

82 - STRENGTH TRAINING RELEVANCE AND ITS VARIABLES IN SEVERAL DIFFERENT GOALS

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INTRODUCTION

Strength training has been widely requested because of its importance in maintaining the health and training of the motor skills required within the different sports. Baechle & Groves (2000) mention that strength training is also called weight training and refers to the use of materials such as dumbbells, appliances, weights and other equipment to improve physical fitness, the appearance and / or sports performance.

Strength is one of the components of physical fitness related to health and influences the body composition of the individual. Thus, exercises involving this physical capacity are important not only for physical performance, but also for the health of those who practice it (GUEDES & GUEDES, 1998).

So strength training can be effective and meet expected goals, stimulus variation becomes necessary. Considering this variation of stimuli, it is required to consider the variables that strength training has: number of repetitions per series, speed of execution, number of sets, the order of the exercises, rest time between series and exercises and the weights used (IDE & LOPES, 2008).

Hence, the objective of this research was to carry out a brief review on the physical ability, strength and training variables, presenting resources for professionals and people who practice this type of training.

1 STRENGTH AND ITS CONCEPTS

Strength, one of the components of physical fitness related to health, has its degree of importance and directly influences the body composition of the individual and should be part of the recommendations of physical exercises (GUEDES & GUEDES, 1998).

According to Kraemer, Fleck & Deschenes (2015) strength can be understood as the maximum tension exerted during a single maximum effort and it is the most regularly tested parameter of the physical fitness, considering it is a component of the physical conditioning and the sports aptitude.

For Knuttgen & Kraemer (1987) apud Fleck & Kraemer (1999, 2007) strength is the maximum capacity of force that a certain muscular group can cause in a pattern of movement at a certain specific speed. Therefore, strength depends directly on the speed of execution of a given exercise or movement.

Ide & Lopes (2008) cite that the generation of strength is determined by the basic units of contraction, called sarcomeres, being formed by several proteins that behave in an active and passive way for the function of contracting the required musculature. Physiologically, strength is defined as "the neuromuscular ability to overcome an external and internal resistance. The maximum strength that an athlete can produce depends on the biomechanical characteristics of a movement (...) and the magnitude of contraction of the muscles involved" (BOMPA, 2002, p.332).

Based on the quotations above, it is possible to verify that strength depends directly on the type of movement the subject will undergo and the number of motor units that will be activated, varying when it comes to the muscles required during this movement to adjust the degree of tension in this musculature.

On the other hand, it can be said that the magnitude of muscle strength depends on the external resistance offered. Zatsiorsky & Kraemer (2008) cite a clear example of the connection between the external and internal environment: requiring an athlete to apply the greatest possible strength onto a coin, in which the effort generated will probably fail because his best effort would be applied at a very small magnitude of strength, since the external resistance would not require a very great amount of effort.

Bompa (2002) mentions that strength is a mechanical characteristic, determined by direction, magnitude or point of application, and is the result of mass (m) times acceleration (a), as predicted by Newton's Second Law. Thus, it is possible to verify that the individual can improve their level of strength as they change one of the two factors that define them, either by increasing their level of acceleration or the displaced mass (or load) (BOMPA, 2002).

Strength can manifest in a variety of ways, such as maximum static force, maximum dynamic force, reactive force, rapid force, resistance strength, and explosive force. Among these manifestations, the maximum force is understood as the greatest neuromuscular capacity of strength production into a maximum voluntary contraction, with a possible joint movement or not, being divided into maximum static force and maximum dynamic force (FLECK & KRAEMER, 2006; IDE & LOPES, 2008).

According to Ide & Lopes (2008) the maximum static force is produced when there is strength, but there are no changes in the angulations of the joints involved in the movement. This manifestation is found in isometric muscular actions, in which there is no visible movement in the musculature, neither shortening nor stretching occurs. Baechle & Groves (2000) report that during a repetition in a certain movement, there is a point of greater difficulty and there is a momentary pause in this movement and at this moment the muscle exerts a static action.

However, the maximum dynamic force can be defined as the greatest force voluntarily used in which there is movement of the required muscle group and can be found in two types of muscular actions: concentric actions and eccentric actions. In concentric actions, there is a shortening of the muscle as it develops tension. However, in the eccentric muscular actions, there is muscle stretching, producing controlled tension (Fleck & Kraemer, 1999, 2006, IDE & LOPES, 2008, and IDE, LOPES & SARRAIPA, 2010).

Reactive force is the effect of force produced within a stretching-shortening cycle, that is, a counter-movement produces the shortening of the shortening musculature (BARBANTI et al., 2002; IDE & LOPES, 2008).

Barbanti et al. (2002) report that resistance strength is the ability to perform strength movement for a longer time and requires a greater number of repetitions, such as working with percentages below the maximum capacity, within an ideal training zone (In this paper, we present a study of the results obtained).

Explosive force is understood as the maximum ability of the muscle to contract and produce force in the shortest time

possible, as if it were an explosion, so that the transfer occurs in the overload to be overcome. A well-known example of this type of force is the beginning of a speed athlete race (BADILLO & AYESTARÁN, 2001; BARBANTI et al., 2002; IDE & LOPES, 2008).

In addition to these manifestations of force, Ide & Lopes (2008) report the hypertrophic force, which definition is still incoherent, since the muscular hypertrophy is a morphological adaptation in which there is an increase in the physiological area of the muscle in cross section. Therefore, as the work carried out in a training environment is aimed at this type of objective, some authors name it hypertrophic force or resistance of hypertrophic force to the protocols that emphasize this purpose (HÄKKINEN, 2002 apud IDE & LOPES, 2008).

2 STRENGTH TRAINING VARIABLES

Strength gain, increase in muscle volume and improvement of localized muscular resistance are results that can be obtained with weight training. And, so these results can be achieved, combinations of strength training variables are essential and should be part of any prescription.

The first variable, number of repetitions per series, must be linked to the training objective. Fleck & Simão (2008) mention that the load used in the exercise influences the number of repetitions performed in a certain exercise and must be proportional. Taking this proportion into account, we have created prediction formulas so that the load is adequate to the number of repetitions, considering that a low load allows the execution of a greater number of repetitions and a high load, a smaller number of repetitions. Therefore, the objectives of each program must conform to the number of repetitions as presented: maximum strength - 1 to 3 or 4 to 6 repetitions; muscle hypertrophy - 7 to 12 repetitions e; localized muscular resistance - 13 to 20 repetitions (FLECK & SIMÃO, 2008).

Another important variable to be considered is the execution speed of the exercises, being appropriate to the stimulus offered and the mobilized load, considering that the higher the load, lower the speed of execution is and, the lower the load, the faster speed of execution is. The literature recommends counting two or two seconds for each concentric and eccentric phase in the execution of a movement, so that it can be controlled. Moreover, the variation of the speed of the movement can lead to several adaptations, being an effective method to emphasize one result over another (BAECHLE & GROVES, 2000; FLECK & SIMÃO, 2008).

Regarding the number of series, Bompa (2002, p.342) mentions that "consists of a few repetitions of an exercise followed by a break", this sequence being an inverse relationship between the load and the number of repetitions performed.

Fleck and Simão (2008) mention that the higher number of sets in a training session is, the greater the total amount of work developed, which influences the total volume and the physiological responses of that session. Also, they indicate that training programs that run a single series, seem to result in significant gains in physical fitness. However, programs with varying grades result in greater gains in overall physical fitness during the longer training periods.

The order that the exercises are performed in each session is also essential in the individual's purpose and influences the training load. Also, if the exercise is performed first in the session, the load used is greater than if the same exercise is performed at the end of the same session (FLECK & SIMÃO, 2008).

There are several possibilities for ordering strength training exercises, which are often used in training sessions, such as the post-exhaustion method, in which exercises are performed for large muscle groups followed by exercise for small muscle groups and the pre-exhaustion method, in which exercises are performed for small muscle groups followed by exercises for large muscle groups (FLECK & SIMÃO, 2008; FLECK & KRAEMER, 2009).

The intention to perform changes in the order in which a given exercise is performed is to promote varied physiological adaptations, intensify the neural, metabolic, hormonal and circulatory responses, improving muscular training (FLECK & KRAEMER, 2009).

Another variable that must be considered in the strength training is the rest time between the series and the exercises, since it may be significant to training responses and determines the recovery characteristic that will occur between series and exercises (FLECK & SIMON, 2008).

According to the recommendations of the American College of Sports Medicine (2002) when training is aimed at strength increasing, pauses of 3 minutes or more should be used. When training is aimed to muscle hypertrophy, periods of 1 to 2 minutes should be recommended. Plus, if strength training aims at localized muscular resistance, intervals of less than 90 seconds should be used.

The last variable presented is related to the weights used, which Baechle & Groves (2000), Uchida et al. (2006), Fleck & Simão (2008) and Kraemer & Fleck (2009) mention that are directly related to the number of repetitions in each series and will determine the degree of intensity of the given exercises, being perhaps the main stimulus linked to the physiological adaptations of the strength training, such as increased strength and localized muscular resistance.

There are several ways to determine strength in strength training and to evaluate the manifestations of strength, among them are the protocol of 1 concentric MRI, 1 eccentric MRI and the protocol of maximum isometric force that aim at the evaluation of maximum dynamic and static force. Also, to evaluate the resistance of the force, there are protocols of the 6 RM and 20 RM tests proposed by Ide and Lopes (2008) along with 12-15 RM method, mentioned by Baechle & Groves (2000).

Within 1 RM concentric and 1 RM eccentric protocols, the main intention is to verify the maximum dynamic force mobilized by superior and inferior members. The execution of such tests consists in three attempts to mobilize or resist to a superior load during concentric or eccentric actions in a certain movement, with pauses of 3 to 5 minutes between each attempt, increasing or decreasing the load if necessary, until an exact weight for a single complete repetition can be found (IDE & LOPES, 2008).

The protocol of maximum isometric force is used to evaluate the greatest static strength of superior and inferior members and "consists in realizing three or four attempts of maximum contraction, in the chosen articular angle. The actions must last from 5 to 6 seconds, approximately. The best attempt is considered." (HÄKKINEN, 1984 apud IDE & LOPES, 2008, p.48).

It is also important to assure the practitioner the necessary adaptation and to avoid any risk of injury. Therefore, it is necessary to stimulate the development of joint flexibility, the ability of tendons to withstand tension, the strength of the trunk muscles and stabilizers, and to train the movements, not the muscles alone (BOMPA, 2001).

With the varied ways of modifying stimuli and promoting physiological changes in the individual practicing strength training, the expected goals can be achieved. It is worth emphasizing that the control of the variables of strength training is necessary to promote the expected results and to stimulate it adequately in each type of objective, always respecting the biological individuality, advancing gradually.

FINAL CONSIDERATIONS

With this review, it can be noticed the importance that variables of strength training assume towards this type of training, considering the growth of the modality demand by the population in general, for health, aesthetics or sports training purposes.

For those who practice strength training, weight training or lifting training and for the Physical Education professional who coaches and works with this type of training, it is extremely important to respect the principles of sports training and apply them properly, respecting the individuality of each Student and as limitations of each body.

To increase the force, it is necessary to apply the principle of progressive overload and variability, controlling the number of repetitions, execution speed of the exercises, rest pause between series and exercises (Fleck and Simão, 2008, Kraemer and Fleck, 2009).

It is also important to ensure the possibility of an adaptation and any other risk of injury by developing joint flexibility, a tendon's ability to withstand tension, trunk muscles strength and stabilizers and to train movements; there are no muscles in isolation (BOMPA, 2001). This way, the intended objectives can be achieved and appropriate physiological alteration is promoted.

In addition, situations must be carried out to enrich a range of relevant knowledge to this area of practice, improving the development of its practitioners and contributing to a regular practice of exercises.

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STRENGTH TRAINING RELEVANCE AND ITS VARIABLES IN SEVERAL DIFFERENT GOALS

Strength training has been widely requested because of its importance in keeping body health and training of the motor skills required within sporting modalities. Strength is one of the components of physical fitness related to health and influences the body composition of an individual. Thus, exercises involving this physical ability are important not only for physical performance, but also for the health of those who practice it. This way, the objective of this research was to perform a brief review

on the strength and variables of the training of this capacity, presenting subsidies for professionals and those who practice this type of training. It can be seen that strength can manifest itself in several ways, such as maximum static force, maximum dynamic force, reactive force, rapid force, resistance strength, and explosive force. Among the variables, number of repetitions per series, speed of execution, number of series, order of exercises, rest time between sets and exercises and weights used, these are essential to alternate the physiological changes necessary for each objective. However, in order to increase the force, it is necessary to apply the principle of progressive overload and variability, controlling the presented variables. Also, it is important to assure the practitioner the necessary adaptation and to avoid any risk of injury by developing joint flexibility, the ability of the tendons to withstand tension, the strength of the trunk muscles and stabilizers, and also to train the movements, not the muscles alone. Finally, other research should be carried out with the purpose of enriching the range of knowledge relevant to this area of practice, improving the development of its practitioners and contributing to a regular practice of exercises.

Key-words: Strength training – Variables – Health promotion.

PERTINENCE DE LA FORMATION DE FORCE ET SES VARIABLES DANS DES OBJECTIFS DIFFÉRENTS

La musculation a été largement sollicitée en raison de son importance dans le maintien de la santé et la formation des habilités motrices requises dans les modalités sportives. La force est l'une des composantes de la condition physique liée à la santé et influe sur la composition corporelle de l'individu. Ainsi, les exercices impliquant cette capacité physique sont importants non seulement pour la performance physique, mais aussi pour la santé du praticien. Ainsi, l'objectif de cette recherche était de faire un bref bilan de la force et des variables de le entraînement de cette capacité, en présentant des subventions aux professionnels et praticiens qui travaillent avec ce type de formation. On peut voir que la force peut se manifester de diverses manières, telles que la force statique maximale, la force dynamique maximale, la force réactive, la force rapide, la force de résistance et la force explosive. Parmi les variables, le numéro de répétitions par série, la vitesse d'exécution, le nombre de séries, l'ordre des exercices, le temps de repos entre les séries, les exercices et les poids utilisés sont essentiels à l'alternance pour favoriser les changements physiologiques nécessaires à chaque objectif. Cependant, afin d'augmenter la force, il est nécessaire d'appliquer le principe de la surcharge et de la variabilité progressive, en contrôlant les variables présentées. En outre, il est important d'assurer au praticien l'adaptation nécessaire et d'éviter tout risque de blessure en développant la flexibilité des articulations, la capacité des tendons à résister à la tension, la force des muscles du tronc et des stabilisateurs, ainsi que les muscles. Enfin, d'autres recherches devraient être menées dans le but d'enrichir l'éventail des connaissances pertinentes à ce domaine d'exercice, d'améliorer le développement de ses praticiens et de contribuer à une pratique régulière des exercices.

RELEVANCIA DEL ENTRENAMIENTO DE FUERZA Y SUS VARIABLES EN LOS MÁS DIVERSOS OBJETIVOS

El entrenamiento de fuerza viene siendo muy requerido actualmente gracias a su importancia en la manutención de la salud y entrenamiento de las habilidades motoras exigidas en las modalidades deportivas. La fuerza es uno de los componentes de la aptitud física que tiene relación con la salud e influencia en la composición corporal. Con eso, los ejercicios que involucran esa capacidad física son importantes no solamente por el desempeño físico, sino en la salud del practicante. De esta manera, el objetivo de esta investigación es realizar una breve revisión respecto a la fuerza y las variables del entrenamiento de esta capacidad, presentando subsidios para profesionales y practicantes que actúan con este tipo de entrenamiento. Es notorio que la fuerza puede manifestarse de diversas maneras, como por ejemplo la fuerza máxima estática, la fuerza máxima dinámica, la fuerza reactiva, la fuerza rápida, la fuerza resistencia y la fuerza explosiva. De hecho con esas variables, el número de repeticiones por serie, la velocidad de ejecución, el número de series, el orden de los ejercicios, el tiempo de reposo entre las series, los ejercicios y pesos utilizados, es imprescindible la alternancia para que ocurra las alteraciones fisiológicas necesarias para cada objetivo. Así, teniendo como meta el aumento de la fuerza, es necesario aplicar el principio de la sobrecarga progresiva y variabilidad, controlando las variables presentadas. También es relevante garantizar al practicante la adaptación necesaria y alejar cualquier riesgo de lesión, desarrollando la flexibilidad articular, la capacidad de los tendones de soportar tensión, la fuerza de los músculos del tronco, estabilizadores y entrenar movimientos, no apenas los músculos aisladamente. Otras investigaciones deben ser hechas con el objetivo de profundizar la gama de conocimiento pertinente a esa área de actuación, mejorando el desarrollo de sus practicantes y contribuyendo para una práctica regular de ejercicios.

Palabras clave: Entrenamiento de Fuerza – Variables – Promocionar salud.

RELEVÂNCIA DO TREINAMENTO DE FORÇA E SUAS VARIÁVEIS NOS MAIS DIVERSOS OBJETIVOS

O treinamento de força tem sido bastante requisitado atualmente devido à sua importância na manutenção da saúde e treinamento das habilidades motoras exigidas dentro das modalidades esportivas. A força é um dos componentes da aptidão física relacionada à saúde e influencia na composição corporal do indivíduo. Com isso, os exercícios que envolvam essa capacidade física são importantes não somente pelo desempenho físico, mas também na saúde do praticante. Desta maneira, o objetivo desta pesquisa se destinou em realizar uma breve revisão sobre a força e as variáveis do treinamento desta capacidade, apresentando subsidios para profissionais e praticantes que atuam com este tipo de treinamento. Percebe-se que a força pode se manifestar de diversas maneiras, como a força máxima estática, força máxima dinâmica, força reativa, força rápida, força resistência e força explosiva. Dentre as variáveis, número de repetições por série, velocidade de execução, número de séries, ordem dos exercícios, tempo de repouso entre as séries e os exercícios e pesos utilizados, estas são imprescindíveis a alternância para promover as alterações fisiológicas necessárias para cada objetivo. Contudo, tendo como objetivo o aumento da força, é necessário aplicar o princípio da sobrecarga progressiva e variabilidade, controlando as variáveis apresentadas. Também, é importante garantir ao praticante a adaptação necessária e afastar qualquer risco de lesão, desenvolvendo a flexibilidade articular, a capacidade dos tendões de suportar tensão, a força dos músculos do tronco e estabilizadores e também treinar os movimentos, não os músculos isoladamente. Por fim, outras pesquisas devem ser realizadas com o intuito de enriquecer a gama de conhecimento pertinente a essa área de atuação, melhorando o desenvolvimento dos seus praticantes e contribuindo para uma prática regular de exercícios.

Palavras-chave: Treinamento de Força – Variáveis – Promoção da Saúde.