

Increasing of special physical fitness of the female athletes practicing sambo

Authors' Contribution:

- A** Study Design
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Abstract

Background and Study Aim:

A high level of special physical fitness is necessary achieving high results in combat sports (martial arts). The purpose of the study is knowledge about effective methods increasing the level of special physical fitness of the junior female practicing sambo.

Material and Methods:

The participants 17-18 years old female (n = 21) practicing sambo for more than 4 years. The study period had been conducted for 32 weeks. Various methods of level increase of athletes' functional fitness were used. The group **A** (n = 11) had used *randori* (sparring) and throws at a fast pace. The group **B** had used the functional training and *randori*. The physical fitness indicators of the female athletes to assess: Special Judo Fitness Test (SJFT), lactate concentration in the blood, test with execution of 30 *ippon-seoi-nage* (throw) analysis of competitive results.

Results:

The female athletes from the group **B** had showed significant ($p < 0.05$) superiority of SJFT results. The level of lactate concentration in the blood was significantly ($p < 0.05$) lower after SJFT among the female of the group **B**. The test with execution of 30 *ippon-seoi-nage* had not revealed significant differences of the recovery parameters among the female. The competitive results of the female of the group **B** were significantly ($p < 0.01$) higher.

Conclusions:

The presented training practice methodology allows increasing the level of special physical fitness of the female athletes significantly without apparent increase of the training loads amount.

Keywords:

crossfit • interval training • randori • throws • training loads

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Sambo – is a Russian martial art and combat sport.

The word “SAMBO” is an acronym for SAMozashchita Bez Oruzhiya, which literally translates as “self-defence without weapons”. Sambo is relatively modern since its development began in the early 1920s by the Soviet Red Army to improve their hand-to-hand combat abilities. It was intended to be a merger of the most effective techniques of other martial arts. The pioneers of Sambo were Viktor Spiridonov and Vasili Oshchepkov. Oshchepkov died in prison as a result of the Great Purge after being accused of being a Japanese spy. Oshchepkov spent several years living in Japan and training in judo under its founder Jigoro Kano [37].

Special Judo Fitness Test – test used to diagnose specific physical fitness in judo, structurally very similar to the structure of judo actions [26, 27].

Randori – sparring in judo in which both participants practice attacking and defending [38].

Technique – *noun* a way of performing an action [39].

Endurance – *noun* the ability or power to bear prolonged exertion, pain or hardship endurance athlete [39].

Endurance training – *noun* exercises designed to increase an athlete's level of aerobic fitness [39].

Physical conditioning – *noun* same as conditioning *noun* the work or programme used to bring somebody or something to a good physical state [39].

Training session – *noun* a period of time during which an athlete trains, either alone, with a trainer or with their team [39].

Circuit training – *noun* a form of sports training that involves performing different exercises in rotation [39].

Functional fitness – ability to perform everyday activities safely and independently without fatigue; requires aerobic endurance, flexibility, balance, agility, and muscular strength [39].

INTRODUCTION

Sambo wrestling is a dynamic and popular type of martial arts [1] – relations between martial arts and combat sports see in glossary. Sambo is characterized by grips of arms and legs, throws (*tachi-waza*), deductions and painful techniques of the limbs. The success of sambo practice depends on the technical skills and tactical training of the athletes with high level physical fitness [2]. The experts emphasize that achieving competitive success is possible only with optimal physical training of the athletes in sambo [3]. An important component of the sambo athletes' physical fitness is the level of special physical (functional) fitness of the athletes [4]. An increase in the level of competitions the scientific interest of specialists increasing the level of special physical fitness of the wrestlers (combat sports athletes) in competitive matches [5]. Experts note that in recent years, an influx of the young girls has been identified in judo and sambo schools in Russia [6]. Modern trends in the development of martial arts (sambo and judo) are expressed by a volume (for a critique of the term ‘volume’ see glossary) increase and intensity of training and competitive loads [7]. An increase in the volume of training loads shows the strict requirements of the level of special physical fitness of the female practicing martial arts [8]. The scientists point out the lack of scientific data of studies of functional preparedness level of the girls and women practicing martial arts in particular sambo and judo [9]. Similar scientific problems were identified by the Russian specialists. An analysis of the publications of the Russian scientists showed that the most of the studies are dedicated to the male athletes [10].

It is known that martial arts applying in practice the grab of the clothing have common technical foundations [11]. Specialists point out that the training process in sambo has a similar structure to the training of athletes in judo [2]. In the Russian Federation and the Commonwealth of Independent States countries, the athletes practicing sambo have significant practice in the competitive judo performances. Many trainers use similar techniques for the functional training of sambo and judo athletes for their competitive activities [12].

A study of modern scientific data shows that the Russian female athletes practicing sambo have approximately equal weekly training with the female athletes from several European countries practicing judo. In sambo practice, the weekly

training volume for the female athletes is about 14-15 hours a week. The female athletes of some countries of the European Union have 14-15.5 hours weekly training time. However, European female athletes have significantly more competitive practice [13]. It can be assumed that a significant amount of competitive practice effects on the level of special physical fitness of the female athletes positively. The analysis of the structure of the training process in sambo shows that the trainers devote a significant number of hours to the process of physical training of the sambo wrestlers [14]. In the total amount of training practice, the physical training of the junior athletes takes 45-50% in sambo [1]. In sambo and judo practice, the various methods are used to increase the level of functional fitness of the athletes in Russia. Scientists point out that many trainers use their own training programs without taking into account the latest scientific recommendations of some specialists [15].

Experts recommend the use of simulation match – *randori* practice in the process of increasing the level of special physical fitness of martial artists [16]. In the pre-competitive period of training the athletes, scientists suggest using *randori* in 40-60 minutes for at least 4 sessions per week [17]. In martial arts imitation of competitive matches is widely used as an alternative protocol for studying the limit of the ability of the cardio-respiratory system of the athletes [18]. However, experts indicate that a mechanical increase of *randori* time does not guarantee a high level of readiness for competitive matches [19].

In the practice of martial arts, high intensive interval training (HIIT) is used to increase the level of athletes' functional fitness [20]. In the scientific date the most part of HIIT protocols are presented for the elite male athletes [21]. In the Russian Federation, intensive interval training is mainly used by the athletes practicing mixed martial arts [22] and judo [23]. In sambo practice, the impact of HIIT protocols of the special physical fitness level of the female athletes is studied insufficient.

Scientists point to the possibility of a significant increase of the special physical fitness level of the martial arts athletes by means of crossfit training [24]. The exercises with weights, work out on exercise machines, own body weight and sparring partner weight are used in the process of sambo and judo athletes special physical training. All

strength exercises are performed at a fast pace in a certain sequence and with the same rest intervals between sets (circuit training) [25]. However, the level of physical fitness and gender characteristics of the girls will not allow them performing some strength exercises. There is a lack of scientific data about the effective methods of using crossfit training in the practice of the female martial arts.

The scientific data presents rather conflicting data of the optimal criteria of assessing the special physical fitness level of the female athletes practicing sambo and judo. The main criterion for assessing the level of athletes' special physical fitness is the result of a Special Judo Fitness Test (SJFT) [26-28]. In the scientific data, various data are presented about the results of SJFT among the female athletes of the same age practicing sambo [29] and judo [28]. Another significant criterion is the level of lactate concentration in the blood of the athletes [30]. In scientific studies, there are significant differences of the data of the lactate concentration in the blood of the female athletes after performing SJFT. Scientists indicate data from 8.9 mmol/L [29] to 14.5 mmol/L [31] of the lactate concentration in the blood of the female athletes after SJFT. Specialists point out the need for new research clarifying existing scientific data [32].

The review and analysis of scientific data determined the main purpose of the research while the methods used made it possible to providing more accurate data of the female's reaction practicing sambo in testing trials that determine the athletes' special physical fitness level.

The purpose of the study is knowledge about effective methods increasing the level of special physical fitness of the junior female practicing sambo.

MATERIAL AND METHODS

Participants

Young female athletes (n = 21) practicing sambo for at least 4 years. The age of the female athletes is 17-18 years old. The athletic performance of the female athletes is close to the elite. Sports qualification – candidates for master of sports of the Russian Federation in Sambo and Judo. Weight categories of the female athletes: up to 56 kg (n = 7), up to 60 kg (n = 9) and up to 65 kg (n = 5). All female athletes underwent a medical

examination and had no contraindications for research. All female athletes gave informed consent to participate and publish the results of the study. All female athletes showed approximately similar results of assessing the special physical fitness level at the beginning of the study period. By a random method, the female athletes were divided into two approximately equal groups: the group A (n = 11) and the group B (n = 10).

The base of research is the wrestling academy named after D.G. Mindiashvili (Krasnoyarsk, Russian Federation). Studies have been conducted for 32 weeks (September 2018 to April 2019). All female athletes had the same amount of training load (14-15 hours per week).

The group A weekly training sessions included: 3 hours of *randori* practice; 2 hours of general and 3 hours of special physical training; 6-7 hours per week were allotted improving the sambo technique. Functional fitness was enhanced through the practice of *randori*. *Randori* practice included 3 sessions per week (each training session 7-8 sambo matches). The general physical preparation of the group A included running (2x30 minutes per week), sport games (2x45 minutes per week). Special physical training included 2 training sessions in the gym (circuit training 2x45 minutes). The rest of the time – about 60 minutes was used performing the various throws: *soto-maki-komi*, *ippon-seoi-nage*, *tai-otoshi* at the fastest pace. At each training session (excluding the practice of *randori*), the female athletes performed the throwing technique at the fastest pace. The time of each training session is 15-20 minutes (throws 2 minutes, rest interval 1 minute). The number of such sessions is at least 3-4 per week.

The group B training sessions included: 2 hours of *randori* practice; 1.5 hours of general physical fitness; 3.5-4 hours of special physical fitness; 6.5-7 hours per week were allotted for the improvement of sambo technique. The practice of *randori* included 2 sessions per week (each session 7-8 sambo matches). The general physical preparation of the group B included running (1x30 minutes per week) and sport games (2x30 minutes per week). Special physical training included 60 minutes of performing sambo throws at a fast pace (3x20 minutes per week). The female athletes of the group B practiced functional training during the remaining time about 150-160 minutes. The time of each functional training was about 40 minutes. In training

Tactics – plural noun the art of finding and implementing means to achieve immediate or short-term aims [39].

Technique – noun a way of performing an action [39].

Tachi-waza – judo throwing techniques executed from a standing position. These include *te-waza* (hand techniques), *koshi-waza* (hip techniques), and *ashi-waza* (foot and leg techniques) [40]; including also sub classification *sutemi-waza* (rear-fall and side-fall judo throws; synonym – "dedication throws").

Load – noun 1. a weight or mass which is supported 2. the force that a body part or structure is subjected to when it resists externally applied forces 3. the amount of something, usually weight, that a body part can deal with at one time [39].

Training load – "A simple mathematical model of training load can be defined as the product of qualitative and quantitative factor. This reasoning may become unclear whenever the quantitative factor is called 'workload volume' or 'training volume' interchangeably with 'volume of physical activity'. Various units have been adopted as measures i.e. the number of repetitions, kilometres, tons, kilocalories, etc. as well as various units of time (seconds, minutes, hours) (...). As in the real world nothing happens beyond the time, the basic procedure of improvement of workload measurement should logically start with separation of the time factor from the set of phenomena so far classified together as 'workload volume'. (...) Due to the fact that the heart rate (HR) is commonly accepted as the universal measure of workload intensity, the product of effort duration and HR seems to be the general indicator of training load defined as the amount of workload. It is useful in analyses with a high level of generality. (...) In current research and training practice the product of effort duration and HR was referred to as conventional units' or further calculations have been made to convert it into points." [41, p. 238].

Combat sports – the group of sports disciplines, in which the gist of the competition is the direct clash of two competing athletes. They are affiliated to the national and international sports organizations in order to carry out official

competition, classification, etc.: "every combat sport is martial arts but not vice versa" [42, p. 18].

Commonwealth of Independent States (CIS) is a regional intergovernmental organization of nine (originally ten) members, plus two founding non-member, post-Soviet republics in Eurasia. It was formed following the dissolution of the Soviet Union in 1991.

sessions (excluding the days of *randori* practice), the female athletes performed a series of strength and gymnastic exercises. Strength exercises included working with dumbbells (weight from 3 to 10 kg); squats and lunges with a load (20-35% of own weight); fast run (30-60m. with a 10-15 kg load); fast run (50-60 m.); long jumps with a load (10-20% of own weight). Acrobatic exercises included performing 10 somersaults and 10 rolls at the fastest pace. The female athletes performed tasks in a different sequence (according to the choice of a coach). The first 12 weeks, the duration of each series of exercises was 3 minutes and the rest interval between the series was 2-2.5 minutes. The number of series is 6-7 during the training. Subsequently, the duration of the series was increased to 4 minutes (the time of a competitive match in sambo). The rest interval has not changed.

The special tests were used assessing the level of female athletes' functional fitness: SJFT and a test with 30 throws of 2 partners. During this test, the female athletes performed 15 *ippon-seoi-nage* to the right and 15 *ippon-seoi-nage* to the left at the fastest pace. Polar H10 heart rate monitors (China) were used to evaluate the indicators of heart rate recovery after a test load. All female athletes recorded an electrocardiogram every minute in the recovery period. A three-channel electrocardiograph Fukuda FX-7102 (Japan) was used. The method of A. Zavyalov [33] was used assessing the dynamics of the ECG. Indicators of the lactate concentration in the blood of female athletes were used for evaluation. A BIOSEN 5030 glucose and lactate analyser (Germany) has been used in research. Blood samples were collected from the female athletes every two weeks in the morning prior to training sessions. Capillary blood sampling from the finger is performed. The level of lactate concentration of the female athletes was measured after performing SJFT.

The competitive results of the studied groups were evaluated over the entire period of the research. All female athletes took an obligatory part in 6 regional sambo competitions. The female athletes who showed good results took part in 2 more competitions at the national level. The rating scale: the 1st place in the competition 1 point; the 2nd place 2 points; the 3rd place 3 points; the 5th-6th places 5 points; the 7th-8th places 7 points. Lower competitive results were rated at 10 points. All results of the groups were summarized after each competition and the

average value was determined for each group. A lower average indicated higher competitive results. We did not take into account the lowest competitive result of the 1st group increasing the reliability of the study in view of the larger number of the female athletes in this group.

Statistical analysis

Statistical analysis of the research data was performed using SPSS20. The validity of the study results was determined using the Mann - Whitney U - test.

RESULTS

At the beginning of the study, the test data of the female athletes did not differ significantly. Both groups showed approximately equal results in the SJFT (average level of fitness assessment of athletes). Data of the lactate concentration in the blood of the female athletes at the beginning of the study did not contain significant differences. The group averages were approximately 8.69 ±2.11 mmol/L after SJFT. The average lactate concentration among the female athletes in 4 weeks of training was 9.79 ±1.31 mmol/L. The recovery interval for girls after 30 throws averaged about 3.17±0.24 minutes. The competitive results were not determined at the start of the study.

At the end of the studies, significant dynamics of the level growth of special physical fitness of the female athletes performing SJFT were revealed. According to the test results, the average values of the SJFT index were: 13.18 ±1.26 (group A) and 12.85 ±1.22 (group B). A significant decrease of the lactate concentration in the blood was found among the female athletes after performing SJFT. The dynamics of lowering the level of lactate concentration among the female athletes of both groups was revealed. The data about the lactate concentration in the group B 7.65 ±2.07 mmol/L which are significantly ($p < 0.05$) lower than the indicators of the group A 8.01 ±2.16 mmol/L. A significant increase of the level of lactate concentration in the blood of the female athletes was found in 32 training weeks. A more significant ($p < 0.05$) increase of the lactate level was found among of the group B. The data obtained in the group B 12.23 ±1.34 mmol/L which was significantly ($p < 0.05$) higher than the indicators of the group A 11.86 ±1.29 mmol/L. The heart rate recovery interval after performing a test load (30 *ippon-seoi-nage*) was significantly

reduced in both groups. All female athletes had showed a typical response to test physical activity. No atypical reactions were detected. No significant differences between group results were found in this test. A comparative analysis of the competitive results had showed the advantage of the group **B**. It was found that the average score in points of the group **B** is 71.27 ± 5.16 points. In the group **A**, this indicator averages 74.12 ± 5.25 points, which is significantly ($p < 0.01$) higher. The main results of the study are presented in Table 1.

DISCUSSION

Experts recommend using *randori* practice increasing the level of special physical fitness of martial artists. There is evidence of the use of a significant (4-5 hours) weekly time of *randori* in the practice of training judo athletes [17]. In our studies, the weekly amount of *randori* practice was about 3 hours in the group **A**. In the group **B**, the weekly time of *randori* was reduced by approximately 30%. The results of testing female athletes showed a significant ($p < 0.05$) advantage of the athletes' group **B** of SJFT indicators. We believe that a significant (over 2-2.5 hours) time of *randori* will not be too effective in the process of functional training of the female athletes in sambo. The concept of reducing the excessive amount of *randori* practice contradicts the position of some Russian scientists about a significant increase in the volume (time) of simulation matches in sambo practice [1, 15]. The differences between the practice of competitive matches and the physiological requirements for *randori* performance are pointed out by experts [19]. Scientists indicate that when performing imitation fights there are some restrictions that affect the effectiveness of training athletes for competitive matches [18].

The level of wrestlers' preparedness for the competitive matches to a certain extent is reflected in the results of testing the athletes' speed-strength characteristics [5, 34]. The scientific literature presents data about the results of SJFT of the female athletes practicing sambo. The SJFT index for the women practicing sambo is on average 13.6 ± 1.6 [29]. Experts qualify such SJFT index values as average. The data of the SJFT index of the group **B** significantly ($p < 0.05$) exceed both the indicators of the group **A** and the literature data. The dynamics of the results of the SJFT index in the group **B** is a movement from average ratings to good ratings. According to literary data, the studied girls are somewhat inferior to the elite female athletes of the same age practicing judo in SJFT results [28, 35]. These results can be explained by differences in the volume of weekly training practice for the female athletes. The elite judo girls have more than 20 hours of training practice per week.

In the scientific date, there are quite heterogeneous data about the lactate concentration in the blood of the female athletes after performing SJFT. Various scientists indicate data from 10-11 mmol/L [36] to 13-14 mmol/L [31]. Data about the lactate concentration are also presented among the women practicing Sambo (excluding elite athletes) on average is 8.9 ± 2.0 mmol/L [29]. Our studies have revealed the dynamics of a significant decrease of the lactate concentration in the blood of the female athletes after performing SJFT. The lactate concentration among the group **B** 7.65 ± 2.07 mmol/L which is significantly ($p < 0.05$) lower than the indicators of the group **A** 8.01 ± 2.16 mmol/L. The obtained results differ from the data presented in the literature significantly. The differences can be explained both by some differences in the measurement procedure and by the use of regular functional training.

Table 1. Test results of the studied female athletes

Test	September 2018		April 2019	
	group A (n = 11)	group B (n = 10)	group A (n = 11)	group B (n = 10)
SJFT	13.62 ± 1.16	13.60 ± 1.13	13.18 ± 1.26	$12.85 \pm 1.22^*$
Lactate (SJFT)	8.72 ± 2.13	8.67 ± 2.09	8.01 ± 2.16	$7.65 \pm 2.07^*$
Lactate	9.77 ± 1.44	9.81 ± 1.13	11.86 ± 1.29	$12.23 \pm 1.34^*$
Ippon-seoi-nage	3.16 ± 0.22	3.19 ± 0.26	2.49 ± 0.21	2.46 ± 0.27
Results (points)	–	–	74.12 ± 5.25	$71.27 \pm 5.16^{**}$

* $p < 0.05$; ** $p < 0.01$.

CONCLUSIONS

The modern practice of sports training is associated with a significant increase of the training volume (especially training time and specific measures such as *randori*) and competition load in martial arts (sambo and judo). Level increase of the functional fitness is a prerequisite for the successful competitive practice in these combat

sports of wrestling types. The female athletes can apply regular functional training (options for crossfit training) in the pre-competition and competition period increasing the special physical fitness level. Using the training practice methodology presented by the authors, can let you increasing the level of special physical fitness of the female athletes practicing sambo significantly.

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