

Dynamics of strength capabilities of the organism in conditions of ecological and biological well-being

Igor Glamazdin¹, Yulia Kropova², Ilya Medvedev³, and Elena Tkacheva^{3,4*}

¹Russian Biotechnological University, Moscow, Russia

²Institute of Natural Science and Sports Technology Moscow City University, Moscow, Russia

³Russian State Social University, Moscow, Russia

⁴Vologda State Dairy Farming Academy named after N.V. Vereshchagin, Vologda, Russia

Abstract. Regular physical activity is of great importance in relation to the formation of all human physical qualities. Differences in the level of strength development within individual sports are recognized. Taking into account this fact, it seems important to study the level of development of strength quality as athletes-athletes grow older. The aim of the study: to evaluate the dynamics of age-related changes in strength abilities in different categories of unicycling athletes. Eighty-one male athletes in adolescence or young adulthood, who regularly trained in judo, hand-to-hand combat or Greco-Roman wrestling sections, were studied. A group of adolescents (14 individuals) who had not practiced sports during their lives and a group of non-sports-connected young men (13 individuals) were examined. Hand muscle strength was recorded by hand dynamometry with calculation of Student's t-criterion. During the evaluation of the level of strength in unicycling athletes, it was found that its greatest development was in wrestlers in adolescence and adolescence. In judoists and hand-to-hand athletes it was a little less pronounced and comparable. The lowest level of it took place in non-sport-related examinees. As growing up, for all categories under consideration, an increase in strength capabilities in adolescence compared to the level in adolescence was noted. Key words: teens, young men, strength, age, sport, wrestlers, judoka, hand-to-hand.

1 Introduction

Basic physical characteristics have innately determined bases, which throughout ontogenesis are able to experience certain dynamics related to living conditions [1]. These conditions of existence are of serious importance for a person to achieve certain physical capabilities [2]. The level of these qualities is able to grow strongly in the course of life in case of regular rationally planned physical activity. The variants of physical performance development known in science and practice still need to be improved in the light of scientific research [3].

* Corresponding author: elenastkacheva@mail.ru

There are peculiarities in the level of development of the main physical characteristics of the organism in athletes involved in different sports. There are also age peculiarities of their state in certain categories of athletes [4]. In this regard, researchers are still very interested in clarifying the course of improvement of physical capabilities in adult athletes undergoing training in different sports. It is clear that sports activity of different categories of athletes provides strictly characteristic influence on their organism [5,6]. Therefore, athletes of different specializations develop different physical qualities somewhat differently [7]. These peculiarities are based on the characteristics of physical loads peculiar to a particular sport [8,9].

In the realization of physical education of young people, especially in the context of school and university education, competent physical training is very important, which should be carried out in a clear age-appropriate manner [10]. Especially important in this are various variants of martial arts.

Maintaining a high level of health among young people can often be linked to martial arts. It is clear that martial arts are physical activities that have a bright emotional coloring with the involvement of the intellect. They provide a person with the need for load, rest and emotional manifestations of athletes, form new skills, develop leadership qualities and expand social contacts in the trained youth [11,12].

In case of practicing martial arts, physical qualities of a person arise and strengthen: strength, agility, coordination, speed capabilities [13]. In this regard, they are able to solve an important social problem - health in young people. This is possible as a result of the fact that martial arts provide a pronounced increase in the level of physical fitness and facilitate the assimilation of modern educational programs of universities [14,15].

In the case of physical activities of physical culture and sports character, the development of basic physical qualities and especially strength qualities, capable of determining the level of general physical fitness and general labor potential of a person, is very significant [16,17].

The influence of martial arts on youth life on the formation of personal qualities of young people is considered in detail by modern researchers [18,19]. Observations have provided information that regular physical activity in martial arts can strongly motivate young people to train, activate psychological work, develop social stability, and increase mental performance due to the acceleration of thinking activity [20].

It is known that physical education classes at the university cannot significantly increase the physical capabilities of students [21]. In this regard, the urgent need to find approaches to enhance the physical development of young people and increase their need for regular physical training, including martial arts, becomes clear. In this regard, modern researchers consider regular sports activities as necessary to achieve physical perfection. At the same time, the influence of martial arts training on the expression of certain physical qualities in young people has not been definitively established [22]. A very important point of martial arts training is recognized as the manner of teaching, integrating all the training information into an accessible form for assimilation during the training process and obtaining a trained athlete. It is clear that high efficiency of training in martial arts is possible only in case of competent construction of training [23]. The development of leading physical qualities in adolescence and adolescence by means of martial arts forms commitment to sport, sometimes for life, which has been noted many times before [24]. The exercises applied in the course of martial arts activities increase the level of agility, strength, flexibility, speed, stimulate the activity of the cardiovascular system, respiratory system and musculoskeletal apparatus.

It is still of great scientific interest to find out the peculiarities of strength development in novice athletes. This information can and should help to improve all aspects of training of novice athletes to minimize the risk of dysfunctions of any nature in their bodies.

Purpose of the work: to evaluate the dynamics of age-related changes in strength abilities in different categories of unicycling athletes.

2 Materials and methods

Eighty-one male unicyclist athletes who regularly trained in specialized sections, including adolescent athletes with at least 2 years of sports experience and youth athletes with at least 3 years of sports experience were monitored. All athletes were divided into groups: judoists-adolescents (14-15 years old) - 12 persons, judoists-youth (18-19 years old) - 15 persons; armwrestlers-adolescents (14-15 years old) - 14 persons, armwrestlers-youth (18-19 years old) - 16 persons; Greco-Roman wrestlers - adolescents (14-15 years old) - 11 persons, Greco-Roman wrestlers-youth (18-19 years old) - 13 persons. Two groups of individuals not previously associated with sports, considered as controls, were also collected: a group of adolescents (14-15 years old) - 14 persons and a group of young men (18-19 years old) - 13 persons.

In the course of the study, the strength of the hand muscles was evaluated using a standard hand dynamometer: in adolescents we used a dynamometer of DK-25 brand (Russia), in young men we used a dynamometer of DK-50 brand (Russia). The results obtained in the work were processed by computer with calculation of Student's t-criterion.

3 Results and discussion

The indicators that were obtained in the course of the study in representatives of martial arts and in individuals who were physically untrained are contained in Table 1 below.

Table 1. Strength characteristics of the examined

Characteristics in the observed groups	Adolescents observed, M±m		The young men observed, M±m	
	Right hand	Left hand	Right hand	Left hand
Strength of hand muscles in judoka, kg	24.4±0.83 p ₁ <0.05	21.2±0.74 p ₁ <0.05	37.8±1.12 p<0.01 p ₁ <0.01	31.4±0.97 p<0.01 p ₁ <0.01
Strength of hand muscles in hand-to-hand fighters, kg	24.9±1.25 p ₁ <0.05	21.4±1.36 p ₁ <0.05	38.2±0.95 p<0.01 p ₁ <0.01	32.9±1.02 p<0.01 p ₁ <0.01
Strength of hand muscles in wrestlers, kg	32.5±1.03	27.8±0.89	55.7±0.98 p<0.01	48.6±0.67 p<0.01
Hand muscle strength in control, kg	21.1±0.82 p ₁ <0.01	17.2±0.65 p ₁ <0.01	24.9±0.94 p<0.01 p ₁ <0.01	23.1±1.02 p<0.01 p ₁ <0.01

Note: p - significance of differences of indicators between the compared ages; p₁ - significance of differences from the level of wrestlers within the same age.

The highest hand strength at both ages was in wrestlers. In adolescence for their right hand it was 32,5±1,03 kg, in youth this index was 55,7±0,98 kg. The strength of the left arm in adolescent wrestlers and in youth wrestlers was slightly less 27,8±0,89 kg and 48,6±0,67 kg, respectively.

The development of strength abilities in adolescent judokas and adolescent hand wrestlers were similar. This index was greater in adolescent wrestlers than in their hand-to-

hand combatant peers (by 29.9% on the left, by 30.5% on the right) and in judoists (by 31.1% on the left, by 33.2% on the right).

In the observed athletes of youth age, the development of strength of both hands in judoists and hand-to-hand wrestlers was close. This parameter was inferior to that of male wrestlers. The strength capabilities of their right arm were greater than those of hand-to-hand fighters by 45.8%, and of judoka by 47.3%. The left arm of wrestlers was stronger than that of armwrestlers by 47.7%, of judokas by 54.8%.

The lowest strength was noted in both ages in physically unloaded observed. This index in untrained adolescents was 21.1 ± 0.82 kg on the right and 17.2 ± 0.65 kg on the left, in physically inactive young men - 24.9 ± 0.94 kg and 23.1 ± 1.02 kg, respectively.

As the age increases, an increase in strength was observed in martial artists and in those who did not physically exert themselves. It was found out that the growth of the hand strength was significant and amounted to 53.4% in the right handed armwrestlers, 54.9% in judoists, 71.4% in wrestlers, and 18.0% in the control group. For the left hand, the dynamics of this parameter of the observed were 53.7%, 48.1%, 74.8% and 34.3%, respectively.

When evaluating the degree of strength development in the observed combatants, it was found that the greatest expression of strength was found in wrestlers, exceeding that in judoists and hand-to-hand wrestlers. The weakest strength abilities were possessed by those observed who did not participate in sports activities.

The differences in the expression of strength among martial artists are related to the peculiarities of their physical loads [25] and the degree of their training [26], which is determined by the composition of their training process [27]. The found increase in the level of strength in the course of increasing age is confirmed by the data from the literature and is associated with the age-related morphofunctional development of the musculoskeletal apparatus in the course of growing up, which is significantly enhanced in the case of regular sports loads [28].

Rational performance of physical exercises is recognized by modern researchers as an effective stimulus for the body [29]. Stimulating the work of skeletal muscles in the course of training in different sports, the blood supply of tissues is intensified, metabolic processes are activated and the formation of a large number of substances in internal organs is activated [30]. It is clear that under conditions of intensive work in transverse striated muscles the number of opened capillaries increases. During increased physical activity, more oxygen and significantly more nutrients are delivered to skeletal muscles [31]. Due to this, the formation of proteins for different purposes increases in the muscles and energy generation is enhanced. At the same time, muscle mass increases and muscle strength increases [32].

Previous observations have shown that regular thoughtful physical activity, adequate to the existing state of the organism, gives a vivid and biologically beneficial stimulation of internal organs. This has been previously observed in some categories of people at different ages [33,34].

At present, the effects of regular physical exertion of varying severity on the human body are being actively studied. It becomes clear that systematic physical activity meaningfully develops the organism, which is clearly noticeable in the case of complex effects. In the case of different types of somatic disorders, it is realistic to achieve an improvement in the physical condition of the body, the severity of which can often vary. For this reason, physical activity should be considered a serious component of recovery procedures for many human body conditions [35].

A significant health-improving effect of increased muscular activity has been noted in the case of sports activities. However, the potential of martial arts to improve health in adolescence and young adulthood has not been definitively clarified [36].

For today's youth, martial arts are highly attractive. This requires detailed clarification of the effects of these activities on the body [37]. The health-improving potential of different types of martial arts is of serious interest, especially in terms of the dynamics of strength capabilities in athletes of adolescence and youth.

Earlier studies have shown that the application of physical loads within the framework of different sports has a stimulating effect on the organism. At the same time there is a bright optimizing effect on different parts of the body. At the same time, many aspects of these phenomena remain not definitively clarified [38]. Even with this gap in scientific knowledge, the need to strengthen skeletal muscles, which can increase the expression of physical capabilities of the organism, was clear [39].

All categories of the observed (adolescents and young men) practiced martial arts with great pleasure, which led to strict regularity of training and ensured a pronounced strengthening effect. The strengthening of the musculoskeletal apparatus and vital organs resulting from regular martial arts training contributed to the attractiveness of this training among the observed youth. As a result of earlier observations, it became clear that the increase in the general level of physical exertion due to regular sports activities is able to increase in people the functional parameters of their internal organs [40].

An extremely important mechanism for the increase in functional parameters of the organism during an increase in regular muscular activity is the increase in the working capacity of the cardiovascular system. It is understood that in the examined athletes there was an increase in oxygen delivery to tissues in the organism. It is also clear that against the background of martial arts activities in the body blood flow increases, vascular tone is optimized and blood rheological properties are normalized. This is most pronounced in wrestlers. In this regard, it can be considered that under conditions of muscular loads during wrestling training, adolescents and young men increase their strength capabilities, which improves their quality of life, improves their health and provides a basis for their success in their sports activities [41].

Weighing the obtained results we can consider that regular exercise in martial arts and especially wrestling has a very effective effect on the state of physical fitness, strengthens the muscles of the limbs and trunk, develops the heart muscle and lungs. Functionally favorable changes noted in the course of the study in the groups of adolescent and youth wrestlers were largely due to the vivid stimulation of cells by regular sports activities [42].

The performed research contributed to the elimination of a number of existing gaps in the system of scientific information, at the same time confirming the previously known facts. As a result of this observation, the strong stimulating possibilities of wrestling in adolescence and young adulthood without risk to somatic health became clear. Taking into account the information obtained in the work, we can think that wrestling training leads to powerful development of musculoskeletal system and internal organs, increasing the strength characteristics of beginning athletes of adolescence and youth. The information obtained in this work allows us to think that regular wrestling training stimulates the nervous regulation of all processes in the body [40,42].

Taking into account the known information about the influence of muscular loads on all parts of the body it becomes clear that during regular training in martial arts and especially wrestling there is an increase in the expression of elasticity and strength of the limbs combined with an increase in the mobility of most joints [43]. Under these conditions, we can say that regular wrestling training leads to the activation of synthesis of a number of biologically important molecules in tissues, providing the process of normalization of the course of vital activity phenomena of the main organs of the human body. In this regard, it should be considered that the increase in physical activity due to training in martial arts leads to the achievement in the brain of athletes of a strict balance between the phenomena of excitation and inhibition, the emergence of normalization of the activity of parts of the

autonomic nervous system, intensification of biosynthesis and energy production in cells [44].

4 Conclusion

Physical characteristics peculiar to a person are capable of changing in the course of his life due to the influence of environmental factors. They have a very pronounced influence on the development of physical parameters of a person. The development of physical qualities can have dynamics in the course of life on the background of regular sports training. The existing types still need a balanced improvement. The peculiarities of development of physical characteristics are noticed in those who have devoted themselves to different kinds of sports. There are still age specific features of physical development parameters in each sport. They are related to the peculiarities of motor actions adopted in a particular sport. For this reason, many specialists have a great interest in considering aspects of the formation of physical qualities in novice athletes in the conditions of regular training.

The development of strength qualities in young athletes who devoted themselves to martial arts was most pronounced in wrestlers. Its expression in judoists and hand-to-hand fighters was somewhat lower and did not differ much among themselves. The lowest level of strength development was in physically inactive adolescents and young men. In the course of increasing age, there was an increase in hand strength in all groups. The highest strength development was found in wrestlers.

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