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Increasing the functional capabilities of Mixed Martial Arts athletes in the process of optimizing different regimes of power load

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Authors' Contribution: A – Study design; B – Data collection; C – Statistical analysis; D – Manuscript Preparation; E – Funds Collection

Abstract

Background and Study Aim	To study the influence of power load regimes different in energy supply and intensity on functional capabilities of Mixed Martial Arts (MMA) athletes.
Material and Methods	We examined 75 men aged 19±0.7 who had been practicing MMA for 4±0.8 years. The athletes were divided into 3 groups, 25 participants in each group. The study participants used power load regimes of different intensity in conditions of anaerobic-glycolytic and anaerobic-alactate energy supply of muscle activity. The study lasted 12 weeks. To assess the functional capabilities of athletes in these conditions we used the method of maximum strength development (1 RM). Control of biochemical blood parameters (creatinine, lactate dehydrogenase, testosterone) allowed determining features of adaptive and compensatory body reactions in response to loads.
Results	During the study the 3rd group athletes showed the most pronounced increase (by 40.1%; $p<0.05$) in strength capabilities development. These changes were observed in conditions of anaerobic-alactate mechanism of energy supply. The smallest dynamics in the studied indicators was fixed in group 1 athletes. They used low-intensity training loads in conditions of anaerobic-glycolytic mechanism of energy supply. The results of laboratory studies showed different changes in the studied biochemical parameters of blood. The basal creatinine level in group 3 athletes was 12 times higher than in group 1 athletes. Lactate dehydrogenase (LDH) activity in group 1 athletes increased by 10 times in response to physical load compared to group 3 results. The basal level of LDH activity increased in group 1 (by 14.6%) and 2 (by 6.7%) athletes. The basal testosterone level increased in athletes of group 3 (by 14.4%) and 2 (by 5.6%). The basal level of the studied hormone had no changes in group 1 representatives.
Conclusions	Accelerated increase in functional capabilities of MMA athletes was observed during high-intensity power loads in conditions of anaerobic-alactate energy supply mechanism. Using this power load regime will strengthen the adaptive body reserves of athletes at the stage of specialized basic training. Determining characteristics in the studied biochemical indicators in response to stress stimuli will allow to optimize training load regimes. The changes in these indicators will also allow to improve strength training in MMA in the shortest possible time.

Keywords: Mixed Martial Arts, functional capabilities, load regimes, biochemical blood parameters, intensity, training.

Introduction

The complexity of the training system optimization in Mixed Martial Arts (MMA) lies in finding the most effective and at the same time adequate to the body adaptation reserved options for using different intensity, volume, direction of physical exertion. This is used on the background of a wide range of training exercises taking into account the peculiarities of technical skills and tactical tasks [1, 2, 3]. Solving the problem of increasing the functional capabilities of athletes, meeting the requirements of competitive activity (especially at the professional level in MMA), is one of the priority tasks for specialists: in physical education and sports [4, 5]; for scientists who study the processes of body adaptation to stress stimuli of various directions [6, 7]. The need for the simultaneous development of explosive power to ensure the effectiveness of attacking actions and power endurance in the process of countering the opponent on the ring complicates the mechanism of optimizing training loads in MMA [8]. Increasing the

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functional capabilities of athletes of the striking or wrestling style of fighting requires the activation of completely opposite energy supply mechanisms for muscle activity and different physical loads in terms of volume and intensity. This is which complicates the optimization of the main structural elements of the training system in MMA [9]. However, specialists in the problems of improving training activity in martial arts have recently paid close attention to the issue of studying the mechanisms of correction of training load indicators noting the individual functional capabilities of the body [3, 10, 11]. The issue of determining informative markers for evaluating adaptive and compensatory body reactions (in conditions of training and competitive activity, depending on the style of fighting and the level of training), has also become acute for researchers in recent years [12, 13, 14].

The study of the main aspects of improving training activity in MMA at the stage of specialized basic training (through an in-depth study of the ratio of parameters of volume and intensity of physical exertion) is an integral component of system optimization in this sport [3, 5, 8]. Despite a number of studies conducted with the aim of determining the optimal load regimes for MMA athletes, mechanisms for assessing the course of adaptive body changes at the stage of specialized basic training have been partially described. We should note that in order to achieve success in competitive activity an athlete will need to maximize not only the level of explosive power development, but also strength endurance depending on the opponent's fighting style. The conditions of fighting tactics require increasing the adaptive body reserves of athletes, which will allow to compensate for the energy expenditure during muscular activity of different duration and power [15, 16].

The purpose of this research is to study the peculiarities of influence of different intensity power load regimes on the functional capabilities of Mixed Martial Arts athletes in the process of training activity optimization at the stage of specialized basic training.

Materials and Methods

Participants

We examined 75 athletes (men) aged 19±0.7 who had been practicing MMA for 4±0.8 years. To achieve the purpose of the study, we divided the athletes into 3 groups, 25 participants in each group. The 1st and 2nd group representatives used anaerobic-glycolytic mode of energy supply for power loads in conditions of low (R_a=0.53) and medium (R_a=0.65) intensity. Athletes of the 3rd group used loads of high (R_a=0.72) intensity in the conditions of the anaerobic-alactate mode of energy supply.

The experimental study was approved by the ethical committee for biomedical research of Lesya Ukrainka Volyn National University in accordance with the ethical standards of the Declaration of Helsinki. Participants gave written informed consent for the research in accordance with the recommendations of the biomedical research ethics committees [17]. During the study, control of functional parameters, biochemical blood indicators in athletes of the examined groups took place in the medical center of the university using appropriate diagnostic equipment.

Research Design

Maximal muscle strength

We evaluated the maximum strength (1 RM) development in athletes of all examined groups using the method of control testing. The duration of the study was 12 weeks. Control of the studied indicators took place at the beginning of the experiment and after every 4 weeks of training while using different intensity load modes. To fulfill the tasks of the study the following exercises were used: bench press on the Smith simulator, block thrust behind the head, lying leg press. Machine exercises were used to ensure a reduction in injury cases and to clearly (without "cheating") determine the level of strength development. The strength exercises used during the study were performed in accordance with the generally accepted technique in power sports [2, 3, 18].

During strength training, the group participants used power load regimes of different intensity in the conditions of anaerobic-glycolytic and anaerobic-alactate energy supply of muscle activity. The study lasted 12 weeks. To assess the functional capabilities of athletes in these conditions we used methods of control testing of the maximum strength development (1 RM). Control of biochemical blood parameters (creatinine, lactate dehydrogenase, testosterone) allowed to determine the nature of adaptive and compensatory body reactions in response to power loads of various intensity.

Power load mode

Using the integral method of quantitative estimation of load capacity in power fitness [18] and the initial parameters of the maximum muscle strength (1 RM) development at the beginning of the study, we determined the load factor (R_a) and the intensity level of proposed by us power load regimes.

Biochemical parameters

In the process of biochemical blood control, we evaluated the activity of lactate dehydrogenase (LDH) and creatinine concentration in group participants by the kinetic method on the equipment of the company "High Technology Inc" (USA) with a set of PRESTIGE 24i LQ LDH reagents (Poland). Testosterone and cortisol concentration in the blood serum was determined by enzyme-linked immunosorbent analysis, using a set of reagents SteroidIFA-testosterone on the equipment of the company "Alcor Bio". Blood was taken from the vein of study participants by a medical worker before and after the training session at the beginning and at the end of 12 weeks of research in compliance with all norms [19].

Statistical analysis

Statistical analysis of the research results was performed using the IBM *SPSS*Statistics 26 program package (StatSoftInc., USA). Descriptive statistics methods were used to calculate the arithmetic mean and error of the mean. The non-parametric Wilcoxon test was used to assess the reliability of pairwise differences, and Friedman's ANOVA was used to analyze repeated measurements [20].

Results

Table 1 presents different levels of intensity of load regimes used by athletes of the examined groups in the process of strength training during the study. Using the integral method of quantitative estimation of load capacity in power fitness [18] and the initial parameters of the maximum muscle strength (1 RM) development, the quantitative indicators of repetitions in a set, the amplitude of movement, the duration of eccentric and concentric phases of movement, we estimated the load factor (R_a). This indicator (R_a) clearly reflects the level of intensity of power load regimes proposed by us. The duration of intense muscle activity in a set and the time allocated for recovery between sets allows making assumptions which regimes of energy supply were involved in training loads of different intensity.

The results presented in Table 2 reflect the nature of changes in the indicators of the maximum muscle strength (1 RM) development in 3 groups of study participants performing control exercises in conditions of using different intensity power load regimes.

The analysis of the results recorded during the study indicated that the average group indicators of strength capabilities development increased the participants of all examined groups. The most pronounced positive changes in the development of the maximum muscle strength indicator (by 49.2%; $p<0.05$) during the entire period of the study were found in athletes of the 3rd group during the exercise "lying leg press". At the same time, the least noticeable compared to the participants of the other groups, but reliable increase of the studied indicator (by 20.3%; $p<0.05$) was found in the athletes of the 1st group during the exercise "block thrust behind the head". The obtained results indicated that using high-intensity loads in conditions of the anaerobic-alactate energy supply regime contributed to the accelerated growth of maximum muscle strength.

The laboratory control of biochemical parameters of creatinine and testosterone concentration, lactate dehydrogenase activity in the blood serum of athletes of all three groups allowed determining the features of adaptive and compensatory reactions to low (R_a=0.53), medium (R_a=0.65) and high (R_a=0.72) training load intensity at different energy supply modes, and the patterns increasing the body functional reserves (Fig. 1, 2, 3).

The changes in creatinine concentration in the blood serum of the study participants, presented graphically in Figure 1, demonstrate a sufficiently different tendency of this indicator in response to loads of different intensity. Thus, in group 3 athletes who used high-intensity training loads in conditions of anaerobic-alactate regime of energy supply, the concentration of creatinine in the blood serum increased significantly both at the beginning (by 11.2%) and after 12 weeks of training (by 9.0%) in response to a stress stimulus. At the same time, the level of creatinine concentration in the blood serum of group 2 participants increased two times less

Table 1. Power load regimes used by MMA athletes in the process of strength training during the study

Intensity of power load regime	Peculiarities of power load regimes
Low intensity (R_a=0.53)	Anaerobic-glycolytic mode of energy supply for muscle activity. Full amplitude of movement with fixation at the peak point. The duration of a repetition is 4 seconds. 12 repetitions in a set. The maximum duration of work in a set is 48-55 seconds. Rest between sets lasts 60 seconds. The projectile working mass is 53-55% of 1RM.
Medium intensity (R_a=0.65)	Anaerobic-glycolytic mode of energy supply for muscle activity. Full amplitude of movement without fixation at the peak point. The duration of a repetition is 5-6 seconds. 8 repetitions in a set. The maximum duration of work in a set is 40-43 seconds. Rest between sets lasts 60 seconds. The projectile working mass is 65-67% of 1RM.
High intensity (R_a=0.72)	Anaerobic-alactate mode of energy supply of muscle activity. Partial (90%) amplitude of movement. The duration of a repetition is 8-9 seconds. 4 repetitions in a set. The maximum duration of work in a set is 32-35 seconds. Rest between sets lasts 45 seconds. The projectile working mass is 72-75% of 1RM.

Table 2. Changes in strength capabilities (1RM) results in study participants during 12 weeks of research, n=75

Exercises	Groups	Term of observation, weeks				χ^2, p df=3
		Initial data	4 weeks	8 weeks	12 weeks	
Bench press on the Smith simulator	1	64.10±1.54	71.96±1.54[1] Z=-4.3; p<0.05	78.98±1.52[1] Z=-4.4; p<0.05	80.96±1.40[1,2] Z=-4.1; p<0.05 Z=-4.4; p<0.05	χ^2=69.5 p<0.000
	2	63.48±1.50	74.59±1.46[1] Z=-4.2; p<0.05	83.42±1.53[1] Z=-4.4; p<0.001	86.12±1.45[1,2] Z=-3.8; p<0.05 Z=-4.4; p<0.05	χ^2=71.9 p<0.000
	3	61.90±1.54	74.62±1.65[1] Z=-4.4; p<0.05	83.70±1.37[1] Z=-4.4; p<0.001	85,90±1,38[1,2] Z=-3,5; p<0,05 Z=-4,4; p<0,05	χ^2=73.2 p<0.000
Block thrust behind the head	1	64.20±1.23	69.76±0.99[1] Z=-4.2; p<0.05	74.70±0.95[1] Z=-4.5; p<0.05	77.24±0.88[1,2] Z=-4.1; p<0.05 Z=-4.3; p<0.05	χ^2=73.6 p<0.000
	2	65.50±1.16	73.00±0.92[1] Z=-4.2; p<0.05	78.60±1.03[1] Z=-4.5; p<0.005	81.28±0.72[1,2] Z=-3.5; p<0.05 Z=-4.3; p<0.05	χ^2=72.6 p<0.000
	3	60.90±1.30	69.78±1.32[1] Z=-4.2; p<0.05	76.56±1.26[1] Z=-4.4; p<0.005	80.72±0.92[1,2] Z=-4.0; p<0.05 Z=-4.3; p<0.05	χ^2=73.4 p<0.000
Lying leg press	1	115.88±2.59	136.68±2.59[1] Z=-4.3; p<0.05	151.24±2.42[1] Z=-4.4; p<0.05	153.56±2.11[1,2] Z=-3.1; p<0.05 Z=-4.3; p<0.05	χ^2=69.5 p<0.000
	2	112.80±3.20	136.82±3.61[1] Z=-4.4; p<0.005	153.80±3.64[1] Z=-4.4; p<0.001	160.86±3.98[1,2] Z=-3.5; p<0.05 Z=-4.3; p<0.05	χ^2=73.2 p<0.000
	3	118.68±3.26	148.32±3.14[1] Z=-4.4; p<0.005	168.04±2.78[1] Z=-4.4; p<0.001	177,04±3,02[1,2] Z=-4.0; p<0.05 Z=-4.4; p<0.05	χ^2=73.9 p<0.000

Notes: [1] - the difference compared to the previous results is significant according to the Wilcoxon test (p<0.05); [2] - the difference compared to the initial values is significant according to the Wilcoxon test (p<0.05); df - is the number of degrees of freedom; p - is the level of significance.

than in group 3 athletes in response to the stimulus. However, the concentration of this biochemical indicator in the blood serum of the 1st group athletes showed positive but unreliable tendency to change. The most pronounced increase in the basal level of creatinine in the blood serum (by 19.2%; p<0.05) was fixed in group 3 athletes, who used loads of high (R_a=0.72) intensity in the conditions of the anaerobic-alactate regime of energy supply during the study.

Figure 2 shows the changes in LDH activity in the blood serum of the participants of all examined groups at rest and after exercise at the beginning of the study and after 12 weeks of training. The observation showed that the activity of the studied enzyme in the blood of group 1 athletes increased by an average of 31.0% (p<0.05) in response to medium-intensity training load in conditions of anaerobic-glycolytic mode of energy supply regardless of control stages. At the same time, the results of laboratory control indicated that LDH activity in the blood serum of group 3 athletes was almost 10 times lower compared to the data recorded in group 1 participants in response to high-intensity exercise in the conditions of anaerobic-alactate energy supply. The most pronounced increase in the basal level of LDH in the blood serum (by 14.6%; p<0.05) was observed in athletes of group 1. At the

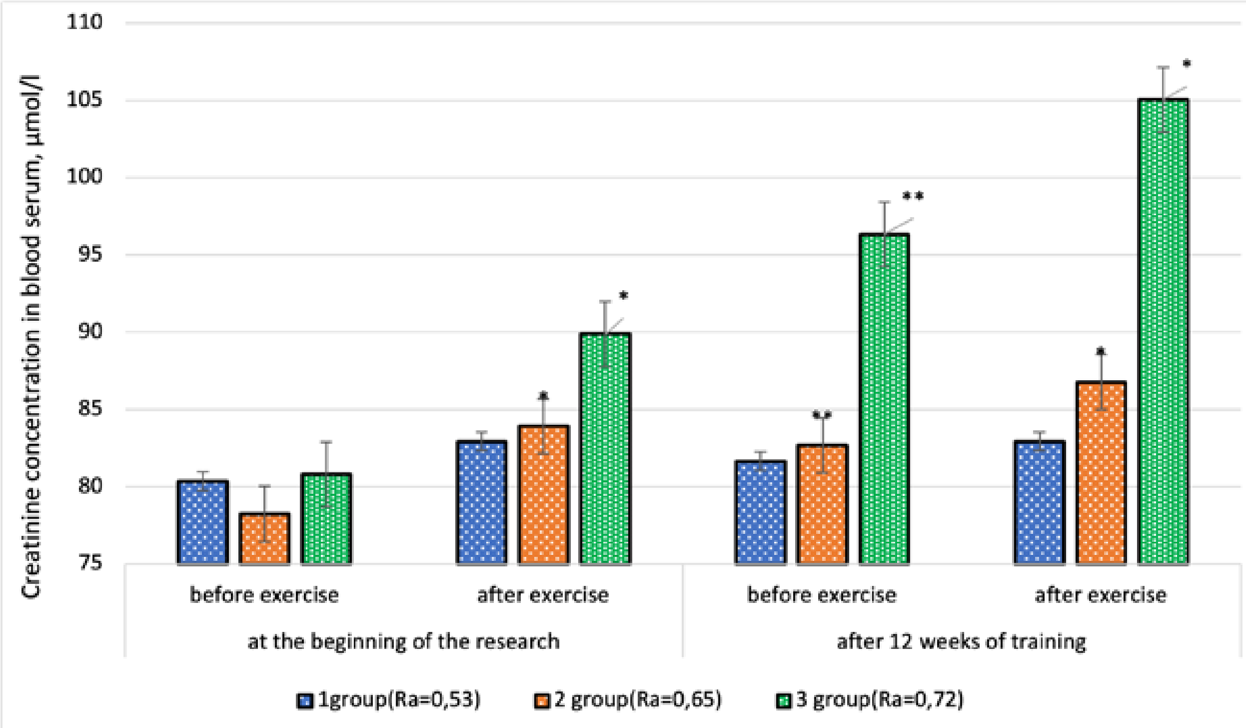

Figure 1. Changes in creatinine concentration in the blood serum of study participants during 12 weeks of training in the conditions of different intensity power load regimes, n=75

Note: * – p<0.05, compared to the indicators before the load; ** – p<0.05, compared to the indicators before the study

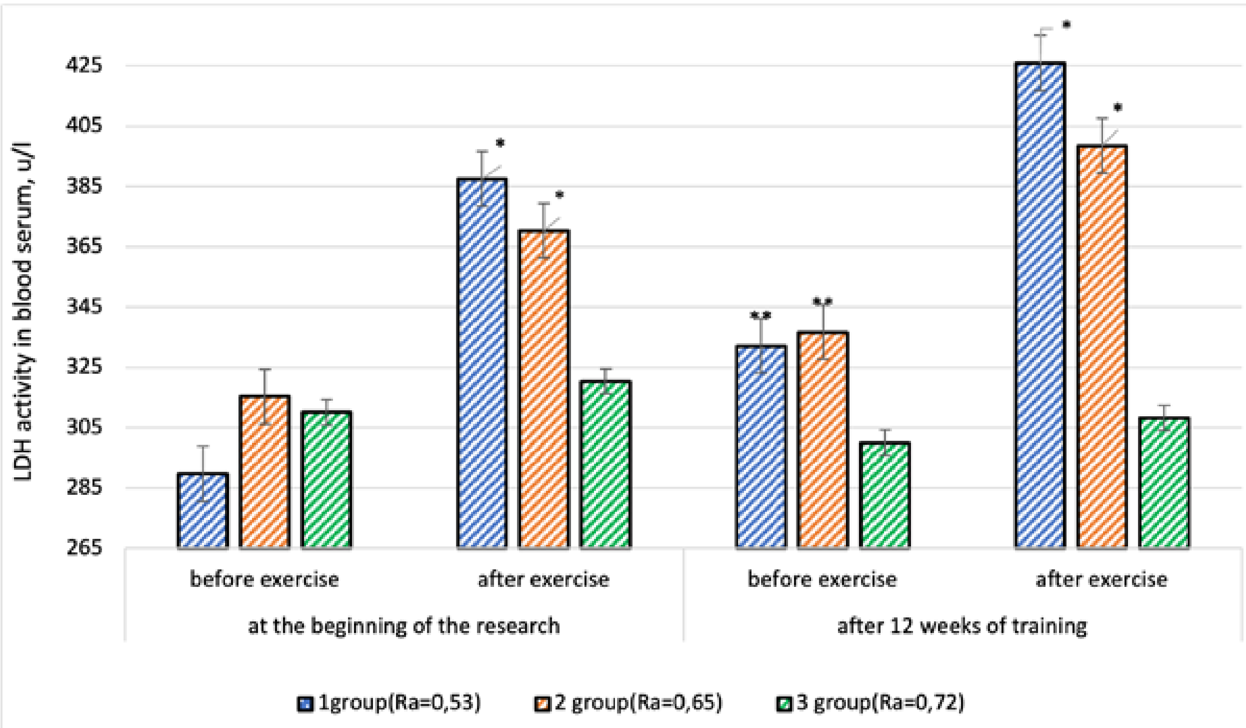

Figure 2. Changes in LDH activity in the blood serum of study participants during 12 weeks of training in the conditions of different intensity power load regimes, n=75

Note: * – p<0.05, compared to the indicators before the load; ** – p<0.05, compared to the indicators before the study

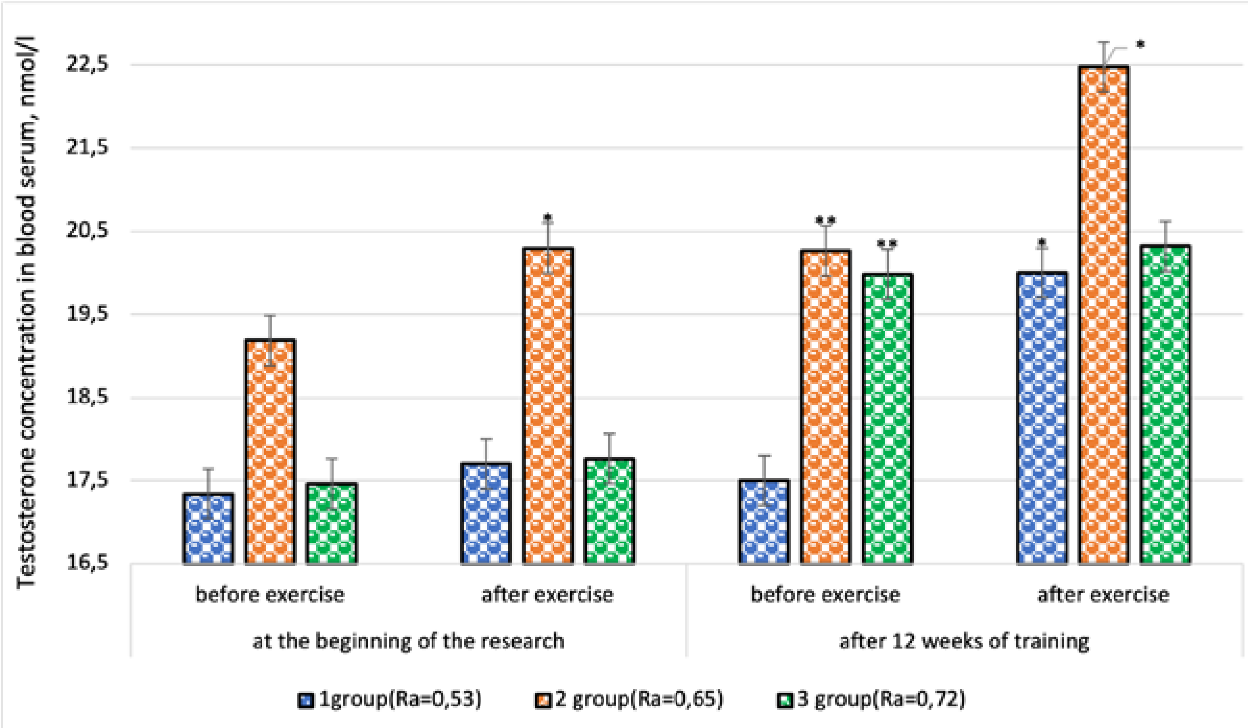

Figure 3. Changes in testosterone concentration in the blood serum of study participants during 12 weeks of training in the conditions of different intensity power load regimes, n=75

Note: * – p<0.05, compared to the indicators before the load; ** – p<0.05, compared to the indicators before the study

same time, the level of this biochemical indicator decreased by 3.2% in group 3 athletes compared to the data fixed at the beginning of the study.

We demonstrated the changes in testosterone concentration in the blood serum of research participants at rest and in response to power loads of different intensity and various energy supply mechanisms on Figure 3. The study showed that the greatest increase in the concentration of this steroid hormone in the blood serum (by 14.3%; $p<0.05$) was recorded at the end of the study in group 1 athletes in response to a physical stimulus. At the same time, the smallest change in this biochemical indicator (by 1.7%) was found in group 3 participants in response to high-intensity training loads. The most pronounced increase in the basal level of testosterone in the blood serum (by 14.4%; $p<0.05$) was fixed in group 3 athletes, whose muscle activity was provided at the expense of anaerobic-alactate energy supply systems. At the same time, the basal concentration of this steroid hormone in the blood serum of group 1 participants had almost no changes.

Discussion

The problem of determining a single complex of mechanisms for optimizing training regimes of loads in Mixed Martial Arts and effective ways of correcting their main indicators, taking into account the peculiarities of the physiological processes of adaptation, individual functional capabilities of athletes, is one of the priority issues not only of trainers, high-level professional fighters, but also of scientists [2, 8, 14, 16, 21]. Determining the most optimal parameters of the intensity of power load regimes at the stage of specialized basic training in MMA is one of the main directions of this problem [3, 8, 10] because it will allow to maximize the functional capabilities of athletes in the shortest possible time. An important aspect of improving the training process at this stage of training is the determination of the most informative markers for assessing adaptive and compensatory reactions to training loads in the conditions of anaerobic-alactate and anaerobic-glycolytic modes of energy supply of muscle activity during matches [7, 9, 10]. It is the use of indicators of laboratory diagnostics of the blood biochemistry of athletes, as the main criteria for assessing the need to correct load regimes, that scientists have been paying attention to in recent years [3, 8, 12, 22].

This research proved that using high-intensity loads in conditions of anaerobic-alactate mode of energy supply of muscle activity contributed to the most accelerated growth of the maximum strength indicator (1 RM) and the functional capabilities of the body on the whole. We suppose that these changes are associated with an increase in the number of moving units in the working muscles and improvement of intermuscular coordination due to the peculiarities of the load regime proposed by us (R_a=0.72) [3, 8].

The results of basal level of creatinine and testosterone concentration in the blood serum indicated their significant increase, especially in the conditions of the anaerobic-alactate mode of energy supply. The changes in biochemical blood markers indicate an increase in the adaptive reserves of the body and an increase in muscle mass [6, 7], which contributes to the maximum increase in the strength capabilities of athletes and their level of functional training. At the same time, the increase in LDH activity in the blood serum of athletes in response to medium and low-intensity training load in conditions of the anaerobic-glycolytic mode of energy supply indicates a significant accumulation of lactate, the manifestation of compensatory reactions and, subsequently, a decrease in the activity of muscle activity [12, 15].

Conclusions

Using high-intensity power loads (R_a=0.72) by MMA athletes in conditions of predominantly anaerobic-alactate energy supply at the stage of specialized basic training contributes to the most accelerated increase in the body functional capabilities and the growth of maximum muscle strength indicators. However, the optimal conditions for using this level of strength capabilities and their most effective implementation occur during attacking or counter-attacking actions of athletes during competitions. Using medium-intensity loads (R_a=0.65) in the training activity will contribute to expanding the necessary adaptation reserves and increasing functional capabilities due to the duration of muscle tension during fights in a ring.

Determining the peculiarities of changes in the biochemical blood parameters (creatinine, LDH, testosterone) of the athletes in response to a stress stimulus of the appropriate intensity will allow in the shortest possible time to optimize the load regimes due to the correction of its main components while improving strength training in MMA.

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Conflict of interest

No potential conflict of interest that is of any relevance to this study was reported by the authors.

References

1. James LP, Haff GG, Kelly VG, Beckman EM. Towards a Determination of the Physiological Characteristics Distinguishing Successful Mixed Martial Arts Athletes: A Systematic Review of Combat Sport Literature. *Sports Medicine*, 2016;46(10):1525–1551. https://doi.org/10.1007/s40279-016-0493-1
2. Matthews JJ, Nicholas C. Extreme Rapid Weight Loss and Rapid Weight Gain Observed in UK Mixed Martial Arts Athletes Preparing for Competition. *Int Journal Sport Nutr Exerc Metab*. 2017;27(2):122–129. https://doi.org/10.1123/ijsnem.2016-0174
3. Chernozub A, Manolachi V, Korobeynikov G, Potop V, Sherstiuk L, Manolachi V, et al. Criteria for assessing the adaptive changes in mixed martial arts (MMA) athletes of strike fighting style in different training load regimes. *PeerJ*, 2022;10: e13827. https://doi.org/10.7717/peerj.13827
4. Slimani M, Davis P, Franchini E, Moalla W. Rating of Perceived Exertion for Quantification of Training and Combat Loads During Combat Sport-Specific Activities: A Short Review, *Journal of Strength and Conditioning Research*, 2017;31(10):2889–2902. https://doi.org/10.1519/JSC.0000000000002047
5. Manolachi V. Direction of knowledge formation in the field of power training of athletes specialized in sports wrestling. *Journal of Physical Education and Sport*, 2019; 19(Suppl. 6): 2218–2222. https://doi.org/10.7752/jpes.2019.s6333
6. Clarkson PM, Kearns AK, Rouzier P, Rubin R, Thompson PD. Serum Creatine Kinase Levels and Renal Function Measures in Exertional Muscle Damage. *Medicine & Science in Sports & Exercise*. 2006;38(4): 623–627. https://doi.org/10.1249/01.mss.0000210192.49210.fc
7. Chernozub A, Potop V, Korobeynikov G, Timnea OC, Dubachinskiy O, Ikkert O, et al. Creatinine is a biochemical marker for assessing how untrained people adapt to fitness training loads. *PeerJ*, 2020;8: e9137. https://doi.org/10.7717/peerj.9137
8. Tota ŁM, Wiecha SS. Biochemical profile in mixed martial arts athletes. *PeerJ*. 2022;10:e12708. https://doi.org/10.7717/peerj.12708
9. Kirk C, Langan-Evans C, Clark D, Morton J. Quantification of training load distribution in mixed martial arts athletes: A lack of periodisation and load management. *PLoS One*, 2021;16(5):e0251266. https://doi.org/10.1371/journal.pone.0251266
10. Del Vecchio FB, Franchini E. Specificity of high-intensity intermittent action remains important to MMA athletes' physical conditioning: response to Paillard. *Perceptual and Motor Skills*, 2011;116(1):233–234. https://doi.org/10.2466/25.05.PMS.116.1.233-234
11. Marques L, Franchini E, Drago G, Aoki M, Moreira A. Physiological and performance changes in national and international judo athletes during block periodization training. *Biology of Sport*, 2017;34(4):371–378. https://doi.org/10.5114/biolsport.2017.69825

12. Kılıc Y, Cetin HN, Sumlu E, Pektas MB, Koca HB, Akar F. Effects of boxing matches on metabolic, hormonal, and inflammatory parameters in male elite boxers. *Medicina*, 2019;55(6):288. https://doi.org/10.3390/medicina55060288
13. Papassotiriou I, Nifli AP. Assessing performance in pre-season wrestling athletes using biomarkers. *Biochemia Medica*. 2018;28(2):020706. https://doi.org/10.11613/BM.2018.020706
14. Wochyński Z, Sobiech K. Impact of special aviation gymnastics instruments training on selected hormones in cadets' blood serum and plasma. *International Journal of Occupational Medicine and Environmental Health*. 2017; 30(4):655–664. https://doi.org/10.13075/ijomeh.1896.00904
15. Walker S, Häkkinen K, Haff GG, Blazevich AJ, Newton RU. Acute elevations in serum hormones are attenuated after chronic training with traditional isoinertial but not accentuated eccentric loads in strength-trained men. *Physiological Reports*, 2017;5(7):e13241. https://doi.org/10.14814/phy2.13241
16. Manolachi V. Theoretical Aspects on Studying Energy Potential, Neuroregulatory Factors and Particularities of Muscle Tissue Structure in Forming the Fighters Force Qualities. *Revista Romaneasca pentru Educatie Multidimensionala,* 2020; 12(1):311–319. https://doi.org/10.18662/rrem/215
17. World Health Organization. *Air quality guidelines for Europe.* 2nd edition. Copenhagen: WHO Regional Office for Europe; 2000.
18. Chernozub A, Titova A, Dubachinskiy O, Bodnar A, Abramov K, Minenko A, et al. Integral method of quantitative estimation of load capacity in power fitness depending on the conditions of muscular activity and level of training. *Journal of Physical Education and Sport*. 2018;18(1):217–221. https://doi.org/10.7752/jpes.2018.01028
19. Tietz NW. *Clinical Guide to Laboratory Tests (ELISA).* 3rd Edition, W.B. Saunders, Co., Philadelphia; 1995.
20. Field A. *Discovering statistics using IBM SPSS statistics*. 5th edition. Thousand Oaks, CA: SAGE Publications; 2017.
21. Podrigalo LV, Podrihalo OO, Jagiello W, Podavalenko OV, Masliak IP, Tropin YM, et al. Morphofunctional characteristics of single combats athletes as factors of success. *Physical Education of Students*, 2021;25(5): 265–271. https://doi.org/10.15561/20755279.2021.0502
22. Akgül M, Baydil B. Thyroid hormone responses to acute aerobic exercise. *Physical Education of Students*. 2021;25(6):359-63. https://doi.org/10.15561/20755279.2021.0604

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