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## LOADS OPTIMIZATION MECHANISMS IN STRENGTH TRAINING IN MIXED MARTIAL ARTS

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### Abstract

*The study purpose.* To study the peculiarities of the influence of different load regimes on the training level of MMA athletes. *Materials and methods.* 75 athletes aged 19-20 years participated in the study. The research lasted 12 weeks. The study participants were divided into 3 homogeneous groups. Each of the groups used training load regimes with different volume and intensity parameters. The integral method of quantitative estimation of load capacity and the method of testing the level of kicking techniques are used in the research. *Results.* The 3rd group athletes who used high-intensity load regime ( $Ra=0.72$ ) had by 16.5% and 39.4% higher initial parameters of the projectile working mass compared to the results of the 1st and 2nd groups of bodybuilders. The load amount indicator in a set was on average by 49.9% higher in conditions of the low-intensity load regime,  $Ra=0.53$  (group 1) compared to other groups. Despite a more pronounced increase in leg strength in group 3 athletes (by 1.5 times), there remained a similar difference between load indicators. During the study this group athletes had 3 times higher level of kicking technique (number of kicks with maximum force for 20 seconds). *Conclusions.* Anaerobic-alactate loads with the maximum muscle strength of 72-75% of 1RM are optimal for increasing the level of kicking technique in MMA athletes at the stage of specialized basic training.

**Key words:** MMA, kicking technique, load regimes, intensity, volume

### 1. Introduction

Both coaches and scientists pay great attention to the problem of studying modern mechanisms for optimizing power loads in mixed martial arts, which will allow influencing on the level of athletes training (Kirk et al., 2021; Tota & Wiecha, 2022). The main aspect of solving this issue is the search for effective ways of combining a certain variability of load indicators, the level of the body resistance to the stressful stimuli, and the athlete's adaptive reserves (James et al., 2016; Chernozub et al., 2022; Giboin & Gruber, 2022).

There is no clear definition of the optimal load parameters which allow to increase the maximum speed, power of kicks in the process of strength training in MMA. A significant number of scientists and practitioners, in their research to solve this issue, used classical strength training programs for most martial arts (Matthews et al., 2017; Liu et al., 2022). In some cases, depending on the qualifications of the athletes and weight categories, there were used loads typical for powerlifting and weightlifting (Kirk et al., 2021). However, the mechanism for assessing the load volume in these sports and the conditions for their correction do



not take into account the peculiarities of special training in MMA. In bodybuilding and power fitness there is a more detailed control of load parameters considering the training direction and the individual body capabilities of athletes (Coratella et al., 2020; Polechoński & Langer, 2022).

Thus, the *purpose of the research* is to study the peculiarities of the influence of different load regimes used in power fitness and bodybuilding on the level of training of MMA athletes.

## **2. Material and method**

75 athletes aged 19-20 took part in the study. The participants were divided into 3 groups, 25 bodybuilders in each group. The load regimes were different in volume and intensity parameters for each group. Quantitative indicators were calculated using the integral method of quantitative estimation of load capacity (Chernozub et al., 2018), which characterizes the features of the proposed load regimes in detail. Thus, group 1 athletes used a low-intensity regime ( $R_a=0.53$ ). The representatives of the 2nd group had medium-intensity loads ( $R_a=0.65$ ). Participants of the 3rd group used high-intensity loads ( $R_a=0.71$ ) during the research. The difference between the components on which the intensity of the power load regime depends is presented in Table 1.

**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.

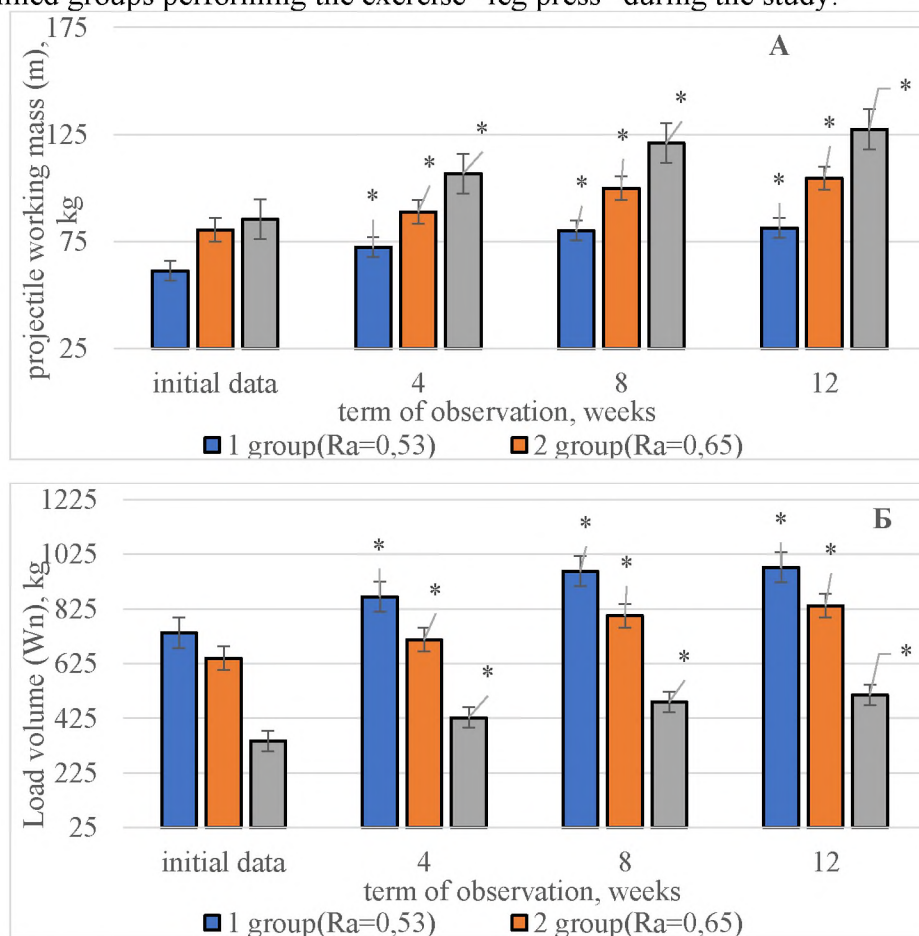
Using the methods of determining the maximum strength (1 RM) and estimating the power load, the projectile working mass parameters (m) and load volume (Wn) were calculated. Determination of these indicators took place during the exercise “leg press” at the beginning of the study and after every 4 weeks.

Using the method of testing the level of kicking technique, the number of “Roundhouse kicks” performed by athletes for 20 seconds with maximum force until complete muscle fatigue was determined. Monitoring of the studied indicators dynamics took place every 30 days during 12 weeks of the study.

Statistical analysis of the research results was performed using the IBM \*SPSS\*Statistics 26 program package (StatSoftInc., USA). Non-parametric methods of mathematical statistics were used.

### 3. Results and Discussions

Figure 1 presents the results of changes in load indicators in the athletes of the examined groups performing the exercise “leg press” during the study.



**Figure 1.** The results of the projectile working mass (A) and the load volume (B) indicators used by study participants performing the exercise “leg press”.

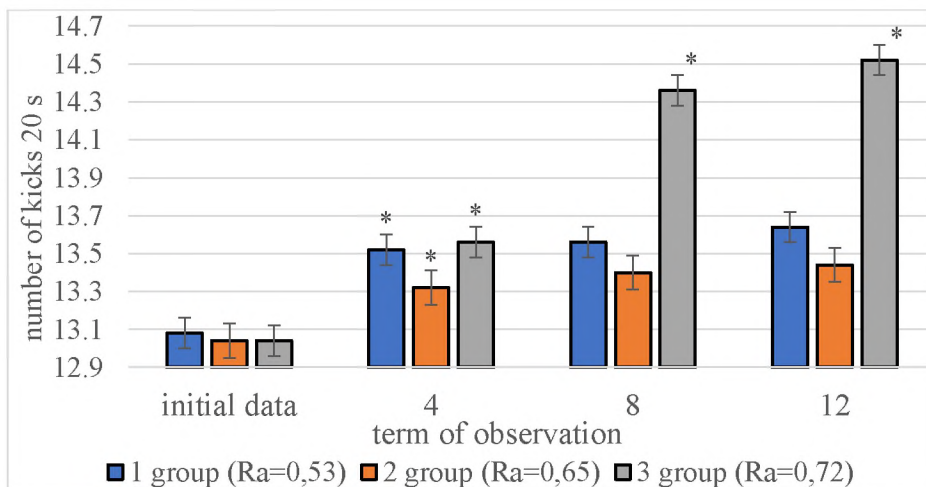
Note: \* ( $p < 0.05$ ) - compared with previous results

The analysis of the results shows that the initial parameters of the projectile working mass was by 16.5% and 39.4% higher in group 3 athletes ( $Ra=0.72$ )

compared to the results of group 1 and 2 athletes, respectively. Although indicators of the maximum strength development (1 RM) were practically identical in athletes of all groups at the beginning of the study. The 3rd group athletes increased the power capabilities of their legs by 1.5 times during the research period, compared to the results of other two groups. However, the initial difference in the projectile working mass in groups only increased during 12 weeks of the study. Control of the dynamics of the load volume indicator in a set showed a completely different ratio among groups both at the beginning of the study and during the entire period. Thus, this indicator was from 42.3% to 50.2% higher in group 1 athletes who used low-intensity load regime (Ra=0.53) compared to the results in other groups. This difference was observed during all 12 weeks of research.

Thus, the obtained results coincide with the studies of MMA specialists regarding the effectiveness of using methods for estimating the load volume indicators (Matthews et al., 2017; Liu et al., 2022). The patterns between the projectile working mass indicator and the load volume in training regimes of different intensity confirm the research results of scientists in bodybuilding and power fitness (Coratella et al., 2020; Polechoński & Langer, 2022).

Figure 2 shows the results of performing the number of “Roundhouse kicks” for 20 seconds with maximum force until full muscle fatigue by the athletes of the examined groups during the study.



**Figure 2.** Results of the number of “Roundhouse kicks” performed for 20 seconds with maximal strength until complete muscle fatigue by the study participants during 12 weeks of the research, n=75

Note: \* (p<0.05) - compared with previous results

The results analysis demonstrates that group 3 athletes had the highest increase in the studied indicator by 11.3% compared to the initial data. The lowest increase

in the number of kicks in this exercise was observed in group 2 participants (by 3.1%) over the same period of time.

The obtained results proved that using a high-intensity load regime ( $Ra=0.72$ ) by MMA athletes helped to increase the indicators of the level of kicking technique by 3.6 times compared to other proposed options. These changes are associated with an increase in the level of intra-muscular and inter-muscular coordination in the conditions of the anaerobic-alactate mechanism of energy supply (James et al., 2016; Chernozub et al., 2022).

The results presented in this paper allow a more in-depth consideration of the problem of special strength training in MMA. To reveal the regularities of using training loads, the value of which is not only an assumption of the coach or an athlete. Load indicators should be scientifically justified on the basis of mathematical calculations, taking into account the adaptive body reserves, training tasks and the stage of preparation (Kirk et al., 2021; Tota & Wiecha, 2022).

#### **4. Conclusions**

Anaerobic-alactate load regime with an external stimulus volume of 72-75% of 1RM is optimal for increasing the level of kicking technique of MMA athletes at the stage of specialized basic training. Indicators of the projectile working mass and the load volume can be used as informative criteria of the load regime intensity for further mechanisms of its correction in the MMA training process.

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