The impact of plyometric exercises on the physical fitness of amateur boxers in Jordan

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Abstract

Objective of the study was to assessment of the impact of plyometric exercises on the explosive power of amateur boxers in Jordan.

Методика и организация исследования. A study was carried out to evaluate the effectiveness of a training regimen employing the plyometric technique on the explosive power of 40 amateur boxers from Jordan.

Results and conclusions. The findings of the pedagogical experiment demonstrate that the boxers' impact force improved by 25% over a two-month period, their impact velocity increased by 12%, and their explosive strength in their arms and legs improved by 18% and 15%, respectively. These results suggest that plyometric training can positively impact a range of indicators related to explosive strength in boxers. Therefore, it is essential to incorporate plyometric training into athletes' training programs to enhance their performance and achieve superior athletic outcomes.

Keywords: *boxing, physical training, amateur boxers, plyometric training, explosive power, amateur sports clubs.*

Introduction. Plyometric training is widely used to improve explosive strength and muscle power in various sports, including team sports and martial arts. Thus, M. Slimani et al. in their systematic review emphasized that plyometric exercises contribute to a significant improvement in the physical performance of athletes. R. Ram rez-Campillo et al. in their meta-analysis showed the effectiveness of plyometric training in young basketball players, confirming the versatility of this method in improving physical performance.

The study of I. Loturco et al. demonstrated the positive effect of plyometric exercises on the sprinting abilities of high-level football players. Given the need for rapid movement and quick reaction of a boxer in a fight, studying the results of this study can be useful for improving the physical training of boxers. G. Markovic and P. Mikulic noted that plyometric exercises improve neuromuscular function and increase the performance of athletes by increasing the speed and strength of muscle contractions. J. Moran et al. studied the effects of combined plyometric and strength training, revealing a significant increase in athletic performance in young football players. The provisions of the methodology proposed by the authors can also be used to develop the strength and power of punches in boxing. Explosive power is especially important in sports that require fast and powerful movements, which include boxing. One of the key aspects of training boxers is to improve the effectiveness of punches. Punch force, speed of execution and coordination of movements play a decisive role in achieving high athletic results in boxing.

Despite the widespread use of plyometric training in various sports, its effect on boxers' performance has not been sufficiently studied [2, 3]. In this regard, there is a need to develop and implement a training program based on plyometric exercises in order to im-

prove the physical performance of boxers in amateur sports clubs in Jordan.

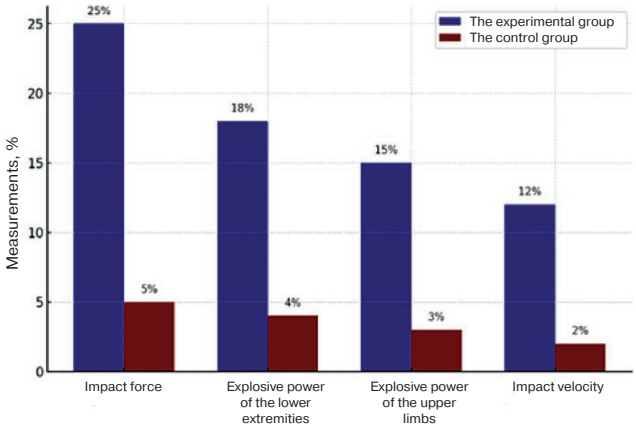
Objective of the study was to assessment of the impact of plyometric exercises on the explosive power of amateur boxers in Jordan.

Methods and structure of the study. Participants: 40 boxers (aged 18–25) from four amateur sports clubs in Jordan. Participants were randomly assigned to the experimental (n=20) and control (n=20) groups. The selection criteria were age, at least two years of boxing experience, absence of injuries, and consent to participate in the study. This ensured sample homogeneity and reliability of the data obtained. The educational experiment lasted eight weeks. The experimental group trained according to a specially developed program based on the recommendations of modern research in the field of plyometric training. Training was conducted three times a week for 75 minutes. The main part of the program included plyometric exercises: vertical jumps without weights, jumps onto a 50 cm high box, arm curls and extensions with hands off the floor, throws of a 3 kg medicine ball, sideways jumps over hurdles, and 20 m sprint accelerations. The loads were progressively increased by 10% every two weeks, increasing the intensity and number of repetitions, which contributed to the continuous stimulation of muscular adaptation. The control group training included endurance running, sparring, and work with punching bags and pads, as well as technical preparation.

The physical parameters of the boxers were assessed before and after the eight-week program. Punch force was measured using a force transducer on the punching bag, which allowed the power of each punch to be accurately determined. To assess the explosive power of the lower limbs, athletes performed a vertical jump test using a force platform, and the explosive power of the upper limbs was assessed by throwing a 3 kg medicine ball for a distance. Punch velocity was determined by the number of punches on the bag in ten seconds.

Statistical analysis was performed using the SPSS version 25 package. The t-test for dependent and independent samples was used, the significance level was set at $p<0.05$. The effect size (d) was calculated to assess the practical significance of changes. The need to calculate the effect size is also due to the small sample sizes in this study, which may distort statistical indicators [1].

Results of the study and discussion. At the end of the eight-week program, the experimental group demonstrated significant improvements in all assessed parameters (see figure). The punching force increased by 25% ($p<0,001$, $d=2,0$), which significantly exceeds the result of the control group, which increased by only 5% ($p=0,05$, $d=0,4$). The punching speed in the experimental group increased to a lesser extent, but still significantly – by 12% ($p<0,001$, $d=1,4$), and in the control group – only by 2% ($p=0,07$, $d=0,2$). The dynamics of both parameters in the experimental group revealed reliable differences and a large effect, while in the control group only reliable trends and insignificant differences were found, as well as a small effect.



Percentage Changes in Explosive Power Stats of Jordanian Amateur Boxers

The explosive power of the lower limbs in the experimental group increased by 18% ($p<0,001$, $d=1,7$), while in the control group it increased only by 4% ($p=0,04$, $d=0,5$). The explosive power of the upper limbs improved by 15% ($p<0,001$, $d=1,5$) in the experimental group and only by 3% ($p=0,06$, $d=0,3$) in the control group. Thus, reliable differences and a large effect were revealed in the dynamics of explosive power of both legs and arms of boxers in the experimental group, while in the control group, the differences in explosive power of arms were reliable and the training effect was average, and in the indicators of explosive power of legs, the differences were insignificant and the effect was small. The obtained results indicate the high efficiency of the plyometric training program for developing the strength and speed of punches and explosive power in boxers. Significant improvements in the experimental group confirm the findings of previous studies that have shown positive effects of plyometric exercises on neuromuscular adaptations and

athletes' performance.

Improvements in punching power and explosive limb strength can presumably be explained by increased neuromuscular stimulation during plyometric exercises and increased efficiency of muscle energy supply. Plyometric exercises contribute to the development of muscle fiber speed of contraction, which is critical for the execution of fast and powerful punches in boxing. The results of the study are consistent with the findings of R. Ram rez-Campillo et al. and J. Moran et al., confirming the versatility and effectiveness of plyometric training in various sports.

Despite the positive results, the conclusions of the study cannot be considered definitive. The sample size of 40 participants is relatively small and may limit the generalizability of the results to a wider population of boxers. Also, the eight-week duration of the study provides information on the short-term effects of the program, but does not allow conclusions to be drawn on the long-term sustainability of the achieved improvements. Furthermore, the lack of biochemical and physiological measurements limits the understanding of the internal mechanisms of the body's adaptation to plyometric training.

Conclusions. The results of the study showed that the plyometric training program significantly improved the physical performance of amateur boxers. The significant increase in punching power, explosive power, and punching speed in the experimental group confirms the effectiveness of using plyometric exercises in training amateur boxers. Future research could be aimed at expanding the generalizability of the results by conducting a study with a larger sample and including boxers of different levels of training; continuing the implementation of the educational experiment to study the long-term effects of plyometric training, including follow-up monitoring of athletes, which will help to understand the sustainability of the achieved improvements. Finally, additional analysis of biochemical and physiological changes under the influence of plyometric training may provide a deeper understanding of the mechanisms of adaptation and the effectiveness of this method.

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