in resistance mode – the method of efforts to the brim is used, the size of the load 50-60% of the

maximum possibilities, and the number of sets 9-12. The state of refusal appears after 25-35 repetitions.
Force in speed regime – the method of medium efforts is used, and the size of the load is 30-50% where speed predominates and 50-80% where force predominates. The number of sets 6-9, and the number of repetitions 3-5 performed at high and maximum speed.
Specific strength – exercises are used especially in difficult conditions:

- ✓ Running uphill, on snow, on sand, in water;
- ✓ Hill jumping, snow, sand;
- ✓ Use of heavy objects: sandbags.

The number of sets 2-4 and repetitions 3-6." (Cojocaru, V. 2002).
In children and juniors, strength training and strength training in resistance mode is recommended to use TRX. Unlike standard training, which allows the use of a larger number of muscle groups simultaneously, as well as a wider spectrum of multiplane movements. Strength training in children and adolescents will be carried out according to principles similar to adults.
Factors that influence muscle strength:

- ✓ age and gender. In children, strength develops with some restrictions. From puberty onwards, the force acquires a very great importance. In girls, it develops with about 75% of the strength of boys;
- ✓ muscle fiber thickness. The more the muscle grows, the more its strength grows;
- ✓ the amount of energy sources;

- ✓ muscle innervation;
- ✓ psychological factors: motivation, willpower, motivation;

3.7. The structure of physical training in performance football

Physical training

Physical training is the support on which all the factors of sports training are based, without this support, without this training, no athlete or sport can be conceived, it being the one that conditions all movements, with or without the ball.

Physical training is the development and growth of all the physical capacities of the body to a higher level, so that it can cope with the effort required to practice the game of football. (Miu Ş, 2002).

The purpose of physical training in football is:

- ✓ to develop basic motor skills;
- ✓ increasing the functional capacity of the body

Physical training is carried out throughout the year, but with different weights, in the winter and summer periods or in training camps, the means of general training being used predominantly, and these will be combined with the means of specific training as we advance in the pre-competition or competitive periods. (Cernăianu C, 1978)

In order to achieve effective physical training, certain aspects must be taken into account, such as:

- ✓ the preparation period;
- ✓ the level of preparation and individual particularities;

- ✓ the methodical requirement of repetition of work for the development of motor qualities at certain time intervals;
- ✓ the deficiencies of each player (working groups are formed based on this criterion);
- ✓ the technical-tactical tasks of training;
- ✓ the criterion of the physical qualities predominantly requested, depending on the position occupied (defenders – relaxed, midfielders – high work, forwards – speed and relaxation);
- ✓ the content and specifics of the effort;
- ✓ championship structure;
- ✓ competitive stress; official games every 3-4 days;
- ✓ insufficient recovery after games;
- ✓ injuries.

A general systematization of physical training includes:

- ✓ general and multilateral physical training;
- ✓ specific physical training;
- ✓ general physical capacity;
- ✓ selective physical capacity;
- ✓ specific physical capacity.

3.7.1. General and Multilateral Physical

Training in the Game of Football General Physical Training in the Game of Football:

- ✓ ensures the development and education of basic motor skills;

- ✓ develops the general baggage of motor skills;
- ✓ ensures the harmonious development of the morphofunctional indices that condition the practice of the game of football;
- ✓ It is the main factor influencing the other components of sports training.

In the game of football, the general physical training is carried out, especially in the preparatory period, with means and methods of a general character or borrowed from other branches of sport. General physical training aims to develop basic motor skills and increase the functional possibilities of the body in general.

3.7.2. Specific physical training

Specific physical training has a content mainly oriented towards the development of the effort capacity specific to a certain branch or sports events, as well as the combined motor qualities, which are required as a priority.

This training has, in turn, a general orientation, addressing each position individually.

Specialists in the field consider that in football the primary motor quality required by the specific physical effort is endurance in terms of speed, strength and skill; therefore, the action on specific physical training will be focused on educating this combined quality.

Observance of the laws of effort physiology regarding the continuous and safe development of the effort capacity required by the increased demands of the game, requires the following:

- ✓ increased efforts throughout the year;

- ✓ stress demands at the aerobic-anaerobic limit specific to football efforts;
- ✓ using maximum efforts;
- ✓ judicious combination of effort with recovery and rest.

Physical training can be carried out:

A. In the basic preparatory period:

- ✓ in training reserved exclusively for physical training;
- ✓ during training – as a sequence of it;
- ✓ at the beginning of training – immediately after warming up;
- ✓ at the end of the training – after performing the technical-tactical tasks;
- ✓ as physical exercises performed during school games;
- ✓ with the entire number of players;
- ✓ individually, by transferring physical training tasks to the players in groups organized as follows:
    - o according to the criterion of deficiencies - deficient in strength, speed, relaxation, etc.;
    - o according to the criteria of the compartments (goalkeepers, defenders, midfielders, forwards);
    - o after the request in the match played (players who played the whole match, one

half or less, players who did not play at all, recovery from injuries).

B. In the preparatory period – the largest share is the general physical training.

- ✓ *In the weekly cycle with one workout/day, the following will be performed:*
  - 2 workouts reserved exclusively for physical training;
  - In the other trainings, it will be included as a physical training sequence (speed, relaxation, coordination – in the first part of the training, immediately after the warm-up; strength and endurance, in the final part of the training, after the technical-tactical tasks).
- ✓ *In the weekly cycle with 2 workouts/day:*
  - one workout/day reserved for physical training in which: reaction speed, execution, short distance movement, coordination and relaxation, will be worked on in the morning, and strength and endurance, in the afternoon.

C. During the competition period:

In the weekly cycle with one training session/day – 15-20 minutes reserved in each training session, physical

preparation: at the beginning of the training – immediately after the warm-up – for working on reaction speed, execution and relaxation, without tiring the players (2-3 training sessions); at the end of the training – according to the technical-tactical task – for strength and endurance work (3 training sessions).

In the weekly cycle with 2 workouts/day: one workout/day will be reserved for physical training – in the morning for reaction and execution speed work, movement speed and relaxation (3 workouts), in the afternoon for strength and endurance work (3 workouts).

The share of physical training work (Niculescu A., 2003):

Until the age of 13, one must work in such a way that about 60-65% of the time goes to physical training, and about 35-40% to learning technique and tactics. In children, since it is about general physical development, the largest share will be the physical part.

At the age of 13-16 it is advisable that about 50% go to physical training, and 50% to technical-tactical improvement, while 17-18 year old juniors will be allocated 40-45% of the time for physical training and 55-60% to improve technique and tactics.

In the preparatory period, the weight is held by multilateral physical training; In the senior juniors (17-18 years old) and in the seniors, towards the end of the preparatory period, the specific physical training begins to have an increasing weight. The concerns regarding the specific physical training are maintained throughout the pre-competition and competition period, in the form of specific exercises.

During the periodization, regarding the tasks within the training sessions for juniors I, with 5-6 trainings/ week/ 90-120'

In the preparatory period:

in 3 trainings: 20-25' warm-up, 10' development of speed and skill, 45-60' technique and tactics, 15-25' development of strength and relaxation;

in 2-3 training sessions: 20-25' warm-up, 60-75' technique and tactics, 10-20' endurance development.

During the competition period with a match on Saturday:

- Friday break: one of the 3 training sessions is given up, the workload is reduced by: giving up some means, reducing the number of repetitions, increasing the intensity, increasing the duration of the breaks,
- giving up one of the 2-3 training sessions: reducing the workload by: giving up some means, reducing the number of repetitions and the distance, increasing the intensity, increasing the duration of breaks.

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