

Methodological approaches to consider for the preparation of the force ***Criterios metodológicos a considerar para la preparación de la fuerza***

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Reception date: October 12, 2022

Acceptance date: November 16, 2022

ABSTRACT

Without place to doubts, the work guided to the increase of the force causes in the sportsman's organism a group of beneficial transformations for the sport practice that requires of a rigorous planning and control of the loads to achieve a good use of these. In a particular way, the development of the force in the sport has wakened up the interest of trainers and specialists. The proposed present, based on the revision of the literature, he/she offers a description of the methodological approaches that you/they sustain the preparation at the present time in this address of the sport training in function of their sustainable improvement.

RESUMEN

Sin lugar a dudas, el trabajo orientado al aumento de la fuerza provoca en el organismo del deportista un conjunto de transformaciones beneficiosas para la práctica deportiva, que requieren de una rigurosa planificación y control de las cargas para lograr un aprovechamiento óptimo de estas. De manera particular, el desarrollo de la fuerza en el deporte ha despertado el interés de entrenadores y especialistas. La presente propuesta, basada en la revisión de la literatura, ofrece una descripción de los criterios metodológicos que sustentan en la actualidad la preparación en esta dirección del entrenamiento deportivo en función de su perfeccionamiento sostenible.

Keywords

Methodological approaches; It forces muscular, Preparation of the force.

Palabras clave

Criterios metodológicos; Fuerza muscular; Preparación de la fuerza.

INTRODUCTION

When reviewing the specialized literature, we appreciate that there are various authorial criteria when conceptualizing sports training, several of them contributed by Harre D. (1973), Weineck (1978), Matveev L. P. (1983), Ranzola A and Barrios J. (1998), Collazo A. (2006), converge when defining it as a complex and specialized pedagogical process based on laws, principles and rules, permanently adapting to workloads, which requires an integrating scientific direction of each one of the components of the teaching process. teaching-learning and is intended for the development of the athlete's preparation to achieve, from obtaining and stabilizing the sporting form, maximum performance in a particular sport.

By preparation of the athlete, it is understood, the use of the entire set of means (content of physical, technical, tactical, psychological and theoretical preparation) from whose arsenal the athlete draws to achieve sports form as a determining element in sports performance. (Matveev, L.P. 1966).

Therefore, in its current conception, the preparation of the athlete must be seen as a process that for its development is governed by goals and objectives, organizing its content based on preparation components, according to Matveev L. P. and training directions, according to Forteza A.

Physical preparation, a topic addressed by several authors, is considered by Ranzola, Barrios and Platonov (1998), the one that promotes the bases of sports actions, guaranteeing an adequate acquisition of skills and the one that guarantees an elevation of their functional possibilities and at the same time. development of motor qualities (strength, speed, resistance, flexibility and agility), according to Ozolin N. (1983).

Therefore, physical preparation is essential to achieve performance or sports results in the sport practiced. The development of resistance, strength, speed, mobility and coordination capacities constitute the fundamental basis for the achievement of superior results in any sports preparation. When an athlete reaches an adequate level of these, the greater the possibilities of assimilating the technical, tactical, psychological, and theoretical loads.

Force, considered a conditional capacity, is one of the fundamental motor capacities of man, which is manifested in any physical activity, since all movement is based on muscular force and really, to change the situation in space of any object in relation to the body, to change the position of parts of the body or of the whole body in relation to any object, it is necessary to make an effort that depends on the muscular contraction. Roman, I. (2012). This author adds that it is the noblest capacity for its development, but at the same time it can be the most dangerous if it is not dosed correctly from the

beginning, especially in children and high-performance athletes, it is necessary to maintain all its principles, regularities and procedures.

When evaluating the issue of muscle strength, it can be determined that in the younger ages there are practically no differences between boys and girls, their muscle strength not increasing due to training, only after 8, 9 years, due to a better intramuscular and intermuscular coordination. (Hollmann, Hettinger, 1976, 1980, 1990; Rodahl, 1992).

They report (Asmusen, 1973; Martin, 1989) that, with sexual maturation and the increase in hormonal secretion in boys and girls, at approximately 12, 13 years of age, a noticeable increase in muscle strength is observed, especially in the upper arms. children, observing a greater muscular hypertrophy in these, due to the secretion of testosterone, an aspect that constitutes a factor that predominates and marks the difference between both sexes.

It should be noted, according to (Hettinger, 1980; Fetz, 1997), cited by Becali A. E. (2009) that hypertrophy in females stops at approximately 13 years of age, while in boys it continues to increase until approximately 18, 19 years of age. old. These values must be highlighted in people who do not train, however, with systematic training for the development of strength, this can continue to increase until approximately after 30 years of age.

Authors such as Asmusen, 1973, Willmore and Costill, 1999, highlight the decrease in muscle strength from the age of 50, a situation that they associate with the gradual atrophy of muscle mass and the loss of up to 60% of the values of the initial magnitude, with disappearance of motor neurons and fast-twitch muscle fibers.

Another topic when evaluating this theme is the preparation of muscular strength with weights in the female sex, an aspect that, according to Cuervo, C. (2005), far from being harmful, contributes to strengthening the locomotor system and benefits health, without which refer Mederos M. and Becali A, (1994), it would be impossible for them to achieve results that could be unattainable if they do not venture into the work for the development of this capacity.

At the same time, we must recognize the differences between women and men, taking into account a series of aspects in the morphological, physiological and functional order. In this sense, Román I. (2014) underlines the difference between men in 8 to 10% of height with respect to women, highlighting in the case of these smaller shoulder widths, a more open pelvis, shorter leg length and the arms. In the same way, they present lower body weight in relation to men, whose value is between 10 and 20% lower. On the other hand, women have less muscle mass, around 30%, men 40%, a value that

increases as a result of training, but growth does not reach the level characteristic of men. It is also common for women to have more fat (adipose tissue) between 16 to 20% higher than 12-14% of men. Becali A. E. (2009) refers that in them (women) the center of gravity is lower than in men, which allows them to better perform balance exercises with support in the lower extremities. This author adds that sexual differences are also manifested in the structure of the vertebral column, which is relatively shorter in the thoracic portion, so that the cervical and lumbar proportions are longer, which makes the column more mobile; mobility that is favored by the high elasticity of the ligamentous apparatus.

Another difference of the woman in relation to the man, expresses Becali A. E. (2009), is the angle of inclination of the femur in relation to the hip, (legs slightly in X), which places her at a disadvantage for events that need a powerful leg extension (running and jumping).

It should be noted that functionally, women are characterized by less development of the cardiovascular and respiratory system; the stroke volume is lower and the heart rate is higher, in this sense, Román I. (2014) considers that in women the average heart rate is 5 to 10 beats per minute higher than in men. According to Becali A. E. (2009), women's respiratory rate is also higher and its depth less than that of men, chest breathing being their own. Román I. (2014) refers to the fact that the vital capacity of women is 20 to 25% lower than that of men, with the average being, according to Becali A. E. (2009), 1 liter less than that of men.

This author adds that in women the muscular strength is 10-30% lower than in men, with the flexors and extensors being weaker in them. In men the strength of the extensor muscles of the trunk (back strength) is equal to 160kg and in women 100kg. This author refers that the lower muscular strength and the lower capacity to produce the effort for a long time limits the physical work capacity of women when making dynamic and static efforts which can exert an unfavorable influence on their organism.

Another particularity that differentiates women from men, according to Becali A. E. (2009), is the highly developed capacity for coordination of movements, characterized by good expressiveness, plasticity, sense of rhythm, high flexibility; and the woman's successful mastery of movement techniques and complex coordination.

Another of the characteristic features of women, according to this author, is the difference in red blood cells, which is 15% lower than in men, a situation that unfavorably influences their sporting activity when the menstrual period appears, a process that in the woman produces functional and psychological alterations, derived from the consequent decrease in the percentage of hemoglobin in the blood; increase in pulse, blood pressure and body temperature, as well as nervous system excitement, generally manifesting in apathy and irritability, also appearing headaches and lower abdomen.

DEVELOPMENT

Currently, strength preparation is used for the development of the different manifestations of this capacity in most sports, since it offers the possibility of a correct dosage and a wide range of exercises for the different muscular planes. (Román I. 2014).

There are several authors, who, when dealing with the subject related to the preparation of muscular strength, do it in a different way, although most of them coincide in their location in the periodization of sports training and in the selection and use of the means to guarantee its development.

Muscular strength, expresses Ozolin N.G. (1970), is considered one of the most important physical qualities, which determines, to a considerable extent, the speed of movements and plays a large role in work when it requires resistance and agility.

Therefore, it is considered, according to Román I. (2014), as one of the fundamental capacities of man, which is manifested in any physical activity, since all movement and effort is based on and depends on muscular strength.

Other authors, among them Grosser M. and Muller, H. (1996) and Forteza A. (2007), consider that force should be characterized taking into account different points of view, from the physical or mechanical, from the biological or physiological and from sports.

From physics or mechanics, force is any cause capable of modifying the state of rest or movement of a body and deforming bodies, either by pressure (compression or attempt to unite the molecules of a body) or by stretching or tension (attempt to separate the molecules of a body) that is, it is the force of pushing something or pulling something or that which pushes or pulls by means of direct mechanical contact or by the action of gravity and that alters or varies the movement of an object (Luttgens and Wells, 1985).

According to Newton I., force is the influence that when acting on an object causes it to change its state of motion, expresses such a definition in the formula "Force is equal to mass times acceleration" ($F = M \times A$). Ehlenz, Grosser, and Zimmermann. (1988) and Bompa T. O. (2003) state that force, from physics, force is the product of mass times acceleration; expressed in the formula and the corresponding magnitudes: $F = M \times A$ (Kg. m/s²).

From the biological or physiological point of view, several authors observe that when conceptualizing force, they recognize muscular contraction as the cause of muscular force. In this sense, Zatsiorski, M. (1964), states that it is the action of overcoming external resistance or counteracting it at the cost of muscular action. García Manso, Navarro Valdivielso, Ruiz Caballero (1996), affirm that it is the ability of a subject to overcome or withstand resistance, a human being's ability that is given as a result of

muscular contraction, while Manno R. (1994) considers that It is the motor capacity of man that allows him to overcome a resistance or oppose it through a tensing action of the muscles.

These expressed criteria are also associated with those contributed by other authors such as Knuttgen and Kraemer (1987), who state that strength is the capacity for tension that each muscle group can generate at a specific speed of execution, while Ruiz A. (1987), affirms that this represents the overcoming of a certain external resistance with great muscular effort.

From this point of view, Ehlenz, Grosser and Zimmermann (1988), as well as Matveev (1983), Kuznetsov (1980) and Novikov (1977), point out that strength is the ability to overcome or counteract resistance through muscular activity, while Hahn E. (1988) states that it is the human being's ability to overcome or act against external resistance based on the nervous and metabolic processes of the musculature, which can develop this ability without modifying the length of the muscles (static behavior), shortening its length (dynamic behavior of overcoming and lengthening it (dynamic behavior of yielding). On the other hand, Bompa T. O. (2003) when defining force, expresses that it is the neuromuscular capacity to overcome internal and external resistance, meanwhile , Forteza A. (2007) considers that it is the muscle's ability to produce tension when activated, which is related to the number of myosin cross-bridges that can interact with actin filaments, the number of sarcomeres, the length of the fibers and of the muscle, the type of fiber and the factors that facilitate and inhibit muscle activation. Something similar is raised by Collazo A. (2014) when referring to the fact that force is a conditional capacity that man possesses in his neuromuscular system and that is expressed through the different modalities manifested in sports to resist, pull, press and push a load. externally or internally satisfactorily.

From the sporting point of view, according to Badillo and Serna (2002), force is the external manifestation (applied force) that is made of the internal tension generated in the muscle or group of muscles in a determined time.

When summarizing the concepts exposed by the consulted authors, we must highlight the coincidence of their criteria in the biological order when considering force as a conditional capacity of the human being to overcome or counteract resistance at the expense of muscular efforts, which is constantly manifested in activities sports physique, and that, based on their development in sport, an adequate preparation is guaranteed to achieve high sports results.

Investigations carried out by several authors show the presence of various types of muscular strength in sports training, which are essential, according to Matveev L. P. (1983) in all the main sports modalities, but in different measurements and correlations. In some, strength aptitudes proper are

required to a greater extent, in others strength-speed and in others strength-endurance. Therefore, to develop muscle strength, it is important to know what its manifestations are in sports activity.

According to Zatsiorski, Vinuesa and Coll, Bergstronn, Weineck, Román Suárez, Holman and Hettinger, etc. Strength manifests itself in three different ways in sporting activity: Maximum Strength, Speed Strength (explosive strength and plyometrics or reactive properties) and Endurance Strength.

For Bompa T. O. Bompa (2003), there are six types of strength that the coach must know in order to conduct sports training more effectively: General Strength (strength of the entire muscular system or muscular planes of the organism without taking into account the type of specialty sport practiced), Specific Strength (the strength of those priority muscles involved in sport movements), Maximum Strength (maximum level of force that the neuromuscular system can perform during a maximum voluntary contraction), Muscular Endurance (capacity of the muscle to maintain a job for a long time), Power (it is the product of the two abilities, strength and speed, and is defined as the ability to execute a maximum force in a very short time), Absolute Strength (FA) (ability of the athlete to carry out maximum tension without assessing body weight), and Relative Strength (RF) (represents the ratio between the absolute strength of the athlete and his weight, as shown in the following formula: $FR = FA / PC$; where PC is Body Weight).

Platonov V. N. (s/a), exposes the existence of three types of force: Maximum Force (the maximum possibilities that the athlete can demonstrate during a voluntary muscular contraction), Impulse Force or Explosive Force (aptitude to overcome a resistance with a speed of high muscle contraction) and Strength Endurance (ability to maintain optimal strength characteristics for a long time).

For Verjoshanski Y. (2003), strength, based on the nature of the effort manifested and the work regime of the muscles, is classified into six types: Slow Strength (ability to manifest efforts of significant magnitude in conditions of slow movement, Maximum Strength (ability to manifest extreme muscular efforts in an isometric regime), Strength Endurance (ability to sustain for a long time or to repeatedly and successively manifest muscular efforts), Explosive Strength (ability to quickly develop maximum effort resistance against significant external resistance), Speed Strength (ability to rapidly execute movement under conditions of negligible external resistance) and reactive capacity of the neuromuscular system (ability to manifest a powerful work effort immediately after a preliminary stretch of the muscles). muscles by an external force).

Other authorial criteria agree when classifying the types of force by the presence of several factors:

- By the muscular planes that participate: the force can be local, regional and total.
- Considering the weight of the athlete: the force can be absolute and relative.

- Attending to the action of the muscular activity: the force can be maximum force, rapid force, resistance to force.
- According to the type of muscular work: the force can be concentric or biometric, eccentric plyometric.
- Attending to the variety of muscular work: the force can be propulsive or acceleration, fixation and braking.
- By the regime of muscular contraction: the force can be isotonic, isometric and auxotonic.
- Due to the nature of the muscular contraction: the force can be of speed, explosive, phasic, tonic, cyclical, acyclical and reactive.

Mirella R. (s/a) when referring to the classification of muscular strength in her work "The new methodologies of strength, resistance, speed and flexibility training", exposes the criteria that various authors have adopted in recent years.

Thus, strength, based on some of its aspects, is subdivided into several classifications:

- Based on the length of the muscle, Zatsiorski considers the existence of 3 types of force: Static or Isometric Force (without variation in muscle length), Concentric Force (with muscle shortening) and Eccentric Force (with muscle lengthening).

In addition to this, this author proposes this other classification: Tonic-Explosive Strength (overcoming very high resistance with rapid muscle recruitment), Reactive Ballistic Tension (overcoming minimal external resistance preceded by muscular pre-stretching) and Explosive Ballistic Tension (overcoming minimum external movements preceded by a stop movement).

- Based on the acceleration values, Kuznetzov exposes the existence of three types of force: Dynamic Force, characterized by contractions with shrinking and lengthening of the muscle and made up of Explosive Force (maximum acceleration against resistances that do not reach the maximum, but rather below) and by Fast Force and Fast Force (fast recruitment of motor units with minimal resistance); Slow Force (low accelerations with high resistance) and Static Force (characterized by muscle contractions without changes in muscle length).
- Based on the application time, Harre D. points out the presence of six types of force: Maximum Force (it is the highest force that the neuromuscular system can exert in a voluntary motor contraction with high external resistance), Fast Force o Fast (it is the ability of the neuromuscular system to overcome low external resistance with great rapidity of contraction of the motor units), the Resistant Force or Resistance to Force (it is the ability of the muscle to face fatigue in prolonged performance of force medium low), Special Strength (it is the expression of the type of strength characteristic of a certain sporting gesture), Absolute Strength (it is the highest amount of strength that an athlete is capable of developing regardless of body weight), Relative Strength (It is the relationship between the developed force and the body weight of the athlete expressed in kg).

- Based on the time of application, Manno (1988) coincides with the first three classifications of muscular strength made by Harre D.: Maximum Strength, Fast or Fast Strength and Resistant Strength or Strength Resistance.
- Based on the type of movement produced, Roi et al. (1990) propose two types of force: Aesthetic or Isometric Force and Anisometric Force, which also includes Concentric, Eccentric and Plyometric Force.

On the other hand, it is very embarrassing to develop strength without knowing what factors limit or stimulate its increase. On this subject there are various authorial criteria issued, however, a coincidence is observed in the majority of researchers.

In this regard, Zatsiorski (1970), Grosser M., Starischka S., Zimmermann E. (1992), García Manso et al. (1996), I. Román (1997), Platonov V. N. (s/a), consider that the magnitude of force presented in the muscles during their contractile activity is determined by several factors, among them:

- Biological: the type (Fast-twitch/Slowtwitch), the structure (fusiform and penniform muscles) and the proportion of the fibers, the hormonal behavior, the excitation threshold of the nerve fibers that supply the muscles, the muscular hypertrophy, the inter and intramuscular coordination, the synchronization of the activity of the agonist muscles and the relaxation of the antagonist muscles, the frequency of the nerve impulses that the muscle receives, the emotional arousal, the diameter and physiological state of the muscle, the type of contraction, the hormonal influences, the degree of excitation of the nerve centers that direct muscle contraction, the chemistry of muscle tissue, the state of the support-ligament apparatus, voluntary and involuntary apnea, hypoxia, hypnosis, etc.
- Mechanical factors: the biomechanical characteristics of the movement, the muscle groups involved, the initial length of the muscles before contraction, the speed of contraction and conduction in the nerve fibers, the elasticity, the length of the lever arms, and the body weight-force relationship.
- Environmental factors: diet, training, climate, day and temperature, sleep, ultraviolet radiation.
- Other factors: age and sex.

Unquestionably, strength preparation in contemporary sport tends to develop different types of strength (maximum strength, rapid strength, endurance strength), whose levels of development must respond to the technical needs and demands of competitive activity and training. of their sport, creating in parallel, the premises for the improvement of the levels of speed, flexibility and coordination capacities. It is opportune to highlight the organization that should prevail in the preparation of the force, as an essential element to achieve the appropriate effects in the development of the different types of this capacity. Otherwise, the effectiveness of the work would be very low, with great probabilities of causing great damage to the athlete's health.

For all cases (young and experienced athletes) strength preparation must be preceded by a preparation period that adjusts to the levels of the athletes. For young athletes, the extension of this period will have a longer duration than in the case of experienced athletes, it can be between 2 to 3 weeks to several months (4-8) months, while in the case of experienced athletes it is not. they require more than 3-4 weeks of preparatory work at the beginning of the season, after the transit period that ends the previous season. Special attention should be paid to the use of the exercises in this period, especially in the work with young people, who, in order to achieve a correct assimilation of the movement technique, increase the level of flexibility, strengthen the muscular system, and create the Basic levels of resistance must be relatively easy, without using a maximum pace of execution, with pauses between them to ensure complete recovery.

It is convenient that loads between 40-50% are used at work, with a number of repetitions per series that do not exceed 50-60% of those affordable for the athlete, depending on the weekly training frequency (two to four times). We must point out that the strength preparation must be varied and influence the entire muscular system, with a wide range of movements and the equal introduction of agonist and antagonist muscles.

Undoubtedly, as the locomotor system adapts and the types of strength increase, its preparation becomes more complex. In it, as the initial planning structures (mesocycles) are completed, more difficult exercises are introduced, with an increase in the magnitude of the loads (up to 70-85% of the maximum strength level), being able to apply short rest breaks. It is advisable not to apply exercises with a number of repetitions close to the maximum not very frequently, to use a volume of work per session that can reach up to 80-90% of the maximum accessible, without forgetting flexibility work and the level development of the different muscle groups.

When talking about the preparation of strength, we cannot forget the periodization model of this capacity proposed by Bompa T. O., which consists of the definition of several phases for its organization: first phase (anatomical adaptation), second phase (hypertrophy), third phase (maximal force), phase four (conversion to power), phase five (conversion to muscular endurance), phase six (maintenance), and phase seven (transition).

When speaking of the means of preparing strength, we must point out those that act on the muscular system as a whole and those that act selectively on certain muscle groups, that is, general preparation exercises and special preparation exercises, among which we can According to Cortegaza and Cols, the following should be mentioned: exercises that allow you to overcome your body weight with dynamic actions, exercises that allow you to overcome your own body weight and then fix it with

isometric efforts contrasting the force of gravity, exercises to overcome the forces of an opponent, exercises to lift the weight of another partner, exercises that allow accelerating body mass using muscle reactivity, exercises that allow elastic goals to be exceeded, weight-throwing exercises, exercises that allow to overcome the opposing force exerted by water, air, starting and braking exercises, volitional exercises, exercises with rigorously dosed loads and static isometric exercises.

The demands of modern sport have resulted in the incorporation, in the preparation of strength, new and innovative forms of its development, especially new and effective methodological procedures that allow the differentiation of muscular work regimes and the linking of strength preparation with the particularities of competition and training in a specific sport modality.

The methods, according to Collazo A. (2006), are differentiated by their form of execution, regulation and control for the development of force, and can be classified as:

- Methods by repetitions: those that are executed, regulated and controlled by the number of exercises performed in a work session or series, which can be classified as standard method by repetitions, linear progressive method by repetitions, linear regressive method by repetitions, pyramidal method by repetitions, stepped method by repetitions, wave method by repetitions and varied method by repetitions.
- Methods by time: those that are executed, regulated and controlled based on the work time that lasts the exercises ordered in a batch or series, which have the same characteristics as those of repetitions, with the difference that here it is controlled and The physical load is organized by the work time to be carried out, the fundamental objective being the realization of the greatest number of repetitions in a unit of time, being able to be classified as standard method by time, progressive linear method by time, regressive linear method by time , pyramid method for time, step method for time, wave method for time, varied method for time.

CONCLUSIONS

The development of physical capacities, especially strength, is essential to achieve sports performance or sports results in the sport practiced. Its adequate development increases the possibilities of assimilating technical, tactical, psychological, and theoretical loads.

Despite the diversity of authorial criteria, strength preparation is essential for all sports modalities, although in different proportions, taking into account that some modalities require strength aptitudes to a greater or lesser extent, while others require strength-speed. and in others of strength-resistance.

In optimizing the preparation of strength, it is necessary to know the level of physical preparation of the athlete, the adaptive processes to the load and, above all, the individual particularities of the athletes to avoid traumas and guarantee sustained sports performance.

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