

The Effect of Plyometric Training on Improving Certain Physical Abilities in Karate Athletes: A Field Study on Kumite Practitioners in the Youth Category (18–20 years) – Chettia – Chlef

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Abstract:

This study aims to examine the impact of plyometric training on improving certain physical abilities in junior karate athletes specializing in kumite. To achieve this, an experimental approach was adopted, involving a purposive sample of 16 athletes from the Chettia Sports Club. The researchers employed both theoretical tools—such as previous studies and scientific observation and practical tools, including physical performance tests. After collecting and statistically analyzing the data, the findings indicated that plyometric training positively affects explosive strength and execution speed in kumite athletes. Based on these results, the study recommends the broader application of plyometric training among youth categories to enhance both physical and technical performance.

Keywords: Plyometric Training; Physical Abilities; Karate; kumite; Junior.

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1. INTRODUCTION

Karate is one of the combat sports that relies on a complex combination of physical and technical abilities. Among its various disciplines, Kumite is considered the most demanding in terms of execution speed and explosive strength ⁽¹⁾. Given the intense competition in national and international championships, the development of advanced physical capacities has become an essential requirement for achieving athletic excellence. Plyometric training is widely recognized as one of the most effective modern training methods aimed at improving explosive power and motor response speed both of which are critical factors in Kumite, where minimal differences in timing and force can determine the outcome of matches.

According to⁽²⁾ plyometric training is an effective method for enhancing muscular strength by promoting rapid muscle contractions that involve both concentric and eccentric actions. Similarly,⁽³⁾ confirmed that this form of training directly contributes to improved athletic performance in activities requiring repeated explosive movements, such as jumping, kicking, and punching all of which are fundamental actions in karate.

However, field observations of training practices in many sports teams particularly in the Algerian context reveal a noticeable lack of systematic implementation of plyometric training within physical preparation programs for karate athletes. This has led to evident deficiencies in execution speed and explosive strength development.

Furthermore⁽⁴⁾, emphasized that modern Kumite demands highly

(1)-Shalaby, 2019. Shalaby, Exploring the mechanics of biomolecules in athletic performance, Molecular & Cellular Biomechanics , vol.21no.1(2024),p31.

(2)- Chu, D. A., Jumping into plyometrics, Human kinetics, 2nd ed, USA, 1998, p112.

(3)- Markovic and Mikulic, Neuro-Musculoskeletal and Performance Adaptations to Lower-Extremity Plyometric Training, Sports Medicine, vol. 40 p859,2012.

(4)-Lehmann G, Jedliczka G. Untersuchungen zur Bestimmung und Entwicklung eines, Investigations on the determination and development of a sport-
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accurate and rapid execution of offensive techniques, often at moments when the opponent loses focus or attention, which necessitates a high level of physical preparedness.

In light of this reality, there is a pressing need for scientific research that examines the effects of plyometric training on specific physical capacities that also have direct implications for the technical performance of karate athletes. The ultimate goal is to propose effective training programs that align with the demands of modern competitive environments.

Given the importance of the topic, **we asked the following questions:**

-Does plyometric training have an impact on the explosive power trait in junior karate athletes?

-Does plyometric training have an impact on the executive velocity trait in junior karate athletes?

Based on the previous questions, we assumed the following:

1-The study hypothesizes that there will be a statistically significant improvement in explosive power in the experimental group compared to the control group after the application of the plyometric training program.

2-The study hypothesizes that the experimental group will show a statistically significant improvement in execution speed compared to the control group in the post-test.

-The study aims to:

1-Identifying the effect of plyometric training on explosive strength in karate athletes specializing in kumite.

event-specific profile of the physical requirements in high-performance training for the sport of karate- kumite, *Leistungs sport*, 1998 36:225-226.

2-Identifying the effect of plyometric training on execution speed in karate athletes specializing in kumite.

The importance of this study lies in: training, in developing key physical abilities directly related to combat performance in karate, especially in the Kumite specialization. The study also provides valuable insights for coaches and athletes through scientific results that can be utilized to improve training programs designed for the youth category aged 18 to 20 years. Additionally, this study addresses a clear gap in local research concerning the effects of plyometric training on karate athletes in Algeria, with a particular focus on the Chlef region. Finally, the study supports competitive performance among youth by enhancing vital physical components such as speed and explosive power, which are essential factors for success in karate competitions.

2. Method and Materials:

This section provides a detailed account of the procedures followed during the study, including both conceptual and operational definitions of the variables involved. A thorough explanation of the methodology allows readers to assess the suitability of the chosen methods as well as the reliability and validity of the findings. It may include participant characteristics, sampling procedures, sample size, measures and research design.

2.1 The method used:

We used the empirical method, which is the most appropriate for solving the research problem, addressing its nature and objectives, as well as to ensure the validity of the hypotheses.

The experimental method is the closest and most honest approach to solving many scientific issues effectively and theoretically, and its contribution to the progress of scientific research in the humanities and social sciences, including sports science⁽⁵⁾.

(5)- Mohammed Hassan Allawi, Osama Kamel Ratib, Scientific Research in sports Education and sports Psychology, Cairo, Dar al-Fikr al-Arabi, 1999.

2.2 Research sample:

The research sample refers to the subset of the study population from which field data is collected. It represents a portion of the whole population, selected to accurately reflect its characteristics, and used to facilitate the implementation and analysis of the study.

As it is a certain part or a certain percentage of the members of the community⁽⁶⁾

Due to the nature of our research, we selected the research sample consisting of 16 karate wrestlers, randomly divided into two groups, including 8 karate wrestlers as a control sample and 8 karate wrestlers as an experimental sample from the male junior category the state of Chettia.

Search fields:

Temporal domain:

-The experiment was conducted in the following chronological order:

-The exploratory experiment took place on 07-12-2025 to 11-12-2025.

-Pre-tests were conducted on 15-12-2025 on the control sample, and on 17-12-2025 on the experimental sample, the training programme was applied from 21-12-2025 until 01-03-2025, while the control sample was left to practice its normal training under the supervision of its trainer and its training periods were the same as the experimental sample's training periods.

The spatial domain: The work with the experimental sample took place in the private hall of the amateur sports club, Individual Sports Champions in Chettia, and the Sprint Sports Complex.

(6)- Mohammed Nasreddin Radwan, 2008.

The human domain: The research sample included 16 karate wrestlers.

- 08 wrestlers representing the experimental sample to which the proposed training programme was applied.

- 08 wrestlers representing the control sample who were left to train under the supervision of their coach.

2.3 Materials:

The research tools that the researcher uses to collect data related to the research topic are considered one of the most important steps.

The main and necessary focus of the study.

- Tests and measurements.

- References and sources.

- Statistical methods.

- Sports equipment: Mat, skipping ropes, beams, rings, barriers, box, decameter, timer, whistle, bag

- sand (sac) - medicine balls (0.5 kg) - floor ladder - dummies - resistance elastics - CrossFit ropes.

Measuring tests:

- Ground Pressure: Calculated with correct repetitions only.

- Broad jump: In metres.

- Kizami Tsuki Technique: by seconds

- Kizami Mwashiri Kiri Technology: by seconds.

2.4 Design and Procedure:

A) The Tests Used:

Inclined prone arm push-up test: (Figure 01):

- Measurement: (30 seconds) with correct repetitions.

-Objective: To determine the level of explosive muscular strength in the shoulder region and arms.

-Working Methods: Push up with the arms with a bend from an inclined prone position.

Physical attributes	TESTS	Sample1	Sample2	Sample3	Sample 4
Power Explosive	Ground pressure with the arms	56 times	51 times	62times	40times
		61 times	50 times	67times	43times
	Broad jump from standing still	1 .85m	2 .10m	2.00m	2.15m
		1 .70m	2.22m	2.13m	2 .16m
Executive Speed	Kizami Tsuki's execution speed	0.57sec	0.64sec	0.72sec	0.58sec
		0.59sec	0.77sec	0.64sec	0.61sec
	Kizami Mwashiri Kiri Technology Implementation Speed	0.67sec	0.72sec	0.69sec	0.70sec
		0.61sec	0.75sec	0.65sec	0.67sec

Tableau (1): measuring tests

Measuring tests:

-Ground Pressure: Calculated with correct repetitions only.

-Broad jump: In metres.

-Kizami Tsuki Technique: by seconds

-Kizami Mwashiri Kiri Technology: by seconds.

B) Statistical Analysis

The study hypothesizes that the experimental group will show a statistically significant improvement in execution speed compared to the control group in the post-test.

3.Present and analyse the results:

3.1-Physical testing of the floor press and broad jump test from static:

a) Pre-testing the experimental and control samples:

Test	Group	N	Arith mean	Stand Deviat	Calcul T	Deg of free	Tab T-	Deci stati
Gp(1)	Exp	08	2.74	7.77	0.00	14	1.76	NS
	Cont	08	2.70	7.66				
Bj(2)	Exp	08	0.02	0.07	0.50	14	1.76	NS
	Cont	08	0.02	0.08				

Table (02): Shows the results of a pre-test for floor press and broad jump for the two samples.

Gp: Ground pressure, Bj: Broad jump

The results for the pre-test of floor press and broad jump test for differences between the two groups in some variables showed, that there were no significant differences before the main experiment for test (1), and the calculated T value was 0.50 and the tabulated T value was 1.76 at the significance level of 0.05 and the degree of freedom 14 for test (2).

This confirms that there were no differences between the two groups in Tests 1 and 2 before the main experiment.

b) The results of the experimental sample:

The test	The experimental group				Calc T	Deg of free	Tab T	Dec static
	Tests	Samp	Arith mean	Stand Devi				
G p (1)	Pre- t	08	2 .74	7.77	4.7 1	7	1.89	signif
	Post- t	08	1.88	5.33				
B j (2)	Pre- t	08	0.02	0 .07	4.2 7	7	1.89	signif
	Post- t	08	0 .05	0.15				

Table 03: Pre- and post-test results for floor press and broad jump from stability for the experimental sample.

From the results in Table 03, we observe statistically significant differences in favor of the experimental group, Specifically, in the floor press test, the pre-test recorded a mean of 2.74 with a standard deviation of 7.77.

This means that there is a difference between the results of the post-test and the pre-test and this difference is statistically significant in favor of the post-test.

c) the results for the control sample:

Test	The experimental group				Calc T	Degr of free	Tab T-	Decis
	Tests	Sam	Aritme an	Staned viati				
G p (1)	Exp	08	1.88	5 .33	4.49	14	1.76	S
	cont	08	2.63	7.46				
B j (2)	Exp	08	0.05	0 .15	3.94	14	1.76	S
	cont	08	0 .03	0.09				

Table (04): The results for the floor press and broad jump from the two samples.

From the results in Table (04), we There were statistically significant differences in favor of the experimental group, as demonstrated by the improvement in the performance of its members during the training process. This was reflected in the variation of the arithmetic means between the experimental and control samples in the post-test results. For the experimental group, indicating a statistically significant difference.

This means that there is a difference between the results of the posttest of the two samples and this difference is significant in favor of the posttest of the experimental sample in both tests.

3.2- Execution speed test for the Kizami Tsuki skill and Kiza Moashi Kiri skill:

a) Pre-testing the experimental and control samples:

The test	The experimental group				Calc T	Degr of free	Tab T	Decision
	Tests	Samp	Arit mean	StandDev				
K T S E S (1)	exp	08	0.01	0.04	0.42	14	1.76	NS
	cont	08	0.01	0.04				
K M K S I (2)	exp	08	0.01	0.03	0.04	14	1.76	NS
	cont	08	0.01	0.03				

Table (05): The results of the pre-test for the speed of execution of Kizami Tsuki and Kiza Moashi Giri for the two samples.

(KTSES): Kizami Tsuki Skill Execution Speed Test

(KMKSI): Speed test of Kiza Moashi Kiri Skill Implementation

The results of the table, in some variations, there were no significant differences before the main experiment, as the calculated T value of 0.42 was lower than the tabular T value of 1.76 at a significance confirms that there were no differences between the two groups in the two tests before the main experiment.

b) The results of the experimental sample:

The test	The experimental group				Calcu T	Deg of free	TabT-	Decision
	Tests	Samp	Arith mean	Stand				
KTSE S (1)	Pre-t	08	0.01	0.04	9.25	7	1.89	signif
	Post-t	08	0.01	0.05				
KMK	Pre-t	08	0.01	0.03				sig nif

SI (2)	Post-t	08	0 .008	0.02	16.94	7	1.89	
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Table (06): Pre- and post-test of the speed of execution of the Kizami Tsuki and Kiza Moashi Giri skills for the experimental sample.

From the results in Table 06, we notice there were statistically significant differences in favor of the experimental group, as evidenced by the improvement in participants' performance throughout the training process. In the implementation speed test of the Kiza Moashi Giri technique, the pre-test recorded a mean of 0.01 with a standard deviation of 0.03, while the calculated T-value was 16.94 — notably higher than the tabulated value. In the post-test, the mean decreased to 0.008 with a standard deviation of 0.02. The results reveal a meaningful improvement in execution speed observed in the post-test, providing strong evidence for the effectiveness of the training program.

c) The results for the control sample:

The test	The experimental group				Calc T	Degr of free	TabT-	Decision
	Tests	Samp	Arit mean	Stand devia				
KTSES (1)	Pre-t	08	0.01	0.04	2.96	7	1.89	signif
	Post-t	08	0.01	0.04				
KMKSI (2)	Pre-t	08	0.01	0 .03	2.19	7	1.89	signif
	Post-t	08	0 .01	0.03				

Table (07): Pre- and post-test results for the speed of execution of

the Kizami Tsuki and Kiza Moashi Giri skills for the control sample.

From the results in Table 07, we can see that there are small significant differences in favor of the control sample.

The pre-test of the Kizami Tsuki skill execution speed test had an arithmetic mean of 0.01 and a standard deviation of 0.04, while the calculated T value of 2.19 was greater than the tabulated T value of 1.89. The pre-test of the Kizamuashi Kiri skill execution speed test had an arithmetic mean of 0.01 and a standard deviation of 0.03, while the calculated T value of 2.19 was greater than the tabulated. The post-test had an arithmetic mean of 0.01 and a standard deviation of 0.03. This indicates that there are small significant differences.

d) Evaluation of the experimental and control samples after testing:

The test	The experimental group				Calc T	Degr of free	Tab-T-	Decision
	Tests	samp	Arit mean	Stand devia				
KTSES (1)	Exp	08	0.01	0.05	5.51	14	1.76	signif
	Cont	08	0.01	0.04				
KMKSI (2)	Exp	08	0.008	0 .02	12.2	14	1.76	signif
	Cont	08	0 .01	0.03				

Table (08): The results of the dimensional test of the speed of execution of the Kizami Tsuki skill and the Kiza Moashi Kiri skill for the two samples.

Through the results in Table (08), we notice that Significant differences were observed in favor of the experimental group, demonstrated by the development of its members during the training process. This was reflected in the differences between the arithmetic means of the two groups in the post-test.

For the “Kizami Tsuki” skill execution speed test, the experimental group’s post-test mean was 0.01 with a standard deviation of 0.05, and the calculated t-value of 5.51 exceeded the critical value of 1.76. The control group’s post-test mean was also 0.01 with a standard deviation of 0.04.

Regarding the “Kizamuashi Kiri” skill execution speed test, the experimental group’s post-test mean was 0.008 with a standard deviation of 0.03, and the calculated t-value of 12.2 was greater than the tabulated value. The control group’s post-test mean was 0.01 with a standard deviation of 0.03.

These results indicate significant differences between the two groups post-test performances, favoring the experimental group.

4. Discussion

Comparing the results with the hypotheses:

-With the topic of our research on the effect of plyometric training on some physical abilities in junior karate athletes, and considering what is required for athletic excellence, this research was directed to the development of some physical qualities (explosive strength and executive speed), where representative tests were conducted according to the systematic sequence of tests.

1- Discussion of the results related to the first hypothesis:

In light of the results of the explosive strength assessments—namely the floor press test and the standing broad jump test—as presented in Tables (02) and (04), statistically significant differences were observed in the post-test between the experimental and control groups, favoring the experimental group. These findings confirm the validity of the first hypothesis, which states that the plyometric training method positively influences the development of explosive strength in junior-level karate athletes.

This is consistent with what Mohamed Zaki Hassan pointed out

that plyometric training develops and improves explosive power, as well as the findings of the study⁽⁷⁾ and the study⁽⁸⁾.

2- Discussion of the results related to the second hypothesis:

The results indicated that there were statistically significant differences in the executive speed variable of the Kizami Tsuki and Kiza Moashi Kiri skill tests between the control and experimental groups for the post-test in favor of the experimental group in improving the executive speed attribute.

In the light of the results of the two tests of executive speed for the two skills mentioned previously and presented in tables (06) and (08), which resulted in the existence of statistically significant differences between the experimental and control group for the post-test in favor of the experimental group.

This is consistent with the findings of previous studies by⁽⁹⁾, and these results were reflected in the improvement of the effectiveness of attack and defense in karate⁽¹⁰⁾.

5. Conclusion:

Karate is a sport that requires its practitioners to possess high

(7) -chenouf Khalid, Using plyometric, weightlifting, and mixed training to develop explosive power and its effect on certain physical abilities in karate fighters, doctoral thesis Abdelhamid Ibn Badis University of Mostaganem , p13-15, 2019

(8) - Lehmann G, Jedliczka G. Untersuchungen zur Bestimmung und Entwicklung eines, Investigations on the determination and development of a sport-event-specific profile of the physical requirements in high-performance training for the sport of karate- kumite, Leistungs sport, 1998 36:225-226.

(9)-chenouf Khaled, chenouf Khaled, The effect of plyometric training on the development of explosive force and its relationship with the development of some offensive skills in karate wrestlers - middle males - (17-19 years) in the state of Tiaret, 2012,p45.

2- Chu, D. A. , Jumping into plyometrics, Human kinetics, 2nd ed, USA, 1998, p44.

(10)-chenouf Khaled, chenouf Khaled, The effect of plyometric training on the development of explosive force and its relationship with the development of some offensive skills in karate wrestlers - middle males - (17-19 years) in the state of Tiaret, 2012,p45.

2- Chu, D. A. , Jumping into plyometrics, Human kinetics, 2nd ed, USA, 1998, p44.

levels of physical abilities. Explosive strength and execution speed are among the fundamental physical attributes in the Kumite discipline, whether in defensive or offensive movements.

Numerous studies have indicated that plyometric exercises are notably effective in improving various physical qualities, particularly those related to explosive power and execution speed.

This study is expected to help direct coaches' attention toward adopting more effective methods for enhancing athletic performance, especially among youth categories, given the limited number of local studies that have explored this topic in depth.

References:

1. chenouf Khaled, The effect of plyometric training on the development of explosive force and its relationship with the development of some offensive skills in karate wrestlers - middle males - (17-19 years) in the state of Tiaret, 2012, magister thesis, University of Mostaganem.
2. Chu, D. A. , Jumping into plyometrics, Human kinetics, 2nd ed, USA, 1998.
3. chenouf Khaled, Using plyometric, weightlifting, and mixed training to develop explosive power and its effect on certain physical abilities in karate fighters, doctoral thesis Abdelhamid Ibn Badis University of Mostaganem , p13-15, 2019.
3. Lehmann G, Jedliczka G. Untersuchungen zur Bestimmung und Entwicklung eines, Investigations on the determination and development of a sport-event-specific profile of the physical requirements in high-performance training for the sport of karate-kumite, *Leistungs sport*, 1998 36:225-265.
4. Markovic and Mikulic, Neuro-Musculoskeletal and Performance Adaptations to Lower-Extremity Plyometric Training, *Sports Medicine*, vol.40 p859-895, 2012.
5. Mohammed Hassan Allawi, Osama Kamel Ratib, Scientific Research in sports Education and sports Psychology, Cairo, Dar al-Fikr al-Arabi, 1999.
6. Mohammed Nasreddin Radwan, 2008.
7. Salah Sayed Zayed, 'The effect of a weight and plyometric training

programme on the growth rates of muscular capacity in prepubertal karate juniors. (2000). PhD thesis, Helwan University.

8. Shalaby, Exploring the mechanics of biomolecules in athletic performance, *Molecular & Cellular Biomechanics* , vol.21no.1(2024)