

Effectiveness of functional training during physical conditioning of students practicing martial arts

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Abstract:

Problem Statement. According to sport physiologists, the intensive strength training as a part of enhancing of speed-strength endurance should be alternated with, for example, the interval exercising aimed to improve the mitochondrial content. That will ease the recovery of the central nervous system and of the martial artist's energy, and also restore myofibrils.

Approach. System-activity and personal-individual approaches were used to design the functional training method for martial artists that involved a strict schedule of exercising with training loads close to the contest levels. The functional training was aimed to develop speed and strength, and different types of endurance in athletes.

The purpose of our study was to provide the experimental justification of the effectiveness of the suggested method of martial artists' training.

Results. The functional training method implied the program where the strength training involved exercises with 70% of maximum possible weight; the athletes also worked with small and medium weights with the maximum force of lifting. The authors believe that such training loads are good for training glycolytic muscle fibers which have low aerobic capacity and tend to decrease their aerobic potential even more due to significant acidification. Mitochondrial content growth in glycolytic muscle fibers resulted from aerobic exercising until the slight local fatigue of the target group of muscles starts, but the muscle are not acidified. The development of oxidative muscle fibers resulted from static-dynamic exercising. The experiment led to significant positive changes in general and special physical fitness of the martial artists.

Conclusions. The results of experiment show that the training process composed of two-week cycles (strength and aerobic) with focus on mitochondria developing exercises allows an athlete to achieve high levels of special endurance and strength which determines a high sport performance.

Key Words: male students; martial arts; functional training; special physical fitness.

Introduction

Martial arts are becoming more and more popular among children and youth which means that it is essential to design an effective system of training based not only on a coach's intuition or serendipity, but also on the modern findings of sport adaptation science and sport training theory.

Modern sports force athletes to play in a constant and extremely competitive environment. Martial arts are not an exception. To achieve high sport performance athletes have to deal with immense loads, be under the intense pressure, and often compete when being injured.

Martial arts are always a battle, and to win it an athlete should always be ready both mentally and physically and have a necessary reserve of tactical and technical abilities. On a day of competition an athlete may fight in several combats with various rivals. If a special endurance is not developed well enough, it is almost impossible to get through to the final of competition (Burdin, 1980; Barbas, 2010).

Today professional athletes pay much attention to so called functional training that makes it possible to reach high levels of special endurance and strength and to prepare the body for specific loads. The kind of martial arts defines what functional training system should be used (Martínez-Abellán, 2010).

The functional training for martial artists implies a strict schedule of predetermined weight exercising, with and without a partner, with training loads close to the contest levels; it is aimed to develop speed and strength, and different types of endurance in athletes (Latishev & Chochorai, 2005).

Materials & methods

The study was conducted at the premises of the combat sambo club affiliated to the Palace of Sports of South Ural State University from September 2015 till March 2016. All the experiments were permitted and approved by the Sport Club of South Ural State University.

Participants

The study involved 30 martial artists who were attending training groups divided into experimental (EG) and control (CG) groups, 15 athletes each. CG athletes followed their usual training program. EG performed exercises based on the functional training in addition to the usual program.

Procedure

According to literature data and the author’s experience a martial artist needs not only the necessary sparring on the tatami, but also the overall physical conditioning, for example, in the gym, to develop strength and strength endurance. Functional changes are impossible without structural ones. The indices of strength and strength endurance grow mainly due to prominent increase of the skeletal muscles – muscle composition by another name.

Strength load has a positive short-term effect on the endocrine system. However, long-term exposure to stress loads such as strength training may badly affect the central nervous and endocrine systems (Selye’s general adaptation syndrome) (Kürkçü & Tekin, 2010).

Persistent high requirements to the stated systems result in their exhaustion and loss of the competition form. For that reason, the intensive strength training should be alternated with, for example, the interval exercising aimed to improve the mitochondrial content. This will provide the necessary “rest” and recovery of the nervous central and endocrine systems, and restore the contractile elements (myofibrils) ruined during the strength exercising.

In this particular case, the EG was recommended to train using 70% of maximum possible weight and to work with small and medium weights, but with the maximum force of lifting (90% and higher), that would make most muscle units work. The stated methods are good for training glycolytic muscle fibers (GMF) that have low aerobic capacity. Strong acidification of these muscle fibers results in even greater decrease of their aerobic potential. The growth of mitochondrial content is provided mainly by aerobic exercising until the slight local fatigue of the target group of muscles starts, but the muscles are not acidified. The example of such exercising is time-limited tactical and technical pair training on the tatami.

Beside GMF, it is necessary to develop oxidative muscle fibers that have very high aerobic capacity. Today, the most effective way to do that is static-dynamic training (Burdin, 1980). That means that the exercise is performed without relaxation of the working muscle, in a moderate or slow tempo, with 60% of maximum possible weight or less.

An athlete keeps training until the burning sensation in the target group of muscles appears which is followed by the interval of rest equal to the interval of training. It is possible to perform three such sets in one series of exercises. The burning sensation during static-dynamic training as well as a muscular failure during dynamic work involving GMF should appear in 20-40 seconds after the set starts.

Statistical analysis

The significance of changes in indices during the experiment was assessed using Student’s t-test considering the standard error of mean difference. Table “Student’s t-test limit values” was used to determine the significance of differences. For that, the obtained t value was compared to the limit one at 5% level of significance ($t = 0.05$). The results allowed for the conclusion about significance or insignificance of differences, and consequently about the effectiveness of the suggested program (Borovikov, 2016).

Results & discussion

The data on the final level of the experiment participants’ general physical fitness (GPF) were subjected to statistical processing. The results (Table 1) indicate significant differences in values of strength and strength-speed capacity indices. It is notable that strength increases on the background of positive changes in coordination ability indices estimated by means of shuttle run.

Table 1 – Indices of general physical fitness of experiment participants

Testing exercise, units of measurement	Group	September 2015	March 2016
Pull-up, number of times	CG	21.4 ± 2.1	22.8 ± 1.9
	EG	19.0 ± 3.2	27.1 ± 3.8
	p	≥ 0.05	≤ 0.05
3-kg stuffed ball overhead throwing, when seated, cm	CG	421.8 ± 12.2	418.1 ± 7.9
	EG	427.0 ± 15.0	445.7 ± 14.1
	p	≥ 0.05	≤ 0.05
Shuttle run 3 x 10 m, s	CG	7.4 ± 0.1	7.3 ± 0.1
	EG	7.4 ± 0.1	7.0 ± 0.1
	p	≥ 0.05	≤ 0.05

More prominent significant differences are observed in testing exercises determining the level of special physical fitness (SPF) of EG and CG athletes (Table 2).

Table 2 – Indices of special physical fitness of experiment participants

Testing exercise, units of measurement	Group	September 2015	March 2016
Pulling force (arms only), kg	CG	11.6 ± 0.7	15.2 ± 0.3
	EG	12.2 ± 0.5	18.1 ± 0.6
	p	≥ 0.05	≤ 0.05
Ball dribbling with 10-second acceleration in the beginning of each minute during 5 minutes, number of times	CG	12.0 ± 0.5	16.2 ± 0.5
	EG	12.7 ± 0.9	21.0 ± 0.6
	p	≥ 0.05	≤ 0.05
Strength capacity realization coefficient, %	CG	49.8 ± 1.2	51.4 ± 1.3
	EG	49.1 ± 1.3	57.3 ± 0.7
	p	≥ 0.05	≤ 0.05

In particular, the martial artists had the best result in testing exercise “arms-only pulling force” characterizing the special strength (McDougall, 2008; Myakinichenko & Seluyanov, 2012). The EG athletes showed higher results in testing exercise “ball dribbling with 10-second acceleration in the beginning of each minute during 5 minutes” characterizing speed-strength endurance (McDougall, 2008). The EG athletes were also better in “strength capacity realization coefficient” (Latishev & Chochorai, 2005).

Conclusions

Thus, the functional training has proved its high effectiveness both for enhancement of the martial artists’ general physical fitness and for improvement of special indices of endurance. It is recommended to divide the training process into two-week cycles one of which is dedicated to strength training, and the next one focuses on exercises aimed to develop mitochondria, glycogen accumulation, and improvement of aerobic capacity of the body. Considering the date of competition, the “aerobic cycle” should be immediately prior to the very start of competition. According to the results of experiment, if these conditions are met an athlete is able to build up high levels of special endurance and force which leads to successful competitive activity.

Conflicts of interest

The authors declare that there is no known conflict of interest.

References:

- Barbas, I., Fatouros, I.G., Douroudos, I.I., Chatzinikolaou, A., Michailidis, Y., Draganidis, D., Jamurtas, A.Z., Nikolaidis, M.G., Parotsidis, C., Theodorou, A.A., Katrabasas, I., Margonis, K., Papassotiriou, I., & Taxildaris, K. (2010) Physiological and performance adaptations of elite Greco-Roman wrestlers during a one-day tournament. *European Journal of Applied Physiology*, 117(7), pp. 1421-36.
- Borovikov, V. *Main characteristics and Student’s t-test*. Retrieved from: <http://www.statistica.ru/local-portals/medicine/osnovnye-statistiki-i-t-kriteriy-studenta/>
- Burdin, I.F. (1980). *Special endurance enhancement in highly-skilled fighters*. Saint-Petersburg: P.F. Lesgaff University Press.
- Kürkçü, R., Tekin, A., Özda, S., & Akçakoyun, F. (2010). The effects of regular exercise on oxidative and antioxidative parameters in young wrestlers. *African Journal of Pharmacy and Pharmacology*, 5(4), pp. 244-51.
- Latishev, S.V., & Chochorai, Z.Yu. (2005). *Special strength training of martial artists*. Donetsk: DonDUET..
- Martínez-Abellán, A., García-Pallarés, J., López-Gullón, J., Otegui, X., Baños, V., & Martínez-Moreno, A. (2010). Factores anaeróbicos predictores del éxito en lucha olímpica. / Anaerobic factors to predict wrestling performance. *Cuadernos de Psicología del Deporte*, 10(2), pp. 1017-23.
- McDougall, J.D. (2008). *Physiological testing of highly-skilled sportsmen*. Kiev: Olimpiyskaya literatura.
- Myakinichenko, E.B., & Seluyanov, V.N. (2012). *Development of local muscle endurance in cyclic kinds of sports*. Moscow: TVT Divizion.