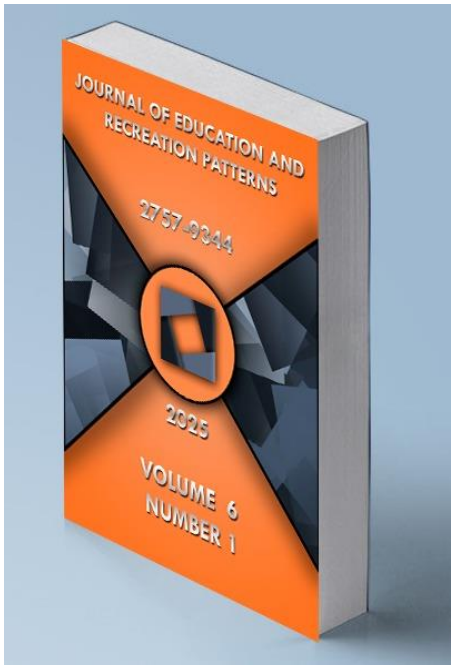

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The Effect of a 4-Week Quick Strength Training Program on Body Composition, Strength, and Jumping Performance in Kickboxers

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ABSTRACT

The aim of this study is to determine the effects of a four-week quick strength training program on body composition parameters, strength, and jumping performance in kickboxers. The study was designed as pre-test post-test experimental research with a control group, employing quantitative research methods. A total of 20 kickboxers (15.75±1.29), ten male and ten female, voluntarily participated in the study. The athletes were randomly assigned into two groups based on gender, with five athletes in each group: an experimental group (n=10) and a control group (n=10). The experimental group underwent quick strength training three times a week in addition to their routine kickboxing training, while the control group continued with only routine kickboxing training. Before and after the four-week training period, body composition analysis, countermovement jump (CMJ), back strength, and handgrip strength tests were conducted on the participants. The normality of the data was assessed using the Shapiro-Wilk test. For normally distributed data, the Independent Sample T-Test was used for comparisons between groups, while the Paired Sample T-Test was employed for within-group comparisons. According to the findings, significant improvements were observed in the back strength ($t = -2.336$; $p = 0.044$) and dominant handgrip strength ($t = -2.877$; $p = 0.018$) of the experimental group, favoring the post-test results. However, no statistically significant differences were found in CMJ, non-dominant handgrip strength, or body composition parameters between pre-test and post-test measurements ($p>0.05$). As a result, it was determined that a four-week explosive strength training program had positive effects on back strength performance and dominant hand grip strength in kickboxing athletes.

Keywords: Body Composition, CMJ, Strength, Quick Strength Training.

INTRODUCTION

Kickboxing is a highly dynamic combat sport that emphasizes speed, agility, strength, and endurance. One of the key factors determining success in this sport is the athletes' ability to effectively utilize their anaerobic capacity and generate quick strength (Slimani et al., 2017). Quick strength refers to the ability of skeletal muscles to produce maximum force in a very short time and is a crucial factor influencing the speed of kicks, punches, and defensive movements in kickboxers (Suchomel et al., 2018). While technical and tactical training is often prioritized in kickboxing training programs, the impact of quick strength training has not been sufficiently investigated. However, existing literature suggests that quick strength training has positive effects on body composition, muscle strength, and jumping performance. Studies have shown that such training can increase muscle mass while reducing body fat percentage, thereby enhancing athletes' movement efficiency (Cormie et al., 2011; Loturco et al., 2014).

Body composition is one of the key components influencing athletic performance. In particular, an increase in lean muscle mass and a decrease in body fat percentage can enhance movement energy levels, thereby improving athletic performance (Malina et al., 2004). Studies have shown that maximal resistance and jump strength training can reduce body fat percentage while promoting muscle hypertrophy (Newton & Kraemer, 1994). In kickboxers, maintaining a low body fat percentage and a high muscle mass ratio enhances both anaerobic endurance and power output, leading to improved performance (Franchini et al., 2013). Recent studies have suggested that high-intensity combined exercise may be the most effective exercise modality for improving cardiovascular fitness and reducing body mass index (Ceviz, 2024). A lower body fat percentage and higher lean muscle mass provide kickboxers with advantages in terms of speed and power generation (Slimani et al., 2017).

Sports performance is largely shaped by well-developed aerobic and anaerobic capacity, strength, speed, and agility (Feito et al., 2018). Physiological and psychological characteristics, physical performance capacity and anthropometric characteristics are important factors in achieving success in sports branches (Ünver et al., 2024). Sportive performance refers to the level of development in sport-specific motor abilities. Owing to its complex nature, it encompasses numerous specific components that influence overall performance. This complexity necessitates a multifaceted approach to training programs aimed at performance enhancement. Achieving peak performance depends on the balanced and harmonious development of all contributing factors (Aslan & Kahraman, 2023).Post-exercise performance enhancement is a principle that posits that following an acute period of high-intensity voluntary exercise, there will be an improvement in strength, power, jumping, and speed on the subsequent task (Sari et al., 2024). Since kickboxing challenges both aerobic and anaerobic systems, the development of these two energy systems increases a kickboxer’s chances of success (Buse, 2009). Muscle strength and jumping performance are critical factors in combat sports, particularly in determining lower limb power. A high jumping capacity is essential for delivering powerful kicks and executing quick movements (Turner et al., 2011). In high-level championship kickboxing competitions, athletes frequently perform rapid attacks lasting between one to five seconds, followed by longer periods of lower-intensity activity. However, transitioning to lower intensity for extended durations can negatively impact performance (Volodchenko, 2017). These competitions push athletes' maximum heart rates to approximately 90%, leading to significantly high lactic acid levels. This exposure indicates that athletes experience substantial physiological stress on both their aerobic and anaerobic systems throughout the match (Øvretveit, 2018).

Quick strength training can enhance neuromuscular adaptations, thereby increasing athletes' maximal force production capacity (Suchomel et al., 2018). Well-developed jumping performance is crucial for delivering more effective strikes and generating quick power. A high

jumping capacity is essential for executing powerful kicks and dynamic movements. Quick strength training improves neuromuscular adaptations, ultimately enhancing athletes' maximal force production performance (Markovic, 2007). However, specific studies on kickboxers remain limited, and the effects of short term, four-week quick strength training programs have not been fully elucidated.

This study aims to determine the effects of a four-week quick strength training program on body composition, muscle strength, and jumping performance in kickboxers.The 4 week training program to be implemented in this study is considered to be significant for the rapid performance enhancement of athletes. The findings are expected to make significant contributions to the development of kickboxing training programs. Identifying the impact of quick strength training on athletic performance will provide valuable practical insights for both coaches and athletes.

METHOD

Research Design

This study is designed as a pre-test post-test control group experimental research using quantitative research methods. The athletes were randomly assigned to two groups: the experimental group (n: 10) and the control group (n: 10). The experimental group received quick strength training in addition to the regular kickboxing training for four weeks, with sessions conducted three times a week. The control group only performed the regular kickboxing training.

Research Group

Research Group The population of this study consists of young kickboxers, while the sample includes 20 kickboxers aged 15–17 who voluntarily participated in the study under the Tatvan District Directorate of Youth and Sports. The participants were randomly assigned into two groups: an experimental group (5 male, 5 female, n=10) and a control group (5 male, 5 female, n=10). Before the study, detailed information about the research was provided to both the athletes and their parents. Participation was entirely voluntary, and only athletes who agreed to participate were included. Written informed consent forms were obtained from the athletes, while parental consent forms were signed by their legal guardians. Participants with chronic illnesses, musculoskeletal injuries in the past year, or those requiring continuous medication were excluded from the study. All participants were instructed to maintain a regular sleep schedule and a balanced diet throughout the study and to avoid any ergogenic aids or stimulants during the experimental period. Additionally, they were advised to refrain from intense physical activity and caffeine consumption within 24 hours prior to testing.

Training Protocol

The quick strength training protocol applied to the athletes was conducted three times a week for four weeks in the experimental group (Table 1).

Table 1

Quick Strength Training Program (Bilici and Alp 2024)

Days	Quick Strenght Drilleri	Duration of Load/Repetition Count	Rest (Between Repetitions)	Number of Sets	Rest (Between Sets)
Three days per week	-Jump Squat -Push Up -Russian Twins -Cooperative Pummeling -Shadow Boxing -Sprow -Bridge and Stretch	30 sec/1x	30 sec.	3-4	5 min. active

sec; second, min; minute

Data Collection Tools & Process

Measurement: The participants' height measurements were taken using a stadiometer (SECA, Germany) with a precision of 0.01 meters (m), while the subjects were barefoot and wearing shorts and a t-shirt.

***Body Weight Measurement*:** The body weights (BW) of the participants were measured using an electronic scale (Tanita BC-418 MA, Japan) with a precision of 0.1 kilograms (kg), while the subjects were barefoot and wearing shorts and a t-shirt.

Body Composition Measurement: For the athletes who met the inclusion and exclusion criteria, body composition components such as body weight, body mass index, body fat percentage, body water percentage, muscle mass, and body visceral fat percentage were measured using bioelectrical impedance analysis (Tanita BC-418 MA, Japan). The participants' previously determined height, age, and gender were entered into the device's data screen to obtain the measurements (Kara & Özal, 2022). After the device completed the measurements, the output values were recorded. Participants were instructed not to take a shower or use the sauna at least 24 hours prior to the measurements and not to consume any food at least 4 hours before the measurement. The measurements were conducted between 08:00 and 10:00 AM, and participants were not asked to engage in exercise on the day of the measurement. During the measurement, care was taken to ensure the feet were dry, and the electrodes were placed on the hands and heels. The participants held onto the handles attached to the electrodes throughout the measurement process.

Countermovement Jump (CMJ) Test: The Countermovement Jump (CMJ) test is used to assess leg quick strength, jump power, and alactic anaerobic power levels. The vertical jump measurements of the athletes were recorded using the electronic Fusion Smart Jump mat. All athletes were instructed to stand on the mat with their hands on their hips, and when ready, they were asked to jump as high as possible. After jumping, athletes were instructed to land back on the mat. Two trials were conducted for each athlete, and the jump heights were measured in centimeters, with the best performance recorded (Atan, 2019).

Back Strength Test: After a five-minute warm-up, the participants positioned their feet on the dynamometer bench with their knees slightly bent. With their arms extended, their back straight, and their torso slightly leaning forward, they were instructed to grip the dynamometer bar with their hands and pull it vertically upward using maximum force, primarily with their legs.

Grip Strength Test

The participant could either be in a standing or seated position. The dynamometer was adjusted according to each participant's hand size. With their arm straight and shoulders positioned at a 10-15° angle from the body, the participant first measured the maximum grip strength with their right hand. The participant was asked to perform a total of four trials, two with the right hand and two with the left hand. Adequate rest was provided between each trial. After each trial, the dial was reset to zero before moving on to the next attempt. All results were recorded, and the best performances were included in the results section for comparison purposes. A table was created to reflect the strong and weak hands' performance. The highest value recorded from the trials was registered as the final result.

Ethics of the Study

Before starting the study, ethical approval was obtained from the Bitlis Eren University Non-Interventional Clinical Research Ethics Committee with the decision number 2024/9-15, E.6803, dated 02.01.2025. Additionally, the study was conducted in accordance with the principles of the Helsinki Declaration.

Data Analysis

The data analysis was conducted using the SPSS software package. The normality of the data was determined using the Shapiro-Wilk test. Parametric tests were applied to data that followed a normal distribution. The Independent Samples T-test was used for comparing two independent groups, while the Paired Sample T-test was used for within-group comparisons.The magnitude of differences or effect size (ES) was interpreted using Cohen's d, where values of 0.2-0.49, 0.5-0.79, and ≥0.8 indicate small, medium, and large effects, respectively. A significant level of 0.05 was accepted for the study.

FINDINGS

Descriptive statistics regarding the general characteristics of the kickboxing athletes who participated in the study are presented in Table 2.

Table 2

Descriptive Statistical Results Related to the General Characteristics of the Participants

General Features	N	Mean	Std. Deviation	Min.	Max.
Age (year)	20	15.75	1.29	13.00	17.00
Height (cm)	20	168.10	9.89	153.00	186.00
Body Weight (kg)	20	59.71	11.20	45.00	86.00
BMI ($kg/m^{2)}$	20	21.00	2.46	16.59	26.25

Table 3

Independent Samples t-Test Results for the Pre-Test Values of the Groups

Parameters	Groups	N	Mean	Std. Deviation	t	p
CMJ (cm)	EG	10	28.49	5.64	.678	.507
	CG	10	27.13	2.96		
Back Strength (kg)	EG	10	98.65	26.69	-.069	.945
	CG	10	99.45	24.81		
Dominant Hand Grip Strength (kg)	EG	10	34.34	10.10	-.361	.722
	CG	10	35.99	10.33		
Non-dominant Hand Grip Strength (kg)	EG	10	31.06	7.17	-.451	.657
	CG	10	32.83	10.12		
Fat-free Mass Percentage (%)	EG	10	80.52	5.11	.503	.621
	CG	10	79.30	5.72		
Fat Percentage (%)	EG	10	19.49	5.11	-1.162	.261
	CG	10	24.64	13.06		

EG: Experimental group. CG: Control group. t: t-test value. p: statistical significance value

According to the findings in Table 3, there was no statistically significant difference in the pre-test values of jump, strength, and body composition parameters between the experimental and control groups of kickboxing athletes ($p>0.05$). Based on these findings, it can be stated that the groups are similar.

Table 4

The Results of the Paired Sample T-Test for the Pre-Test and Post-Test Values of the Experimental Group

Parameters	Tests	N	Mean	Std. Deviation	t	p	Cohen's d
CMJ (cm)	Pre-test	10	28.49	5.64	-1.307	.223	0.109
	Post-test	10	29.08	5.09			
Back Strength (kg)	Pre-test	10	98.65	26.69	-2.336	.044*	0.229
	Post-test	10	105.40	31.94			
Dominant Hand Grip Strength (kg)	Pre-test	10	34.34	10.10	-2.877	.018*	0.337
	Post-test	10	35.73	9.99			
Non-dominant Hand Grip Strength (kg)	Pre-test	10	31.06	7.17	-1.280	.233	0.253
	Post-test	10	33.04	8.43			
Fat-free Mass Percentage (%)	Pre-test	10	80.52	5.11	-0.245	.812	0.015
	Post-test	10	80.60	5.57			
Fat Percentage (%)	Pre-test	10	19.49	5.11	0.096	.925	0.006
	Post-test	10	19.46	5.46			

t: t-test value. p: statistical significance value. ES: effect size expressed as Cohen's d. *$p<0.05$.

According to the findings in Table 4, a statistically significant difference was found between the pre-test and post-test values of back strength (t=-2.336; p=0.044; Cohen's *d* =0.229) and dominant hand grip strength (t=-2.877; p=0.018; Cohen's *d* =0.337) in favor of the post-tests, at a small level. However, no statistically significant difference was found between the pre-test and post-test values for CMJ, non-dominant hand grip strength, and body

composition parameters (p>0.05).

Table 5

Results of the Paired Sample T-Test for the Pre-Test and Post-Test Values of the Control Group.

Parameters	Tests	N	Mean	Std. Deviation	t	p
CMJ (cm)	Pre-test	10	27.13	2.96	-1.067	.314
	Post-test	10	27.78	3.35		
Back Strength (kg)	Pre-test	10	99.45	24.81	-1.286	.230
	Post-test	10	103.60	26.06		
Dominant Hand Grip Strength (kg)	Pre-test	10	35.99	10.33	-0.408	.693
	Post-test	10	36.28	10.42		
Non-dominant Hand Grip Strength (kg)	Pre-test	10	32.83	10.12	0.913	.385
	Post-test	10	32.27	8.60		
Fat-free Mass Percentage (%)	Pre-test	10	79.30	5.72	0.055	.958
	Post-test	10	79.29	5.69		
Fat Percentage (%)	Pre-test	10	24.64	13.06	0.769	.462
	Post-test	10	24.45	12.53		

t: t-test value. p: statistical significance value.

According to the findings in Table 5, there was no statistically significant difference between the pre-test and post-test values for jump, strength, and body composition parameters in the control group of kickboxing athletes (p>0.05)

DISCUSSION

In this study, the effects of a 4-week quick strength training protocol on body composition, strength, and vertical jump performance were investigated in kickboxing athletes aged 15-17. According to the results of the study, a statistically significant difference was found between the pre-test and post-test values of back strength and dominant hand grip strength in favor of the post-tests, at a small level. However, no statistically significant difference was observed between the pre-test and post-test values for CMJ, non-dominant hand grip strength, and body composition parameters.

When reviewing the literature on similar studies, the positive effects of quick strength training on muscle strength are highlighted in several studies (Erdoğan & Pulur, 2000; Cengizhan & Günay, 2020; Koźlenia et al., 2024). Similarly, a study involving football players revealed significant improvements in the athletes' back strength following the implementation of various strength exercises (Ghigiarelli et al., 2009). A study examining the impact of strength training on young wrestlers found improvements in strength parameters (Arabacı, 2003). In another study, after an 8-week training program applied to university-level boxers, improvements in anaerobic power and hand grip strength were observed (Savaş & Uğraş, 2004). A different study, focusing on female boxers, identified significant improvements in hand grip strength and back strength parameters in the post-test following an 8-week pre-competition training program (Söyler & Çingöz, 2022). In a study that examined the effects of an 8-week quick strength training program on university students' athletic performance, improvements in hand grip and back strength were noted in the post-test results (Polat, 2000). A similar study found that after 6 weeks of strength training, there were improvements in hand grip and back strength, as well as a reduction in body fat percentage (Harbili et al., 2005). While the results

of the current study support findings related to back strength and hand grip strength, they do not align with the body fat percentage results. This discrepancy is likely due to the longer duration of the training program in the referenced study. Additionally, it is important to note that fat loss can be highly specific and that individual differences in fat loss may also contribute to the variation in results. The fact that our study period is limited to 4 weeks and the number of participants is not very high limits our study to a certain extent.

One noteworthy aspect of our study results is the absence of a significant change in CMJ, non-dominant handgrip strength, and body composition parameters. The greater strength of the dominant hand compared to the non-dominant hand is thought to be related to grip ability. In a study conducted by Peterson et al., it was found that the right dominant hand had approximately 10% greater grip strength than the non-dominant hand (Petersen et al., 1989). In a similar study examining the effects of hand grip strength on shooting accuracy in basketball players, it was determined that the grip strength of the dominant hand was greater than that of the non-dominant hand (Gencer et al., 2019).This finding suggests that short-term training programs may have limited effects on certain performance and body composition parameters. Indeed, the literature indicates that noticeable changes in body composition may require training programs lasting at least six weeks or employing different training approaches (Cengizhan & Günay, 2015). In another study, rapid strength exercises applied to athletes aged 16-18 led to improvements in handgrip and back strength in post-test measurements, while no changes were observed in body fat percentage (Erol & Sevim, 1993). Similarly, a specific study investigating performance improvements in basketball players following rapid strength training found that the applied training protocols significantly improved dominant hand and back strength, whereas no significant improvement was detected in the non-dominant hand (Cengizhan & Günay, 2015).

In a study examining the effects of quick strength training on athlete performance, significant improvements in back strength were observed in the post-test results after 6 weeks of training (Tokgöz, 2023). In another study comparing high-intensity quick strength training with traditional strength training in 52 adolescent individuals with no prior sport training, significant differences in strength development and vertical jump performance were found in the group that underwent 6 weeks of quick strength training (Gavanda et al., 2022). However, the vertical jump performance results from this study do not align with the findings of our study. It is believed that the difference is due to the longer 6-week training duration and the differing levels of readiness among the participants in the two studies.

In another study, following 8 weeks of pre-season intensive training with 29 boxers, significant differences in hand grip strength and vertical jump performance were identified, while no significant differences were found in body fat percentage (Pala & Savucu, 2011). The results related to grip strength and body fat percentage in this study support our findings, but vertical jump performance values differ from our study. This discrepancy is likely attributed to the difference in sample groups, as the participants in the other study were adults and at the national team level, which may contribute to variations in performance.

A study investigating the physical fitness changes in kickboxers following a modified Crossfit training protocol found improvements in hand grip strength (Ambroży et al., 2022). Additionally, another study examining body composition and performance values after a 5-week training period in kickboxers showed no significant difference in body fat percentage or CMJ values (Ouergui et al., 2014), which supports the findings of our study.

Conclusion

This study was conducted to determine the effects of a 4-week quick strength training protocol on body composition, muscle strength, and CMJ performance in kickboxers. The

findings are expected to provide significant contributions to the development of kickboxing as a sport and the improvement of training programs for kickboxers. In conclusion, the 4-week quick strength training protocol led to significant improvements in back strength and dominant hand grip strength, but it did not have a notable impact on vertical jump performance or body composition.

Recommendation

- Based on the results of this study, the following recommendations are made to contribute to the literature:
- Future studies should consider increasing the training duration and examine the effects of quick strength training conducted over different time periods (e.g., 8-12 weeks).
- The study focused only on strength and vertical jump parameters; therefore, it would be beneficial to assess the effects on motor skills such as flexibility, balance, and reaction time in future research.
- Since no significant change was observed in body composition, it is recommended to incorporate nutritional habits and supplemental nutrition into the training process for a more comprehensive evaluation of this variable.
- Comparative studies involving different age groups and genders could provide a broader perspective on the effects of the training protocol.

Limitations

The study duration was limited to only 4 weeks; thus, long-term adaptations could not be assessed. Longer training protocols may yield different results. The sample group consists solely of kickboxers aged 15-17. Conducting similar research into different age groups and sports could increase the generalizability of the results. Specific performance parameters (strength, vertical jump, body composition) were evaluated in the study, while other performance components such as flexibility, endurance, or technical development were not analyzed. Individual factors such as nutrition and sleep were not controlled. These factors could influence the athletes' adaptation to the training process. Measurements were conducted under field conditions rather than in a laboratory environment. For more precise evaluations, advanced laboratory analyses could be utilized.

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