

Improving kickboxers' special physical preparedness which accounts for their individual tactical style and technical skills

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Abstract

Background. The research was devoted to increase of kickboxers' special physical preparedness as a basis of technical and tactical improvement in the long-term development. Analysis of the literature enabled to reveal a great amount of researches dedicated to physical training in combative sports. According to the last changes in competition rules (2013), there is a need for scientific researches based on analysis of kickboxers' competitive activity and factors of its effectiveness.

Problem and aim. The issue of physical training in kickboxing is mentioned in a great amount of works. However, an individual tactical style as basis for special physical preparedness in kickboxing is considered fragmentally, especially after introducing changes in competition rules. That points at absence of one approach in its realization at different stages of long-term development.

Results and Conclusions. For the solvation of the set tasks there were done several measurements with the help of chrono-dynamometry. The traditional comparison of indices of qualified kickboxers from control and experimental groups before and after pedagogical experiment revealed the dominance of experimental group representatives. This prevalence has been localized in "overall tonnage" of workload, "coefficient of speed endurance", and "index of glycolytic capacity for work". It enabled us to assume that application of special physical training program for kickboxers at the stage of specialized basic training gives new possibilities for their improvement. Particularly, the main accent in the program should be made on the athletes' individual tactical style and technical skills.

Key words: kickboxers, special physical training, preparedness, tactical skills, individual style.

Introduction

The athletes' training in martial arts is a multi-component system and all elements (physical, technical, tactical, psychological etc.) are interconnected. Each of these elements must tackle its individual totality of tasks at each stage of a multi-year training (Frolov *et al.*, 1976; Platonov, 2004; Bradley, 2010; Czajkowski, 2010).

The primary steps for athletes' achievements in the national and international competitions should include the improvement of different components of athletic skills. Moreover, this requires well-coordinated training system and substantiated competitive activity at each stage of long-term development (Nykyforov, 1978; Ostianov, Hryb, 2011; Pityn *et al.*, 2017).

According to the researchers in the field of physical culture and sport, the improvement of athletes' training system is interrelated not only with implementation of efficient means and methods, but also with application of various approaches (Borysiuk, Pakosz, 2011; Friedman, 2016). The timeliness of such application is one of the most significant factors of efficiency realization. Therefore, a huge range of scientific works indicate the need of searching the reserves in the structure and content of training system from the primary stages. At the same time, the training program at each stage should take into account athletes' individual characteristics such as competitive style and level of physical preparedness (Kalmykov, 1983; Ostianov, Haidamak, 2001; Johnson, Hyo Jung Kang, 2018). A great amount of research papers were dedicated to the use of individual approach in the training process in martial arts (Rusanov, 1985; Stepanov, 2009; Zadorozhna *et al.*, 2018).

The current researches illustrate that the requirements to kickboxers' special physical preparedness are complicated by the available individual inclination to a tempo, character of competition activity etc. At such approach, physical development should be based on the account of dominants in the structure and content of athletes' technical and tactical actions.

The aforementioned factors indicate obvious contradiction between the need of improving special physical preparedness at the primary training stages and introduction of the competition rules changes and lack of taking into account athletes' technical and tactical actions (individual style) within training process in kickboxing.

The aim of research was to increase the efficiency of kickboxers' special physical training taking into account their individual tactical style and technical skills.

Materials and Methods.

Due to the lack of a unified approach to special physical training in kickboxing caused by new changes in the competition rules, there was held an expert survey using a questionnaire. There were defined the general approaches to kickboxers' training and ways for their improving at different stages of long-term development. The main accent in those approaches was made on accounting athletes' individual tactical style and technical skills.

The survey involved 81 respondents (members of Ukrainian national team and coaches with average experience almost 10 years). The survey was held at competitions in various martial arts (mostly kickboxing and boxing).

The next step included pedagogical observation. It enabled to receive an information about individual style characteristics of experienced kickboxers (national Ukrainian team members and highly qualified athletes, total amount 40) which was used as a basis for the experimental program. The recording of competition bouts was performed by the camera ("Panasonic" SDR-H280) in the "sport" function. Besides, there was analyzed the effectiveness of technical and tactical actions used by kickboxers at the Ukrainian national championships and the world championship (2015-2016). According to those results, there was made an assumption of the athletes' belonging to the competitive activity style ("knock-outer", "tempo-runner" and "play-runner").

To test the effectiveness of the author's program, a pedagogical experiment was conducted. It was done on the basis of kickboxing sports clubs. Thus, athletes of experimental group had their classes in "Fasters" Sports Club, Lviv, while athletes of control group – in "Muay Thai" Sports Club, Lviv. The total amount of athletes was 40, including kickboxers at the stage of specialized basic training and sportsmen with the status of Candidate in Master of Sports. The age of the participants ranged from 17 to 19. Division of athletes by belonging to a sports club proved certain discrepancy among representatives of different individual styles. The control group included 5 "knock-outers", 7 "tempo-runners", and 8 kickboxers with dominating "play-running" style. Experimental group included: 6 "knock-outers" and 6 "tempo-runners", 8 "play-runners". The total duration of pedagogical experiment was 9 months (from April 2015 through February 2016).

Organization

To testify the experimental program in kickboxing there was made the range of special physical preparedness measurements. The manifestations of kickboxers' special physical features were defined by the chrono-dynamometry method, popular among representatives of martial arts (Petukhov, 1969; Ostianov, Haidamak, 2001; Prystupa *et al.*, 2019). Chrono-dynamometry is a contemporary method of scientific research in punching and kicking martial arts that uses special hitting ergometers "Spuderg-10". The devices of "Spuderg-10" series allow measuring special physical preparedness (complex manifestations), and measuring power of specialized work of athletes (Ostianov, Haidamak, 2001; Prystupa *et al.*, 2019).

Due to the method of chrono-dynamometry, researchers are able to measure the force and efficiency of single and serial hits. This method also allows defining power of specialized work in punching and kicking martial arts, which is one of the most integrated characteristics of the level of preparedness in these kinds of sports (Petukhov, 1969).

There were made such measurements in our research:

1. Measuring of kickboxers' single hits power, for which athletes delivered ten blows to the apparatus (a punch bag with a sensor inside). Three best blows were registered in a protocol and their arithmetic average was calculated (absolute index of hitting power). This exercise was done by kickboxers using arms and legs separately.

2. Calculation of hitting relative force done with the help of revealing correlation between average force of three best blows and athlete's body weight.

3. Defining the available level of athletes' special phosphocreatine workability. This test represents an 8-second workflow on a dynamometry device with an instruction to deliver as hard and frequent blows as possible. While being tested a kickboxer takes middle position in relation to the apparatus that is being supported by an assistant. When ready, the kickboxer starts to deliver straight punches (by left and right hand alternatively). Countdown for punches parameters starts with the first punch. After completion of the test, indices of the number of punches and their overall volume (tonnage) are registered in the protocol. A total number of three attempts were given to each athlete (Hutsul, Savchyn, 2016). When administering these tests we used both punches and kicks. When testing kicks we used sidekicks with right leg in the mid-section. Two attempts were given to each athlete for this test.

In order to obtain calculation data, indices of the best attempt were taken into account. Based on these values, special integral indices were defined for each athlete:

- power of workflow per 1 kg of athlete's body weight in 1 s; $W_8 = F_8/P/8$, $\text{kg} \cdot \text{m}^{-1}$ (2.1), in which P – athlete's body weight (kg), F_8 – total power index of workflow during the test;

- coefficient of "explosive" (speed-and-power) endurance – CEE : $CEE = (F_2 \cdot K_2) / (F_1 \cdot K_1)$ (2.2), in which F_1 i F_2 – force index of the first and second halves of the test, K_1 i K_2 – number of blows in the first and second halves of the test (blows delivered);

- index of "explosive" endurance – IEE: $IEE = W_8 \cdot K_{BB}$ (2.3);

- index of phosphatocreatine workability: $IPCW = IBB \cdot K_8$ (2.4), in which K_8 – number of blows during the test "8 s" (blows delivered).

Another calculation and interpretation are presented in academic papers (Hutsul, Savchyn, 2016).

4. Defining the available level of athletes' glycolytic anaerobic capacity for work. It is represented in the research of kickboxers' speed endurance in order to reveal athletes' glycolytic anaerobic capacity for work. This test represents a 40-second workflow on a dynamometric device with an instruction to deliver as frequent blows as possible. When administering these tests we used punching and kicking separately. When being tested a kickboxer takes middle position in relation to the apparatus that is supported by an assistant. When ready, the kickboxer starts to deliver straight punches (by left and right hand alternatively). For testing kicks we used sidekicks in the mid-section with both legs alternatively. Countdown for parameters starts with the first blow.

After the test is done, indices of the number of blows and their total tonnage are registered in the protocol. Based on the obtained values of maximum capacity for work of a kickboxer, the following integral indices are calculated: workforce for 1 kg of athlete's bodyweight per 1 second; coefficient of speed endurance – CSE; index of quick endurance – IQE; index of glycolytic endurance – IGE (Hutsul, Savchyn, 2016).

Test, conditions of its accomplishing, algorithm of indices calculation etc. are similar to the previous one.

Results

According to the curriculum for kickboxing Children's and Youth Sports School of Olympic Reserve (Hutsul, Savchyn, 2016), a total number of 1352 academic hours are envisaged for the second year of studies, of which 444 hours are envisaged for special physical training. On the third year of studies, the volume of academic workload is 1456 hours, of which 454 hours – special physical training.

The specific nature of pedagogical experiment and involvement of various kickboxing sports clubs allowed us to calculate the volume of experimental and standardized (traditional) program with 450 hours per year given for special physical training.

The pedagogical experiment was done on the basis of sports clubs that promote kickboxing. Thus, athletes of experimental group had their classes in "Fasters" Sports Club, Lviv, while athletes of control group – in "Muay Thai" Sports Club, Lviv. 40 qualified kickboxers, being at the stage of specialized basic training and had ranks of Candidate in Master of Sports, were involved to the comparative pedagogical experiment. Age of participants ranged from 17 to 19. Division of athletes by belonging to a sports club proved certain discrepancy among representatives of different styles of competition activity. Control group included 5 "punchers", 7 "tempo-runners", and 8 kickboxers with dominating "play-running" style. Experimental group included: 6 "punchers" and 6 "tempo-runners", 8 "play-runners".

The total duration of pedagogical experiment was 9 months (from April 2015 through February 2016). Within this period, two preparatory stages were envisaged (April-August 2015 and September 2015 – January 2016), so that the structure of a year-long training included two macro-cycles with identical content of the program in the field of specialized physical training.

The main differences proposed by us for the experimental program were:

- to take into account specific nature of athlete's competitive activity in order to select exercises for special physical training in preparatory period of training macro-cycle;

- to differentiate means of training taking into account individual features of kickboxers' competitive activity;

- to change the volume of special physical training exercises, at which 40% of time will be given for special physical qualities improvement (exercises done by athletes together), 30% of time is differentiated by dominant common features for individual styles of competitive activity, and another 30% – exclusively for preventatives of individual styles of competitive activity;

- to increase the general intensity of special physical training exercises, which corresponds to the specific feature of executing technical and tactical actions within competitive activity in kickboxing, which is achieved by the use of complex-orientation exercises (combination of influence on physical and technical-tactical preparedness).

The comparison of generalized results of the pedagogical experiment by two groups was done (table 1, 2). The first one is related to the work within "8 s" test, done with hands and legs; then second one – "40 s" test, done with legs and hands.

Table 1

The comparison of specific work indices of upper limbs muscles (“8 s” test) in the control and experimental groups (X±m)

		Indices	Groups	
			Control (n=20)	Experimental (n=20)
Work of upper limbs	before PE	Number of blows	43,30±4,03	43,55±5,82
		Overall tonnage, standard units	3333,10±81,69	3348,45±43,20
		Work power, W	5,80±0,12	5,75±0,16
		CEE	1,05±0,01	1,04±0,02
		IPCW	297,90±12,82 ¹	303,40±10,12 ¹
	after PE	Number of blows	45,85±3,54 ¹	47,90±4,68 ¹
		Overall tonnage, standard units	3529,05±88,05 ¹	3569,30±46,37 ¹
		Work power, W	6,19±0,14 ¹	6,19±0,17 ¹
		CEE	1,07±0,01 ¹	1,08±0,02 ¹
		IPCW	314,60±14,34 ¹	328,90±7,31 ^{1,2}
Work of lower limbs	before PE	Number of blows	14,55±1,20	14,00±1,30
		Overall tonnage, standard units	1351,10±43,49	13,48,85±35,24
		Work power, W	1,64±0,08	1,64±0,12
		CEE	1,00±0,02	1,00±0,02
		IPCW	212,40±5,50	211,15±9,25
	after PE	Number of blows	17,25±1,15 ¹	18,95±0,86 ^{1,2}
		Overall tonnage, standard units	1554,05±56,95 ¹	1600,60±35,30 ^{1,2}
		Work power, W	1,67±0,08 ¹	1,73±0,10 ¹
		CEE	1,04±0,01 ¹	1,04±0,01 ¹
		IPCW	219,85±2,97 ¹	224,85±3,38 ^{1,2}

Note: ¹ – availability of true inner-group differences (p≤0,05); ² – availability of true intergroup differences (p≤0,05); PE – pedagogical experiment; CEE – coefficient of explosive endurance; IPCW – index of phosphocreatine workability.

The results of data comparison according to specific work in “8 s” test enabled to reveal true increase of indices for representatives of both experimental and control group by all aforementioned indices. We attribute the total increases of efficiency to accumulation of certain changes that were registered on the basis of individual styles of running a competition activity. It should be noted, that qualified kickboxers of control group managed to increase all indices by 1,57–6,69% (p≤0,05). At the same time, qualified kickboxers of the experimental group, whose program of special physical training was slightly different in content, also improved their results by all indices, only by 3,40–9,99% (p≤0,05).

Thus, having equal level of improvement of the results of specific hand work within “8 s” test, representatives of the experimental group managed to achieve slightly higher indices of preparedness increases.

With purpose of finding out the efficiency of the applied approaches to special physical training, comparison of data of qualified kickboxers from experimental and control groups was done at two stages of research (before and after the pedagogical experiment).

By general indices of qualified kickboxers, lack of true differences on the output level of preparedness have been proven (p>0,05). By the majority of indices, differences ranged from 0,46 до 1,85% of prevalence of a certain group of athletes. After completion of the pedagogical experiment, significant differences as dominance of a certain group within “8 s” test using hands manifested themselves only in one index (index of phosphocreatine workability), the dominance of kickboxers from experimental group being 4,55% (p≤0,05).

The same analysis within this test (“8 s”) that was done with lower limbs showed different results. All qualified kickboxers (representatives of both experimental and control group) showed significant increases of the results by general indices throughout the pedagogical experiment.

It should be noted that values of increases of athletes from the experimental group were higher than the ones of athletes from the control group. In some cases, level of validity was also higher. Thus, increases for

qualified kickboxers from experimental and control groups, for overall number of blows per time span were 18.56% $p \leq 0,05$ (CG) and 35,36%, $p \leq 0,01$ (EG); “overall tonnage” – 15,02%, $p \leq 0,05$ (CG) and 18,66%, $p \leq 0,05$ (EG); “work power” – 1,98%, $p \leq 0,05$ (CG) and 5,14%, $p \leq 0,05$ (EG); “coefficient of explosive power” – 4,37%, $p \leq 0,05$ (CG) and 4,82%, $p \leq 0,05$ (EG); “index of phosphocreatine workability” – 3,51%, $p \leq 0,05$ (CG) and 6,49%, $p \leq 0,05$ (EG).

The indices comparison for control and experimental groups throughout the pedagogical experiment enabled to make the following conclusions. On the one hand, no significant differences were revealed between representatives of the two groups on the output level – the differences ranged within 0,10–3,78% ($p > 0,05$). On the other hand, the implementation of two methodologically-different programs of special physical training proved availability of only two true advantages of representatives of the experimental group. They were seen in the overall number of kicks per time span of 40 seconds (9,86%, $p \leq 0,05$) and in “overall tonnage” (3,00%, $p \leq 0,05$). This proves efficacy of the author’s approach to the content of special physical training of qualified kickboxers at the stage of specialized basic training. The same analysis was done for “40 s” test indices (table 2).

Table 2

The comparison of specific work indices of lower limbs muscles (“40 s” test) in the control and experimental groups ($\bar{X} \pm m$)

Indices		Groups		
		Control (n=20)	Experimental (n=20)	
Work of upper limbs	before PE	Number of blows	204,55±19,15	207,65±25,01
		Overall tonnage, standard units	4300,85±88,27	4347,70±75,74
		Work power, W	3,87±0,11	3,92±0,14
		CSE	0,62±0,01	0,62±0,01
		IGE	230,90±6,91	238,65±4,26 ²
	after PE	Number of blows	213,00±16,80 ¹	222,95±20,56 ¹
		Overall tonnage, standard units	4705,10±114,89 ¹	4887,55±78,65 ^{1,2}
		Work power, W	4,07±0,07 ¹	4,09±0,09 ¹
		CSE	0,65±0,01 ¹	0,66±0,02 ¹
		IGE	236,30±5,73 ¹	247,85±3,77 ^{1,2}
Work of lower limbs	before PE	Number of blows	69,35±4,15	67,30±5,26
		Overall tonnage, standard units	2714,80±54,86	2735,70±48,38
		Work power, W	1,47±0,07	1,48±0,09
		CSE	0,60±0,02	0,60±0,02
		IGE	168,90±4,60	169,75±5,43
	after PE	Number of blows	77,15±3,18 ¹	77,70±4,67 ¹
		Overall tonnage, standard units	3006,70±115,37 ¹	3139,90±121,08 ^{1,2}
		Work power, W	1,56±0,04 ¹	1,60±0,06 ¹
		CSE	0,64±0,02 ¹	0,66±0,02 ¹
		IGE	178,95±5,05 ¹	183,95±3,25 ^{1,2}

Note: ¹ – available true inner-group differences ($p \leq 0,05$); ² – available true inter-group differences ($p \leq 0,05$); PE – pedagogical experiment; CSE – coefficient of speed endurance; IPCW – index of phosphocreatine workability.

According to this, the efficiency of kickboxers’ training activity using two programs (traditional and experimental) was proved. When doing this test with hands, true increases were registered for all indices and qualified kickboxers from both experimental and control group. Increases ranged from 2.34% to 9.40% ($p \leq 0,05$) for qualified kickboxers of the control group and 3,86–12,42% ($p \leq 0,05$) – experimental group. For both groups, somewhat higher increases were registered by the indices of general number of blows in time span and “overall tonnage” of work.

The comparison of data by the “40 s” test (done with hands) before and after pedagogical experiment defined no true differences on the output level in most of indices (1,09–1,52%, $p > 0,05$). The data of “the index

of phosphocreatine workability” were an exception. So that, dominance of qualified kickboxers from the experimental group (3,36%, $p \leq 0,05$) was registered.

After the implementation of special physical training programs the number of such differences slightly increased for kickboxers from the experimental group. The dominance manifested itself in “overall tonnage” and increase of dominance in “the index of phosphocreatine workability” (3,88 and 4,89%, $p \leq 0,05$ compared to indices of athletes from the control group respectively).

According to the data of this test, done with legs, similar increases for inner-group indices of specific work were registered in “40 s” test. It has been revealed that as in the previous case, inner-group results by indices of the test increased ($p \leq 0,05$) in both groups (experimental and control).

Values of these increases were 11,25% (CG) and 15,45% (EG) by overall number of kicks within a time span; 10,75% (CG) and 14,78% (EG) – “overall tonnage”; 5,81% (CG) and 8,14% (EG) – “work power”; 7,02% and 10,48% - “coefficient of speed endurance”; 5,95% and 8,37% - “index of glycolytic capacity for work”.

Discussion

Most of scientific and methodological papers indicated by researchers were written before introduction of changes of competition rules (Ostianov, Haidamak, 2001; Ostianov, Hryb, 2011; Boostani M.A., Boostani M.H., Nowzari, 2012). In July 2013, new rules for kickboxing competitions were adopted. This boosted scientific research of the analysis of competition activity of kickboxers and factors of ensuring its efficiency, namely improvement of leading manifestations of special physical preparedness of kickboxers for efficient realization of technical and tactical excellence. With no true differences (0,42–2,96%, $p > 0,05$) on the output level, traditional comparison of indices of qualified kickboxers from control and experimental groups before and after pedagogical experiment revealed dominance of representatives of experimental group after completion of this stage of research. This prevalence was localized in “overall tonnage” of workload, “coefficient of speed endurance”, and “index of glycolytic capacity for work” (4,43; 3,67 and 2,79% at $p \leq 0,05$ for all values).

Thus, generalizing data of this subdivision, we may assume that application of the program of special physical training of qualified kickboxers at the stage of specialized basic training taking into account dominants of technical and tactical actions has slightly higher values in increase indices on inter-group level at relatively equal number of such indices, by which improvements were made. At the same time, application of this program gives new possibilities for more quality improvement of the results of specific “8 s” and “40 s” tests done with the help of upper and lower limbs, as shown above.

Moreover, the results of pedagogical experiment enabled to define some accents which should be taken into account within training process of particular sportsman. They are connected with the indexes of special physical preparedness for representatives of different tactical styles.

According to the results of the pedagogical experiment, it was found that:

- the special physical training of "play-runners" should be aimed at the solvation of the following tasks: improvement of attacking actions performed from a great distance; improving the movement in different directions of the ring; improvement of serial attacks, changing the pace and protecting the stands; improvement of explosive and attacking actions; improvement of various methods of tactical training with repeated attack and false movements; improvement of the ability to use the opponent's mistakes in the match with the use of counterattacking actions; conducting duels taking into account the opponents; peculiarities of (fast, technical, strong opponent).

- the tasks in the special physical training of "tempo-runners" should include: improving attacking actions in a duel with a middle and close distance; improvement of protective actions opposite to attacking actions from different distances; improvement of counterattacking actions taking into account the attacking actions of the opponent; improvement of general and special endurance; improvement of impact actions (maximum number of strokes) with the maximum speed of their drawing in a bout; improvement of combative techniques in exercises with acceleration, reaching maximum speed; improving attacks and counterattacks at different distances; conducting bouts with accounting the opponents' peculiarities (fast, technical, strong opponent).

- the tasks in the special physical training of "knock-outers": improvement of the attacking action with the maximum impact that is carried out from a great distance; improvement of protective actions from receptions with shock actions, which were carried out from different distance; enhancement of counterattacks taking into account the opponent's attack in the fight; Improving the strength and accuracy of impact on shells and pairs; improvement of the maximum strong actions that affect the accuracy and strength of the strike; conducting duels taking into account the opponents' peculiarities (fast, technical, strong opponent).

Conclusions

1. Educational and training activity of qualified kickboxers at the stage of specialized basic training, namely special physical training, must be subordinated to program and normative requirements (implemented via studying the content of curriculum for Children's and Youth Sports School of Olympic Reserve), development of this kind of sport (analysis of changes in rules), tendencies and specific features of competition activity (analysis of structure and content), level of athlete's special physical preparedness etc.

2. In general, dominance ($p \leq 0,05-0,01$) of qualified kickboxers from experimental group over the ones from the control group at the stage of specialized basic training via means of the program of individualization of special physical training was seen in the following indices: "index of phosphocreatine workability" while working with hands in "8 s" test - 4,55%; overall number of kicks and "tonnage" in "8 s" test - 3,00-9,86%; "tonnage" and "index of glycolytic capacity for work" while working with hands in "40 s" test - 3,88-4,89%; "tonnage", "work power", "coefficient of speed and power endurance", and "index of glycolytic capacity for work" - 2,79-4,43% of the respective index of control group.

3. The range of tasks proposed within special physical training for representatives of three individual styles: "knock-outer", "tempo-runner" and "play-runner" should be different. They consist in using different distances, combinations of attacks and counterattacks, range of special exercises.

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