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**THEORETICAL AND METHODOLOGICAL BASES AND
APPLIED ASPECTS OF STRENGTH QUALITIES
DEVELOPMENT IN HIGHLY QUALIFIED ATHLETES**
(based on materials regarding Olympic wrestling events)

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CONCEPTUAL PROVISIONS OF THE RESEARCH

Actuality. Wrestling, national wrestling and martial arts are widespread in the world. The types of wrestling presented in the programs of the Olympic Games are especially popular.

These are Greco-Roman (classical) wrestling (in the Olympic Games program since 1896), freestyle wrestling (in the Olympic Games program since 1904), judo - a type of Japanese martial art and combat sports that has received international recognition (in the Olympic Games program since 1964), taekwondo is a form of Korean martial art and combat sports, widespread in the world (in the Olympic Games program since 2000).

The exceptionally high level of competition in the types of martial arts and the importance of sports success predetermine the unquenchable interest of specialists in the development of the technical and tactical arsenal of each type, the improvement of the methodology of physical and psychological training, which is reflected in specialized scientific literature, legal acts and regulations, is the basis for optimization of the training athletes process, contributing to revealing further reserves of expanding and developing knowledge in the field of theory and practice of sports training. This applies to all aspects of training athletes - technical, physical, tactical, psychological. However, our analysis of the accumulated system of knowledge and practical experience testifies to the multilevel elaboration and validity of knowledge related to various types of training of athletes.

In the basic teaching literature, (books and learning aids) including hundred of papers, which reflects the general foundations of training in different types of wrestling, the knowledge presented in the overwhelming volume is associated exclusively with sports technique and, to a lesser extent, to tactics one. Issues related to other aspects of training in a significant part of the works are either not touched upon at all, or extremely succinctly and fragmentarily, at a level absolutely incomparable with that on which knowledge related to sports technique is presented. And this applies to the entire modern history of the development of various types of wrestling events. For example, back in the 1940-1960s, a series of textbooks and teaching aids on wrestling were published in the USSR, the authors of which were leading experts in these sports events [34, 45, 75, 79, 80 etc.]. In all these and other works, either all or more than 90% of the material related exclusively to sports technique and the methodology of teaching techniques and motor actions. As for physical qualities – (strength, speed, agility, endurance), without which technical skill can neither be mastered nor realized [36, 58, 60, 66, 68, 91 etc.], then the definition of their significance and development methodology was given, at best, several pages only with a statement of the need for physical training. For example, in A.A. Kharlampiev's voluminous book "Sambo Struggle" (1964), which summarized the author's 40-year experience in the development of this sport, the whole problem of developing physical qualities is reduced to mentioning that training lessons should find a place for exercises aimed at "general strengthening of the activity of the main systems of the body, increasing mobility in the joints and strengthening the ligamentous apparatus, developing strength, speed, muscle elasticity and the ability to relax them, developing posture (p. 357), and in the work plan "it is necessary to take into account schedule of preparation and delivery of standards for the GTO complex" (p. 363). As for the sambo technique, it is considered in many ways and is presented on 355 pages with a total volume of 381 pages [80].

Many years have passed since then, during which a large number of works published in the USSR, countries located on its territory after the collapse of the country have been published. However, the improvement of the content of numerous educational publications did not lead to a change in their methodological orientation. Again, the overwhelming volume of the text is attributed exclusively to the technique of procedures and motor actions, the method of technical improvement, while ignoring or maximally simplified the knowledge in the field of physical training [32, 37, 44, 73, 78, 88, 90 etc.].

A similar picture is observed when studying the literature on the methodology of training foreign athletes specializing in different types of wrestling events - judo (Otaki T. [63]; Harrington P. [81]; Kiddo B. [40] etc.), taekwondo (Sun Man Lee [76]; Choi Sung Mo [86]; Shulika Yu.A. et al., [89] etc.), aikido (Tamura N. [77]; Brand R. [33]; Rulioni D. [72]; Rudakov N.E. [71] ş.a.), kickboxing (Kulikov A. [43]; Kleshev V.N. [41]; Karamov S.K. [38]; Shegrikovich D.V. [87] ş.a.); karate (Yamaguchi N.G. [92]; Katansky S.A. [39]; Hili K. [82] ş.a.), wushu (Ji Jiancheng, [84]; Hongjun L., Lei T. [83]; Zhongshen Li, Xiaohui Li [85]; Medvedev A., [61]; Hantău I., Manolachi V.G. [24] etc.).

This attitude to knowledge in the field of motor skills development and physical training of athletes is in contradiction with the general principles of sports training [8, 58, 60, 62, 65, 66, 68 etc.], as well as with the results of numerous studies reflecting the structure of competitive activity in wrestling and the characteristics of the factors that determine its effectiveness, the peculiarities of the physical training of wrestlers, the development of various motor qualities in them, first of all, strength.

Insufficient attention to physical training and its most important part - strength, could not but affect and influenced the ideas of specialists in this area, the scientific level of the development of the problem, led to its inconsistency with the level of knowledge characteristic not only of the general theory of sports training, sports anatomy, physiology and morphology, but also for many other sports, which are characterized by the same serious attitude to the development of motor qualities, as well as to the improvement of technical skill.

Summarizing the content of literary sources, which resulted from research and practical activities in the field of physical training of wrestlers and, in particular, those related to the development of strength, it can be found that there is no analysis of the structure of strength training of wrestlers, which is extremely complex, requiring the manifestation of different types of strength qualities in concentric, eccentric, isometric, plyometric, ballistic modes of muscle work with their constant change and sequence in a variety of specific motor actions characteristic of wrestling. It is clear that without such an analysis, there is no need to talk about the current level of knowledge in the field of strength training [6, 7, 69].

There is no reflection and understanding of the fact that strength training of combat athletes should be carried out mainly due to neuroregulatory components that are not significantly associated with muscle hypertrophy [2, 12], since muscle hypertrophy leads not only to a significant increase in body weight, but also to the nonspecific development of strength (the so-called slow strength), which limits the speed-strength and coordination capabilities of athletes [5, 17]. However,

no attention is paid to extremely important issues related to the methodology of the development of strength qualities due to the synchronization of the activity of muscles of agonists, synergists, stabilizers, antagonists [11, 22], activation of the maximum volume of motor units of muscles carrying the main load during performance of a specific technique or motor action [16, 19], in the special literature on wrestling. This also applies to many other processes associated with the development of specific types of strength, characteristic of the competitive activity of athletes in single combats. For example, the high importance of intense impulses of motor units for achieving the maximum level of strength development [1, 10], optimization of the process of muscle activation in response to the reactions of muscle and tendon mechanoreceptors as an important factor in the manifestation of strength qualities [23, 74] or of great importance for effective motor actions of the strength of postural muscles [9, 15]. All these important issues generally remain outside the attention of coaches who are developing the problem of strength training of athletes, specializing in judo, Greco-Roman and freestyle wrestling.

It should also be noted that all the problems associated with the structure of the strength readiness of wrestlers, the methodology for the development of various strength qualities, presented in the special literature, is cut off from the potential of the athletes' energy supply systems - the power and capacity of the alactate and lactate energy supply systems, the training and power of the aerobic system. Although it is absolutely obvious that the level of explosive power of athletes, manifested in short-term actions with the maximum available power, is closely related to the amount of energy released as a result of the breakdown of ATP and CrP [11, 22], while Similar strength manifestations in a state of fatigue are largely associated with the power and capacity of anaerobic glycolysis, the rapidity of the development of aerobic reactions, and the level of oxygen consumption [3, 4, 21]. It is clear that research in this area can seriously improve the process of special strength training of wrestlers.

The dramatic expansion of the arsenal of means for the development of motor qualities, the emergence of many special devices, simulators that make the process of development of motor qualities, in particular, strength, much more effective, selective, purposeful, related to the specifics of competitive activity, has not been reflected in the special literature on the physical training of combat athletes [2, 64]. As before, in most of the works in the development of strength qualities and the assessment of strength training , such means as pull-ups on the bar, push-ups on the uneven bars, rope climbing, long and high jumps are mainly recommended, which unacceptably primitives the approach to the development of this important quality.

All these and many other facts testify to the discrepancy between the ideas and approaches in the field of physical training, strength training as its important part, which have developed in the scientific and educational-methodical literature on combat sports, the modern level of knowledge in the field of theoretical, methodological and biological foundations of the development of motor qualities in athletes.

Unfortunately, this has become a serious problem for the content of program and regulatory documents that determine the structure and content of the process of training athletes in the systems of children and youth, Olympic reserves and elite sports. For example, the "Federal standard of

sports training in the sport of wrestling" existing in the Russian Federation noted the extremely high importance of physical training, which at different stages of long-term improvement makes up 50% of the total time allotted for the training process, with a focus on the predominant development of speed abilities, strength and endurance. The content of the process of physical training is not defined, however, the attitude towards it becomes clear if we turn to the presented standards of general and special physical fitness, which are necessary for enrollment in training groups. For example, even for enrollment in the groups of higher sportsmanship, the following tests are recommended for assessing strength: flexion and extension of the arms in the prone position (at least 48 times), throwing a medicine ball (3 kg) backward (at least 9 m), throwing a medicine ball (3 kg) forward from behind the head (at least 8 m).

A similar approach is used in the formation of standards in other sports. In judo, athletes applying for enrollment in the groups of higher sportsmanship must have a level of strength that allows them to pull themselves up on the bar at least 20 times, bend and straighten their arms 35 times while lying on the floor, raise their straightened legs at least 20 times from the hang on the gymnastic wall in position and angle; in taekwondo, it is enough to pull up on the crossbar at least 20 times. This approach does not stand up to critical analysis: firstly, these tests are complex in nature and are very weakly associated with various strength qualities characteristic of wrestling; secondly, they are not specific and very weakly correlate with the level of athletes' sportsmanship [26, 60, 65, 68]. However, the very presence of such tests as a normative basis for enrollment in training groups orients the process of strength training of wrestlers on an erroneous path not related to the specifics of competitive activity and long rejected by the results of serious scientific research [5, 20, 22].

There is no difference between the program and regulatory requirements for the physical training of highly qualified single combatants, adopted in other countries (Romania, Bulgaria, Ukraine, Belarus, Kazakhstan, Moldova, etc.).

In general, there are sufficient grounds to assert that the body of knowledge in the field of training athletes specializing in wrestling was formed in a relatively narrow, mainly specific for these sports, subject area without proper interconnection with the basic provisions of the general theory of sports training and the accumulated body of biological knowledge.

If in relation to the fundamentals of motor actions control, the technical training of athletes, the methodology of mastering technical techniques, this problem is not distinguished by its acuteness, then with respect to the development of motor qualities, especially strength, there is a huge gap between the ideas that have developed in sports wrestling and the corresponding practice and the opportunities provided by the achievements of the general theory of sports training, sports sections of physiology, morphology, biochemistry, biomechanics and psychology.

The foregoing predetermines the relevance of research aimed at the formation of theoretical and methodological foundations of strength training in athletes specializing in wrestling. Such studies should be based on the appropriate methodology, focused mainly on the theoretical and analytical approach, the comprehension of the knowledge accumulated both in wrestling and in a number of related disciplines, which, with their modern content, can transfer the problem of

physical training of athletes to a fundamentally new level of understanding and development of the problem, in particular, strength training.

There are enough grounds to assert that the development of knowledge in the field of strength training of athletes specializing in wrestling should be ensured by using the patterns and special principles developed by the general theory of sports and sports training. It is equally important to put the modern achievements of special sections of biological disciplines into the basis of the strength training methodology, revealing the mechanisms of manifestation and development of different types of strength qualities. The theory and methodology of strength training of wrestlers cannot ignore such an important problem for modern sports as the need for a close relationship between the content of strength training and the characteristics of age-related development and puberty of athletes.

Striving to form an integral system of knowledge in the field of strength training of athletes specializing in wrestling, based on the integration of empirical and theoretical material accumulated by rich theoretical, methodological and practical experience in wrestling, an array of relevant knowledge from the areas of the general theory of sports training and a range of disciplines of general scientific and biological character, predetermined the target orientation and novelty of the work, its tasks, means, methods and organization of its own research, processing and analysis of empirical material.

The aim of the work is to develop the theoretical and methodological bases and the applied aspects of developing the wrestlers' strength qualities.

In the process of analysis and primary generalization of the empirical material, an important place was occupied by the elaboration of hypotheses, as a tool for conducting experimental research, studying specialized sources, organizing surveys and observations. At the same time, it was taken into account that the elaboration of the hypothesis includes three stages: the accumulation of the factual material and the formulation of some preliminary assumptions, the transformation of the preliminary assumptions into a hypothesis, the verification of the veracity of this hypothesis [70]. As a **basic hypothesis** served the assertion that the contemporary system of strength training must ensure the integration, in a unitary system, the knowledge of the empirical and theoretical material, accumulated in the field of the general theory of performance athletes training, of the general compartments of disciplines in the biological cycle (anatomy, morphology, physiology, biochemistry, biomechanics), theory and methodology of training in sports wrestling.

The object of research is the training system of performance athletes, who specialize in sports wrestling.

Research objectives:

1. To characterize the modern system of knowledge in the field of training athletes, specializing in wrestling, and the main ways of its further development.
2. To study the level of knowledge and practical experience in the field of physical training of athletes specializing in wrestling, to compare it with the body of scientific knowledge accumulated in the theory of sports and special sections of biological disciplines.

3. To analyze the structure of wrestlers' strength readiness and the correspondence to it of the strength training methodology; to form the concept of strength training of athletes specializing in wrestling, corresponding to the modern level of knowledge.

4. To subject to the analysis the special principles that underlie the rational construction of the process of sports training and reveal their possibilities for increasing the effectiveness of strength training among athletes specializing in wrestling.

5. To study the totality of factors that determine the level of strength qualities and show their importance for increasing the efficiency of the process of strength training of wrestlers.

6. To study the age dynamics of the growth of wrestlers' sportsmanship and to characterize the system of their long-term training.

7. To develop a fundamental model of strength training of athletes specializing in wrestling at various stages of long-term improvement.

8. To reveal the promising directions of optimization of the process of strength training of athletes specializing in wrestling.

The theoretical significance and the scientific novelty of the paper lie in:

1) elaboration of the theory of the development of wrestling athletes' strength qualities, including: definition and spread of the notion "strength training" of athletes who specialize in wrestling trials; substantiation of the legalities, the general and peculiar principles of the development of the athletes strength qualities within the structural-functional approach of the process of training the performance fighters; the mechanism for correlating the achievements in the field of sports physiology and biochemistry, medicine and sports morphology in order to argue the concept of sports training of wrestling athletes; the conception and the functional-structural model of the fighters strength training, based on both the laws and principles, as well as a series of factors that determine the logic, stages and process of developing strength qualities in interdependence with the formation of other motor qualities .

2) elaboration of the methodology (in the narrow sense) for developing the strength qualities of athletes specialized in wrestling which is conditioned by the age dynamics of increasing sports mastery in wrestling and which includes stages, methods and principles of their strength training.

The theory and methodology for developing the strength qualities of athletes specialized in wrestling, developed by us, allows us to say that this research is a new direction in sports pedagogy and opens new possibilities for further research in the field of training the performance athletes.

The practical value of the work lies in the revision of traditional ideas in the field of the structure and content of strength training of athletes specializing in wrestling, the expediency of using the results obtained when improving the program, regulatory and organizational foundations of training athletes in the system of long-term improvement. The research materials should be reflected in the educational and educational-methodical literature for students of special educational institutions, as well as in the system of advanced training of the coaching staff. The approach

implemented in the work should be extended to the study of problems related to the development of other motor qualities - speed, coordination, endurance, flexibility.

The research field is the theoretical-methodological bases of strength training in the physical training system, the structure of the strength training level and the methodology of developing the strength qualities of the athletes-fighters.

Methods and levels of own research

Methods as a set of techniques and operations aimed at studying the subject area covered by the problems of our research, in accordance with the generally accepted methodology, are divided into three types: general, general scientific and specific. The dialectical method was used as a universal method - a philosophical, universal method, which is the basis of rationally structured research at any of their stages. It is based on the principle of objectivity, which does not allow distortion of reality, idealization and engagement; the principle of historical continuity, which requires the study of a process or phenomenon in development, in constant connection with other phenomena and processes.

The potential of the universal method of cognition in our research was realized through the use of general scientific and specific methods. The systematic approach and the structural-functional method, retrospective and logical methods were used as general scientific methods.

System approach and structural-functional method. The system approach was used as a set of general scientific methodological requirements, based on the consideration of the studied object, the subject area as integrity; understanding that the properties of the whole are not reducible to the sum of properties and elements, the functioning of the system requires its presentation as a dynamic and developing integrity, taking into account the characteristics of individual elements and interaction with the environment. The use of the structural-functional method was based on the need to study the structure and content of the system object, the study of its elements and their functions, the characteristics of development and functioning [42].

In accordance with this, the structure of strength training and the development of various types of strength qualities among athletes specialized in wrestling were studied in close connection and interaction with the structure of competitive activity, other motor qualities (speed, coordination, flexibility, endurance) and sides of training (technical tactical, psychological). No less important was the study of the problem of strength training, the development of types of strength based on the basic specific principles of sports training and on a wide array of medical and biological knowledge associated with numerous structural and functional factors of the body of athletes that determine the level of development of strength qualities and the effectiveness of their manifestation of competitive activities.

The retrospective method, as one of the methods of historical cognition, was used to study the subject area covered by the problems of our research, based on a consistent examination of processes and phenomena from the present to the past.

The logical method as a method of cognition the state and development of a system of knowledge and practical experience in the field of strength training of athletes is focused on using a

set of theoretical analysis tools for a comprehensive study of the subject area, presenting it in the development and variety of constituent phenomena and processes.

Retrospective and logical methods in the system of constructing theoretical knowledge act in close interaction and complementarity. The retrospective method was not only used to form the empirical basis of knowledge in a historical sequence, but also to understand and explain phenomena and processes. The logical method was used to formulate hypotheses, identify patterns, formulate principles and rules based on an empirical base cleared of chances.

Private methods were: **expert survey** - a form of specialized survey of competent specialists, focused on the development of an objective consideration of a particular discussion issue; **content analysis** - qualitative and quantitative analysis of program and regulatory documents; **testing** - standardized tasks that allow us to measure, in relation to the tasks of our work, the level of development of various types of strength qualities. Instrumental research methods are also used to assess the structure of motor actions, the activity of muscle tissue, the capabilities of energy supply systems.

The research was carried out at two levels - empirical and theoretical. The empirical level assumed the accumulation of primary material as a basis for subsequent generalization and theoretical comprehension. Particular attention was paid to the study of the accumulated scientific knowledge in the field of the general theory of sports training and special sections of biological sciences - anatomy, biochemistry, biomechanics, which has both direct and indirect relation to physical training, first of all, to various types of strength training. This knowledge was supplemented by the results of our own experimental research devoted to the study of a number of particular problems that reveal controversial and little-studied issues related to both basic and special levels of knowledge in the field of theory and methodology of strength training. The primary systematization and generalization of this knowledge in close relationship with the relevant specific material accumulated in the theory and methodology of training athletes specializing in wrestling, formed the basis for interdisciplinary theoretical generalizations - the expansion of the objective foundations and regularities that should form the basis of the theory and methodology of strength preparation of athletes specializing in wrestling, the formation of the corresponding principles and provisions of the methodology for the development of strength qualities.

For the systematization and use of the material registered in the process of testing and application of the instrumental methods, for the confirmation of the hypotheses, of the degree of safety and of the precision of the conclusions, the corresponding statistical-mathematical methods were used.

The main scientific results presented for defense:

1. Analysis and characteristics of scientific knowledge and achievements of advanced practice in the field of training athletes specializing in wrestling, as well as the foundations of the methodology for the development of their strength qualities.
2. The set of specific principles of wrestlers' strength training (Figure 1).
3. Model of wrestlers' strength training in different stages of multiannual training (Table 4).
4. The concept of strength training for athletes specializing in wrestling, which is based on:

- compliance with the laws and special principles of the formation of sportsmanship in the process of long-term improvement;
- use of the achievements of sports physiology and biochemistry, sports morphology and medicine in the areas related to the optimization of the methodology for the development of strength qualities;
- systematization and analysis of special principles of sports training, substantiation of the basic special principles that should be used as the basis for the development of strength qualities in athletes specializing in wrestling;
- a set of factors that determine the level of power qualities, and their use to improve the methods of strength training of athletes specializing in wrestling;
- age dynamics of the growth of sportsmanship of athletes specializing in wrestling, the structure and content of the process of their long-term training;
- a fundamental model of the long-term process of strength training of wrestlers in relation to their age characteristics of athletes and the tasks of each of their stages of long-term improvement;
- substantiation of a number of directions of optimization of the process of strength training of wrestlers on the basis of the achievements of modern science and their compliance with the specific requirements of the competitive activity of athletes specializing in wrestling.

Approval and implementation of research results. The program and experimental methodology were implemented in the training and coaching process of sports schools, universities in Romania, Ukraine, Kazakhstan, Belarus and Russia, as well as the Wrestling Federations of the Republic of Moldova and Romania and the Judo Federation of the Republic Moldova.

Thesis structure: abstract in 3 languages; introduction; 5 chapters; general conclusions and recommendations; bibliography - 330 sources; 3 appendixes; 195 pages of main text; 9 figures; 23 tables. The results are published in 40 scientific articles.

Keywords: strength training; highly qualified athletes; training process; many years of preparation; special principles; muscle mode: concentric, eccentric, isometric, plyometric, ballistic; hormonal status; age dynamics; tests.

1. STRENGTH TRAINING IN THE TRAINING PROCESS OF ATHLETES SPECIALIZED IN SPORTS WRESTLING

(summary of the first chapter)

Sports training, as the main form of sports training, with all its content is aimed at achieving the highest sports results. Means and methods of sports training, its special principles, forms of training, the structure of microcycles, periods, stages that make up the content of sports training, are aimed at teaching the technique of techniques and motor actions characteristic of a particular kind of sport; development of motor qualities - strength, speed, flexibility, dexterity, coordination, endurance; increasing the capabilities of the functional systems of the athlete's body, ensuring the effectiveness of competitive activity; education of moral and volitional qualities, expanding the

capabilities of the psyche [18, 25, 26, 27, 35, 58, 59, 60, 62, 66, 67, 68]. In accordance with the nature of the tasks to be solved, the types of training are determined - technical, tactical, physical, moral-volitional, integral, theoretical (Ozolin N.G., [62]); mental, physical, technical, tactical (Matveev L.P., [58, 59]); technical, tactical, physical, psychological, integral (Platonov V.N., [66, 67]). The division of the integral process of sports training into these types is relative, since the effectiveness of motor actions in sports is conditioned by the simultaneous manifestation and integration of technical and tactical skill, physical and mental qualities of an athlete. However, the selection of various types or independent sides in training streamlines ideas about the structure and content of sportsmanship, allows you to systematize the means and methods, to streamline the management of the process of sports training [57, 59, 62]. At the same time, the effectiveness of training and, especially, competitive activity is determined not only by a high level of development of qualities and abilities related to various types, but also by the balance of their development and implementation in the process of training and competition [65, 66, 68].

These concepts and long-established theoretical positions are not in all cases reflected in the special literature and practice of training athletes specialized in various sports, in particular, in wrestling.

The section presents the analysis of the problem of strength training in the system of training activity of athletes specializing in wrestling. It is shown that in the system of knowledge and practical activity, reflecting the training of athletes specializing in wrestling, the main attention is paid to techniques and technical-tactical actions with a clear underestimation of the importance of other types of training, especially physical, and, especially, such essential qualities for wrestling, as strength qualities.

In most of the modern literature, which deals with the problems of strength training, wrestlers of different styles, the ideas reflected in the works published in the 1950s – 1970s have survived. The practice of developing the strength qualities of the wrestlers was also practically not used. This testifies to the discrepancy between representatives in the field of strength training of wrestlers to the modern level of knowledge in the field of theoretical, methodological and medical and biological foundations of the development of motor qualities in athletes.

In the special literature, the issues related to the significance of various types of power qualities with the structure of competitive activity, the effectiveness of the main techniques and motor actions fulfillment are clearly insufficiently reflected. The use and interconnection of exercises performed in various modes of muscle activity, especially plyometric and ballistic ones, is not reflected either.

The connection between power capabilities and motor memory, the formation of a component of motor memory in organic interconnection with the spatial and temporal structure of techniques and motor actions is practically not revealed. The interconnection of various types of force with the capabilities of various energy supply systems is fragmentarily.

Serious reserves for the development of knowledge and an increase in the effectiveness of wrestlers' strength training are hidden in the development of specific principles of strength training for wrestling, arising from general didactic principles, special principles developed by the general

theory of sports, specific features of wrestling. Optimization of the process of development of strength qualities of wrestlers on the basis of knowledge about the structure of muscle tissue and the totality of processes of its activation also seems promising.

An important direction of increasing the effectiveness of strength training of wrestlers is to improve the means and methods of control over the level and dynamics of the development of strength qualities. The approach, widely accepted in sports practice and presented in the main program documents, and testing of strength on the basis of traditional means, reflecting general training, should be supplemented with specific tests based on the material of physical activity specific for wrestling.

2. SPECIAL PRINCIPLES OF SPORTS TRAINING AND THEIR IMPLEMENTATION DURING THE DEVELOPMENT OF POWER QUALITIES IN ATHLETES SPECIALIZING IN SPORTS WRESTLING

(summary of the second chapter)

The theoretical analysis carried out in our work showed that the methodology of sports training, especially in that part of it that is associated with the development of motor qualities, cannot rely only on the views and principles characteristic of traditional pedagogy, isolated from a wide array of special medical, biological and psychological knowledge, the broadest and contradictory experience of sports practice, modern trends and approaches characteristic of the theory of management, the system approach, the theory of functional systems.

In sports, the process of learning and training mainly occurs at the motor level and on the basis of the corresponding physiological, biochemical, and psychoregulatory processes [65, 68]. An additional difficulty is that sport is focused on the maximum available levels of various aspects of training, motor qualities, manifestations of the psyche [8, 57, 58, 66, 67 etc.], as well as the use of huge loads associated with such concepts as stress, fatigue, overstrain of functional systems, overtraining, recovery, urgent and delayed adaptive effect, etc. [11, 26].

Therefore, it becomes clear that general didactic principles in conjunction with a wide amount of knowledge related to sports training, the practice of elite sports, related disciplines and approaches are only the basis for the formation of special patterns and principles, that is, didactics of the second level, based on an appropriate base, including general didactic principles [58, 60, 66, 67].

The development of the principles of general didactics in relation to sports training is the pivotal moment in the development of the principles of the second level - special principles. These principles, arising from stable regularities reflecting the connections between the means and methods of influencing the athlete's body and the corresponding adaptation reactions, the development of an urgent, cumulative and delayed training effect, are the basis for the coach's effective activity.

The development of special principles is a subject area for the research of many well-known specialists [8, 35, 62]. As a result, both the general methodological foundations of the development of the principles of sports training and the specific content of each of them were developed. These

principles formed the basis for successful coaching, the development of rules, instructions, techniques, the selection of tools and methods, their distribution in time, etc. in relation to a variety of specific tasks that arise in the training process. Among the special principles are: striving for the highest achievements; advanced specialization; continuity of the training process; the unity of the gradual increase in the load and the trend towards maximum loads; undulation of loads; load variability; unity of general and special training; the cyclical nature of the preparation process; unity and interconnection of the content of the training process and competitive activity, etc. [58, 60, 65, 66, 68].

Special principles as basic attitudes, provisions, rules that determine the content of sports training, reflecting stable relationships between its various components - natural inclinations and the possibilities of their implementation in order to achieve a high level of sportsmanship; between factors affecting the athlete's body and his adaptive reactions; between different physical qualities, sides of fitness and the structure of competitive activity, etc. Special principles do not strictly standardize the structure and content of athletes' training, but are generalizations and methodological attitudes that ensure the rational training of athletes, translating it onto a solid scientific platform [59, 65, 67, 68].

The content of specific principles, which generally applies to the system of sports training, can be expanded in relation to its various components, in particular, to physical training and even the development of individual motor qualities [13, 46, 52, 53, 54, 55, 56]. This can be ensured by the formulation of rules and guidelines or by the establishment of special principles of the third level as a basis for the subsequent development of rules, selection of means and methods, etc. It is this approach that we have implemented in relation to the process of strength training of athletes specializing in wrestling. The following specific principles are highlighted and presented in Figure 1.

The indicated principles concretize the possibilities of general didactic and special principles in relation to the peculiarities of the development of strength qualities among athletes specializing in wrestling, which allows objectifying the process of strength training.

Thus, a vertical can be created that includes general didactic principles as a basis, special principles that reveal their capabilities in relation to the sport of elite achievements and specific principles for wrestling, which allow placing the most significant accents for this sport.

The use of the principles of each level (general didactic, special, specific for the kind of sport) or different principles related to one of the levels cannot be distinguished by strict selectivity and independence of their reflection in the training process. Separate content components of the system of sports training often presuppose the implementation of the provisions characteristic of different principles, ensuring the complexity of the impact on the body of those involved. The desire to single out absolutely independent, mutually exclusive principles in such a complex and multifactorial process as sports training in general or in a variety of private processes associated with the formation of various aspects of sports mastery, the development of certain motor qualities, components of competitive activity, etc., suffers from artificiality and one-sidedness.

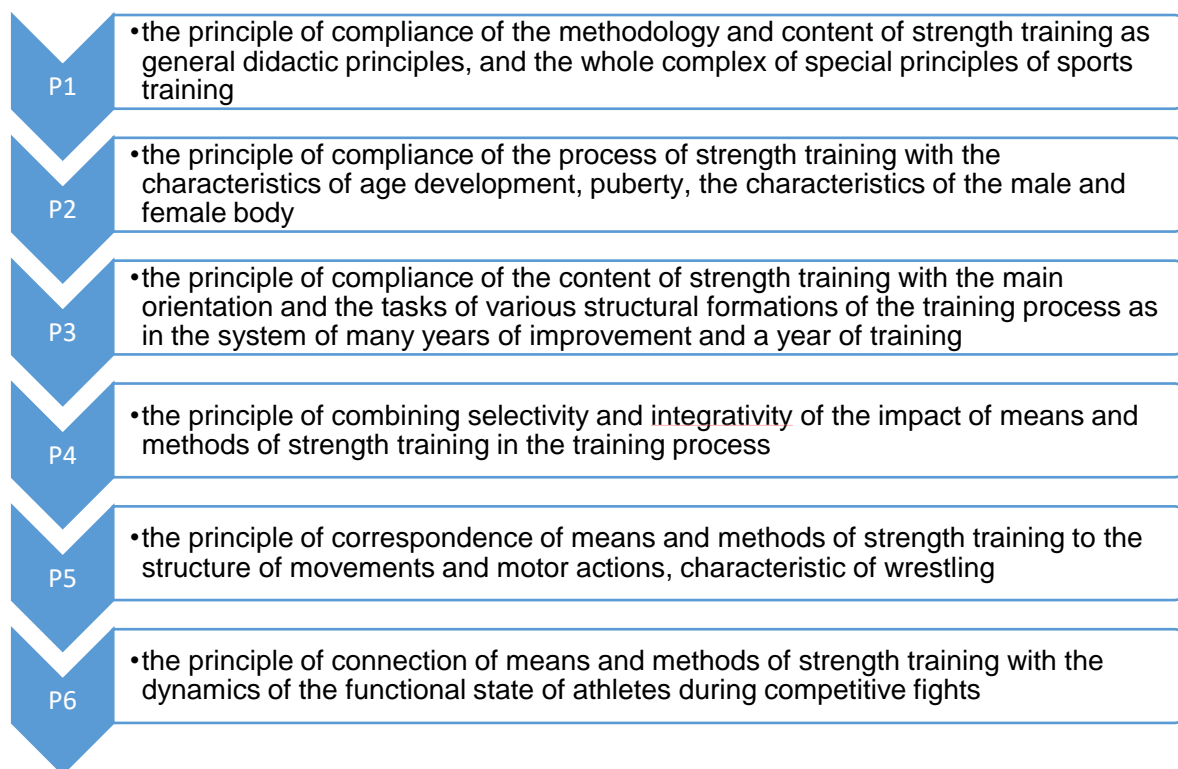


Figure 1. Specific principles of strength training of wrestlers (Manolachi V.V., 2020)

3. FACTORS DETERMINING THE COMPOSITION OF THE MEANS AND METHODS OF POWER TRAINING OF ATHLETES SPECIALIZED IN SPORTS WRESTLING

(summary of the third chapter)

The implementation of special principles characteristic of the process of strength training of athletes specialized in wrestling requires a comprehensive consideration of the structure and functioning of the human musculoskeletal system: the characteristics of skeletal muscles; factors that determine the level of development and manifestation of various types of power qualities; the peculiarities of the manifestation of power qualities, their place and role for the effectiveness of the main motor actions that make up competitive activity; means of selective and integrative influence on various sides of strength readiness; interaction of power qualities with other motor qualities, and also the peculiarities of energy supply of various types and manifestations of strength qualities.

The use of this approach should be based on the achievements of modern science in the field of both the general theory of training athletes and the theory and methodology of training in wrestling, as well as advanced sports practice. No less important is a broad reliance on the achievements of sports areas of biomedical disciplines - physiology, biochemistry, anatomy and morphology, kinesiology, which have accumulated a large amount of empirical material, which makes it possible to significantly expand and objectify the level of knowledge in this area.

Our analysis of a large volume of empirical material related to these areas of science allows us to significantly expand our understanding of strength and strength training, the factors that determine the level of strength qualities in wrestling, open up broad prospects for increasing the effectiveness of the strength training process, bringing it in line with the achievements of science

and the specific requirements of wrestling. In the previous section of the work, the possibilities of special principles for increasing the effectiveness of strength training of athletes were revealed. This section reveals the prospects for using the knowledge accumulated by modern sports physiology, kinesiology, biochemistry, morphology, medicine to expand the ideas about the strength and strength training of athletes, to improve the methods of strength training of wrestlers. This knowledge relates to the mechanisms of muscle contraction, the structure and functioning of sarcomeres, myofibrillar and sarcoplasmic hypertrophy, the structure and adaptation of various types of muscle fibers [11, 74, etc.]. The possibilities of neuroregulatory adaptation of muscle motor units for the development and manifestation of strength qualities, the importance of taking into account and reducing the protective reactions of muscle and tendon mechanoreceptors are shown [23]. The role of muscle microtrauma and activation of muscle fiber regeneration in the development and manifestation of strength qualities has been revealed [5]. The prospects for the use of the hormonal response to physical activity in organic connection with nutritional processes to increase the effectiveness of the strength training process have been determined.

This knowledge opens up wide opportunities for the development and practical implementation of the concept we are developing in the direction of ensuring their organic combination with the sports material characteristic of wrestling - the structure of motor actions, the features of the manifestation of strength qualities and their relationship with technical and tactical mastery, flexibility, coordination, agility, endurance.

The combination of scientific and practical achievements in these two areas, as the basis of the modern concept of strength training, can only lead to the formation of a system of knowledge in the field of strength training of athletes specialized in wrestling that meets the requirements of our time.

Figure 2 shows the content of our concept of strength training for athletes specialized in wrestling

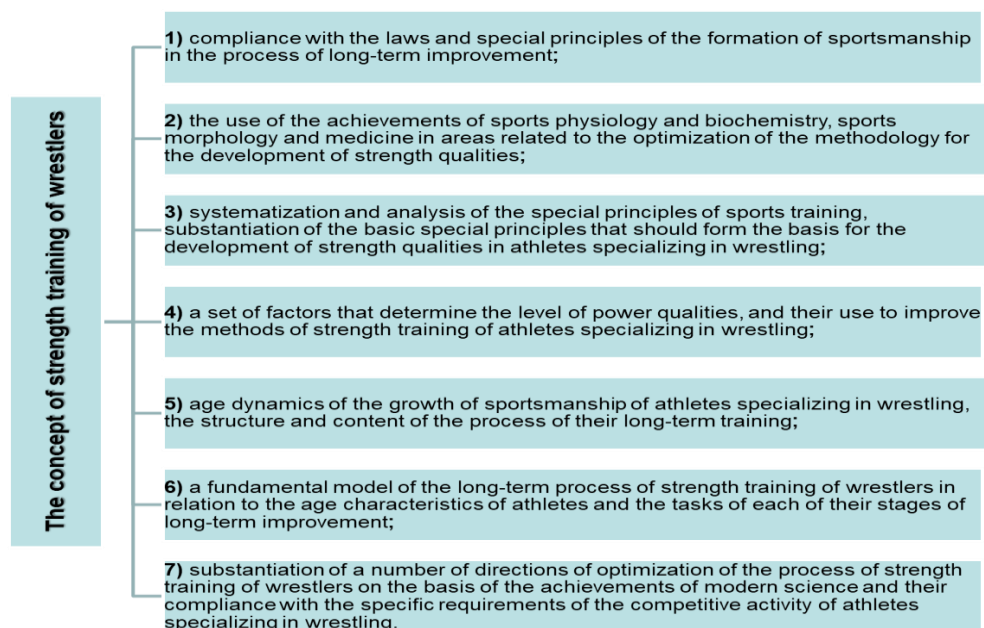


Figure 2. The concept of strength training of wrestlers

4. GENERAL STRUCTURE OF THE LONG-TERM TRAINING PROCESS OF ATHLETES SPECIALIZED IN SPORTS WRESTLING, AND THE BASIS OF THEIR POWER TRAINING

(summary of the fourth chapter)

The development of strength qualities in the process of long-term improvement of athletes, specialized in wrestling, as in other sports, is conditioned by many factors. These include the general structure of the process of long-term training, the predominant focus and content of each of its stages, the age and gender characteristics of athletes, the peculiarities of the puberty period, sensitive periods in relation to various types of strength qualities, the connection between strength training and the structure of competitive activity, etc.

It is equally important to understand that in the structure of strength readiness there are a number of components of a morphological and physiological nature, which together provide the level of various types of strength qualities. And each of these components related to the structure of muscle tissue, neuroregulatory processes of activation of motor units of muscles, energy supply of muscle activity, biomechanical structure of movements, etc. cannot be subjected to highly effective development without taking into account the age and gender characteristics of the trainees, the specifics of the sport, the stage of long-term improvement and the period of one-year training.

It is extremely important to approach the strength training of athletes not as an isolated process focused on achieving the maximum available strength capabilities, but as a process, the result of which should be an integral part of versatile training, combining various types of power qualities with speed and coordination abilities, mobility in joints and endurance, technical and tactical characteristics, that is, into a system that determines the effectiveness of competitive activity in all its complexity and multifactorial nature [13, 14, 27, 65, 68]. It is quite natural that this context in the strength training of athletes also provides for its close relationship with the age and gender of the athlete, the stage of long-term and annual training, sports specialization, and the model of competitive activity.

By now, in relation to each of the many factors related to the problem of strength training of athletes, a huge amount of empirical and theoretical knowledge has been accumulated, which allows to reveal the tasks, means and methods of strength training in relation to each of the stages of long-term improvement. However, this can be done only if there is a general structure of long-term training, which includes such indicators as the optimal age for starting wrestling, the duration of preparation for the first sporting successes and the age of athletes who achieve them, the duration of the period from the first successes to the highest achievements and the age at which they were available. This knowledge is the basis on which, relying on abundant empirical and theoretical material, it is possible to structure the entire structure of long-term training and show the place, focus, means, methods of strength training in their dynamics with the task of bringing an athlete to the highest level of special strength training in optimal for this age zone.

In our research, on the basis of a large amount of factual material, the dynamics of the formation of sportsmanship in judo, Greco-Roman and freestyle wrestling, has been studied. As a result of the research, the optimal age for starting wrestling lessons was determined, the age at

which athletes achieve their first sporting successes, the age of reaching the level of highest achievements, the age at which major successes have been achieved in the international arena. These data are presented in Tables 1, 2 and 3.

Table 1. Age dynamics of sports achievements of champions and prize-winners of the 2004–2016 Olympic Games in Greco-Roman wrestling (men) (n = 30)

| Weight category | Olympic Games | Athlete, country, place at the Olympics | Date of Birth | Age, years | | | | |
|-----------------|---------------|---|---------------|------------------|------------------------|--|---------------|------------------------|
| | | | | Start of classes | First sports successes | Reaching the level of highest achievements | Highest score | Retirement from sports |
| up to 66 kg | XXXI, 2016 | Rasul Chunaev, Azerbaijan, III | 07.01.1991 | 9 | 22 | 23 | 24 | 27* |
| up to 70 kg | XXXI, 2016 | Roman Vlasov, Russia, I | 06.10.1990 | 7 | 21 | 22 | 26 | 26 |
| | XXXI, 2016 | Kim Hyun Woo, South Korea, III | 06.11.1988 | 9 | 18 | 23 | 24 | 30* |
| | XXXI, 2016 | Zhan Beleniuk, Ukraine, II | 24.01.1991 | 9 | 21 | 23 | 25 | 28* |
| | XXXI, 2016 | Denis Kudla, Germany, III | 24.12.1994 | 6 | 22 | 22 | 22 | 24* |
| up to 98 kg | XXXI, 2016 | Artur Aleksanyan, Armenia, I | 21.10.1991 | 9 | 20 | 21 | 25 | 27* |
| | XXXI, 2016 | Jenk Ildem, Turkey, III | 05.01.1986 | 10 | 22 | 25 | 30 | 30 |
| up to 55kg | XXX, 2012 | Hamid Sorian, Iran, I | 24.08.1985 | 13 | 20 | 22 | 27 | 29 |
| up to 55kg | XXX, 2012 | Rovshan Bayramov, Azerbaijan, II | 07.05.1987 | 12 | 20 | 21 | 25 | 31* |
| up to 55kg | XXX, 2012 | Mingiyon Semyonov, Russia, III | 11.06.1990 | 9 | 21 | 22 | 22 | 27* |
| up to 60kg | XXX, 2012 | Zaur Kuramagomedov, Russia, III | 30.03.1988 | 10 | 19 | 22 | 24 | 24 |
| up to 66 kg | XXX, 2012 | Kim Hyun Woo, South Korea, I | 16.11.1988 | 9 | 18 | 23 | 24 | 30* |
| up to 74kg | XXX, 2012 | Roman Vlasov, Russia, I | 06.10.1990 | 7 | 21 | 22 | 26 | 26 |
| up to 74kg | XXX, 2012 | Arsen Julfalakyan, Armenia, II | 08.05.1987 | 11 | 19 | 23 | 25 | 27 |
| up to 74kg | XXX, 2012 | Emin Akhmedov, Azerbaijan, III | 06.10.1986 | 11 | 20 | 26 | 26 | 26 |
| up to 74kg | XXX, 2012 | Alexander Kazakevich, Lithuania, III | 06.06.1986 | 10 | 21 | 26 | 26 | 26 |
| up to 84kg | XXX, 2012 | Alan Khugaev, Russia, I | 27.04.1989 | 8 | 18 | 20 | 23 | 25 |
| up to 84kg | XXX, 2012 | Karam Gaber, Egypt, II | 01.09.1979 | 8 | 19 | 23 | 25 | 33 |
| up to 84kg | XXX, 2012 | Daniyal Gadzhiev, Kazakhstan, III | 20.02.1986 | 15 | 21 | 26 | 26 | 27 |
| up to 96kg | XXX, 2012 | Rustam Totrov, Russia, II | 15.07.1984 | 13 | 22 | 26 | 28 | 28 |
| up to 96kg | XXX, 2012 | Artur Aleksanyan, Armenia, III | 21.10.1991 | 9 | 19 | 20 | 25 | 27* |
| up to 55kg | XXIX, 2008 | Rovshan Bayramov, Azerbaijan, II | 07.05.1987 | 12 | 19 | 19 | 21 | 28 |
| up to 55kg | XXIX, 2008 | Roman Amoyan, Armenia, III | 09.09.1983 | 10 | 20 | 20 | 25 | 33 |
| 7 up to 4 кг | XXIX, 2008 | Chang Yongxiang, China, II | 16.09.1983 | 10 | 21 | 23 | 24 | 25 |
| up to 84 кг | XXIX, 2008 | Nazmi Avluca, Turkey, III | 14.11.1976 | 11 | 19 | 21 | 31 | 35 |
| up to 96 kg | XXIX, 2008 | Aslanbek Khushtov, Russia, I | 01.01.1980 | 12 | 20 | 24 | 28 | 30 |
| up to 55 kg | XXVIII, 2004 | Istvan Mayoros, Hungary, I | 11.07.1974 | 10 | 19 | 26 | 30 | 32 |
| up to 55 kg | XXVIII, 2004 | Artyom Kyureghian, Greece, II | 09.09.1976 | 6 | 21 | 23 | 28 | 31 |
| up to 60kg | XXVIII, 2004 | Armen Nazaryan, Bulgaria, III | 09.03.1974 | 9 | 19 | 22 | 26 | 34 |
| up to 66kg | XXVIII, 2004 | Farid Mansurov, Azerbaijan, I | 10.05.1982 | 10 | 20 | 20 | 22 | 28 |
| \bar{x} | | | | 9,80 | 20,07 | 22,63 | 25,43 | 28,47 |
| S | | | | 2,06 | 1,23 | 2,01 | 2,42 | 2,94 |
| min | | | | 6 | 18 | 19 | 21 | 24 |
| max | | | | 15 | 22 | 26 | 31 | 35 |

Note. * - did not complete sports career (as of 2019)

Table 2. Age dynamics of sporting achievements of champions and prize-winners of the 2004–2016 Olympic Games in freestyle wrestling (men) (n = 31)

| Weight category | Olympic Games | Athlete, country, place at the Olympics | Date of Birth | Age, years | | | | |
|-----------------|---------------|---|---------------|------------------|------------------------|--|---------------|------------------------|
| | | | | Start of classes | First sports successes | Reaching the level of highest achievements | Highest score | Retirement from sports |
| up to 57kg | XXXI, 2016 | Rei Higuchi, Japonia, II | 28.01.1996 | 4 | 20 | 20 | 20 | 22 |
| | XXXI, 2016 | Haji Aliyev, Azerbaidjan, III | 21.04.1991 | 8 | 22 | 23 | 25 | 27 |
| up to 65kg | XXXI, 2016 | Torgul Asgarov, Azerbaidjan, II | 17.09.1992 | 10 | 17 | 20 | 24 | 24 |
| | XXXI, 2016 | Ikhtiyor Navruzov, Uzbekistan, III | 05.07.1989 | 10 | 19 | 19 | 27 | 29 |
| up to 74kg | XXXI, 2016 | Jabrail Hasanov, Azerbaidjan, III | 24.02.1990 | 11 | 19 | 20 | 26 | 28 |
| up to 84kg | XXXI, 2016 | Jaden Cox, SUA, III | 03.03.1995 | 4 | 21 | 21 | 21 | 23 |
| up to 97kg | XXXI, 2016 | Albert Saritov, România, III | 08.07.1985 | 12 | 26 | 26 | 31 | 31 |
| up to 60 kg | XXX, 2012 | Togrul Asgarov, Azerbaidjan, I | 17.09.1992 | 10 | 17 | 17 | 24 | 24 |
| | XXX, 2012 | Besik Kudukhov, Rusia, II | 15.08.1986 | 9 | 19 | 20 | 26 | 26 |
| | XXX, 2012 | Yogeshwar Dutt, India, III | 02.11.1982 | 8 | 24 | 29 | 29 | 31 |
| up to 66 kg | XXX, 2012 | Sushil Kumar, India, II | 26.05.1983 | 14 | 20 | 25 | 29 | 29 |
| up to 84kg | XXX, 2012 | Jaime Espinal, Puerto Rico, II | 14.10.1989 | 9 | 24 | 24 | 28 | 31 |
| | XXX, 2012 | Dato Marsagishvili, Georgia, III | 30.03.1991 | 6 | 20 | 20 | 21 | 25 |
| up to 120kg | XXX, 2012 | Bilyal Makhov, Rusia, III | 20.09.1987 | 8 | 20 | 20 | 24 | 28 |
| up to 55kg | XXX, 2012 | Besik Kudukhov, Rusia III | 15.08.1986 | 9 | 17 | 29 | 25 | 26 |
| up to 60 kg | XXIX, 2008 | Mavlet Batirov, Rusia, I | 12.12.1983 | 7 | 19 | 19 | 20 | 24 |
| | XXIX, 2008 | Sushil Kumar, India, III | 26.05.1983 | 14 | 20 | 25 | 29 | 29 |
| up to 74kg | XXIX, 2008 | Buvaysar Saytieyev, Rusia, I | 11.03.1975 | 10 | 19 | 20 | 33 | 33 |
| up to 84kg | XXIX, 2008 | Yusup Abdusalomov, Tadjikistan, II | 08.11.1977 | 14 | 24 | 24 | 30 | 34 |
| up to 120kg | XXIX, 2008 | David Musulbes, Slovacia, II | 23.05.1972 | 10 | 22 | 23 | 28 | 36 |
| up to 55kg | XXVIII, 2004 | Mavlet Batirov, Rusia, I | 12.12.1983 | 7 | 19 | 19 | 20 | 24 |
| | XXVIII, 2004 | Stephen Abas, SUA, II | 12.01.1978 | 6 | 23 | 23 | 24 | 26 |
| up to 66kg | XXVIII, 2004 | Elbrus Tedeev, Ucraina, I | 05.12.1974 | 11 | 20 | 20 | 29 | 30 |
| up to 74kg | XXVIII, 2004 | Buvaysar Saytieyev, Rusia, I | 11.03.1975 | 10 | 19 | 20 | 21 | 34 |
| | XXVIII, 2004 | Gennady Laliev, Kazahstan, II | 30.03.1979 | 10 | 20 | 24 | 25 | 25 |
| up to 84kg | XXVIII, 2004 | Moon Ui Jae, Coreea de Sud, II | 10.02.1975 | 13 | 23 | 24 | 25 | 30 |
| up to 96kg | XXVIII, 2004 | Khadzhimurat Gatsalov, Rusia, I | 11.12.1982 | 11 | 20 | 20 | 22 | 33 |
| | XXVIII, 2004 | Magomed Ibragimov, Uzbekistan, II | 18.08.1983 | 7 | 17 | 19 | 21 | 21 |
| | XXVIII, 2004 | Alireza Heydari, Iran, III | 04.03.1976 | 7 | 18 | 20 | 28 | 30 |
| up to 120kg | XXVIII, 2004 | Alireza Rezai, Iran, II | 11.06.1976 | 13 | 20 | 20 | 28 | 28 |
| | XXVIII, 2004 | Aidin Polatci, Turcia, III | 15.05.1977 | 10 | 18 | 21 | 27 | 27 |
| \bar{X} | | | | 9,42 | 20,19 | 21,45 | 25,48 | 28,00 |
| S | | | | 2,69 | 2,32 | 2,63 | 3,56 | 3,80 |
| min | | | | 4 | 17 | 17 | 20 | 21 |
| max | | | | 14 | 26 | 29 | 33 | 36 |

Table 3. Age dynamics of sports achievements of champions and prize-winners of the Olympic Games (1996–2016) in judo (men) (n = 34)

| Weight category | Olympic Games | Athlete, country, place at the Olympics | Date of Birth | Age, years | | | | |
|-----------------|---------------|---|---------------|------------------|------------------------|--|---------------|------------------------|
| | | | | Start of classes | First sports successes | Reaching the level of highest achievements | Highest score | Retirement from sports |
| up to 60 kg | XXXI, 2016 | Eldos Smetov, Kazakhstan, II | 09.09.1992 | 5 | 18 | 21 | 24 | 24 |
| | XXXI, 2016 | Naohisa Takato, Japonia, III | 30.05.1993 | 7 | 18 | 20 | 23 | 26* |
| up to 66 kg | XXXI, 2016 | Fabio Basile, Italia, I | 07.10.1994 | 7 | 18 | 22 | 22 | 22 |
| | XXXI, 2016 | Rishod Sobirov, Uzbekistan, III | 11.09.1986 | 11 | 21 | 22 | 26 | 30 |
| up to 73 kg | XXXI, 2016 | Shohei Ono, Japonia, I | 03.02.1992 | 7 | 19 | 21 | 24 | 26* |
| up to 81 kg | XXXI, 2016 | Travis Stevens, SUA, II | 28.02.1986 | 6 | 18 | 22 | 30 | 30 |
| | XXXI, 2016 | Takanori Nagase, Japonia, III | 14.10.1993 | 6 | 18 | 20 | 23 | 23 |
| up to 100 kg | XXXI, 2016 | Elmar Gasimov, Azerbaidjan, II | 02.11.1990 | 7 | 21 | 21 | 25 | 26 |
| | XXXI, 2016 | Ryunosuke Haga, Japonia, III | 28.04.1991 | 5 | 19 | 24 | 25 | 25 |
| over 100 kg | XXXI, 2016 | Teddy Riner, Franța, I | 07.04.1989 | 5 | 18 | 18 | 27 | 28 |
| | XXXI, 2016 | Hisayoshi Harasawa, Japonia, II | 03.07.1992 | 6 | 24 | 24 | 24 | 26 |
| up to 60 kg | XXX, 2012 | Arsen Galstyan, Rusia, I | 19.02.1989 | 7 | 20 | 20 | 23 | 27 |
| | XXX, 2012 | Rishod Sobirov, Uzbekistan, III | 11.09.1986 | 11 | 21 | 21 | 25 | 30 |
| up to 73 kg | XXX, 2012 | Mansur Isaev, Rusia, I | 23.09.1986 | 8 | 22 | 22 | 25 | 25 |
| up to 81 kg | XXX, 2012 | Ivan Nifontov, Rusia, III | 05.07.1987 | 9 | 22 | 22 | 25 | 27 |
| up to 90 kg | XXX, 2012 | Masashi Nishiyama, Japonia, III | 09.07.1985 | 6 | 21 | 21 | 24 | 24 |
| up to 100 kg | XXX, 2012 | Tagir Khaibulaev, Rusia, I | 27.07.1984 | 11 | 24 | 24 | 28 | 28 |
| | XXX, 2012 | Dmitry Peters, Germania, III | 04.05.1984 | 11 | 22 | 22 | 28 | 31 |
| over 100 kg | XXX, 2012 | Teddy Riner, Franța, I | 07.04.1989 | 5 | 18 | 18 | 23 | 28 |
| | XXX, 2012 | Alexander Mikhaylin, Rusia, II | 18.08.1979 | 7 | 20 | 20 | 33 | 37 |
| up to 100 kg | XXIX, 2008 | Movlud Miraliev, Azerbaidjan, III | 27.02.1974 | 9 | 23 | 23 | 33 | 33 |
| | XXIX, 2008 | Abdullo Tangriev, Uzbekistan, II | 28.03.1981 | 10 | 21 | 22 | 27 | 35 |
| up to 81 kg | XXVIII, 2004 | Dmitry Nosov, Rusia, III | 09.04.1980 | 11 | 24 | 24 | 24 | 24 |
| over 100 kg | XXVIII, 2004 | Keiji Suzuki, Japonia, I | 03.06.1980 | 3 | 22 | 22 | 24 | 32 |
| up to 60 kg | XXVII, 2000 | Jong Bu Kyung, Republica Coreea, II | 26.05.1978 | 11 | 21 | 22 | 22 | 25 |
| up to 73 kg | XXVII, 2000 | Giuseppe Maddaloni, Italia, I | 10.07.1976 | 3 | 21 | 21 | 24 | 32 |
| | XXVII, 2000 | Anatoly Laryukov, Belarus, III | 28.10.1970 | 10 | 26 | 26 | 30 | 34 |
| up to 81 kg | XXVII, 2000 | Nuno Delgado, Portugalia, III | 27.08.1976 | 12 | 22 | 22 | 23 | 27 |
| over 100 kg | XXVII, 2000 | David Douillet, Franța, I | 17.02.1969 | 11 | 21 | 21 | 27 | 31 |
| up to 65 kg | XXVI, 1996 | Udo Kwellmalz, Germania, I | 08.03.1967 | 8 | 21 | 21 | 29 | 29 |
| up to 71 kg | XXVI, 1996 | Kenzo Nakamura, Japonia, I | 18.10.1973 | 5 | 21 | 22 | 22 | 28 |
| up to 78 kg | XXVI, 1996 | Toshihiko Koga, Japonia, II | 21.11.1967 | 12 | 20 | 20 | 24 | 29 |
| up to 86 kg | XXVI, 1996 | Jung Gi Young, Coreea de Sud, I | 11.07.1973 | 7 | 20 | 20 | 23 | 24 |
| up to 95 kg | XXVI, 1996 | Pavel Nastula, Polonia, I | 26.06.1970 | 10 | 21 | 21 | 26 | 30 |
| X | | | | 7,91 | 20,76 | 21,53 | 25,44 | 28,25 |
| S | | | | 2,62 | 2,02 | 1,66 | 2,90 | 3,68 |
| min | | | | 3 | 18 | 18 | 22 | 22 |
| max | | | | 12 | 26 | 26 | 33 | 37 |

The developed periodization predetermined the content of each of the stages of long-term training, based on general didactic principles, special principles of sports training and narrowly specialized principles developed by us that underlie rational strength training. An equally important aspect of the content of strength training was its compliance with numerous factors of a physiological and morphological nature, which determine the level of strength qualities, as well as the peculiarities of age development and puberty of those who train. Table 4 presents the general structure and the main content of the fundamental model of strength training of athletes, specializing in wrestling, in the process of many years of improvement.

Table 4. The fundamental model of strength training of athletes specialized in wrestling at various stages of long-term improvement

| Preparation period | Age of athletes, years | Period of age development | Period of puberty | The main focus of the work. Means and methods |
|---|------------------------|---------------------------|---|--|
| Initial | 9–11 | School childhood | – | Strength training as a side result of versatile physical activity, speed, technical and coordination training |
| Basic | 12–15 | Puberty | Prepubertal | Versatile strength training focused on the development of neuroregulatory components of strength training. The maximum variety of means and methods focused on both selective and complex development of various components of strength training. Close connection of the content of strength training with coordination and technical training, the development of flexibility. Resistances in various exercises are not more than 50-60% of the maximum available. |
| Special | 16–18 | Adolescence | Postpubertal | Versatile strength training mainly focused on the neuroregulatory components of strength readiness, postural stability, a wide range of movements in organic interconnection with special technical training, the development of speed and coordination abilities with the wide use of various methods and special means. Resistances in various exercises should not exceed 60-70% of the maximum available. |
| Preparation for the highest achievement | 19–21 | Early adulthood | Between puberty and completion of body growth | Versatile strength training focused on the development of neuroregulatory components of strength training and muscle hypertrophy, the unity of strength training with technical actions, coordination training, and the development of flexibility. Wide |

| Preparation period | Age of athletes, years | Period of age development | Period of puberty | The main focus of the work. Means and methods |
|----------------------|------------------------|---------------------------|-------------------|---|
| | | | | use of all modes of manifestation of strength qualities - concentric, eccentric, plyometric, ballistic, isometric. Use of equipment specific to wrestling. The amount of weights in a wide range, up to 80-90% of the maximum available. |
| Higher sportsmanship | 22-25 | Adulthood | – | Versatile strength training mainly aimed at developing the power of motor actions, close connection with other motor qualities, energy supply systems of work. Synchronization of strength training with the structure of competitive activity. The magnitude of weights in a wide range, up to 90%, with a special emphasis on weights of 50-70%, the most effective for the development of power. |

It is important to note that the recommended model of long-term strength training of athletes specialized in wrestling is organically linked to the historically established system of competitions adopted for various age groups - children, adolescents, youth, early adults, adults. This point is fundamentally important, as it will improve the program and regulatory documents, educational literature, the system of training and advanced training of personnel, without violating the established traditions of holding competitions in different age groups.

5. DIRECTIONS FOR OPTIMIZING THE PROCESS OF POWER TRAINING OF ATHLETES SPECIALIZED IN SPORTS WRESTLING

(summary of the fifth chapter)

The analysis of special literature, advanced sports practice, a number of our own experimental studies, carried out by us, made it possible to expand ideas in the field of strength training of wrestlers and to highlight specific directions for increasing the effectiveness of the development of strength qualities among athletes specialized in wrestling.

The following areas were identified as areas of their own research:

- bringing the process of strength training of wrestlers in line with the rules of the competition and the structure of competitive activity;
- ensuring the influence of strength training of wrestlers on the volume of specific motor memory, variability and efficiency of motor actions;
- ensuring the relationship of the process of strength training of wrestlers with static-dynamic body stability when performing specific motor actions;

- demonstration of the importance of using plyometric and ballistic modes of muscle activity in the process of strength training of wrestlers;
- bringing the process of strength training of wrestlers in accordance with their individual characteristics, individual structure of the main motor actions;
- development of a system of tests for an integral assessment of the speed-power potential and the capabilities of energy supply systems for muscular activity of varying intensity and duration.

The modern tendencies in the development of wrestling, reflected in the rules of competitions, stimulating the activity of athletes, the intensity of their offensive actions, the dynamism and entertainment of fights are considered. This significantly influenced the content of the training methodology for wrestlers, especially in the part related to speed-strength training, strength and special endurance.

The necessity of providing such content of the process of strength training, which would be organically connected with the structure of competitive activity, would provide the creation of a broad foundation of strength preparedness in the form of an extensive dynamic memory, organically connected with the structure of new techniques and motor actions. This presupposes a sharp expansion of the volume of strength training means in order to bring the unity of the dynamic and spatio-temporal characteristics of the main techniques and motor actions. The variety of means of training in relation to its types, peculiarities of muscular activity, the use of various inventory and equipment predetermines the volume of dynamic motor memory, its relationship with the kinematic structure of techniques and motor actions.

Our research shows the effectiveness of strength exercises, performed on an unstable surface, as an effective means of increasing static-dynamic stability and the effectiveness of motional actions of a strength nature.

The studies were carried out using a video computer complex "Qualisys" (Sweden), which allows obtaining 3D coordinates of the examined points of the body in real time, which in turn involves applying reflective passive spherical markers to the corresponding anthropometric points of the athlete. The video computer complex "Qualisys" is synchronized with the eight-channel strain-gauge platform "Kistler" (Germany) to register the coordinates of the movement of the general center of pressure (GCP) of the subject's body in the sagittal and frontal planes, as well as the components of the support reaction in the sagittal, frontal and vertical planes.

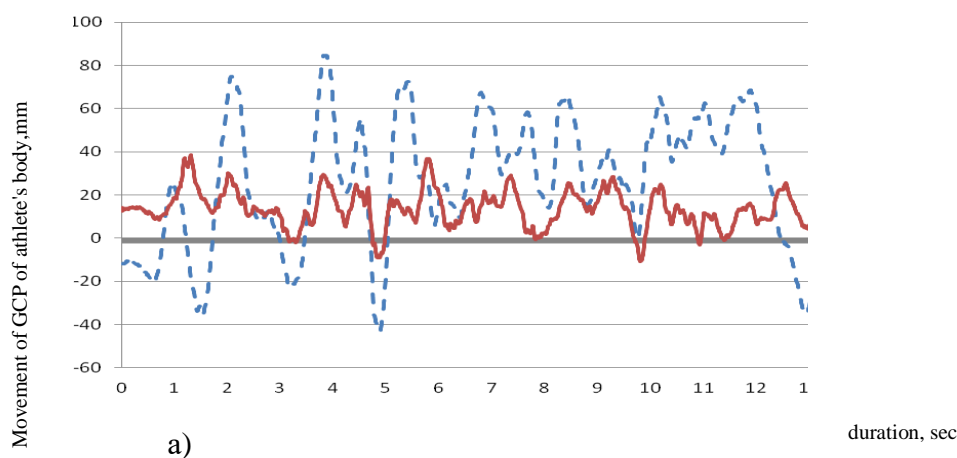
The research involved the masters of sports ($n = 12$), specialized in freestyle wrestling. Each athlete performed two exercises (flexion and extension of the arms at the elbow joints in a standing position ("lifting the bar to the biceps")); flexion and extension of the arms in the elbow joints from behind the head, in a standing position ("French press standing") with weights 55 - 60% of the individual maximum. Exercises were carried out by athletes standing on the "Bosu" hemisphere, which was located with its flat part upward. Sportsmen performed 7 sets of 12-14 repetitions in each. The pace was within 0.7 - 0.8 movements per 1sec. The rest between sets was 2 minutes 30 seconds.

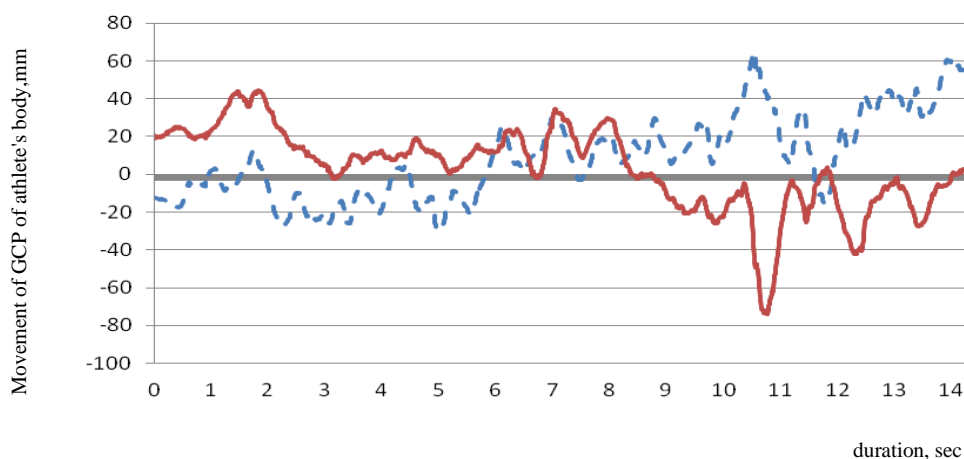
The indicators of the statodynamic stability of the body of athletes in the 1st and 7th sets were obtained, which made it possible to assess the dynamics of their change, reflecting the peculiarities of the body's adaptive reactions to the conditions of the implementation of a given program of movement on a movable support.

Analysis of the special literature [28, 31, 47] showed that it is advisable to assess the static-dynamic stability taking into account the following biomechanical characteristics: the length of the body's GCP trajectory in the sagittal plane; the length of the trajectory of the GCP of body in the frontal plane; the amplitude of the body's GCP oscillations in the sagittal plane; the amplitude of the body's GCP oscillations in the frontal plane; indicator of the component of the support reaction in the sagittal plane; the indicator of the component of the support reaction in the frontal plane (the indicator of the vertical component of the support reaction was not taken into account by us in the analysis of the data obtained, since the magnitudes of its change are associated, first of all, with the specifics of the exercises performed, namely, the cyclical lifting and lowering of the weights, leading to the corresponding regular changes in the vertical component of the support reaction, and to a lesser extent are associated with the mechanism of ensuring the stability of the athlete's body).

A decrease in the absolute values (in modulus) of these biomechanical characteristics reflects an improvement in the static-dynamic stability of the athlete's body, which has been repeatedly shown by various studies. At the same time, the absolute values largely depend on a number of factors, in particular, the athlete's height, his body weight, the location of the feet on the support (in the absence of strict standardization of the conditions for performing physical exercises), etc., which in turn explains the absence of model indicators.

It should be noted that the studies carried out by us and the indicators of the statodynamic stability of the body of athletes obtained in their course are, as a rule, of an individual nature, but have a general dynamics of change, which is characteristic of the entire group, which is widely reflected in the literature. In this regard, the results of the research are presented on the example of indicators of static-dynamic stability of individual athletes.





b)

Figure 3. An example of statokinesigrams of an athlete L-ko, performing flexion and extension of the arms in the elbow joints in a standing position ("lifting the bar to biceps"):

a) - on a fixed support;

b) - on a movable support;

■ ■ – movement of the GCP of the body in the sagittal plane;

■ – movement of the GCP of the body in the frontal plane

Comparative analysis of the quantitative indicators obtained in the exercise of flexion and extension of the arms in the elbow joints in a standing position ("lifting the bar to the biceps") in the first approach on a movable support, with the indicators obtained when performing a similar exercise in conditions of a fixed support, it was found that in the latter case (fixed support), the length of the trajectory of the CCP of the body in the sagittal plane is 210 - 260 mm, in the frontal plane - 124 - 131 mm; the amplitude of the body's GCP oscillations in the sagittal plane within 27 - 29 mm, in the frontal plane - 11 - 12 mm; the indicators of the components of the support reaction have the following limits of change (an interval that indicates the magnitude of the change in the indicator): in the sagittal plane within 40 - 42 N, in the frontal plane - 19 - 21 N.

When performing a similar exercise, but standing on a movable support, the indicators of the statodynamic stability of the body of the athletes were as follows: the length of the trajectory of the GCP of the body in the sagittal plane was within 140 - 160 mm, in the frontal plane - 110 - 118 mm; the amplitude of body GCP oscillations in the sagittal plane was 16 - 18 mm, and in the frontal plane it did not exceed 9 - 10 mm; indicators of the components of the support reaction varied within: in the sagittal plane 35 - 37 N; in the frontal plane 18 - 19 N.

The established fact probably testifies to the well-developed adaptive capabilities of highly qualified athletes, which allow the performer to mobilize in new difficult conditions for fulfilling the set program of movements, requiring the athlete to display more subtle intramuscular and intermuscular coordination, which confirms the results of scientific research by a number of specialists.

It should be noted that after the implementation of the planned series of exercises on a movable support, the indicators of static-dynamic stability also increased.

As you know, a significant part of the most effective techniques and motor actions in wrestling involves movements with a rapid transition from muscle stretching to muscle contraction and a high level of speed strength and power. However, in the overwhelming amount of special literature, as was shown in the first section of the work, the main means of strength training of wrestlers are various exercises performed in concentric and eccentric modes of muscle work. This is a manifestation of the one-sidedness of strength training, its insufficient compliance with the structure of competitive activity, as well as serious hindering factors both in relation to the development of speed (starting and explosive) strength, power of movements, and in relation to the formation of a large volume of specific motor memory, in particular, its dynamic component.

To test the effectiveness of the plyometric mode of muscle activity for the manifestation of speed strength and power, we carried out a comparative experiment aimed at studying the manifestation of speed power when performing absolutely identical motor actions in concentric or plyometric modes of muscle activity. We used three generally accepted tests, which largely reflect the requirements of the basic strength training of athletes specialized in wrestling:

- long jump from a place with the presence of two phases - inferior (eccentric, stretching mode of muscle activity) and overcoming (concentric): Figure 4;
- throwing a medball (6 kg) from bottom to front with inferior and overcoming phases (Figure 5);
- throwing a medball (6 kg) from behind the head with inferior and overcoming phases (Figure 6).

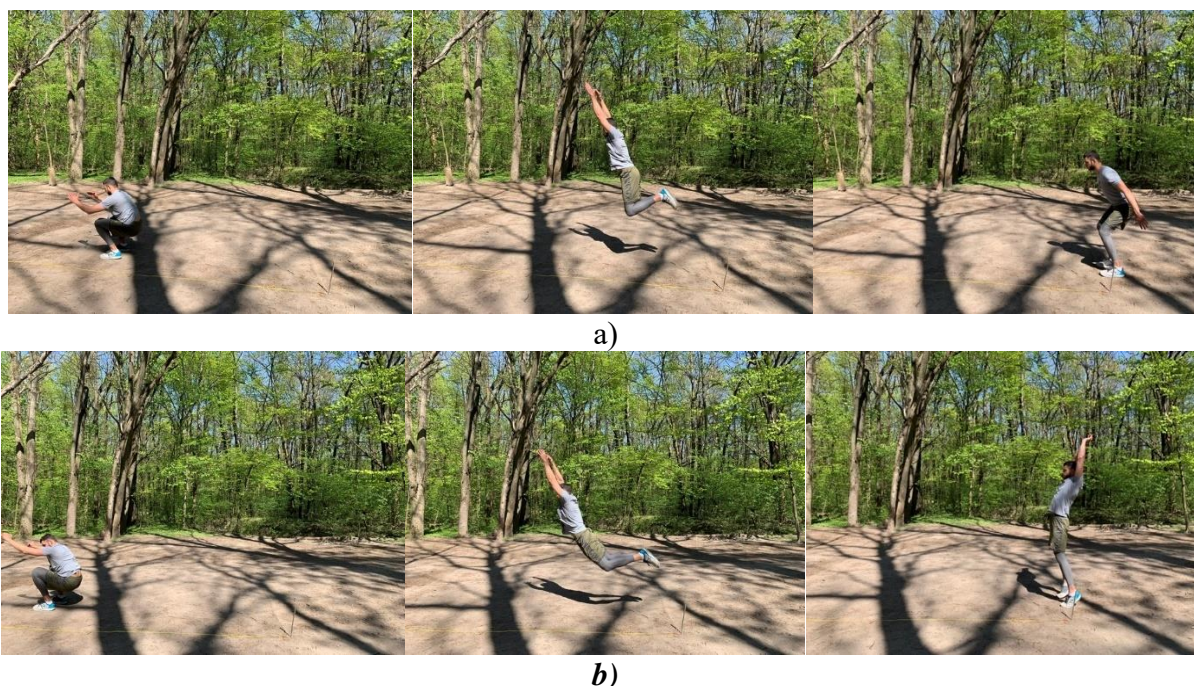


Figure 4. Long jump from a place



a)



b)

Figure 5. Throwing medicine ball from bottom to front



a)



b)

Figure 6. Throwing medicine ball from behind the head

As a result of the conducted studies, significant and reliable differences were established in the level of manifestation of speed strength when performing movements in concentric and plyometric modes of muscle activity (Tables 5, 6, 7). Such significant advantages of the plyometric regime are due to a combination of factors. Among them, activation of a greater number of motor units of agonists and synergists, characteristic of the plyometric mode [5], more intense impulses of muscle motor units [16]. The effect associated with the use of elastic energy accumulated in muscles and connective tissue (fascia, tendons) as a result of their mechanical stretching is also of significant importance [17].

Table 5. Testing of speed strength when performing a long jump from a place

| Technique variant | Distance, cm | | t | Veracity of results, P |
|---|-----------------|-----------------|------|------------------------|
| | Initial | Finale | | |
| | $\bar{X} \pm m$ | $\bar{X} \pm m$ | | |
| Performance with an emphasis on overcoming work | 205,10±5,70 | 217,79±5,60 | 2,20 | < 0,05 |
| Execution with an emphasis on stretching the muscles with a quick transition to contraction | 223,20±6,20 | 241,70±5,82 | 2,98 | < 0,01 |

Note: n=20; P - 0,05 0,01 0,001
f=19 t - 2,093 2,861 3,883 r - 0,468

Table 6. Testing of speed power when throwing a medball from bottom to front

| Technique variant | Distance, cm | | t | Veracity of results, P |
|---|-----------------|-----------------|------|------------------------|
| | Initial | Finale | | |
| | $\bar{X} \pm m$ | $\bar{X} \pm m$ | | |
| Performance with an emphasis on overcoming work | 781,50±21,71 | 786,74±21,36 | 2,36 | < 0,05 |
| Execution with an emphasis on stretching the muscles with a quick transition to contraction | 1266,50±35,18 | 1279,19±31,20 | 2,97 | < 0,01 |

Note: n=20; P - 0,05 0,01 0,001
f=19 t - 2,093 2,861 3,883 r - 0,468

Table 7. Testing of speed power when throwing a medball from behind the head

| Technique variant | Distance, cm | | t | Veracity of results, P |
|---|-----------------|-----------------|------|------------------------|
| | Initial | Finale | | |
| | $\bar{X} \pm m$ | $\bar{X} \pm m$ | | |
| Performance with an emphasis on overcoming work | 592,50±16,46 | 633,30±16,10 | 2,43 | < 0,05 |
| Execution with an emphasis on stretching the muscles with a quick transition to contraction | 816,50±22,68 | 882,51±21,77 | 2,88 | < 0,01 |

Note: n=20; P - 0,05 0,01 0,001
f=19 t - 2,093 2,861 3,883 r - 0,468

Taking into consideration the advantages of the plyometric mode, it should be noted that it corresponds to the specificity of the most effective techniques and motor actions typical for wrestling, which reflects the implementation of the most important special principle - the correspondence of means and methods of strength training to the most important techniques and motor actions, characteristic of competitive activity in wrestling [48, 49, 51].

The study of the relationship between the qualifications of athletes and the level of speed strength, manifested in concentric and plyometric modes, revealed a high degree of interconnection between these indicators in all tests used.

Figure 7 shows the dependence of speed strength, determined by the distance of a standing jump, on the qualifications of athletes. The wrestlers occupying the first places in the rating and having the qualification of a master of sports or a master of sports of international class clearly outperform the athletes occupying the last places in the rating and having sports qualifications at the level of the second or first category. Differences in jumping range between top-qualification athletes (master of sports, master of sports of international class) and wrestlers of the second and first sports categories can reach 30–35 cm.

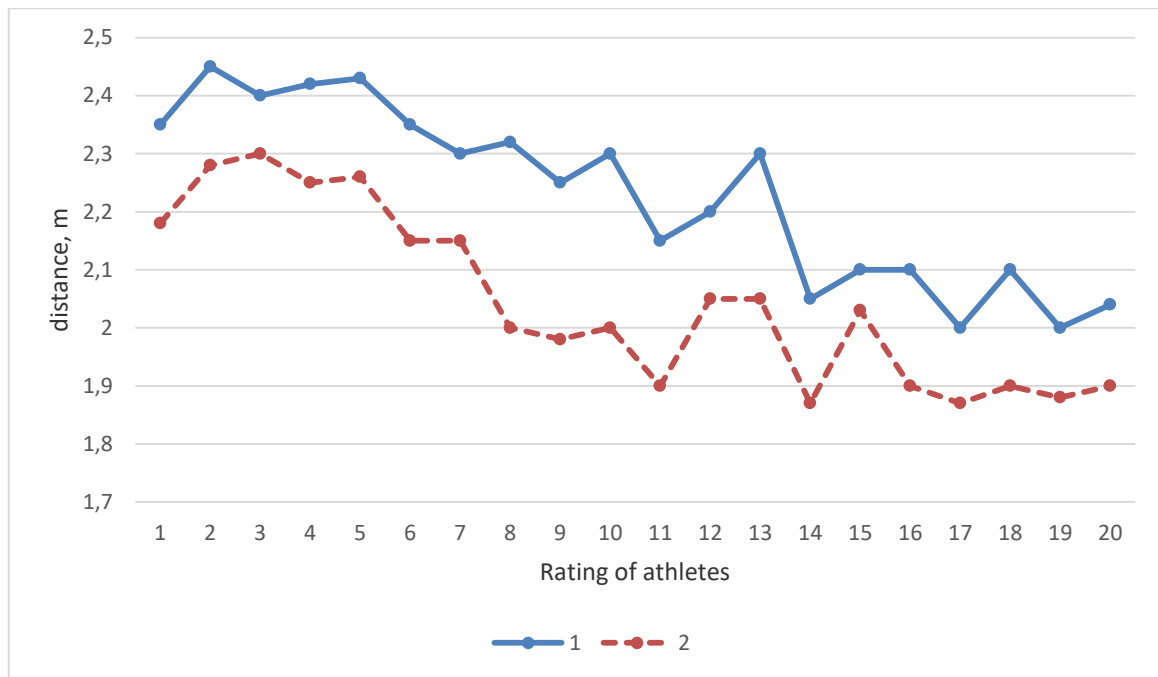


Figure 7. The relationship between the qualifications of athletes and the distance of a standing jump: 1 - plyometric mode, 2 - dynamic mode

The high efficiency of strength exercises performed on unstable surfaces for the formation of an effective dynamic structure of movements and rational application of force along its entire amplitude has been experimentally proved. It is recommended to sharply expand the number of strength exercises in the preparation of athletes, performed in conditions requiring the manifestation of strength while maintaining the stability of the body.

The study of the comparative efficiency in relation to the manifestation of speed-strength qualities and the power of motor exercises, performed in concentric and plyometric modes of muscle activity, showed the high significance of plyometric exercises. Also, exercises in organic unity with concentric, eccentric, isometric, ballistic are a guarantee of versatile strength readiness of wrestlers, its compliance with the requirements of competitive activity.

The material is presented, reflecting the need to bring the process of strength training of wrestlers in accordance with the individual characteristics of athletes, the style of conducting fights, the chosen model of competitive activity. Recommendations are given on the direction of the process of strength training of wrestlers who prefer each of the three types of fighting - tempo, power, game.

The system of special tests for assessing power qualities has been supplemented, taking into account the specifics of competitive activity in wrestling. The interrelation of the content of tests with the capabilities of anaerobic and aerobic energy supply systems, types of strength qualities is shown, methods for selecting test programs and evaluating their results are proposed. The expediency of testing speed-power capabilities, special endurance and potential of various energy supply systems has been substantiated on the basis of the use of tests of various durations, based on the material of the basic techniques characteristic of Greco-Roman wrestling, freestyle wrestling and judo. However, in contrast to the approaches based on determining the number of motor actions at a given time, it is recommended to focus on the time spent on the performance of one motor actions in the time range of a specific series.

GENERAL CONCLUSIONS AND RECOMMENDATIONS

1. A comprehensive analysis of knowledge and achievements of sports practice in the field of training athletes specializing in wrestling was carried out. The system of physical training of wrestlers, the development of various motor qualities in them from the standpoint of its correspondence to modern concepts in the theory of sports, the body of scientific knowledge in special sections of biomedical disciplines, was analyzed. Special attention is paid to power qualities, which are of great importance for the sports performance of wrestlers.

2. As a result of theoretical analysis, we have put forward the concept of strength training of athletes specializing in wrestling. It is based on:

- building the process of strength training based on the content of specific principles of sports training;
- the relationship between the development of strength qualities with the structure and tasks of the modern system of periodization of long-term training, the peculiarities of the age development of those involved;
- using the achievements of sports physiology, sports morphology, sports biochemistry, kinesiology in determining the content of strength training as the most important reserve for increasing the effectiveness of the development of wrestlers' strength qualities [54].

3. A comprehensive analysis of general didactic and special principles used in the system of modern sports training has been carried out. It is shown that in sports training, especially in that part of it, which concerns the development of motor qualities, one cannot rely only on the views of traditional pedagogy, divorced from the array of special medical and biological, psychological knowledge and sports and pedagogical knowledge, modern concepts characteristic of control theory, systems approach, theory of functional systems [48].

The necessity of building the process of strength training of wrestlers on the basis of modern special principles of sports training, based on stable regularities, reflecting the connections between the means and methods of influencing the athlete's body and the corresponding adaptive reactions of an urgent, current and delayed nature.

4. The necessity of expanding the special principles of sports training in relation to the physical training of wrestlers and, in particular, the development of their strength qualities has been substantiated. It is proposed to highlight the following principles that expand and clarify the capabilities of the process of strength training of athletes specializing in wrestling:

- the principle of compliance of the methodology and content of strength training both with general didactic principles and with the whole complex of special principles of sports training;
- the principle of compliance of the process of strength training with the peculiarities of age development, puberty, the characteristics of the male and female body;
- the principle of correspondence between the content of strength training of the main orientation and the tasks of various structural formations of the training process both in the system of long-term improvement and annual training;
- the principle of combining selectivity and integrativeness of the impact of means and methods of strength training in the training process;
- the principle of correspondence of means and methods of strength training to the structure of movements and motor actions, characteristic of wrestling;
- the principle of connection of means and methods of strength training with the dynamics of the functional state of athletes during competitive fights.

5. Comprehensive analysis of empirical knowledge, expanding the understanding of strength qualities and strength training of athletes and accumulated over the past decades by sports physiology, kinesiology, biochemistry, morphology, medicine, can be used to fundamentally increase the effectiveness of the process of strength training of wrestlers. This knowledge covers the mechanism of muscle contraction, the structure and functioning of sarcomeres, myofibrillar and sarcoplasmic hypertrophy, the structure and adaptation of various types of muscle fibers, neuroregulation of muscle activity, microtrauma and regeneration of muscle fibers, hormonal responses and substrates replacement [14, 49].

6. The study of the dynamics of the growth of sportsmanship of a large group of the strongest athletes specializing in Greco-Roman wrestling, freestyle wrestling, judo, allowed to reflect the most important characteristics that should be the basis for the rational construction of long-term training of athletes: 1) the age of the beginning of wrestling; 2) the age at which athletes achieve their first great successes; 3) the age of reaching the level of highest achievements; 4) the age of achieving the highest results in a sports career [53, 55].

7. The results of studying the dynamics of the growth of sportsmanship of athletes specializing in Greco-Roman wrestling, freestyle wrestling, judo, made it possible to concretize, in relation to these sports, general theoretical ideas in the field of periodization of long-term training of athletes. The period of initial training is highlighted (9–11 years old, children); basic training (12–15 years old, adolescence); special training (16–18 years old, youth); preparation for higher achievements (19–21 years old, early adult age); higher sportsmanship (22–25 years old, adult age).

8. The proposed periodization formed the basis of the fundamental model of strength training of athletes specialized in Greco-Roman wrestling, freestyle wrestling and judo, with the specification of goals, objectives and content of each of its stages. The content is based on general

didactic principles, special principles of sports training, supplemented by the specialized principles of strength training developed by us, which should be used in the process of strength training of wrestlers. An equally important aspect of the content of strength training was its compliance with the most important factors of a biological nature, which determine the level of strength qualities and the effectiveness of strength training.

9. An important aspect of the developed model of long-term strength training of athletes specialized in wrestling is its compliance with the historically established system of competitions adopted for various age groups - children, adolescents, youth, early adults, adults. This is fundamentally important for the implementation of the results of our research in the program and regulatory documents, without violating the established traditions of planning competitions in different age groups.

10. As a result of theoretical and experimental research, the following directions of increasing the efficiency of the process of strength training of wrestlers have been revealed:

- bringing the process of strength training of wrestlers in accordance with the rules of the competition and the structure of competitive activity;
- ensuring the influence of strength training of wrestlers on the volume of specific motor memory, variability and effectiveness of motor actions;
- ensuring the interconnection of the process of strength training of wrestlers with static-dynamic body stability when performing specific motor actions;
- demonstration of the importance of using plyometric and ballistic modes of muscle activity in the process of strength training of wrestlers;
- bringing the process of strength training of wrestlers in accordance with their individual characteristics, individual structure of the main motor actions;
- development of a system of tests for an integral assessment of the speed-power potential and the capabilities of energy supply systems for muscular activity of varying intensity and duration.

1. The results of our research should be reflected in the curricula of academic disciplines in institutions of higher and secondary specialized education. This applies not only to the theory and practice of training in wrestling, but also to the theoretical disciplines (sports theory, theory and methodology of sports training, theory and methodology of physical education), as well as the medical and biological cycle (physiology, anatomy, biochemistry, morphology, medicine). It is also necessary to intensively introduce the proposed material into the training system of the coaching staff and directly into the coaching activities. It is necessary to promptly reflect the results obtained in the program and normative documents regulating sports training at all levels - from the stage of initial training to the stage of higher sportsmanship.

In these documents, it is fundamentally important to reflect the tasks and content of the process of strength training with the stages of long-term improvement of athletes. For the stage of initial training (childhood, 9–11 years old), the development of strength qualities is a by-product of versatile physical activity with a large role of play and entertainment moments.

At the stage of basic training (adolescents, 12–15 years old), strength training is extremely diverse in nature, focused on a wide variability of dynamic and spatial-temporal characteristics of exercises, excluding exercises with large weights. The main focus is on the development of neuroregulatory mechanisms that determine the level of various types of strength qualities.

Strength training at the next stage - special training - is also primarily associated with neuroregulatory factors that determine the level of strength qualities. However, the composition of the means is shifting towards conformity to the specificity of wrestling in relation to the structure of movements, connection with coordination and speed abilities. Age and burdens, which can reach 60-70% of the maximum available.

At the next two stages of long-term improvement, the process of strength training is mainly focused on the development of the power of motor actions, work in all modes of muscular activity, organic connection with technical mastery, other motor qualities. The amount of weights in a wide range, up to 80-90% of the maximum available.

2. The results of our research open up broad prospects for the development of training means - various kinds of exercises with the use of a variety of equipment, which allows the process of strength training to be as close as possible to the specificity of motor activity in wrestling. It is necessary to differentiate the training means in relation to the dynamic and kinematic characteristics of the main motor actions characteristic of wrestling. It is also necessary to divide training means according to the predominant manifestation of strength qualities in concentric, eccentric, isometric, plyometric and ballistic conditions of muscle activity.

3. It is required to narrow the approach to equipping sports halls with equipment for strength training of athletes. Traditionally, equipping gyms with exercise machines for strength training, barbells, weights, dumbbells should be expanded by the introduction of a wide range of special means that ensure the maximum possible correspondence of the dynamic and kinematic characteristics of strength exercises to the requirements of the competitive activity of a particular sport.

ANNOTATION

Manolachi Victor: *Theoretical and methodological foundations and applied aspects of strength qualities development in highly qualified athletes (based on materials regarding Olympic wrestling events)*: dissertation of PhD habilitat of pedagogical sciences, specialty 533.04. Physical education, sports, kinetotherapy and recreation. Chisinau, 2021.

Thesis structure: abstract in 3 languages; introduction; 5 chapters; general conclusions and recommendations; bibliography - 330 sources; 3 appendixes; 195 pages of main text; 9 figures; 23 tables. The results are published in 40 scientific articles.

Key words: strength training; highly qualified athletes; training process; many years of preparation; special principles; muscle mode: concentric, eccentric, isometric, plyometric, ballistic; hormonal status; age dynamics; tests.

Purpose of the research is to develop the theoretical and methodological bases and the applied aspects of developing the wrestlers' strength qualities.

Research objectives: 1. To characterize the modern system of knowledge in the field of training athletes, specialized in wrestling, and the main ways of its further development. 2. To study the level of knowledge and practical experience in the field of physical training of athletes specialized in wrestling, to compare it with the body of scientific knowledge accumulated in the theory of sports and special sections of biological disciplines. 3. To analyze the structure of the strength training of the wrestlers and the correspondence to it of the method of strength training; to form the concept of strength training of athletes, specialized in wrestling, corresponding to the modern level of knowledge. 4. Subject to the analysis the special principles that underlie the rational construction of the process of sports training and reveal their possibilities for increasing the effectiveness of strength training of athletes specialized in wrestling. 5. To study the totality of factors that determine the level of strength qualities and show their significance for increasing the effectiveness of the process of strength training of wrestlers. 6. To study the age dynamics of the growth of wrestlers' sportsmanship and to characterize the system of their long-term training. 7. To develop a fundamental model of strength training of athletes specialized in wrestling at various stages of long-term improvement. 8. To reveal promising directions of optimization of the process of strength training of athletes specialized in wrestling.

The theoretical significance and the scientific novelty of the paper lie in:

1) elaboration of the theory of the development of wrestling athletes' strength qualities, including: definition and spread of the notion "strength training" of athletes who specialize in wrestling trials; substantiation of the legalities, the general and peculiar principles of the development of the athletes strength qualities within the structural-functional approach of the process of training the performance fighters; the mechanism for correlating the achievements in the field of sports physiology and biochemistry, medicine and sports morphology in order to argue the concept of sports training of wrestling athletes; the conception and the functional-structural model of the fighters strength training, based on both the laws and principles, as well as a series of factors that determine the logic, stages and process of developing strength qualities in interdependence with the formation of other motor qualities .

2) elaboration of the methodology (in the narrow sense) for developing the strength qualities of athletes specialized in wrestling which is conditioned by the age dynamics of increasing sports mastery in wrestling and which includes stages, methods and principles of their strength training.

The theory and methodology for developing the strength qualities of athletes specialized in wrestling, developed by us, allows us to say that this research is a new direction in sports pedagogy and opens new possibilities for further research in the field of training the performance athletes.

The practical value of the work lies in the revision of traditional ideas in the field of the structure and content of strength training of athletes specialized in wrestling, the expediency of using the results obtained when improving the program-normative and organizational foundations of training athletes in the system of long-term improvement. Research materials should be reflected in the educational and educational-methodical literature for students of special educational institutions, as well as in the system of advanced training of the coaching staff. The approach implemented in the work should be extended to the study of problems related to the development of other motor qualities - speed, coordination, endurance, flexibility.

Implementation of research results. The experimental program and methodology were introduced into the sports, educational and training process of sports schools, specialized universities in Romania, Ukraine, Kazakhstan, Belarus and Russia, as well as the Wrestling Federation of the Republic of Moldova and Romania and Judo Federation of Moldova.

ADNOTARE

Manolachi Victor: *Bazele teoretico-metodologice și aspectele aplicative ale dezvoltării capacităților de forță la sportivii de performanță (în baza materialelor probelor olimpice de lupte)*: teza de doctor habilitat în științe ale educației, specialitatea 533.04. Educație fizică, sport, kinetoterapie și recreație. Chișinău, 2021.

Structura tezei: adnotare în 3 limbi, introducere, 5 capitole, concluzii generale și recomandări, bibliografie – 330 surse, 3 anexe, 195 pagini text de bază, 9 figuri, 23 tabele. Rezultatele au fost publicate în 40 de articole științifice.

Cuvinte-cheie: pregătire de forță; sportivi de performanță; proces de antrenament; pregătire multianuală, principii speciale; regim de activitate musculară: concentric, excentric, izometric, pliometric, balistic; statut hormonal; dinamică de vârstă; teste.

Scopul cercetării constă în elaborarea bazelor teoretice și metodologice și a aspectelor aplicative ale dezvoltării calităților de forță ale sportivilor luptători.

Obiectivele cercetării: 1. Caracterizarea sistemului contemporan de cunoștințe în sfera pregătirii sportivilor care se specializează în lupte și a principalelor căi de dezvoltare ulterioară a acestuia. 2. Studiarea nivelului de cunoștințe și a experienței practice în domeniul pregătirii fizice a sportivilor luptători, confruntarea lor cu volumul imens de cunoștințe științifice acumulate în teoria sportului și în compartimentele speciale ale disciplinelor biologice. 3. Analiza structurii pregătirii de forță a luptătorilor și a gradului de concordanță a acesteia cu metodica pregătirii de forță ; formarea unei concepții a pregătirii de forță a sportivilor luptători care să corespundă nivelului actual de cunoștințe. 4. Analiza principiilor speciale care stau la baza organizării raționale a procesului de pregătire sportivă și relevarea posibilităților acestora în vederea sporirii eficacității pregătirii de forță a sportivilor luptători. 5. Studiarea totalității factorilor care determină nivelul calităților de forță și relevarea importanței lor pentru sporirea eficacității pregătirii de forță a luptătorilor. 6. Studiarea dinamicii de vârstă a măiestriei sportive a luptătorilor și caracterizarea sistemului de pregătire multianuală a acestora. 7. Elaborarea unui model principal al pregătirii de forță a luptătorilor la diferite etape ale perfecționării multianuale. 8. Determinarea direcțiilor de perspectivă ale optimizării procesului de pregătire de forță a sportivilor luptători.

Semnificația teoretică și noutatea științifică a lucrării rezidă în:

1) elaborarea teoriei dezvoltării calităților de forță ale sportivilor luptători, inclusiv: definirea și extinderea noțiunii ”pregătire de forță” a sportivilor care se specializează în probe de lupte; fundamentarea legităților, a principiilor generale și speciale de dezvoltare a calităților de forță ale sportivilor în cadrul abordării structural-funcționale a procesului de pregătire a luptătorilor de performanță; mecanismul corelării realizărilor din domeniul fiziologiei sportive și al biochimiei, al medicinei și morfologiei sportive în vederea argumentării concepției pregătirii sportive a luptătorilor; concepția și modelul funcțional-structural al pregătirii de forță a luptătorilor, la baza cărora se află atât legitățile și principiile, cât și o serie de factori ce determină logica, etapele și procesul de dezvoltare a calităților de forță în interdependență cu formarea altor calități motrice.

2) elaborarea metodologiei (în sensul restrâns al cuvântului) de dezvoltare a calităților de forță ale sportivilor luptători, care este condiționată de dinamica de vârstă a sporirii măiestriei sportive în lupte și care include etapele, metodele și principiile pregătirii de forță a acestora.

Teoria și metodologia de dezvoltare a calităților de forță ale sportivilor luptători, elaborată de noi, ne permite să afirmăm că cercetarea de față reprezintă o nouă direcție în pedagogia sportivă și deschide noi posibilități pentru cercetări ulterioare în domeniul pregătirii sportivilor de performanță.

Valoarea aplicativă a lucrării constă în revizuirea concepțiilor tradiționale privind structura și conținutul pregătirii de forță a luptătorilor, în oportunitatea utilizării rezultatelor obținute pentru perfecționarea bazelor normative, curriculare și organizaționale ale pregătirii sportivilor în sistemul de perfecționare multianuală. Materialele cercetărilor trebuie să-și găsească reflectare în literatura didactică și cea metodică-didactică pentru studenții instituțiilor de profil, precum și în sistemul formării profesionale continue a antrenorilor. Abordarea aplicată în lucrare urmează a fi extinsă și asupra studierii problematicei ce ține de dezvoltarea altor calități motrice: de viteză, de coordonare, de rezistență, suplețea.

Implementarea rezultatelor cercetării. Programa și metodica experimentală au fost implementate în procesul de instruire și antrenament din cadrul școlilor sportive, al universităților de profil din România, Ucraina, Kazahstan, Belarus și Rusia, precum și al Federațiilor de Lupte din Republica Moldova și România și al Federației de Judo din Republica Moldova.

АННОТАЦИЯ

Манолаки Виктор: *Теоретико-методологические основы и прикладные аспекты развития силовых качеств у спортсменов высокой квалификации (на материалах олимпийских видов борьбы)*: диссертация доктора habilitation педагогических наук, специальность 533.04. Физическое воспитание, спорт, кинетотерапия и рекреация. Кишинэу, 2021.

Структура диссертации: аннотация на 3-х языках; введение; 5 главы; общие выводы и рекомендации; библиография - 330 источников; 3 приложения; 195 страниц основного текста; 9 рисунков; 23 таблицы. Результаты опубликованы в 40 научных статьях.

Ключевые слова: силовая подготовка; спортсмены высокой квалификации; тренировочный процесс; многолетняя подготовка; специальные принципы; режим работы мышц: концентрический, эксцентрический, изометрический, плиометрический, баллистический; гормональный статус; возрастная динамика; тесты.

Цель исследования – разработать теоретические и методологические основы и прикладные аспекты развития силовых качеств спортсменов, специализирующихся в спортивной борьбе.

Задачи исследования: 1. Охарактеризовать современную систему знаний в сфере подготовки спортсменов, специализирующихся в спортивной борьбе, и основные пути ее дальнейшего развития. 2. Изучить уровень знаний и практического опыта в области физической подготовки спортсменов, специализирующихся в спортивной борьбе, сопоставить его с массивом научного знания, накопленного в теории спорта и специальных разделах биологических дисциплин. 3. Подвергнуть анализу структуру силовой подготовленности борцов и соответствие ей методики силовой подготовки; сформировать концепцию силовой подготовки спортсменов, специализирующихся в спортивной борьбе, соответствующую современному уровню знаний. 4. Подвергнуть анализу специальные принципы, лежащие в основе рационального построения процесса спортивной подготовки и раскрыть их возможности для повышения эффективности силовой подготовки спортсменов, специализирующихся в спортивной борьбе. 5. Изучить совокупность факторов, определяющих уровень силовых качеств и показать их значимость для повышения эффективности процесса силовой подготовки борцов. 6. Изучить возрастную динамику роста спортивного мастерства борцов и охарактеризовать систему их многолетней подготовки. 7. Разработать принципиальную модель силовой подготовки спортсменов, специализирующихся в спортивной борьбе на различных этапах многолетнего совершенствования. 8. Раскрыть перспективные направления оптимизации процесса силовой подготовки спортсменов, специализирующихся в спортивной борьбе.

Теоретическое значение и научная новизна работы заключаются:

1) В разработке теории развития силовых качеств у спортсменов, специализирующихся в спортивной борьбе включающей: определение и расширение понятия «силовая подготовка» относительно спортсменов, специализирующихся в спортивной борьбе; обоснование закономерностей, общих и специальных принципов развития силовых качеств у спортсменов в рамках структурно-функционального подхода к процессу подготовки высококвалифицированных спортсменов, специализирующихся в спортивной борьбе; механизм корреляции достижений спортивной физиологии и биохимии, спортивной морфологии и медицины для обоснования концепции силовой подготовки спортсменов, специализирующихся в спортивной борьбе; концепцию и функционально-структурную модель силовой подготовки спортсменов, специализирующихся в спортивной борьбе, имеющую, в своей основе, как закономерности и принципы, так и ряд факторов, предопределяющих логику, этапы и процесс развития силовых качеств в единстве с формированием других двигательных качеств.

2) В разработке методологии (в узком смысле этого слова) развития силовых качеств у спортсменов, специализирующихся в спортивной борьбе, предопределяемой возрастной динамикой роста спортивного мастерства в борьбе и включающей этапы, методы и принципы их силовой подготовки.

Разработанная теория и методология развития силовых качеств у спортсменов, специализирующихся в спортивной борьбе, позволяют утверждать, что данное исследование представляет новое направление в спортивной педагогике и открывает новые возможности для дальнейших исследований в области подготовки спортсменов высокой квалификации.

Практическая ценность работы заключается в пересмотре традиционных представлений в области структуры и содержания силовой подготовки спортсменов, специализирующихся в спортивной борьбе, целесообразности использования полученных результатов при совершенствовании программно-нормативных и организационных основ подготовки спортсменов в системе многолетнего совершенствования. Материалы исследований должны найти отражение в учебной и учебно-методической литературе для студентов специальных учебных заведений, а также в системе повышения квалификации тренерского состава. Реализованной в работе подход следует распространить и на изучение проблематики, связанной с развитием других двигательных качеств – скоростных, координационных, выносливости, гибкости.

Внедрение результатов исследования. Экспериментальная программа и методика были внедрены в спортивно-образовательный и тренировочный процесс спортивных школ, профильных университетов Румынии, Украины, Казахстана, Белоруссии и России, а также Федерации Борьбы Республики Молдова и Румынии и Федерации Дзюдо Республики Молдова.

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