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EFFECT OF 8-WEEK PLYOMETRIC TRAINING ON PHYSICAL FITNESS PARAMETERS IN WRESTLERS

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ABSTRACT

This study aims to examine the effects of an 8-week plyometric training program on certain physical parameters in wrestlers. Nineteen athletes, who have been involved in wrestling and have not experienced neurological, auditory-visual disorders, or severe injuries to the upper or lower extremities within the last year, participated in the study. The athletes were divided into experimental (n=10) and control (n=9). The experimental group underwent approximately 60 minutes of plyometric training, including warm-up exercises, three times a week for eight weeks, guided by their coach. Measurements taken in the study include the athletes' height, body weight, and body composition, Wingate anaerobic power test, and back strength measurements. Data was analyzed using the SPSS 25 statistical package. The Wilcoxon Test was used for intra-group pre-test and post-test comparisons, and the significance level was set at $p<0.05$. In the VKK values, a significant decrease was observed between the pre-test and post-test in the experimental group, while the control group saw a significant increase ($p<0.05$). Similarly, in the VYY values, the experimental group displayed a significant decrease between the pre-test and post-test, while the control group showed a significant increase ($p<0.05$). No statistically significant difference was found between the pre-test and post-test in both groups ($p<0.05$) for the PPW and AP values. In the right and left claw strength values, a statistically significant difference was observed between the pre-test and post-test in the experimental group but not in the control group ($p<0.05$). In back strength values, no significant difference was observed between the pre-test and post-test in both groups. The lack of a significant difference between the pre-test and post-test in both groups indicates a focus on lower extremity exercises. In conclusion, the results demonstrate that plyometric training improves physical attributes, especially strength..

Keywords: Wrestling, Plyometric training, Physical fitness

INTRODUCTION

Throughout history, sports have been defined by one prominent feature: Competition not only signifies the race but also brings with it many components and opportunities for development. Athletes, coaches, sports clubs, facilities, equipment manufacturers, and scientists are just a few of the actors in this competition (Söyler & Çingöz, 2022). Moreover, combat sports are performed by two athletes in similar weight categories, according to the rules set by the respective federations, and under the supervision of referees. In these sports, athletes use their upper and lower limbs to defend, attack, and counter their opponents. Taekwondo, karate, judo, wrestling, and kickboxing are prominent examples of such sports (Demir & Çelebi, 2019).

Wrestling is fundamentally defined as a contest between two individuals on a mat of specific dimensions, without the use of any equipment, as they strive to physically and psychologically dominate each other within a defined set of rules, striving to dominate each other physically and psychologically within a set of rules (Açak, 2015). Wrestling is also described as an intermittent physical condition that requires high anaerobic energy metabolism and significant power and muscular strength for both upper and lower body extremities (Hubner-Wozniak et al., 2004).

One of the reasons for the shift in wrestling training methods by coaches is the frequent changes made to the competition rules by the International Wrestling Federation (FILA). Training planned for competitors preparing for matches should not only improve technical skill but should also meet the biomechanical and physiological requirements specific to wrestling (Akbal, 1998).

For many strength and conditioning experts, the selection of training methods to efficiently and effectively improve athletes' performance within a limited time frame is of critical importance (Li et al., 2019). Plyometric training is particularly intriguing in this quest for performance.

Plyometric training is a high-intensity resistance method based on the lengthening and shortening phases of a muscle (Newberry & Bishop, 2006). It is also defined as "exercises aimed at achieving maximum force in a muscle as quickly as possible." This training model consists of exercises aimed at improving muscle contraction mechanism, muscle power, jump height, sprint speed, and agility (Foqhaa et al., 2021). Furthermore, plyometric training has the advantage of requiring reduced physical space, time, and equipment to complete training sessions (Field, 1991).

Research indicates that plyometric training can enhance strength, power output, coordination, and athletic performance. Plyometric exercises aim to enhance an athlete's improved coordination, the ability to quickly increase muscle tension, and consequently, a higher maximum force development rate. However, when the literature is examined, research on the effect of plyometric training on physical fitness parameters in wrestlers is quite limited.

In the field of wrestling, the main goal of the training programs that coaches plan is to improve the individual features of the athlete, help them excel in their branch, and achieve success. While new approaches and training methods for these core performance objectives are captivating, the contributions that branch-specific research will provide are crucial when reviewing the literature. Therefore, the aim of this study is to examine the effects of plyometric training on strength and anaerobic power in wrestling.

This study aims to investigate the effect of an 8-week plyometric training on anthropometric measurements, anaerobic performance, back, and grip strength in wrestlers.

METHOD

Research Model

The causal comparison model, which is one of the quantitative research methods, is used to determine the causes or influencing factors of a phenomenon. According to this model, the measurement results of plyometric training are compared with each other for individuals interested in wrestling. The aim is to reveal the relationship between the variables (Sayım, 2017).

Study Group

The study groups consist of a total of 19 healthy male wrestlers, 10 in the experimental group and 9 in the control group. The participants were randomly divided into two groups by the researcher: the experimental and control group. It was determined that the selected athletes did not experience any neurological or auditory-visual problems in the past year and did not have any upper or lower extremity injuries in the last six months. All participants who wanted to participate in the study were informed in advance and declared their consent in writing. The tests applied were conducted under the supervision of health experts. This research was conducted in the laboratories of Karabük University Hasan Doğan Physical Education and Sports Vocational School and Karabük Public Health Laboratory.

Training Program

In our study, in addition to wrestling training, the experimental group was given approximately 60 minutes of plyometric training including warm-up exercises 3 days a week for 8 weeks under the guidance of a coach. Plyometric exercises were applied for the first 4 weeks (3 sets-12 reps) and for the remaining 4 weeks (3 sets-15 reps), totaling 8 weeks. 60-second rest was given between sets and 15-second rest between repetitions during plyometric training. Athletes were asked to perform plyometric exercises at maximum level. Exercises known as box jump, drop jump, split squat jump, squat jump, and overhead slam were applied to the experimental group during plyometric training (Reyment et al., 2006).

Table.1 Plyometric Training Program

Plyometric exercises	1st, 2nd, 3rd, 4th week	5th, 6th, 7th, 8th weeks
box jump	3x12x15	3x15x15
drop jump	3x12x15	3x15x15
split squat jump	3x12x15	3x15x15
overhead slam	3x12x15	3x15x15

*(Set X repetitions X rest) **Rest between techniques: 60 sec.

Height, Body Weight, and Body Composition Measurements

The weight, FFM, and BFM measurements of the participating athletes were determined using the tanita 270 inbody device, which operates using the bioelectrical impedance analysis method. Height measurement was recorded in centimeters on a hard and flat surface with the athlete standing upright and barefoot.

Wingate Anaerobic Power Test

For the Wingate Anaerobic Power Test, a Monark 894E model leg bicycle ergometer with compatible software was used. Ergometer settings were adjusted according to the height of each athlete. During the test, athletes worked on a load equivalent to 75 gr/kg of their weight. For the athletes, a 5-minute warm-up program involving two or three short sprints at 60-70 rpm with 20% of the predetermined load was applied on the bicycle ergometer. After this warm-up period, athletes were given a 3-5 minute rest. Athletes were asked to reach the maximum pedal speed in the shortest possible time without resistance. Approximately 3-4 seconds after reaching maximum speed, the previously determined 75 gr/kg load was added to the ergometer and the test began. Throughout the test, continuous motivation was provided for the athletes to exhibit their fastest pedal rotation performance against this resistance for 30 seconds (Ozan, 2013).

Back Strength Measurement

After placing their feet on the dynamometer stand, the subjects tightly gripped and pulled the dynamometer bar vertically. During this process, their knees and arms were stretched, their backs were straight, and their bodies were slightly tilted forward. Three separate trials were conducted, and the highest result was recorded (Heyward, 2002).

Statistical Analysis of the Data

The SPSS 25 statistical program was used to analyze the data. The Shapiro Wilk-W test was examined to determine whether the data were normally distributed, and it was determined that the data did not show normal distribution. The Wilcoxon Test was used to determine differences between pre-test and post-test results within the group. The significance level was set at ($p<0.05$).

FINDINGS

Table 2: Age and height values of the participants

Groups	Age (years)	Height (cm)
Experiment (n:10)	21,6±2,27	176,8±5,30
Control (n:9)	20,77±1,39	1,74,11±7,25
whole group (n:19)	21,21±±1,90	175,52±6,27

When examining Table 1, it is seen that the average age of the experimental group is 21.6 ±2.27 years, and the average height is 176.8 ± 5.30 cm. For the control group, the average age is 20.77 ±1.39 years, and the average height is 174.11 ± 7.25 cm. The average age for all groups combined is 21.21 ±1.90 years, and the average height is 175.52 ± 6.27 cm.

Table 3: Body Composition Parameters

Variable	Group		n	Avg.	**± SS**	z	p
Body weight	Experiment	Pre- Test	10	75,28	9,34	-2,09	0,03*
		Post-Test	10	73,85	8,35		
	Control	Pre- Test	9	73,77	11,49	-1,10	0,27
		Post-Test	9	73,11	10,91		
body fat percentage	Experiment	Pre- Test	10	36,47	3,77	-2,80	0,00*
		Post-Test	10	37,92	3,52		
	Control	Pre- Test	9	34,22	5,02	-0,50	0,61
		Post-Test	9	33,91	4,53		
body muscle ratio	Experiment	Pre- Test	10	14,99±	5,90	-2,09	0,03*
		Post-Test	10	13,96	4,90		
	Control	Pre- Test	9	15,40	5,36	-1,68	0,09
		Post-Test	9	16,16	4,60		

When Table 3 is examined, there is a statistically significant decrease in the pre-test weight value of the experimental group from 75.28±9.34 to 73.85±8.35, while no statistically significant difference was observed in the control group's pre-test weight of 73.77±11.49 and post-test weight of 73.11±10.91 (p<0.05). For VKK values, there is a significant decrease in the experimental group's pre-test value of 36.47±3.77 to 37.92±3.52, while there is a significant increase in the control group's pre-test value of 34.22±5.02 to 33.91±4.53 (p<0.05). For VYY values, there is a significant decrease in the experimental group's pre-test value of 14.99±5.90 to 13.96±4.90, while there is a significant increase in the control group's pre-test value of 15.40±5.36 to 16.16±4.60 (p<0.05).

Table 4: Ratios of PPW, AP, Left Claw, and Back Strength of the Participants

Variable	Group		n	Avg.	**± SS**	z	p
PPW	Experiment	Pre- Test	10	698,53	191,08	--1,78	0,07
		Post-Test	10	777,53	201,05		
	Control	Pre- Test	9	699,02	201,35	-0,41	0,67
		Post-Test	9	710,43	138,86		
AP	Experiment	Pre- Test	10	473,60	84,68	-2,49	0,01*
		Post-Test	10	554,14	125,35		
	Control	Pre- Test	9	497,79	137,22	-0,53	0,59
		Post-Test	9	520,90	103,54		

RİGHT CLAW	Experiment	Pre- Test	10	55,60	4,76	-2,39	0,01*
		Post-Test	10	57,50	5,29		
	Control	Pre- Test	9	54,44	5,63	-1,02	0,30
		Post-Test	9	55,11	6,09		
LEFT CLAW	Experiment	Pre- Test	10	54,40	4,19	-1,60	0,10
		Post-Test	10	55,40	4,76		
	Control	Pre- Test	9	53,22	4,40	-1,27	0,20
		Post-Test	9	52,44	5,10		
BACK STRENGTH	Experiment	Pre- Test	10	151,00	13,90	-2,69	0,00*
		Post-Test	10	159,30	14,54		
	Control	Pre- Test	9	151,66	19,36	-0,68	0,49
		Pre- Test	9	155,00	11,18		

When Table “4 is examined, no statistically significant difference is observed in the PPW values between the pre-test value of the experimental group, which is 698.53±191.08, and the post-test value, which is 777.53±201.05. Similarly, in the control group, no statistically significant difference is observed between the pre-test value of 699.02±201.35 and the post-test value of 710.43±138.86, $p<0.05$. For the AP values, a statistically significant difference is observed between the pre-test value of the experimental group, which is 473.60±84.68, and the post-test value, which is 554.14±125.35. However, in the control group, no statistically significant difference is observed between the pre-test value of 497.79±137.22 and the post-test value of 520.90±103.54, $p<0.05$. For the claw right strength values, a statistically significant difference is observed between the pre-test value of the experimental group, which is 55.60±4.76, and the post-test value, which is 57.50±5.29. In the control group, no statistically significant difference is observed between the pre-test value of 54.44±5.63 and the post-test value of 55.11±6.09, $p<0.05$. For the claw left strength values, no statistically significant difference is observed between the pre-test value of the experimental group, which is 54.40±4.19, and the post-test value, which is 55.40±4.76. Similarly, in the control group, no statistically significant difference is observed between the pre-test value of 53.22±4.40 and the post-test value of 52.44±5.10, $p<0.05$. For the back strength values, a statistically significant difference is observed between the pre-test value of the experimental group, which is 151.00±13.90, and the post-test value, which is 159.30±14.54. However, in the control group, no statistically significant difference is observed between the pre-test value of 151.66±19.36 and the post-test value of 155.00±11.18, $p<0.05$. The results indicate that there is no significant difference between the pre-test and post-test in both the experimental and control groups, which suggests the frequent administration of lower extremity exercises.”

CONCLUSION and DISCUSSION

This study was designed to comprehensively examine the effects of plyometric training methods on jumping ability and overall performance in wrestlers. It aimed not only to assess the effects on performance but also to evaluate the changes in physiological parameters of the athletes to provide a more comprehensive evaluation. In the experimental group, there was a statistically significant decrease in muscle mass values between the pre-test and post-test during the period in which plyometric training was applied. In contrast, the control group

recorded a significant increase in muscle mass values during this time. This notable difference between the two groups indicates that the intensity and nature of the applied training methods play a determining role in physiological adaptations.

There was a significant decline in the VYY values between the pre-test and post-test for the experimental group, whereas the control group observed a significant increase. Yaşar & Sağır (2019) noted in their research that Greek, Iranian, Italian, Czech, and Azerbaijani athletes have low fat ratios. Kara, & Özal (2022) determined the XVYY value for wrestlers as 10.97±3.89. In 2007, Vardar and colleagues found this value to be XVYY= 9.7±6.3 in a study on 8 male wrestlers. Compared to the VYY values in the literature, the values obtained in our study are higher.

After applying an 8-week plyometric training program to wrestlers, there was no statistically significant difference in the PPW values between the pre-test (698.53±191.08) and post-test (777.53±201.05) for the experimental group. Similarly, for the control group, there was no significant difference between the pre-test (699.02±201.35) and post-test (710.43±138.86) $p<0.05$. In 2020, a study by Çalışkan showed wrestlers' anaerobic power measurements as follows: absolute PP value 702.40±204.51, relative PP value 10.83±1.46, absolute AP value 499.45±176.49, and relative AP value 7.91±0.85. In contrast, Ünver's study in 2011 on international wrestlers reported values of: absolute PP 1206.2±258, relative PP 15.35±2.34, absolute AP 611±144.9, and relative AP 7.35±0.7. Although the results of both studies do not match exactly, they support the conclusion that strength is a critical parameter in wrestling.

In grip strength values for the right hand, the experimental group showed a statistically significant difference between the pre-test (55.60±4.76) and post-test (57.50±5.29). In contrast, the control group did not show a significant difference between the pre-test (54.44±5.63) and post-test (55.11±6.09) $p<0.05$. For grip strength values of the left hand, the experimental group did not show a significant difference between the pre-test (54.40±4.19) and post-test (55.40±4.76). Similarly, the control group showed no significant difference between the pre-test (53.22±4.40) and post-test (52.44±5.10) $p<0.05$. The lack of significant change in grip strength in the experimental group indicates that the athletes reached a certain level of strength and the 8-week intensive lower body workouts played a significant role. In the literature, Bayer (2018) and a study conducted by Bağcı in 2016, found a statistically significant decrease in grip strength between pre-test and post-test for the experimental group. In contrast, the control group showed a statistically significant increase in grip strength for both right and left hand.

For back strength values, the experimental group showed a statistically significant difference between the pre-test (151.00±13.90) and post-test (159.30±14.54), while the control group did not show a significant difference between the pre-test (151.66±19.36) and post-test (155.00±11.18) $p<0.05$.

In this study, the effect of an 8-week plyometric training on the physical fitness parameters of wrestlers was examined. The results suggest that plyometric exercises contribute significantly to the muscle development of wrestlers. The exercises show significant improvements in their physical attributes, especially in strength parameters. Moreover, it has been determined that the training can also enhance the overall performance and endurance of the wrestlers during competitions.

SUGGESTIONS

• Plyometric training with different training methods can be recommended to improve the physical performance of wrestlers
• Detailed physical fitness tests should be applied before and after to evaluate the effects of plyometric training on wrestlers.
• It is recommended to continuously monitor how the energy consumption, muscle strength, and endurance values of the wrestlers change during the training period.
• Providing detailed information about the content, frequency, and duration of the plyometric training program applied to wrestlers is critical for the transparency and repeatability of the study.
• To reduce the potential injury risks of plyometric training, wrestlers should be constantly educated and provided feedback on using the correct techniques during training
• This study can be recommended to be used to contribute to sports science by shedding light on future studies.

ETHICAL TEXT

In this article, journal writing rules, publication principles, research and publication ethics rules, journal ethics rules were followed. “In this article, the journal writing rules, publication principles, research and publication ethics, and journal ethical rules were followed. The responsibility belongs to the author (s) for any violations that may arise regarding the article”. The ethics committee permission of the article was obtained by Bayburt University/Publication Ethics Committee with the decision numbered E-15604681-100-138505 dated 19.06.2023.

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