

IMPROVEMENT OF THE STRUCTURE AND CONTENT OF AN ANNUAL TRAINING MACROCYCLE FOR YOUNG PANKRATION ATHLETES

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Abstract

The study objective is to improve the structure and content of the annual training macrocycle for athletes aged from 15 to 16 years old in pankration, taking into account the specifics of their competitive performance.

Materials and methods. Theoretical analysis and generalization were used during work with literary sources on the problems of the research. Survey (questionnaire) was used for studying general approaches to the structure and content of young athletes' training (aged from 15 to 16 years old) in pankration. There were also analyzed official programs for experienced pankration athletes which are used in Ukraine. Pedagogical experiment was held during September 2018 – July 2019. Its total duration was 10 months and 906 hours. Two identical six-month training macrocycles were performed. The control (21 athletes) and experimental (22 athletes) groups were formed.

Results. It was more effective for the development of technical and tactical actions and special physical fitness of young athletes aged from 15 to 16 years old. It was confirmed by significant intra-group increases in indicators of athletes' preparedness ($p \leq 0.05-0.01$). The total number of significant changes in the experimental group ($p \leq 0.05-0.01$) during the first and second stages of the experiment was 12 of 13 indicators, and their values were higher than in the control group. In the control group, significant positive changes ($p \leq 0.05-0.01$) were found in 6 indicators during the first stage of the experiment and 8 – during the second one. After the second stage of the experiment athletes of the experimental group performed about half of the technical and tactical actions with a higher level of stability, economy, efficiency in various situations during sparring matches.

Conclusions. An experimental program made it possible to achieve an earlier deployment of adaptation processes to the specific physical activity available in training and competitive activities in pankration.

Keywords: pankration, macrocycle, experimental program, training, athletes.

Introduction

Problem statement. Mixed martial arts become more and more popular all over the world. The basis of technique in mixed martial arts is a combination of elements taken from different kinds of classical wrestling (Greco-Roman and freestyle wrestling, judo, jujutsu, etc.) and traditional combat sports (boxing, kickboxing, taekwondo karate, etc.) (Del Vecchio, Hirata, & Franchini, 2011; Tota, Drwal, Maciejczyk, Szyguła, Pilch, Pałka, & Lech, 2014; Marchenko &

Bezpalco, 2020). Instead of Olympic combat sports, scientific information concerning mixed martial arts at the national level is significantly limited (Marinho, Follmer, Del Conti Esteves, & Andreato, 2016; Skrypka, & Cherednichenko, 2018; Nakonechny, 2020).

Analysis of recent research and publications. In modern scientific works, the issues of pankration have been studied fragmentally. At the same time, some scientists emphasize the importance of composition the proper training process (Del Vecchio, Hirata, & Franchini, 2011; Menescardi, & Estevan, 2017; Sogor & Pityn, 2018). According to them, adequate training process should include the improvement of special physical qualities, technical elements (professional

and applied aspects such as punches, kicks and wrestling elements) (Bridge, Ferreira da Silva Santos, Chaabène, Pieter, & Franchini, 2014; Marchenko & Satdyiev, 2021), development of moral qualities and psychological states (Garanin & Kuznetsov, 2015; Radchenko, 2015; Biletsky & Ponomarev, 2017). In general, the authors point out that achieving a high level of athlete's performance in pankration is impossible without self-regulation, internal self-discipline, balance, restraint.

It is mentioned that the first step to high achievements in pankration is the development of physical skills in combination with psychological qualities. Such an approach allows demonstrating the best results in the competitions of different level (Wojciech, Jong-Hoon, & Przemyslaw, 2017; Meyer, 2018; Prystupa, Okopnyy, Hutsul, Khimenes, Kotelnik, Hryb, & Pityn, 2019). The basis of training for adult pankration athletes was discussed in works by (López-López, Menescardi, Estevan, Falcó, & Hernández-Mendo, 2015; Menescardi, Lopez-Lopez, Falco, Hernandez-Mendo, & Estevan, 2015). The main accent was made on studying combinations which consisted of punches (hand strikes) and wrestling elements. López-López, Menescardi, Estevan, Falcó, and Hernández-Mendo (2015) and Menescardi, Lopez-Lopez, Falco, Hernandez-Mendo, and Estevan (2015) emphasizes that in mixed combat sports fighters usually develop their skills by performing classic sports (boxing, kickboxing or wrestling) and then try to adapt them to the rules of particular mixed combat sports (Zadorozhna, Briskin, Pityn, Smyrnovskyy, Semeryak, Khomiak & Hlukhov, 2020). In our opinion, this approach to the athletes' long-term development is not scientifically and methodologically justified (Sasanfar, Pourkiani, & Sasanfar, 2011; Meyer, 2018) and doesn't take into account peculiarities of particular kinds of mixed sports.

At the same time, recent changes in pankration rules (Arvanitis, 2019; Georgiou, 2005) are aimed at distinguishing technical and tactical actions in the competitive activities of different disciplines (grappling, full and traditional), which affects the specialization of the athletes' long-term training process.

In pankration the specifics of training process for athletes aged from 15 to 16 years old should be seen in the need to redistribute the training load between general and special training, widespread use of exercises in related sports with a transition to a narrower specification of the structure and content of training, taking into account the requirements of modern competition rules (Arvanitis, 2019). That is why, our research is actual.

The article's goal deals to improve the structure and content of the annual training macrocycle for athletes aged from 15 to 16 years old in pankration, taking into account the specifics of their competitive performance.

Materials and methods

Study participants

Our research included few stages. Theoretical analysis and generalization were used during work with literary sources on the problems of research. Survey (questionnaire) was used for studying general approaches to the structure and content of young athletes' training (aged from 15 to

16 years old) in pankration. There were also analyzed official programs for experienced pankration athletes which are used in Ukraine (Pankration, 2010).

The next step of the research was pedagogical observation. There was compared competitive activity of two groups of sportsmen – 15-16 years old and elite fighters (middle weight categories, adult athletes). The observation aimed to determine the difference between competition performances of athletes with different experience. There were made several conclusions on the content and structure of competition performance and expediency of studying different technical elements by athletes aged 15-16 years old depending on their effectiveness for adult fighters and at higher level competitions.

The analysis of athletes' performance at the age of 15-16 years was conducted at Ukrainian National Championship and official Ukrainian tournaments in Sumy, Chernivtsi, Lviv in 2017. There were analyzed 25 fights of athletes in medium weight categories, beginning from the stage of ¼ final. As for adult athletes (middle weight categories), we analyzed 25 fights of the World Pankration Championship, which took place from 09/29/2016 to 10/02/2016 in Georgia. The detailed analysis and comparison of these results are represented in previous papers (Sogor & Pityn, 2018).

The next step was a survey. We recruited 16 coaches (their average age was $31,31 \pm 4,76$ years old, an average experience in pankration training – $7,63 \pm 3,95$ years). The questionnaire included different types of questions concerning the structure and content of training process for young pankration athletes. It was found that at the age of 15-16 years old athletes should attend 6 training sessions per week (46.67% of coaches confirmed this fact). 75.0 % of coaches indicated that training session should last during 120 minutes. 93.75% of coaches are assured that athletes should use exercises from related sports which are basis of technique in pankration. Sparring as a training method should be used once per week (62.50% of coaches). 56.25% indicated the need for parallel training and improvement of punch elements (hand strikes) and wrestling actions. Another 31.25% of respondents focus only on wrestling and one respondent indicated the priority of improving punch technique.

Study organization

This information was the basis of the experimental program. Pedagogical experiment was held during September 2018 – July 2019. Its total duration was 10 months and 906 hours. Two identical six-month training macrocycles were performed. The control (21 athletes) and experimental (22 athletes) groups were formed. We used three identical testing sessions at the beginning of the first macrocycle (before experiment), between training macrocycles (in the middle of experiment) and at the end of the annual training (after experiment).

We redistributed the load and offered 160 hours for selective training of technical elements. Selective improvement of tactical training was carried out within 70 hours. This formed a reserve of 110 hours, which we proposed to allocate for the use of combined technical and tactical training.

We have proposed a similar approach for athletes' physical training. General physical training lasted during 50 hours, special physical training – during 70 hours, and

for the means of combined action with technical and tactical training – 40 hours.

The next difference between the traditional and author's programs in pankration was reduction of hours used for control standards for technical training and tests for general and special physical fitness (by 20 and 30 hours respectively) (Kostikiadis, Methenitis, Tsoukos, Veligekas, Terzis, & Gregory, 2018). We also reduced the number of classes using swimming exercises, track-and-field, sports games etc., but added classes involving the exercises of more related to pankration sports (boxing, wrestling, kickboxing, etc.) (Marinho, Del Vecchio, & Franchini, 2012; Khudolii, Ivashchenko, Iermakov, Veremeenko, & Lopatiev, 2019; Prystupa, Okopnyy, Hutsul, Khimenes, Kotelnik, Hryb, & Pityn, 2019).

In addition, we used the same amount of hours (140 hours) for sparring matches, but the main accent was made on the planned fights, when an athlete has special tactical and technical scheme for every sparring depending on the opponent (in traditional program the main accent is made on free fighting and control bouts).

To compare the results in the control and experimental groups before, in the middle and after experiment we used different types of tests: for general physical fitness, special physical fitness, psychophysiological reactions, technical and tactical skills.

Special physical fitness was estimated in such exercises:

- rope-climbing (5-meter rope) at standing position without the help of legs was used to determine speed and strength endurance;
- burpee test (number of repetitions during 30 seconds) was conducted to determine speed and strength endurance. The athlete performed as quickly as possible consistently squatting – lying down – squatting – starting position;
- squats with a 20 kg disk (number of repetitions during 60 seconds) were used to determine special endurance of the muscles of the upper and lower extremities;
- rotation with a 20 kg disk (number of repetitions during 60 seconds) – to determine the special endurance of the muscles of the arms and torso;
- imitation of passages in the legs with pulling partner with shock-absorbing rubber (number of repetitions during 60 seconds);
- the pull of the damping rubber (number of repetitions during 60 seconds) was used to determine the speed and strength endurance of the torso muscles. The athlete stands at a certain distance from the fixed shock-absorbing rubber so as to obtain individually optimal tension and performs twisting of the torso (alternately to the right and left) at the maximum speed for himself for 1 minute. To estimate technical and tactical skills we used such tests:

- “Drill №1” – a complex of subsequent technical and tactical actions with a limit of performance by 10 times. The complex includes such pain techniques at a fast pace: “armbar” (bottom of the guard), “triangle” (bottom of the guard), “kimura” (bottom of the guard), passage of the guard, pain element on the leg (to Achilles Tendon from standing position). Time for series of identical receptions and the general time of continuous performance was registered;
- “Drill №2” (“dead zone”) – a complex of technical and tactical actions with a time limit of 180 seconds (number

of repetitions). The subsequence of actions was the same, but the partner could use painful or suffocating techniques with possible resistance;

- “Work on a bag” – series of exercises to determine the quantitative indicators of technical and tactical skills. Athletes carried out serial work to perform maximum speed strikes for 30 seconds. There were performed such strikes: 1 – work with hands (“jab”, back straight, side punches, etc.); 2 – footwork (“low kick”, “high kick”, “middle kick”, direct kick, etc.); 3 – combined work with hands and feet using the same punches;
- “Sparring duel with the task (free fight)”. It was proposed to perform consecutive sparring matches with several opponents lasting 3-5 minutes. The quality of technical and tactical actions was evaluated in conditions close to competition. The evaluation was conducted by three experts (coaches, adult qualified athletes) on external grounds (kinematic and dynamic characteristics of movements and their correctness). Grades were divided into “unsatisfactory” (gross errors, or action is not performed at the proper level), “satisfactory” (action is mostly consistent with the basic technique), “good” (action has minor errors, but may give preference to the athlete in a competitive match).

The study of psychophysiological indicators included: choice reaction time (a method of determining the reaction time to signals with the condition of analysis of their color and choice); distinction reactions as a kind of complex sensorimotor reaction, which involved clarifying it to one specific stimulus from several different stimuli; reactions on a moving object aimed at measuring the degree of balance of excitation and inhibition; tapping test as an express method of diagnosing the strength of nervous processes by measuring the dynamics of the pace of hand movements.

Statistical analysis

Statistical processing of the data was carried out on a computer using the standard STATISTICA 7.0 programs.

Results

To obtain objective information on the dynamics of indicators during the experiment, we used several blocks of test exercises (Tables 1-3).

As shown in Table 1, the indicators of hand-held dynamometry (wrist strength measurement of stronger hand) there are slight increases in the results during the research. Only some of them acquire reliable values ($p \leq 0.05$). For representatives of the experimental group at the first stage of the experiment, the changes were only 0.50% ($p > 0.05$) and the second – 6.91% ($p \leq 0.01$). For representatives of the control group for the first stage – 1.04% ($p > 0.05$) and for the second – 5.24% ($p \leq 0.01$).

A different situation was observed for the indicators of back extensor muscle dynamometry. Athletes of the experimental group in the first and second stages were able to increase the result by 1.26% ($p \leq 0.01$) and 2.27% ($p \leq 0.01$). Representatives of the control group did not experience significant changes during the first (0.62%) or during the second stage of the pedagogical experiment (0.41%).

In the exercise “a stuffed ball throwing” athletes of the experimental group improved the results by 6.92% ($p \leq 0.01$)

Table 1. General physical fitness of young pankration athletes during the experiment

Test		Indicators of general physical fitness						The difference between groups																																																																																																																																																																																																																																			
		before experiment		in the middle of experiment		after experiment		p*	p**	p***																																																																																																																																																																																																																																	
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Hand-held dynamometry (wrist strength measurement)	X	36.6	36.8	36.8	36.4	39.4	38.3	0.90	0.69	0.32																																																																																																																																																																																																																																	
	SD	3.4	2.5	3.4	2.3	3.1	2.8				Back extensor muscle strength test	X	183.6	186.3	186.0	187.4	190.2	188.2	0.15	0.40	0.24		SD	5.3	4.2	4.6	4.5	3.7	4.9	Standing long jump, cm	X	195.6	194.7	200.4	199.0	207.6	201.2	0.67	0.56	0.01		SD	5.7	5.5	7.1	5.4	7.6	4.7	A stuffed ball throwing, meters	X	12.7	12.9	13.6	13.3	14.2	13.7	0.68	0.17	≤0.01		SD	0.9	0.9	0.6	0.6	0.6	0.5	Running 1000 m, seconds	X	243.3	238.3	232.4	233.9	218.5	228.1	0.11	0.53	≤0.01		SD	9.5	7.2	6.8	6.5	4.3	6.2	Running 20 m, seconds	X	4.0	4.0	4.0	4.0	3.9	3.9	0.54	0.71	0.76		SD	0.1	0.1	0.1	0.1	0.1	0.1	Push-ups, number of repetitions	X	39.3	39.4	42.7	40.9	44.4	42.6	0.87	≤0.01	0.01		SD	2.9	2.4	1.2	2.0	1.7	1.7	Crunches, number of repetitions in 30 seconds	X	20.3	20.9	22.0	21.4	23.1	22.7	0.26	0.19	0.36		SD	1.4	1.4	1.3	1.2	1.3	1.2	Hanging on bent arms, seconds	X	22.9	27.7	28.5	30.4	34.0	32.8	≤0.01	0.24	0.38		SD	4.0	5.5	3.0	5.0	3.8	3.4	Chin-ups on a horizontal bar, number of repetitions in 30 seconds	X	13.3	13.9	14.7	15.0	16.7	15.7	0.18	0.44	0.11		SD	1.2	1.2	1.1	1.0	1.7	1.4	Shuttle run 4×9 meters (seconds)	X	10.0	10.0	9.9	9.9	9.7	9.8	0.40	0.78	0.11		SD	0.2	0.2	0.1	0.2	0.2	0.2	Torso tilt sitting, cm	X	4.2	5.1	6.7	5.9	8.0	7.5	0.14	0.12	0.55		SD	1.5	1.8	1.5	1.2	1.9	2.0	Twist the ruler behind the back, cm	X	49.0	45.3	45.9	44.3	40.5	40.4	≤0.01	0.10	0.91		SD	2.8	2.3	1.7
Back extensor muscle strength test	X	183.6	186.3	186.0	187.4	190.2	188.2	0.15	0.40	0.24																																																																																																																																																																																																																																	
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	SD	0.9	0.9	0.6	0.6	0.6	0.5				Running 1000 m, seconds	X	243.3	238.3	232.4	233.9	218.5	228.1	0.11	0.53	≤0.01		SD	9.5	7.2	6.8	6.5	4.3	6.2	Running 20 m, seconds	X	4.0	4.0	4.0	4.0	3.9	3.9	0.54	0.71	0.76		SD	0.1	0.1	0.1	0.1	0.1	0.1	Push-ups, number of repetitions	X	39.3	39.4	42.7	40.9	44.4	42.6	0.87	≤0.01	0.01		SD	2.9	2.4	1.2	2.0	1.7	1.7	Crunches, number of repetitions in 30 seconds	X	20.3	20.9	22.0	21.4	23.1	22.7	0.26	0.19	0.36		SD	1.4	1.4	1.3	1.2	1.3	1.2	Hanging on bent arms, seconds	X	22.9	27.7	28.5	30.4	34.0	32.8	≤0.01	0.24	0.38		SD	4.0	5.5	3.0	5.0	3.8	3.4	Chin-ups on a horizontal bar, number of repetitions in 30 seconds	X	13.3	13.9	14.7	15.0	16.7	15.7	0.18	0.44	0.11		SD	1.2	1.2	1.1	1.0	1.7	1.4	Shuttle run 4×9 meters (seconds)	X	10.0	10.0	9.9	9.9	9.7	9.8	0.40	0.78	0.11		SD	0.2	0.2	0.1	0.2	0.2	0.2	Torso tilt sitting, cm	X	4.2	5.1	6.7	5.9	8.0	7.5	0.14	0.12	0.55		SD	1.5	1.8	1.5	1.2	1.9	2.0	Twist the ruler behind the back, cm	X	49.0	45.3	45.9	44.3	40.5	40.4	≤0.01	0.10	0.91		SD	2.8	2.3	1.7	2.9	3.0	2.4																																																						
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	SD	9.5	7.2	6.8	6.5	4.3	6.2				Running 20 m, seconds	X	4.0	4.0	4.0	4.0	3.9	3.9	0.54	0.71	0.76		SD	0.1	0.1	0.1	0.1	0.1	0.1	Push-ups, number of repetitions	X	39.3	39.4	42.7	40.9	44.4	42.6	0.87	≤0.01	0.01		SD	2.9	2.4	1.2	2.0	1.7	1.7	Crunches, number of repetitions in 30 seconds	X	20.3	20.9	22.0	21.4	23.1	22.7	0.26	0.19	0.36		SD	1.4	1.4	1.3	1.2	1.3	1.2	Hanging on bent arms, seconds	X	22.9	27.7	28.5	30.4	34.0	32.8	≤0.01	0.24	0.38		SD	4.0	5.5	3.0	5.0	3.8	3.4	Chin-ups on a horizontal bar, number of repetitions in 30 seconds	X	13.3	13.9	14.7	15.0	16.7	15.7	0.18	0.44	0.11		SD	1.2	1.2	1.1	1.0	1.7	1.4	Shuttle run 4×9 meters (seconds)	X	10.0	10.0	9.9	9.9	9.7	9.8	0.40	0.78	0.11		SD	0.2	0.2	0.1	0.2	0.2	0.2	Torso tilt sitting, cm	X	4.2	5.1	6.7	5.9	8.0	7.5	0.14	0.12	0.55		SD	1.5	1.8	1.5	1.2	1.9	2.0	Twist the ruler behind the back, cm	X	49.0	45.3	45.9	44.3	40.5	40.4	≤0.01	0.10	0.91		SD	2.8	2.3	1.7	2.9	3.0	2.4																																																																									
Running 20 m, seconds	X	4.0	4.0	4.0	4.0	3.9	3.9	0.54	0.71	0.76																																																																																																																																																																																																																																	
	SD	0.1	0.1	0.1	0.1	0.1	0.1				Push-ups, number of repetitions	X	39.3	39.4	42.7	40.9	44.4	42.6	0.87	≤0.01	0.01		SD	2.9	2.4	1.2	2.0	1.7	1.7	Crunches, number of repetitions in 30 seconds	X	20.3	20.9	22.0	21.4	23.1	22.7	0.26	0.19	0.36		SD	1.4	1.4	1.3	1.2	1.3	1.2	Hanging on bent arms, seconds	X	22.9	27.7	28.5	30.4	34.0	32.8	≤0.01	0.24	0.38		SD	4.0	5.5	3.0	5.0	3.8	3.4	Chin-ups on a horizontal bar, number of repetitions in 30 seconds	X	13.3	13.9	14.7	15.0	16.7	15.7	0.18	0.44	0.11		SD	1.2	1.2	1.1	1.0	1.7	1.4	Shuttle run 4×9 meters (seconds)	X	10.0	10.0	9.9	9.9	9.7	9.8	0.40	0.78	0.11		SD	0.2	0.2	0.1	0.2	0.2	0.2	Torso tilt sitting, cm	X	4.2	5.1	6.7	5.9	8.0	7.5	0.14	0.12	0.55		SD	1.5	1.8	1.5	1.2	1.9	2.0	Twist the ruler behind the back, cm	X	49.0	45.3	45.9	44.3	40.5	40.4	≤0.01	0.10	0.91		SD	2.8	2.3	1.7	2.9	3.0	2.4																																																																																												
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	SD	2.9	2.4	1.2	2.0	1.7	1.7				Crunches, number of repetitions in 30 seconds	X	20.3	20.9	22.0	21.4	23.1	22.7	0.26	0.19	0.36		SD	1.4	1.4	1.3	1.2	1.3	1.2	Hanging on bent arms, seconds	X	22.9	27.7	28.5	30.4	34.0	32.8	≤0.01	0.24	0.38		SD	4.0	5.5	3.0	5.0	3.8	3.4	Chin-ups on a horizontal bar, number of repetitions in 30 seconds	X	13.3	13.9	14.7	15.0	16.7	15.7	0.18	0.44	0.11		SD	1.2	1.2	1.1	1.0	1.7	1.4	Shuttle run 4×9 meters (seconds)	X	10.0	10.0	9.9	9.9	9.7	9.8	0.40	0.78	0.11		SD	0.2	0.2	0.1	0.2	0.2	0.2	Torso tilt sitting, cm	X	4.2	5.1	6.7	5.9	8.0	7.5	0.14	0.12	0.55		SD	1.5	1.8	1.5	1.2	1.9	2.0	Twist the ruler behind the back, cm	X	49.0	45.3	45.9	44.3	40.5	40.4	≤0.01	0.10	0.91		SD	2.8	2.3	1.7	2.9	3.0	2.4																																																																																																															
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	SD	1.4	1.4	1.3	1.2	1.3	1.2				Hanging on bent arms, seconds	X	22.9	27.7	28.5	30.4	34.0	32.8	≤0.01	0.24	0.38		SD	4.0	5.5	3.0	5.0	3.8	3.4	Chin-ups on a horizontal bar, number of repetitions in 30 seconds	X	13.3	13.9	14.7	15.0	16.7	15.7	0.18	0.44	0.11		SD	1.2	1.2	1.1	1.0	1.7	1.4	Shuttle run 4×9 meters (seconds)	X	10.0	10.0	9.9	9.9	9.7	9.8	0.40	0.78	0.11		SD	0.2	0.2	0.1	0.2	0.2	0.2	Torso tilt sitting, cm	X	4.2	5.1	6.7	5.9	8.0	7.5	0.14	0.12	0.55		SD	1.5	1.8	1.5	1.2	1.9	2.0	Twist the ruler behind the back, cm	X	49.0	45.3	45.9	44.3	40.5	40.4	≤0.01	0.10	0.91		SD	2.8	2.3	1.7	2.9	3.0	2.4																																																																																																																																		
Hanging on bent arms, seconds	X	22.9	27.7	28.5	30.4	34.0	32.8	≤0.01	0.24	0.38																																																																																																																																																																																																																																	
	SD	4.0	5.5	3.0	5.0	3.8	3.4				Chin-ups on a horizontal bar, number of repetitions in 30 seconds	X	13.3	13.9	14.7	15.0	16.7	15.7	0.18	0.44	0.11		SD	1.2	1.2	1.1	1.0	1.7	1.4	Shuttle run 4×9 meters (seconds)	X	10.0	10.0	9.9	9.9	9.7	9.8	0.40	0.78	0.11		SD	0.2	0.2	0.1	0.2	0.2	0.2	Torso tilt sitting, cm	X	4.2	5.1	6.7	5.9	8.0	7.5	0.14	0.12	0.55		SD	1.5	1.8	1.5	1.2	1.9	2.0	Twist the ruler behind the back, cm	X	49.0	45.3	45.9	44.3	40.5	40.4	≤0.01	0.10	0.91		SD	2.8	2.3	1.7	2.9	3.0	2.4																																																																																																																																																					
Chin-ups on a horizontal bar, number of repetitions in 30 seconds	X	13.3	13.9	14.7	15.0	16.7	15.7	0.18	0.44	0.11																																																																																																																																																																																																																																	
	SD	1.2	1.2	1.1	1.0	1.7	1.4				Shuttle run 4×9 meters (seconds)	X	10.0	10.0	9.9	9.9	9.7	9.8	0.40	0.78	0.11		SD	0.2	0.2	0.1	0.2	0.2	0.2	Torso tilt sitting, cm	X	4.2	5.1	6.7	5.9	8.0	7.5	0.14	0.12	0.55		SD	1.5	1.8	1.5	1.2	1.9	2.0	Twist the ruler behind the back, cm	X	49.0	45.3	45.9	44.3	40.5	40.4	≤0.01	0.10	0.91		SD	2.8	2.3	1.7	2.9	3.0	2.4																																																																																																																																																																								
Shuttle run 4×9 meters (seconds)	X	10.0	10.0	9.9	9.9	9.7	9.8	0.40	0.78	0.11																																																																																																																																																																																																																																	
	SD	0.2	0.2	0.1	0.2	0.2	0.2				Torso tilt sitting, cm	X	4.2	5.1	6.7	5.9	8.0	7.5	0.14	0.12	0.55		SD	1.5	1.8	1.5	1.2	1.9	2.0	Twist the ruler behind the back, cm	X	49.0	45.3	45.9	44.3	40.5	40.4	≤0.01	0.10	0.91		SD	2.8	2.3	1.7	2.9	3.0	2.4																																																																																																																																																																																											
Torso tilt sitting, cm	X	4.2	5.1	6.7	5.9	8.0	7.5	0.14	0.12	0.55																																																																																																																																																																																																																																	
	SD	1.5	1.8	1.5	1.2	1.9	2.0				Twist the ruler behind the back, cm	X	49.0	45.3	45.9	44.3	40.5	40.4	≤0.01	0.10	0.91		SD	2.8	2.3	1.7	2.9	3.0	2.4																																																																																																																																																																																																														
Twist the ruler behind the back, cm	X	49.0	45.3	45.9	44.3	40.5	40.4	≤0.01	0.10	0.91																																																																																																																																																																																																																																	
	SD	2.8	2.3	1.7	2.9	3.0	2.4																																																																																																																																																																																																																																				

Legend: CG – control group; EG – experimental group; p* – the difference between experimental and control groups before experiment; p** – the difference between experimental and control groups in the middle experiment; p*** – the difference between experimental and control groups after experiment.

and 4.47% ($p \leq 0.01$) in the first and second stages of the pedagogical experiment. Athletes of the control group were inferior to their colleagues in percentage terms. The results increased by 3.25% and 2.90% (in both cases $p \leq 0.01$).

In the test “Running 20 m” the changes in the experimental group were 1.15–2.14% ($p > 0.05$) and the control 1.06–1.20% ($p > 0.05$). At all stages there were no significant differences, the advantage in results was 0.37–0.67% ($p > 0.05$) in favor of one or another group of athletes.

In the test “Push-ups” we observed significant changes in the experimental group for the first stage by 8.80% ($p \leq 0.01$) and for the second – 3.83% ($p \leq 0.01$). Similar trends were observed in the control group.

Athletes of the experimental group significantly improved their results in the test “Crunches” both on the first (8.74%, $p \leq 0.01$) and on the second (4.74%, $p \leq 0.01$) stages of experiment. Similarly, the representatives of the control group in the first stage improved the results in this exercise by 2.58% ($p > 0.05$) and the second – 5.78% ($p \leq 0.01$).

In the test “Chin-ups on a horizontal bar” at the first stage of the study sportsmen of the experimental group were able to improve their results by 10.58% ($p \leq 0.01$) and in the second – by 13.27 ($p \leq 0.01$). Their colleagues from the

control group in the first stage improved the results by 8.58% ($p = 0.02$) and in the second – by 4.43% ($p = 0.17$).

During all stages of testing there were no significant changes ($p > 0.05$) for athletes of both groups in the test “Shuttle run 4×9 meters”.

When determining the flexibility of the spine and hip joints and mobility in the shoulder joints during the first stage of the experiment, the athletes of the experimental group improved the result by 59.14% ($p \leq 0.01$), and the control – 18.02% ($p = 0.21$). At the second stage of the experiment, the representatives of both groups were able to significantly increase their results, the experimental group – by 18.24% ($p \leq 0.05$), and the control – 27.42% ($p \leq 0.05$).

When testing the mobility in the shoulder joints, it was found that the representatives of the experimental group significantly improved their results – by 6.40% ($p \leq 0.01$) after the first and 11.60% ($p \leq 0.01$) after the second stage of the experiment. For athletes in the control group, the values of improvement were also high, the first stage – by 2.04 ($p > 0.05$) and the second – 8.81% ($p \leq 0.01$).

The indicators of special physical fitness of young athletes aged from 15 to 16 years old in pankration during the experiment in both groups were the following (Table 2).

Table 2. Special physical fitness of young pankration athletes during the experiment

Test		Indicators of special physical fitness						The difference between groups		
		before experiment		in the middle of experiment		after experiment		p*	p**	p***
		EG	CG	EG	CG	EG	CG			
Rope-climbing, seconds	X	17.1	16.4	15.0	15.2	14.0	14.6	0.19	0.49	0.09
	SD	1.3	1.4	0.8	0.8	1.0	0.9			
Burpee test, number of repetitions in 60 seconds	X	12.5	12.9	13.7	13.6	14.7	14.1	0.35	0.74	0.07
	SD	1.0	1.3	0.9	1.0	0.9	0.9			
Squats with a 20 kg disk, number of repetitions in 60 seconds	X	23.4	23.5	26.0	24.1	26.7	24.7	0.92	0.01	≤0.01
	SD	1.7	1.8	1.8	1.3	1.4	1.1			
Rotation with a 20 kg disk, number of repetitions in 60 seconds	X	19.7	19.8	22.3	21.6	23.2	22.9	0.84	0.27	0.49
	SD	1.7	1.5	1.8	1.2	1.4	1.2			
Imitation of passages in the legs with pulling partner, number of repetitions in 60 seconds	X	9.1	10.8	11.1	12.4	13.1	12.7	≤0.01	≤0.01	0.27
	SD	1.0	1.4	1.3	1.0	0.9	1.1			
Pull of the damping rubber, number of repetitions in 60 seconds	X	41.5	42.4	43.6	43.2	46.5	44.6	0.29	0.63	0.02
	SD	2.2	2.1	1.9	1.7	2.2	1.8			

Legend: CG – control group; EG – experimental group; p* – the difference between experimental and control groups before experiment; p** – the difference between experimental and control groups in the middle experiment; p*** – the difference between experimental and control groups after experiment.

Table 3. Psychophysiological indicators of young pankration athletes during experiment

Test		Psychophysiological indicators						The difference between groups		
		before experiment		in the middle of experiment		after experiment		p*	p**	p***
		EG	CG	EG	CG	EG	CG			
Choice reaction time, seconds	X	336.0	323.2	329.4	323.2	326.7	319.7	0.42	0.66	0.65
	SD	40.9	42.0	38.8	36.2	39.0	41.4			
Distinction reaction time, seconds	X	352.9	346.7	344.4	345.0	344.0	341.9	0.56	0.95	0.84
	SD	29.2	23.2	28.9	20.5	29.6	24.5			
Reaction on a moving object, seconds	X	0.4	0.4	0.9	0.6	0.1	1.0	0.30	0.66	0.20
	SD	2.3	1.9	1.7	1.6	1.8	2.2			
Exact reproductions	X	12.6	12.0	15.0	12.3	18.3	11.3	0.56	≤ 0.01	≤ 0.01
	SD	2.5	2.6	2.8	1.4	2.4	1.6			
Tapping test	X	243.3	259.0	253.5	261.6	281.2	273.8	0.38	0.56	0.63
	SD	45.0	45.8	35.6	36.5	45.7	37.6			

Legend: CG – control group; EG – experimental group; p* – the difference between experimental and control groups before experiment; p** – the difference between experimental and control groups in the middle experiment; p*** – the difference between experimental and control groups after experiment.

As shown in Table 2, the highest increase in the experimental group was indicated in test “Imitation of passages in the legs with pulling out a partner” – 21.39%; “Rotation with a 20 kg disk” – 13.16%; “Rope-climbing” – 12.50%. Slightly lower results were observed in other tests (“Burpee test”, “Squats with a 20 kg disk”, “The pull of the damping rubber”). They amounted to 5.04-11.07% of the initial level. In the second stage, the experimental group for most indicators showed an increase in results from 6.67 to 18.03% ($p \leq 0.01$). The exception was the control exercise “Squats with a 20 kg disk” – 2.80% ($p = 0.06$).

As for the control group, at the first stage of the experiment, significant changes at the level of $p \leq 0.01$ were received only in four exercises: “Rope-climbing”, “Burpee test”, “Rotation with a 20 kg disk”, “Imitation of passages in the legs with pulling out a partner”. Their values ranged from 5.33 to 17.72%. In the second stage of the experiment the

results were improved only in three of the six tests (“Rope-climbing”, “Rotation with a 20 kg disk”, “Pull of the damping rubber”). The positive changes were 3.08–5.73% ($p \leq 0.01$). According to other tests, the changes were not statistically confirmed and amounted to 2.17–3.86% ($p > 0.05$).

There were also found some positive changes in athletes’ psychophysiological characteristics (Table 3).

At the first stage of the study athletes of the experimental group showed significant increases in the results ($p \leq 0.01$) in such tests: “Choice reaction time”, “Reaction on a moving object” and “Distinction reaction time” from 1.98% to 19.06%. At the second stage, the changes were in “Exact reproductions test”, “Reaction on a moving object” (21.45%, $p \leq 0.01$) and “Taping test” (10.94%, $p \leq 0, 01$).

In the control group at the first stage of the experiment athletes did not achieve a significant increase in any test. The

Table 4. Technical and tactical preparedness of young pankration athletes during the experiment

Test	Indicators of technical and tactical preparedness						The difference between groups			
	before experiment		in the middle of experiment		after experiment		p*	p**	p***	
	EG	CG	EG	CG	EG	CG				
Drill №1	X	230.5	225.6	219.3	221.0	210.6	216.3	0.01	0.33	≤ 0.01
	SD	4.7	4.8	4.1	4.3	5.8	3.7			
Drill №2	X	14.9	15.4	16.7	15.6	17.9	16.3	0.14	0.01	≤ 0.01
	SD	0.8	1.0	1.3	1.0	1.3	1.2			
Work on a bag with hands, number of repetitions in 30 seconds	X	19.0	19.9	20.7	21.0	22.2	21.0	0.14	0.53	≤ 0.01
	SD	1.2	1.8	1.1	1.3	1.2	1.2			
Work on a bag with feet, number of repetitions in 30 seconds	X	13.3	13.7	14.8	14.7	15.3	15.0	0.34	0.86	0.33
	SD	1.1	1.2	0.9	0.8	0.9	0.9			
Combined work with hands and feet, number of repetitions in 30 seconds	X	21.0	20.2	22.2	21.9	23.2	22.6	0.09	0.40	0.16
	SD	1.2	1.0	1.2	1.2	0.9	1.1			

Legend: CG – control group; EG – experimental group; p* – the difference between experimental and control groups before experiment; p** – the difference between experimental and control groups in the middle experiment; p*** – the difference between experimental and control groups after experiment.

relative values ranged from 0.01 to 2.26% (the difference was from 0.46 to 0.98). However, at the second stage of the experiment they managed to improve the results of most psychophysiological tests. Significant changes were found for the “Reactions on a moving object” ($p = 0.03$) and “Tapping Test” ($p \leq 0.01$) with relative values of 4.64%. According to other tests, the changes ranged from 0.91 to 8.49 ($p = 0.08$ to 0.28).

We also estimated technical and tactical preparedness of athletes in both groups (Table 4).

The highest increase in the experimental group was found in Drill №2 (“dead zones”), which was 12.20% of the initial level ($p \leq 0.01$). The same level of confidence ($p \leq 0.01$) was observed in the results for other exercises, although their values were slightly lower from 4.83% to 10.92%. In the second stage, the growth rates were slightly lower, but still significant ($p \leq 0.01-0.05$). In all tests the increase ranged from 3.69% to 7.47% and the highest values were found in the results of Drill №2 and Work on a bag with hands – 7.07% and 7.49% respectively.

There were also significant positive changes in most tests in the control group. The highest increase was observed in combined work with hands and feet (7.71%, $p \leq 0.01$) and Drill №1 (2.00%, $p \leq 0.01$). The same concerned the work on a bag with hands (6.02%, $p \leq 0.05$) and feet (7.51%, $p \leq 0.01$). However, in the second stage of the experiment, the values of reliability were lower. Thus, significant indicators were available only for the Drill №1 (2.11%, $p \leq 0.01$) and combined work with hands and feet (3.49%, $p = 0.02$). As for other tests, during the second stage of the experiment, the changes were insignificant ($p = 0.07-0.87$) and the percentage values ranged from 0.23 to 4.27%.

In addition, we used special training sparring match with the task for assessment of athletes’ technical and tactical skills. It was discovered that at the first stage of the study the athletes of the experimental group have significant changes in six of the eight indicators. Sportsmen have become more successful in “low kick” (by 15.34%, $p \leq 0.01$). As for other technical and tactical actions, the percentage values of improvement ranged from 4.17% to 8.67% at $p \leq 0.01-0.03$. At the second stage of the experiment, significant changes were

found in “throws through the thigh”, throws “hook”, types of suffocating from the back and pain actions on the knee and leg – from 8.51% to 13.44% with values of $p \leq 0.02$.

In the control group at the first stage of the research we received positive changes in seven of the eight indicators. The exception was the performance of throws “hook” where the changes were within 3.03% ($p = 0.09$) in comparison with the initial data. For all other indicators, the improvement in the quality of technical and tactical actions ranged from 4.82% to 11.06% ($p \leq 0.01-0.03$) in comparison with the initial data. At the second stage of the pedagogical experiment, there were no significant positive changes in any of such indicators. All assessments ranged from 0.57 to 11.70% of the level in the middle of the pedagogical experiment ($p = 0.09-0.90$).

Discussion

Pankration as a kind of mixed martial sports becomes more and more popular, especially in Ukraine. However, a lot of issues are still described fragmentally (Sasanfar, Pourkiani & Sasanfar, 2011; Marinho, Del Vecchio & Franchini, 2012; Nakonechny, 2020). First of all, it concerns the composition of long-term training process and development of different sides of athletes’ preparedness: physical skills, technical and tactical mastership, psychological qualities, etc. In our opinion, the main problem is the fact that main approaches to the development of athletes’ preparedness are accommodated from other martial arts. On the one hand, technique and tactics in pankration are similar to classic combat sports (boxing, kickboxing or wrestling). On the other hand, competition rules are different, that is why the requirements for the level of technical and tactical actions and their arsenal are different (Arvanitis, 2019).

Analysis of official programs for sports clubs indicated the presence of some shortcomings in the construction of the training process for athletes aged from 15 to 16 years old. In the future, these shortcomings may lead to the impossibility of achieving high results in competitions of various levels, because the adaptive capabilities of young athletes were not developed in time and in adequate manner (Karpowicz, &

Karpowicz, 2013; Koryagin, Blavt, & Grebinca, 2016). To avoid this, we have developed author's training program and verified it in the pedagogical experiment. The obtained data allowed us to make conclusions on the dynamics of athletes' preparedness during an annual macrocycle and to compare its' influence with the traditional one.

According to many experts in martial arts and other sports, it is quite difficult to influence on the speed qualities of athletes (Garanin & Kuznetsov, 2015; Artioli, Gualano, Franchini, Batista, Polacow, Lancha, 2009; Biletsky & Ponomarev, 2017). We can confirm this data with the obtained results. As for other indicators of general physical preparedness, they increased both in the experimental and control groups. During the first stage of experiment the increase of results in most tests was significant in both groups. Instead, during the second stage of experiment the level of general physical fitness of in both groups remained stable. In addition, the priority should be given to improvement of speed and strength. This situation is typical not only for pankration, but also for other kinds of martial arts (Tota, Drwal, Maciejczyk, Szyguła, Pilch, Pałka, & Lech, 2014; Meyer, 2018; Prystupa, Okopnyy, Hutsul, Khimenes, Kotelnik, Hryb, & Pityn, 2019).

During the first stage of study in the experimental group there were positive changes in all indicators of special physical fitness. The reliability of changes was at a high level ($p \leq 0.01$). It is interesting that intra-group changes were more significant in the experimental program in comparison with the control group. This allows asserting the pronounced effectiveness of author's training program, which takes into account the current trends in competitive activities and the recommendations of experts.

In our opinion, certain differences in the results obtained by athletes of the control and experimental groups during the first and second stages of experiment are connected with increasing requirements for athletes' technical and tactical training. That is, in the case of athletes of the experimental group managed to maintain a positive dynamics of growth in the second stage, although their values were slightly lower in the first stage of the experiment. At the same time, the athletes of the control group, having higher positions during the first stage, could not, to some extent, maintain the growth rate in the second part of the pedagogical experiment, which was reflected in the relevant assessments for technical and tactical actions.

Another confirmation of the effectiveness of the author's program is the fact that after the second stage of the experiment athletes of the experimental group performed about half of the technical and tactical actions with a higher level of stability, economy and efficiency in various situations during sparring matches.

Conclusions

Pankration as a kind of mixed martial sports becomes more and more popular, especially in Ukraine. However, a lot of issues are still described fragmentally. One of the main problems is composition of training process for young athletes.

An experimental program made it possible to achieve an earlier deployment of adaptation processes to the specific physical activity available in training and competitive activi-

ties in pankration. It was more effective for the development of technical and tactical actions and special physical fitness of young athletes aged from 15 to 16 years old. It was confirmed by significant intra-group increases in indicators of athletes' preparedness ($p \leq 0.05-0.01$).

The total number of significant changes in the experimental group ($p \leq 0.05-0.01$) during the first and second stages of the experiment was 12 of 13 indicators, and their values were higher than in the control group. In the control group, significant positive changes ($p \leq 0.05-0.01$) were founding 6 indicators during the first stage of experiment and 8 – during the second one.

Conflicts of interest

The authors declare that they have no competing interests.

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ВДОСКОНАЛЕННЯ СТРУКТУРИ І ЗМІСТУ РІЧНОГО НАВЧАЛЬНОГО МАКРОЦИКЛУ ДЛЯ ЮНИХ СПОРТСМЕНІВ У ПАНКРАТІОНІ

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Авторський вклад: А – дизайн дослідження; В – збір даних; С – статаналіз; D – підготовка рукопису; Е – збір коштів

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Мета дослідження – розвідка вдосконалення структури та змісту щорічного тренувального макроциклу для юних спортсменів 15-16 років у панкратіоні з урахуванням особливостей їх змагальних результатів.

Матеріали та методи. Теоретичний аналіз та узагальнення використовувались під час роботи з літературними джерелами над проблемою дослідження. Опитування (опитувальник) було використано для вивчення загальних підходів до структури та змісту підготовки юних спортсменів (15-16 років) у панкратіоні. Також були проаналізовані офіційні програми для досвідчених спортсменів з панкратіону, які використовуються в Україні. Педагогічний експеримент, тривалістю 10 місяців 906 годин проводився протягом вересня 2018 р. – липня 2019 р. Були проведені два однакові шестимісячні тренувальні макроцикли. У дослідженні приймали участь контрольна (21 спортсмен) та експериментальна (22 спортсмени) групи.

Результати. Експериментальна програма виявилась ефективною у розвитку техніко-тактичних дій та спеціальної фізичної підготовленості юних спортсменів

(15-16 років). Це було підтверджено значним підвищенням показників підготовленості спортсменів у межах групи ($p \leq 0,05-0,01$). Загальна кількість значущих змін в експериментальній групі ($p \leq 0,05-0,01$) протягом першого та другого етапів експерименту становила 12 із 13 показників, і їх значення були вищими, ніж у контрольній групі. У контрольній групі значущі позитивні зміни ($p \leq 0,05-0,01$) були виявлені у 6-ти показниках на першому етапі експерименту та 8-ми – на другому. Після другого етапу експерименту спортсмени експериментальної групи виконали близько половини техніко-тактичних дій з більш високим рівнем стійкості, економічності, ефективності в різних ситуаціях під час спаринг-поєдинків.

Висновки. Експериментальна програма дозволила досягти більш раннього розгортання процесів адаптації до конкретних фізичних навантажень, доступних під час тренувань та змагальних занять з панкратіону.

Ключові слова: панкратіон, макроцикл, експериментальна програма, тренування, спортсмени.

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