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Application of Physiological Methods Helping to Produce Strength in Heavy Athletes

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Abstract: Muscle strength is one of the most important physical qualities. Muscle strength depends on the physiological diameter and elasticity of the muscles, biochemical processes within them, energy potential, and tactics. Different methods of strength development and assessment have been studied in weightlifters, depending on the form of strength expression and muscle working modes. In the research, the following methods of strength development are used: myometric, isometric, and combined.

Keywords: Muscle strength, hypertrophy, adaptation, dynamometry, Newton (N), proteins, creatine phosphate, ATP, glycogen, myofibril fibers, connective tissue.

INTRODUCTION

For many years, it was believed that increased strength was a direct result of muscle enlargement (hypertrophy). Increases in muscle size tend to parallel increases in strength, and decreases in muscle size are closely related to decreases in strength. However, muscle strength involves more than just muscle size. Peripheral and central factors that determine maximum muscle tension are distinguished. The group of peripheral factors is divided into structural and functional groups. Structural factors include the number of muscle fibers, length of muscle fibers, structure (degree of inclination of muscle fibers to the axis of movement), and composition of the muscles. Functional factors depend on the quantitative composition of proteins, creatine phosphate (KrP), ATP, and glycogen in the muscles. With an increase in the number of contractile fibers in the muscle, the contraction force increases. Under natural conditions, the strength of muscle contraction increases with the number of nerve impulses entering the muscle. Additionally, the more fast-twitch fibers a muscle has, the greater its contraction force.

LITERATURE REVIEW

Power (P) is the ability to overcome external resistance or to resist muscle tension. Work is done due to force (A). Force is determined in physiology by the following formula: [A = F * S], where S is the load; therefore, F = A / S (for the same movement). When the load is raised (P), A = P * h (where h is the lifting height).

Around and within skeletal muscles is collagen-rich connective tissue, which also forms tendons and ligaments. Tendons play a key role in transmitting contractile force to bone and producing elastic energy, while ligaments stabilize joints to prevent excessive movement that can damage the joint. Connective tissue within the muscle contributes to muscle stiffness and force transmission between muscle fibers. Adaptations in connective tissue occur in parts adapted to strength training [Magnusson, S. P. *et al*., 2003; Magnusson, S. P. *et al*., 2010]. Through the adaptation of skeletal muscles with the help of strength training, the intramuscular connective tissues, tendons, and ligaments also lead to an increase in the cross-section of the muscles [Reeves, N. D. *et al*., 2003; Kongsgaard, M. *et al*., 2007]. Tissue regeneration in the connective tissues of the musculoskeletal system is somewhat slower than in the proteins of skeletal muscle cells. Therefore, tendons undergo hypertrophy a little more slowly than muscles [Magnusson, S. P. *et al*., 2008; Wiesinger, H. *et al*., 2015]. However, increased tendon stiffness may precede tendon hypertrophy. This is due to adaptations in the internal structures of the tendon, for example, modulation of the crosslinking structure between collagen molecules, which improves the mechanical properties of the tendon [Kongsgaard, M. *et al*., 2009; Kubo, K. *et al*., 2002]. An increase in thigh stiffness can enhance the use of elastic energy during stretch-contraction cycles and increase the rate of force development in explosive (fast) muscle movements [Magnusson, S. P. *et al*., 2008; Kubo, K. *et al*., 2007].

Bone mass, mineral density, and structure change under the influence of mechanical load. The bone

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adapts to external stress, especially when the magnitude of high stress due to loads is sufficient. Strength training leads to a decrease in ATP, phosphocreatine (PKr), and glycogen reserves in the athlete's body, and it also significantly increases the concentration of lactate in the blood. This indicates a high rate of anaerobic glycolysis in the body. As a result, reduced glycogen stores lead to muscle fatigue [Knuiman, P. *et al*., 2015]. Depending on exercise-induced myofibrillar damage, the amount of energy used, and the carbohydrate content in the diet, glycogen stores can be replenished within days after exercise [Ivy, J. L. *et al*., 2004]. The activity of anaerobic enzymes (for example, creatine phosphokinase, myokinase, and glycosidases) has been shown to increase as a result of continuous strength training. This also increases muscle phosphocreatine and glycogen concentration reserves [Tesch, P. A. *et al*., 2003]. Continuous strength training further enhances the oxidative capacity of skeletal muscle [Pesta, D. H. *et al*., 2017; LeBrasseur, N. K. *et al*., 2011].

During physical exercise, glucose content significantly increases in working muscles [Pesta, D. H. *et al*., 2017; Sylow, L. *et al*., 2017]. Studies show that insulin sensitivity increases with high-intensity exercise and that adaptations occur mainly locally in the exercised muscles [Colberg, S. R. *et al*., 2010; Mann, S. *et al*., 2014]. One of the main mechanisms of muscle adaptation to increase insulin sensitivity in response to strength training is the increased production of glucose transporter type 4 (GLUT 4), which is the primary transporter responsible for facilitating the distribution of circulating glucose into skeletal muscle cells [Holten, M. K. *et al*., 2004; Strasser, B. *et al*., 2013]. Capillary growth occurs in parallel with the expansion of muscle fibers, resulting in higher capillary density primarily in muscles hypertrophied by strength training [Hellsten, Y. *et al*., 2015].

In general, long-term resistance training is beneficial for body composition, leading to increases in lean mass and decreases in fat mass [Fleck, S. J. *et al*., 2014; Sparti, A. *et al*., 1997]. Maximum voluntary strength is manifested during voluntary movements and depends on two main factors: muscle (peripheral) and coordination (central - nervous).

RESEARCH METHODOLOGY

Dynamometry is a method of measuring the force of contraction of various muscle groups. Since the force of contraction of certain muscle groups, up to certain limits, can be considered proportional to the level of development of the entire muscular system, the dynamometer indicators describe the level of physical development. The unit of force change is the Newton (N) [Koryagin, Y.V, 2003]. A wrist dynamometer or digital physiology laboratory force sensor was used to measure arm muscle strength. During measurement, the participant is as relaxed as possible, seated with knees bent, elbows on the table, and back straight. Measurements were taken three times at short intervals. With a straight arm holding the dynamometer, the participant pulled to the side and squeezed with all their might. The test was performed with each hand in turn.

In the first stage, the strength of the arm muscles of 18-21-year-old weightlifters, 57 canoe rowers, and 50 individuals who did not participate in sports was measured. After taking the average of the right and left hands, the results were compared.

RESEARCH RESULTS AND DISCUSSION

The comparative analysis of the obtained data showed that the strength of the arm muscles of weightlifters (73.23 - 71.37 N) is higher than that of non-athletes (53.99 - 50.27 N). It was found that the average measurement of the right arm of weightlifters was higher by 19.2 N, and the left arm by 21.1 N, compared to non-athletes (Table 1).

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Table 1: Indicators of hand strength of non-athletes and athletes (in Newton units) (n = 157; m±3)

	Control		Canoeists		Weightlifters	
	Right-hand force is in Newtons	Left-hand force is in Newtons	Right-hand force is in Newtons	Left-hand force is in Newtons	Right-hand force is in Newtons	Left-hand force is in Newtons
Average value	53,99	50,27	63,6	62,1	73,23	71,37

According to the results obtained in the research, the average strength of the right hand was 53.99 N, while the average strength of the left hand was 50.27 N. The difference between them was 3.72 Newtons. Thus, the index of association of hand muscles is not well formed. The average difference between the indicators of the right hand and the left hand was 1.86 in weightlifting athletes. This indicator shows that muscle strength has developed, and myofibrils fibers have formed congeal bundles. As a result, the highest hand muscle strength was found in athletes with the first grade. Among them, Z.A., who has the greatest right-handed strength, holds the first rank. In this weightlifter, the right hand strength was 96.8 N, and the left hand strength was 98 N. It was also determined that this athlete is overweight. According to the results, the sports coaches noted that he had the highest performance among the athletes participating in the experiment in both squatting and lifting. The difference between the power of the left hand and the right hand was 1.5 Newtons. The difference between the power of the right hand and the left hand in athletes without a discharge was 5.4 Newtons. Accordingly, physiological recommendations were made for developing muscle strength in athletes with poor results, forming muscles with congeal bundles between myofibril fibers.

PHYSIOLOGICAL RECOMMENDATIONS

1. Organization of body muscle massage in a vertical position.
2. Taking a cold bath after training and performing aerobics after 2 hours.
3. Performing exercises that develop the vestibular apparatus.

CONCLUSION

After starting to follow these recommendations, the work coefficient of athletes increased by 20% in jerking and lifting. In canoeists, the two-arm force index improved by 2.5 Newtons. The organization of vertical massage of the body muscles helped create congeal bundles in the athletes' muscles and improved the exchange of oxygen and nutrients. As a result, 20 out of 25 athletes did not report muscle pain. In 5 athletes, additional massage was recommended to enhance muscle performance.

Athletes who took a cold bath after training experienced an increase in muscle strength; the cold water tightened the tissues of the body and increased strength 2 hours post-training. A decrease in tension in blood vessels was also observed. Exercises developing the vestibular apparatus included visual 3D carousel exercises and exercises for creating a vacuum in the ear. Following this, 100% success was achieved in maintaining balance in athletes even after lifting weights. Additionally, these exercises directly increased arm muscle strength by 2%.

REFERENCES

1. Koryagin, Y.V. “Physiology silovykh vidov sporta.*”* *Uchebnoe posobie. - Omsk: SibGUFK*, (2003): 55 .
2. Magnusson, S. P., Hansen, P. & Kjaer, M. "Tendon properties in relation to muscular activity and physical training." *Scandinavian Journal of Medicine & Science in Sports* 13 (2003): 211–223.
3. Magnusson, S. P., Langberg, H. & Kjaer, M. "The pathogenesis of tendinopathy: Balancing the response to loading." *Nature Reviews Rheumatology* 6 (2010): 262–268.
4. Reeves, N. D., Maganaris, C. N. & Narici, M. V. "Effect of strength training on human patella tendon mechanical properties of older individuals." *Journal of Physiology (London)* 548 (2003): 971–981.
5. Kongsgaard, M., Reitelseder, S., Pedersen, T. G., Holm, L., Aagaard, P., Kjaer, M, *et al.* "Region-specific patellar tendon hypertrophy in humans following resistance training." *Acta Physiologica (Oxford)* 191 (2007): 111–121.
6. Magnusson, S. P., Narici, M. V., Maganaris, C. N. & Kjaer, M. "Human tendon behaviour and adaptation, in vivo." *Journal of Physiology (London)* 586 (2008): 71–81.

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7. Wiesinger, H., Ksters, A., Mller, E. & Seynnes, O. R. "Effects of increased loading on in vivo tendon properties: A systematic review." *Medicine & Science in Sports & Exercise* 47 (2015): 1885–1895.
8. Kongsgaard, M., Kovanen, V., Aagaard, P., Doessing, S., Hansen, P., Laursen, A. H, *et al*. "Corticosteroid injections, eccentric decline squat training and heavy slow resistance training in patellar tendinopathy." *Scandinavian Journal of Medicine & Science in Sports* 19 (2009): 790–802.
9. Kubo, K., Kanehisa, H. & Fukunaga, T. "Effects of resistance and stretching training programmes on the viscoelastic properties of human tendon structures in vivo." *Journal of Physiology (London)* 538 (2002): 219–226.
10. Kubo, K., Morimoto, M., Komuro, T., Yata, H., Tsunoda, N., Kanehisa, H, *et al*. "Effects of plyometric and weight training on muscle-tendon complex and jump performance." *Medicine & Science in Sports & Exercise* 39 (2007): 1801–1810.
11. Knuiman, P., Hopman, M. T. E. & Mensink, M. "Glycogen availability and skeletal muscle adaptations with endurance and resistance exercise." *Nutrition & Metabolism (London)* 12 (2015): 59.
12. Ivy, J. L. "Regulation of muscle glycogen repletion, muscle protein synthesis and repair following exercise." *Journal of Sports Science & Medicine* 3 (2004): 131–138.
13. Tesch, P. A. & Alkner, B. A. "Acute and chronic muscle metabolic adaptations to strength training." In: Komi, P. V., ed. *Strength and Power in Sport.* 2nd ed. Oxford: Blackwell Science Ltd, 2003. 265–280.
14. Pesta, D. H., Goncalves, R. L. S., Madiraju, A. K., Strasser, B. & Sparks, L. M. "Resistance training to improve type 2 diabetes: Working toward a prescription for the future." *Nutrition & Metabolism (London)* 14 (2017): 24.
15. LeBrasseur, N. K., Walsh, K. & Arany, Z. "Metabolic benefits of resistance training and fast glycolytic skeletal muscle." *American Journal of Physiology-Endocrinology and Metabolism* 300.3 (2011).
16. Sylow, L., Kleinert, M., Richter, E. A. & Jensen, T. E. "Exercise-stimulated glucose uptake—regulation and implications for glycaemic control." *Nature Reviews Endocrinology* 13 (2017): 133–148.
17. Colberg, S. R., Sigal, R. J., Fernhall, B., Regensteiner, J. G., Blissmer, B. J., Rubin, R. R, *et al*. "Exercise and type 2 diabetes: the American College of Sports Medicine and the American Diabetes Association joint position statement." *Diabetes Care* 33 (2010): 147.
18. Mann, S., Beedie, C., Balducci, S., Zanuso, S., Allgrove, J., Bertiato, F, *et al*. "Changes in insulin sensitivity in response to different modalities of exercise: A review of the evidence." *Diabetes/Metabolism Research and Reviews* 30 (2014): 257–268.
19. Holten, M. K., Zacho, M., Gaster, M., Juel, C., Wojtaszewski, J. F. P. & Dela, F. "Strength training increases insulin-mediated glucose uptake, GLUT4 content, and insulin signaling in skeletal muscle in patients with type 2 diabetes." *Diabetes* 53 (2004): 294–305.
20. Strasser, B. & Pesta, D. "Resistance training for diabetes prevention and therapy: Experimental findings and molecular mechanisms." *BioMed Research International* 2013 (2013): 805217.
21. Hellsten, Y. & Nyberg, M. "Cardiovascular adaptations to exercise training." *Comprehensive Physiology* 6 (2015): 1–32.
22. Fleck, S. J. & Kraemer, W. J. *Designing Resistance Training Programs.* Champaign: Human Kinetics, 2014. 109–115.
23. Sparti, A., DeLany, J. P., de la Bretonne, J. A., Sander, G. E. & Bray, G. A. "Relationship between resting metabolic rate and the composition of the fat-free mass." *Metabolism: Clinical and Experimental* 46 (1997): 1225–1230.

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