https://journal.mutiarahatimoeslem.id/index.php/cores/index
P-ISSN: XXX-XXX E-ISSN: XXX-XXX (Vol. 2 No. 1)
DOI: 10.64131/cores.v2i1.89

Research Article

The Effect of Resistance Band and Push-Up Training on the Speed of Gyaku Tsuki Strikes in Karate Athletes Aged 9–17 Years

Zidane Raja Min Sihotang[1], Hirja Hidayat[2], Rivan Saghita Pratama[3]

[12] Physical Education, State University of Riau, Indonesia
[3] Sports Coaching Education, State University of Semarang, Indonesia

Email author corresponding: zidane.raja3718@student.unri.ac.id

Abstract:

Background: This research was motivated by the low speed of gyaku tzuki strikes by karate athletes and the suboptimal training methods used. **Aims:** The objective of this study was to analyze the effect of resistance band training and push-ups on improving the speed of gyaku tzuki strikes by karate athletes aged 9–17 years at the Kulim Dojo in Pekanbaru. **Methods:** This study used a quantitative approach with an experimental method and a one-group pre-test post-test design. The study sample consisted of 20 athletes selected through purposive sampling. The research instrument used in this study was the gyaku tzuki punch speed test to measure an athlete's ability to perform rapid punches within 30 seconds. The number of valid and properly executed punches was recorded as the athletes' punch speed score. Data analysis was performed using the Shapiro–Wilk normality test, Levene's homogeneity test, and the paired-samples t-test. **Results:** The homogeneity test showed that the data were homogeneous (Sig. = 0.305 > 0.05). The paired sample t-test results indicated a significant improvement in gyaku tzuki punch speed after the training intervention, with the mean score increasing from 35.05 to 37.60 (Sig. = 0.000 < 0.05). These findings demonstrate that resistance band and push-up training significantly improved the punch speed of karate athletes. **Conclusion:** Thus, it can be concluded that both training methods are effective in increasing the speed of gyaku tzuki punches in karate athletes.

Keywords: Resistance Bands, Push-ups, Punching Speed, Gyaku Tzuki, Karate.

Introduction

Background of the study: Sports are physical activities that are carried out in a planned and continuous manner with the aim of improving physical fitness, physical and mental health, and individual skills in various sports (Lassalvia et al., 2023; Lopes-Silva & Franchini, 2021). In the context of competitive sports, sports activities are directed at achieving optimal performance through structured, disciplined, and continuous training in order to achieve maximum results in competition (Chaabene et al., 2019; Maldonado et al., 2026). One of the rapidly developing competitive sports is martial arts, which requires a combination of physical condition, technique, tactics, and mental strength from athletes (Navickaitė & Thomas, 2023). Karate is a competitive martial art that is divided into three main components, namely kihon (basic techniques), kata (forms), and kumite (sparring) (Alifa Beauty et al., 2026; Repany Julianty et al., 2025). In kumite,

https://journal.mutiarahatimoeslem.id/index.php/cores/index
P-ISSN: XXX-XXX E-ISSN: XXX-XXX (Vol. 2 No. 1)
DOI: 10.64131/cores.v2i1.89
Research Article

the speed of the punch is an important factor in determining the effectiveness of an attack, especially in the gyaku tzuki technique. This technique requires strength, coordination, and optimal arm speed so that the attack can be carried out quickly, accurately, and powerfully (Silvia & Wijono, 2023; Suprianto Kadir, 2025)

Punching speed is greatly influenced by the athlete's physical condition, especially the strength and explosive power of the arm muscles. Physical condition components such as strength, endurance, speed, agility, coordination, and balance are the main foundations in supporting the performance of karate athletes (Adil et al., 2024; Tri Ardilaini et al., 2025). Without adequate physical condition, the application of techniques and strategies in competition cannot be maximized (Gautam et al., 2026). Observations conducted on karate athletes at the Dojo showed that the speed of the gyaku tzuki punch was still not optimal. The punches tended to be slow and ineffective in hitting the target, thereby reducing the quality of attacks and the performance of athletes in training and competition. This problem is thought to be influenced by physical aspects and training methods that are not specifically aimed at increasing punch speed.

One alternative training method that is considered effective and safe for athletes aged 9–17 years is resistance band training and push-ups. Resistance band training can progressively increase arm muscle strength and speed(Butnariu et al., 2026; Coşkun et al., 2025). while push-ups play a role in increasing arm muscle strength and endurance, which support explosive power and striking speed (Erol, 2022; Zhao et al., 2022). Muscle explosive power contributes directly to increasing the speed of gyaku tzuki punches. Based on this description, research is needed to empirically examine the effect of resistance band and push-up exercises on increasing the speed of gyaku tzuki punches in 9-17-year-old karate athletes at the Dojo. This research is expected to provide a scientific basis for developing effective, targeted training programs that are appropriate for the characteristics of young and adolescent athletes.

Literature Review: Sports are planned physical activities aimed at improving physical fitness, health, and quality of life (Campillo-Sánchez et al., 2025; Wang et al., 2025). In competitive sports, training is systematically and measurably designed to achieve optimal performance in competitions, emphasizing the integrated development of athletes' physical condition, technique, tactics, and mental strength (Barakou et al., 2025; Martin Ginis, 2025; Piepiora, et al., 2025) Karate as a competitive martial art requires mastery of technique, physical readiness, and good mental control (Piepiora, Jurczyk, et al., 2025; Rahmatilah et al., 2026) Karate consists of three main components, namely kihon, kata, and kumite (Piepiora, 2025). In kumite, striking techniques, especially gyaku tzuki, are important elements in determining the effectiveness of attacks and scoring points (Gheorghiu et al., 2026). Striking speed is defined as the ability to perform movements in the shortest possible time and is a crucial factor in kumite (Cynarski & Piwowarski, 2024). High-speed punches are more difficult for opponents to anticipate and increase the chances of a successful attack. Punching speed is influenced by strength, muscle power, coordination, and movement technique efficiency (Kacprzak et al., 2025; Mahdi, 2025). Physical condition plays a major role in supporting the performance of karate athletes. The dominant components of physical condition include strength, endurance, speed, agility, coordination, and balance (Dos Santos et al., 2025; Pinto et al., 2025; Zhang et al., 2025).

Arm strength and muscle power are directly related to the ability to deliver fast and powerful punches (Kumar et al., 2025; Stewart et al., 2025). Resistance band training is a form of elastic resistance training that is effective for increasing muscle strength and contraction speed. States that resistance band training can improve the quality of gyaku tzuki punches through progressive loading. This finding is reinforced by (Dos Santos et al., 2025), who showed a significant increase

https://journal.mutiarahatimoeslem.id/index.php/cores/index
P-ISSN: XXX-XXX E-ISSN: XXX-XXX (Vol. 2 No. 1)
DOI: 10.64131/cores.v2i1.89
Research Article

in the speed of karateka punches after applying resistance band training. Additionally, push-ups are bodyweight exercises that focus on strengthening the arm, shoulder, and chest muscles. According to (Cinarli et al., 2025; Piepiora, Jurczyk, et al., 2025), push-ups are effective in increasing the strength and endurance of the arm muscles needed in martial arts. Also emphasizes that push-ups contribute to improved physical fitness and muscle endurance. Theoretically, the combination of resistance band exercises and push-ups has the potential to increase arm muscle strength and power, which directly affects the speed of gyaku tzuki punches. Therefore, the application of these two training methods in a program is expected to increase the punching speed of karate athletes aged 9–17 years.

Gap Analysis: Various studies show that striking speed is a crucial factor in supporting the performance of karate athletes, especially in the gyaku tzuki technique, which is influenced by the strength and explosive power of the arm muscles. Several studies have proven that resistance band and push-up exercises separately can increase strength and striking speed. reported that resistance band training has a significant effect on improving the quality and speed of karate punches (R. Wu & Choosakul, 2026; Yang et al., 2025). Meanwhile, emphasized that push-up training is effective in increasing the strength and endurance of the arm muscles that support the effectiveness of punches. However, most previous studies have focused on one type of training method and have not comprehensively examined the effectiveness of combining resistance band and push-up training, especially in karate athletes aged 9–17 years (Rizqi Kornia et al., 2025; H. Wu et al., 2025). Additionally, research at the dojo level with child and adolescent subjects remains limited, including among karate athletes at the Kulim Pekanbaru Dojo. Therefore, empirical research is needed to examine the effect of combining these two training methods on the speed of gyaku tzuki punches to serve as a basis for developing effective, safe, and age-appropriate training programs for young and adolescent athletes.

Rationale of the study: Punching speed is a performance component that greatly determines the success of karate athletes, especially in the gyaku tzuki technique in kumite. Observations of karate athletes at the Kulim Dojo in Pekanbaru show that the speed of gyaku tzuki punches is still not optimal, so a more specific and targeted training approach is needed. Resistance band and push-up exercises are simple, easy to implement, and safe for athletes aged 9–17 years, with complementary benefits for increasing the strength, endurance, and explosive power of the arm muscles, which directly affect punch speed. Although the effectiveness of these two training methods has been widely proven separately, research examining the effects of their combination, especially in child and adolescent karate athletes at the dojo level, is still limited. Therefore, this study aims to empirically test the effect of resistance band training and push-ups on the speed of gyaku tzuki punches in 9-17-year-old karate athletes at the Kulim Dojo in Pekanbaru, as a basis for developing an effective, efficient training program that is in line with the developmental characteristics of athletes.

Purpose or Hypotheses of the study: This research aims to analyze the effect of resistance band training and push-ups on the speed of gyaku tzuki punches in karate athletes aged 9–17 years at the Kulim Dojo in Pekanbaru. Based on the study's objectives and theoretical framework, the null hypothesis (H_0) states that resistance band and push-up training do not significantly affect the speed of gyaku tzuki punches in karate athletes aged 9–17 years**.**

https://journal.mutiarahatimoeslem.id/index.php/cores/index
P-ISSN: XXX-XXX E-ISSN: XXX-XXX (Vol. 2 No. 1)
DOI: 10.64131/cores.v2i1.89
Research Article

Material & Methods

Research Design: This research used a quantitative approach with an experimental method through a one-group pretest–posttest design, i.e., one group without a control group (Ahmadin, 2022; Emon, 2024). The research subjects were given a pretest to measure the speed of their gyaku tzuki punch, then underwent a structured training program using resistance bands and push-ups, and finally took a posttest to determine the change in punch speed after the treatment. The research subjects were karate athletes aged 9–17 years from the Kulim Dojo in Pekanbaru. The independent variable in this study was resistance band and push-up training, while the dependent variable was gyaku tzuki punch speed. The difference between the pretest and posttest results was used to assess the effect of training on improving the athletes' punch speed.

Participant: The sample is part of the total number and characteristics inherent in a population (Sugiyono, 2017). The population in this study consisted of karate athletes from Dojo Kulim Pekanbaru who actively participated in training and were aged between 9 and 17 years. From this population, a number of athletes were selected as research samples, with a sample size of 22 people, while the population that met the age criteria of 9–17 years consisted of 20 athletes (Arikunto, 2021). The sample was determined using purposive sampling, which is the deliberate selection of samples based on certain criteria, particularly age suitability for the research objectives. This technique was used to ensure that the sample involved was truly relevant and able to represent the characteristics of the research subjects.

Instrument: Research instruments play a major role as tools for measuring or determining the magnitude of a variable that is the focus of research. The instrument used in this study was the gyaku tzuki strike speed test. This test aims to measure athletes' ability to perform gyaku tzuki strikes quickly within a certain time frame (Rozi et al., 2025). The test was conducted by having athletes perform gyaku tzuki strikes at a predetermined target for 30 seconds, after which the number of valid and correct strikes was counted as the strike speed score. To ensure data accuracy, measurements were taken using the same procedure in the pretest and posttest, using consistent tools and competent test supervisors. This research instrument is expected to provide objective and valid data on changes in gyaku tzuki punch speed as a result of the training treatment given.

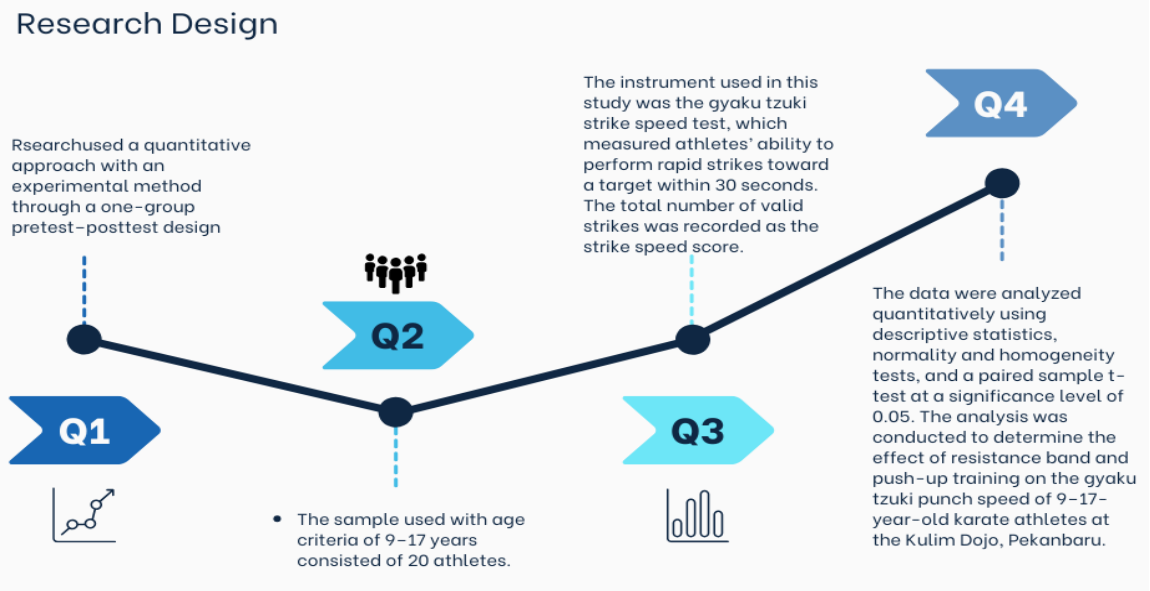

Figure 1. Analysis Plan Research Design

https://journal.mutiarahatimoeslem.id/index.php/cores/index
P-ISSN: XXX-XXX E-ISSN: XXX-XXX (Vol. 2 No. 1)
DOI: 10.64131/cores.v2i1.89
Research Article

Analysis plan: The data analysis techniques used in this study were based on the results of the pretest and posttest of gyaku tzuki strike speed, which were analyzed quantitatively. The initial stage of analysis used descriptive statistics to determine the number of values, means, standard deviations, minimum values, and maximum values from measurements before and after the resistance band and push-up training treatment. Before testing the hypothesis, the data were tested for prerequisites for analysis, including normality and homogeneity tests to ensure normal and homogeneous distribution. Next, hypothesis testing was performed using a paired sample t-test to determine significant differences between the pretest and posttest results. All statistical tests were conducted at a significance level of 0.05 ($\alpha = 0.05$). The results of the analysis were used to determine whether or not resistance band and push-up training had an effect on the gyaku tzuki punch speed of 9-17-year-old karate athletes at the Kulim Dojo in Pekanbaru.

Table 1. Gyaku Tzuki Punching Standards Beginner Category (Ages 9-11)
source: (Rozi et al., 2025)

Norm	Description
42-60	Excellent
38-41	Good
34-37	Fair
31-33	Poor
10-30	Very Poor

Table 2. Gyaku Tzuki Punching Standards Beginner Category (Ages 12-14)
source: (Rozi et al., 2025)

Norm	Description
39-60	Excellent
37-38	Good
35-36	Fair
33-34	Poor
10-32	Very Poor

Table 3. Gyaku Tzuki Punching Standards Beginner Category (Ages 15-17)
source: (Rozi et al., 2025)

Norm	Description
44-60	Excellent
42-43	Good
40-41	Fair
38-39	Poor
10-37	Very Poor

Results

Research Stage

The research stages were carried out systematically and sequentially to examine the effect of resistance band and push-up exercises on the speed of gyaku tzuki punches in karate athletes.

1. Observation

https://journal.mutiarahatimoeslem.id/index.php/cores/index
P-ISSN: XXX-XXX E-ISSN: XXX-XXX (Vol. 2 No. 1)
DOI: 10.64131/cores.v2i1.89
Research Article

The research began with direct observation of training activities at the Kulim Dojo in Pekanbaru to identify problems, which showed that the speed of the athletes' punches still needed to be improved through more structured training methods.

2. The implementation and data collection

The implementation stage began with the development of a resistance band and push-up training program tailored to training principles, including the adjustment of frequency, intensity, volume, sets, repetitions, and duration according to the athletes' age characteristics. The study was conducted over 16 sessions, consisting of 1 pre-test, 14 training sessions, and 1 post-test. Data collection began with a pre-test to determine the initial striking speed ability, then the subjects followed a controlled training program, and after that, a post-test was conducted using the same procedure so that the results could be compared objectively.

3. Data analysis

The final stage of the research was data analysis using statistical tests through prerequisite tests (normality and homogeneity) and paired sample t-test hypothesis testing. Conclusions were then drawn based on the analysis results to answer the research questions and were compiled systematically in a thesis report.

a. Initial Test Data Results

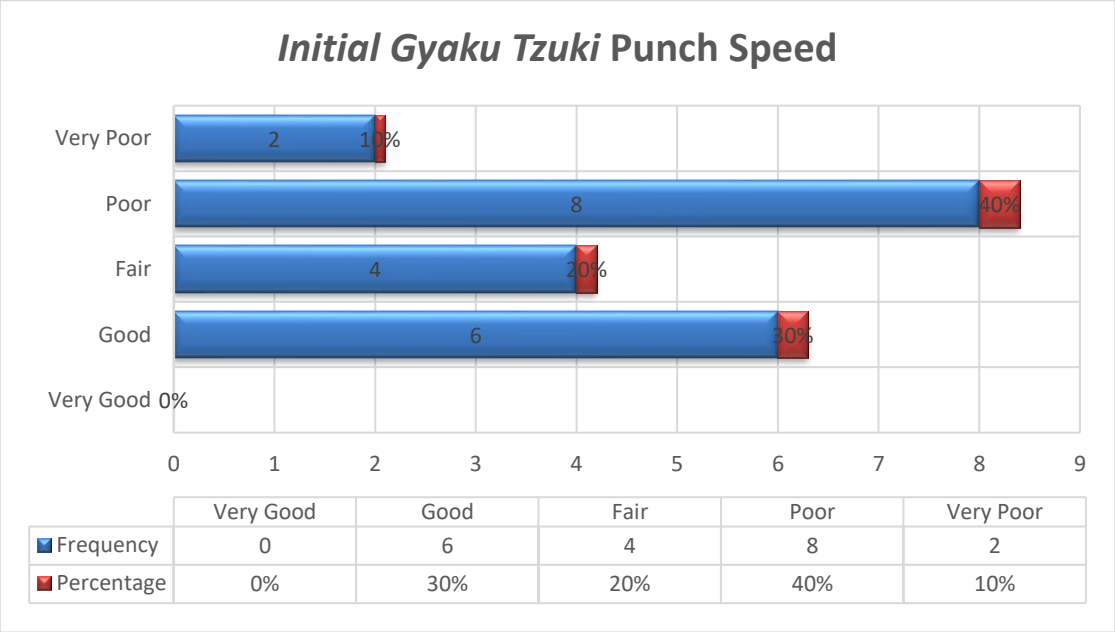

Figure 1. Histogram of The Final *Gyaku Tzuki* Test Results

Based on the histogram above, it is known that the initial gyaku tzuki test results for athletes with the criteria Very poor showed 2 male or female athletes with a percentage of 10%, the “Poor” criterion was met by 8 male or female participants, representing 40% of the sample, the ‘Fair’ criterion was met by 4 male or female participants, representing 20% of the sample, and the “Good” criterion was met by 6 male and female participants, representing 30% of the sample.

https://journal.mutiarahatimoeslem.id/index.php/cores/index
P-ISSN: XXX-XXX E-ISSN: XXX-XXX (Vol. 2 No. 1)
DOI: 10.64131/cores.v2i1.89
Research Article

b. Final test data results

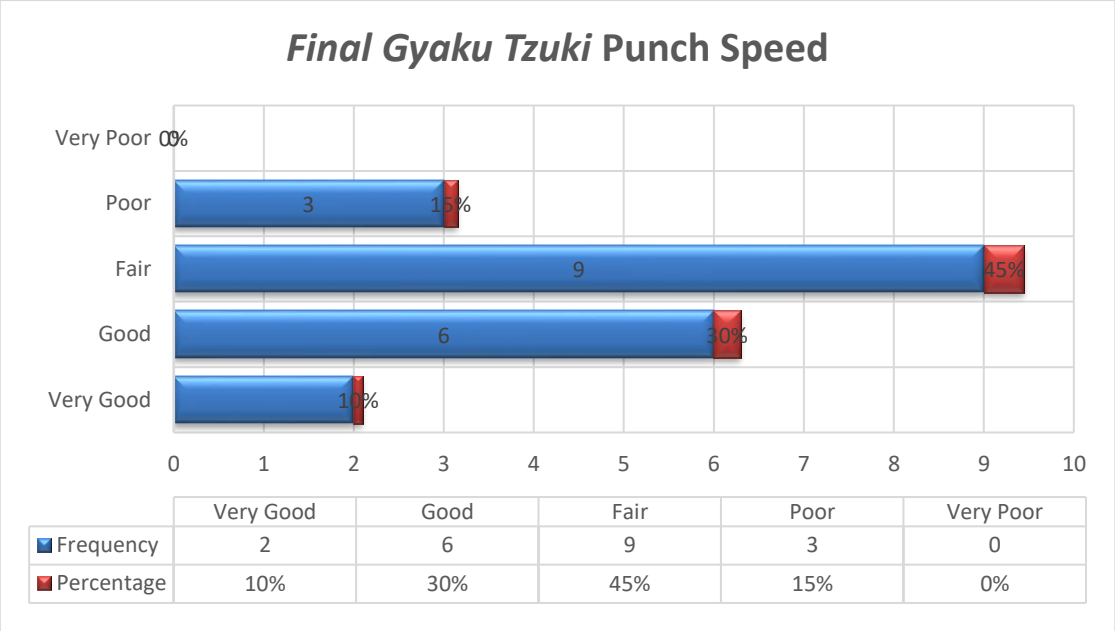

Figure 1. Histogram of Final *Gyaku Tzuki* Punch Test Results

Based on the histogram above, it is known that the final test results for the gyaku tzuki punch for athletes with the criteria of Poor show 3 male or female athletes with a percentage of 15%, the "Adequate" criterion was met by 9 male or female athletes with a percentage of 45%, and the 'Good' criterion was met by 6 male or female athletes with a percentage of 40%, while the "Very Good" criterion was met by 2 male or female athletes with a percentage of 10%. From the results of the initial test (pre-test) and final test (post-test) that had been carried out, it can be concluded that the number of punches increased significantly before and after the treatment of resistance band and push-up exercises.

c. Normality Test

Table 4. *Kolmogorov-Smirnov and Shapiro-Wilk* Normality Test

Tests of Normality						
	Kolmogorov-Smirnov			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Result pretest	.196	20	.042	.909	20	.062
Result postest	.200	20	.035	.927	20	.134
Lilliefors Significance Correction						

Based on the results of the normality test using the Shapiro-Wilk method in the table above, the significance value of the pre-test in the experimental group was 0.062, and the significance value of the post-test in the experimental group was 0.134. Thus, the two data groups were declared to be normally distributed because they had a significance value > 0.05.

https://journal.mutiarahatimoeslem.id/index.php/cores/index
P-ISSN: XXX-XXX E-ISSN: XXX-XXX (Vol. 2 No. 1)
DOI: 10.64131/cores.v2i1.89
Research Article

d. Homogeneity Test

Table 4.5 Homogeneity Test *Levene*

Test of Homogeneity of Variances			
Result pretest posttest			
Levene Statistic	df1	df2	Sig.
1.080	1	38	.305

Based on the results of the homogeneity test using the Levene test shown in the table above, the significance value obtained from the experimental group is 0.305. Thus, it can be concluded that the experimental group (pre-test and post-test values) has homogeneous variance. This means that the pre-test and post-test values of the experimental group have the same or homogeneous variance. This conclusion provides a strong basis that the data meet the assumption of homogeneity, so that parametric tests can be used validly in the further analysis process.

e. Paired Sample T-Test

Table 4.6 Paired Sample T-Test

Paired Samples Test										
		Paired Differences					t	df	Sig. (2-tailed)	
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference					
					Lower	Upper				
Pair 1	Pretest - Posttest	-2.550	1.050	.235	-3.041	-2.059	-10.860	19	.000	

Based on the table above, the Paired Samples Test value can be obtained by looking at the mean value in the Descriptive Statistics test. The initial test (pre-test) has a value of 35.05, and the final test (post-test) has a value of 37.60. The mean value in the initial test is smaller than the mean value in the final test, so it can be concluded that there is an increase from the pre-test to the post-test. Considering the increase in the mean value and supported by the paired sample test significance value of 0.000, which is less than (<0.05), it can be concluded that there is an increase in the speed of the gyaku tzuki punch and that the resistance band and push-up training methods influence the increase in the speed of the gyaku tzuki punch. The results obtained for the hypothesis are that Ho is rejected and Ha is accepted.

After researchers complete descriptive data analysis, prerequisite testing, and hypothesis testing, the next step is to draw conclusions based on the results of the analysis and discuss the findings in relation to the objectives and relevant theoretical studies. The conclusions are used to answer the research questions scientifically, and then all research results are systematically compiled in the form of a thesis report in accordance with applicable scientific writing rules.

https://journal.mutiarahatimoeslem.id/index.php/cores/index
P-ISSN: XXX-XXX E-ISSN: XXX-XXX (Vol. 2 No. 1)
DOI: 10.64131/cores.v2i1.89
Research Article

Discussion: The results of the study indicate that resistance band and push-up training programs have a significant effect on improving the speed of gyaku tzuki punches in karate athletes aged 9–17 years at the Kulim Dojo in Pekanbaru. The difference in results between the pretest and posttest, which was proven to be significant through a paired sample t-test, shows that structured training can improve athletes' physical abilities. This improvement is related to neuromuscular adaptation in the form of increased arm muscle strength and explosive power, which are the main components in producing fast and effective punches. Physiologically, training using resistance bands provides elastic resistance that trains dynamic muscle contraction throughout the range of motion, thereby increasing the ability of muscles to generate force quickly (Kacprzak et al., 2025; Pinto et al., 2025). On the other hand, push-ups strengthen the arm, shoulder, and chest muscles, which are the main drivers in the punching mechanism. The combination of these two exercises creates complementary stimuli between increased strength and contraction speed, thereby directly impacting the quality of gyaku tzuki technique execution (Alifa et al., 2026; Silvia & Wijono, 2023; Ardilaini et al., 2025). From a coaching perspective, these findings confirm that simple, structured training methods tailored to age-specific developmental characteristics can produce optimal performance improvements. Athletes aged 9–17 years are in a phase of physical development that is responsive to strength and coordination training, making bodyweight and elastic resistance exercises a safe, effective, and appropriate choice for developing biomotor skills without placing excessive strain on the musculoskeletal system. This indicates that improvements in technical speed in karate are not only determined by technical mastery but are also significantly influenced by supporting physical conditions, particularly explosive strength and movement coordination (Cinarli et al., 2025; Rizqi Kornia et al., 2025; Stewart et al., 2025). The practical implication of this study is that coaches can integrate resistance band and push-up exercises into routine training programs as an efficient, easy-to-implement method that does not require complex equipment. This approach can be an effective training alternative to improve striking performance while maintaining training safety for child and adolescent athletes. However, this study has limitations because it only involved one group without a control group and was conducted in a specific dojo, so the generalization of the findings is still limited. Therefore, further research is recommended to involve a stronger experimental design, a larger sample size, and variations in other training methods to obtain a more comprehensive understanding of the development of technical speed in karate.

Conclusions

This study shows that resistance band and push-up exercises have a significant effect on increasing the speed of gyaku tzuki punches in 9- to 17-year-old karate athletes at the Kulim Dojo in Pekanbaru. A comparison of pretest and posttest results indicates that these exercises can increase the strength and explosive power of the arm muscles, which play an important role in delivering fast and effective punches. The combination of these two forms of training produces a mutually supportive stimulus between increased muscle strength and accelerated contraction, so it needs to be applied in a planned manner in technical training programs, especially in kumite. Practically, this training method has proven to be effective, simple, and safe for use with child and adolescent athletes because it is easy to implement without requiring complex equipment. However, considering that this study only involved one group

https://journal.mutiarahatimoeslem.id/index.php/cores/index
P-ISSN: XXX-XXX E-ISSN: XXX-XXX (Vol. 2 No. 1)
DOI: 10.64131/cores.v2i1.89
Research Article

in a limited scope, further research with a stronger design and a larger sample size is needed so that the findings can be generalized more broadly.

Acknowledgment

The author would like to express his deepest gratitude to all those who contributed to the completion of this research. Special appreciation is given to the Faculty of Teacher Training and Education, University of Riau, particularly the Department of Physical Education, for the facilities and support provided during the research process. The author also thanks his family and close friends, who cannot be mentioned one by one, for their motivation, encouragement, and prayers, which kept him going until this research was completed successfully and on time. Thanks are also extended to the coach of Dojo Kulim Pekanbaru, the athletes, and the athletes' parents, who were willing to participate as research subjects from start to finish. Finally, the author appreciates his own efforts, perseverance, and commitment in completing this research, with the hope that the knowledge gained will be beneficial to many people.

Author Contribution Statement

ZRS is responsible for designing and conducting research, from developing research ideas and designs, collecting data in the field, processing and analyzing data, to writing manuscripts. The lead author also compiled the results and discussion sections and prepared the article for publication. AV provided academic guidance in formulating the problem, developing the theoretical basis and research methods, and supervising and evaluating all stages of the research and manuscript preparation. HH provided technical and methodological support, assisted in refining the data analysis, and reviewed and revised the manuscript to ensure it complied with scientific principles. All authors have read and approved the final version of the manuscript and are responsible for the content of the research.

AI Disclosure Statement

The authors used ChatGPT (OpenAI) during the manuscript preparation process only to help improve language clarity, grammar, and writing structure. All results of using this tool have been thoroughly reviewed and edited, and the authors are fully responsible for the content of this publication. The authors also affirm that this research was designed, conducted, analyzed, and written based on their own work and expertise, without using artificial intelligence (AI) to generate research ideas, process data, or conclude.

References

Adil, A., Bachtiar, I., Fahrizal, & Kamaruddin, I. (2024). The Effect of Weight Training and Reaction Speed on Gyaku Tsuki Punches in INKANAS Selayar Karate Sports. *ETDC: Indonesian Journal of Research and Educational Review*, *3*(2), 207–217. https://doi.org/10.51574/ijrer.v3i2.1525

Ahmadin. (2022). Social Research Methods: Qualitative and Quantitative Approaches. *Jurnal*

Kajian Sosial Dan Budaya, *6*(1), 104–113. https://letrunghieutvu.yolasite.com/resources/w-lawrence-neuman-social-research-methods_-qualitative-and-quantitative-approaches-pearson-education-limited-2013.pdf

Alifa Beauty, Suwirwan, Bakhtiar, S., & Sasmitha, W. (2026). Pengaruh Latihan Resistance Band Terhadap Kecepatan Pukulan Gyaku Tsuki Atlet Dojo SMKC Kabupaten Padang Pariaman. *JPO (Jurnal Pendidikan Dan Olahraga*, *9*(3), 1544–1553. https://doi.org/https://doi.org/10.24036/JPDO.9.2026.0156

Arikunto, S. (2021). *Penelitian tindakan kelas: Edisi revisi* (1st ed.). Bumi Aksara. https://books.google.com/books?hl=en&lr=&id=-RwmEAAAQBAJ&oi=fnd&pg=PA1&dq=arikunto&ots=TDUoYTdft0&sig=WGgvp_Yx4NpPJVxAbQyxCfPZPho

Barakou, I., Seves, B. L., Abonie, U. S., Finch, T., Hackett, K. L., & Hettinga, F. J. (2025). Health-related quality of life associated with fatigue, physical activity and activity pacing in adults with chronic conditions. *BMC Sports Science, Medicine and Rehabilitation*, *17*(1), 13. https://doi.org/10.1186/s13102-025-01057-x

Butnariu, M., Tănăsescu, D. E., Rada, L., & Amzăr, E. L. (2026). The Influence of Elastic Resistance Band Circuit Training Implemented in Physical Education Classes on Segmental Dynamic Strength in 11–13-Year-Old Students. *Revista Romaneasca Pentru Educatie Multidimensionala*, *18*(1), 306–323. https://doi.org/10.66388/rrem/18.1/20

Campillo-Sánchez, J., Borrego-Balsalobre, F. J., Díaz-Suárez, A., & Morales-Baños, V. (2025). Sports and Sustainable Development: A Systematic Review of Their Contribution to the SDGs and Public Health. *Sustainability*, *17*(2), 562. https://doi.org/10.3390/su17020562

Chaabene, H., Negra, Y., Capranica, L., Prieske, O., & Granacher, U. (2019). A Needs Analysis of Karate Kumite With Recommendations for Performance Testing and Training. *Strength & Conditioning Journal*, *41*(3), 35–46. https://doi.org/10.1519/SSC.0000000000000445

Cinarli, F. S., Aydogdu, O., Aydin, Y., Tokgöz, G., Kahraman, A., Beykumül, A., Aygoren, C., Yılmaz, N., & Ramirez-Campillo, R. (2025). Maximal strength, sprint and jump performance in elite kumite karatekas. *BMC Sports Science, Medicine and Rehabilitation*, *17*(1), 8. https://doi.org/10.1186/s13102-024-01051-9

Coşkun, T., Gürses, V. V., & Yaşar, O. M. (2025). The Effect of Resistance Band Exercises on Strength Parameters in Pubertal Soccer Players. *Spor Bilimleri Araştırmaları Dergisi*, *10*(2), 263–280. https://doi.org/10.25307/jssr.1624410

Cynarski, W. J., & Piwowarski, J. (2024). Conference of IMACSSS and JAB in Osaka, Japan as a scientific event, including its importance for research into fighting arts and for martial arts tourism. *Ido Movement for Culture Journal of Martial Arts Anthropology*, *24*(2), 95–107. https://doi.org/10.14589/ido.24.2.11

Dos Santos, M. H., Yusmawaty, Y., Samsudin, S., Dos Santos, H. A., Kamaruddin, I., Hasnah, H., Pratama, H. G., Wibawa, J. C., & Prasetyo, Y. D. (2025). Effectiveness Of Developing A Model Of Punches And Kick Speed Excercise For Karate Martial Arts. *Balneo and PRM Research Journal, No. 4, December 2025*(Vol 16). https://doi.org/10.12680/balneo.2025.916

Emon, M. M. H. (2024). *Research Approach: A Comparative Analysis of Quantitative and Qualitative Methodologies in Social Science Research*. https://doi.org/10.20944/preprints202412.1128.v1

Erol, S. (2022). Investigation of the Effect of Resistance Training Applied Using Functional Exercise Band (TRX) and Body Weight Applied to Male Basketball Players Aged 15-17 on Selected Physical Characteristics. *Journal of Educational Issues*, *8*(3), 1.

https://doi.org/10.5296/jei.v8i3.19972
Gautam, H., Das, J., & Jakhar, R. (2026). Analysis of Physical, Psychological, Physiological and Performance parameters of Professional athletes of six different combat sports: A Narrative Review. *International Journal of Physiology, Sports and Physical Education*, *8*(3), 20–37. https://doi.org/10.33545/26647710.2026.v8.i3a.222
Gheorghiu, I., Carp, I., Ciorbă, C., Branişte, G., & Reaboi, N. (2026). The correlation between physical training and the acquisition of technical-tactical procedures in mixed martial arts (MMA). *Journal of Physical Education and Sport ® (JPES)*, *26*(3), 547–554. https://doi.org/10.7752/jpes.2026.03056
Kacprzak, J., Mosler, D., Tsos, A., & Wąsik, J. (2025). Biomechanics of Punching—The Impact of Effective Mass and Force Transfer on Strike Performance. *Applied Sciences*, *15*(7), 4008. https://doi.org/10.3390/app15074008
Kumar, S., Pradhan, P., Minu, T., Saini, P., Babu, T. S., Bagchi, A., & Thapa, R. (2025). Activation of upper- and lower-limb muscles during hook punch using lead- and rear-arm. *Journal of Human Sport and Exercise*, *20*(3), 989–999. https://doi.org/10.55860/1ha8tf90
Lassalvia, C., Julio, U. F., & Franchini, E. (2023). Physiological Responses During Karate Kata in Practitioners and Athletes: A Scoping Review. *Strength & Conditioning Journal*, *45*(2), 149–161. https://doi.org/10.1519/SSC.0000000000000706
Lopes-Silva, J. P., & Franchini, E. (2021). Effects of Isolated and Combined Ingestion of Sodium Bicarbonate and β-Alanine on Combat Sports Athletes' Performance: A Systematic Review. *Strength & Conditioning Journal*, *43*(3). https://doi.org/10.1519/SSC.0000000000000603Buy
Mahdi, O. A. (2025). The Effect of Special Exercises on Developing Speed-Strength and Straight Punches for Junior Boxers. *Modern Sport*, *24*(4), 562–569. https://doi.org/10.54702/2708-3454.2103
Maldonado, M., Eisenman, M., & Snarr, R. (2026). Exercise Technique: Seated Anatomical Core Exercises. *Strength & Conditioning Journal*, *48*(2), 240–248. https://doi.org/10.1519/SSC.0000000000000953
Martin Ginis, K. A. (2025). Physical activity and quality of life/subjective well-being in people with disabilities: A look backwards and a way forwards. *Psychology of Sport and Exercise*, *80*, 102916. https://doi.org/10.1016/j.psychsport.2025.102916
Navickaitė, A., & Thomas, G. (2023). Strength and Conditioning Considerations for Kyokushin Karate Athletes. *Strength & Conditioning Journal*, *45*(3), 272–282. https://doi.org/10.1519/SSC.0000000000000721
Piepiora, P. A. (2025). The Health Effects of Karate Training: A Review of 21st Century Research. *Healthcare*, *13*(2), 118. https://doi.org/10.3390/healthcare13020118
Piepiora, P. A., Jurczyk, J. B., & Vveinhardt, J. (2025). Mental preparation of karateka for sports competition in kata. *Frontiers in Sports and Active Living*, *6*. https://doi.org/10.3389/fspor.2024.1525853
Piepiora, P. A., Piepiora, Z. N., Stackeová, D., Bagińska, J., Gąsienica-Walczak, B., & Čaplová, P. (2025). Editorial: Physical culture for mental health. *Frontiers in Psychology*, *15*. https://doi.org/10.3389/fpsyg.2024.1537842
Pinto, M., Crisóstomo, J., Kirk, C., Abián-Vicén, J., & Monteiro, L. (2025). Influence of Anthropometric Characteristics and Muscle Performance on Punch Impact. *Sports*, *13*(8), 281. https://doi.org/10.3390/sports13080281
Rahmatilah, R. P., Alif, M. N., & Lengkana, A. S. (2026). Analysis of Karate Athletes' Emotional

P-ISSN: XXX-XXX E-ISSN: XXX-XXX (Vol. 2 No. 1)
DOI: 10.64131/cores.v2i1.89
Research Article

Intelligence and its Relationship to Competition Performance. *Tadulako Journal Sport Sciences And Physical Education*, *14*(1), 54–66. https://doi.org/10.22487/tjsspe.v14i1.6023

Repany Julianty, Sagitarius, & Geraldi Novian. (2025). Analysis of the Test Results of the Physical Condition Ability of Karate Athletes in West Java. *ACTIVE: Journal of Physical Education, Sport, Health and Recreation*, *14*(3), 1071–1076. https://doi.org/10.15294/active.v14i3.33781

Rizqi Kornia, M., Suyoko, A., Pranoto, A., & Prisma Nugraha, D. (2025). The effect of interval training and push-up exercises on cardiorespiratory endurance and upper body strength in adolescents. *Jurnal Penelitian Pembelajaran*, *11*(2), 321–335. https://doi.org/10.29407/js_unpgri.v11i2.26379

Rozi, F., Muhammad Zulqarnain Mohd Nasir, & Siti Nursyahiirah Hasan. (2025). Analysis of gyaku tsuki in Karate: Injury risk and fitness implications. *Journal of Sports and Physical Activity*, *1*(1), 38–46. https://doi.org/10.64268/jospa.v1i1.10

Silvia Ratna Kartika, & Wijono. (2023). Pengaruh Latihan Resistance Band Terhadap Kecepatan Pukulan Gyaku Tsuki Atlet Debi Martial Art Tuban. *JPO: Jurnal Prestasi Olahraga*, *6*(1), 91–94. https://doi.org/10.1234/jpo.v6i3.57416

Stewart, C., Cornett, R., Baker, J. S., Gu, Y., Dutheil, F., & Ugbolue, U. C. (2025). The Role of Lower Limb Kinetics in Boxing Punches and the Impact of Fatigue on Biomechanical Performance. *Bioengineering*, *12*(12), 1355. https://doi.org/10.3390/bioengineering12121355

Sugiyono, P. D. (2017). Metode penelitian bisnis: pendekatan kuantitatif, kualitatif, kombinasi, dan R&D. *Penerbit CV. Alfabeta: Bandung*, *225*(87), 48–61. https://opac.perpusnas.go.id/DetailOpac.aspx?id=1084409

Suprianto Kadir. (2025). Studi literatur: Pelatihan Yang Efektif Meningkatkan Performa Pukulan Karate. *Jurnal Riset Dan Pengabdian Interdisipliner*, *2*(3), 753–758. https://doi.org/10.37905/jrpi.v2i3.34083

Tri Ardilaini, Reza Resah, & Destriani. (2025). The Relationship Between Arm Flexibility and Muscle Strength and The Results of Gyaku Tsuki Karate Punching Ability. *ACTIVE: Journal of Physical Education, Sport, Health and Recreation*, *14*(1), 298–306. https://doi.org/10.15294/active.v14i1.16992

Wang, C., Zhang, P., Zhu, Y., Li, J., Yang, Y., Tan, X., Yang, L., Zeng, L., & Huang, W. (2025). A theoretical model of sports and health integration to promote active health. *BMC Public Health*, *25*(1), 1039. https://doi.org/10.1186/s12889-025-22237-x

Wu, H., Zhai, H., Ma, R., & Wei, H. (2025). A predictive model for vertical ground reaction force during incline push-ups. *Scientific Reports*, *15*(1), 44454. https://doi.org/10.1038/s41598-025-28012-7

Wu, R., & Choosakul, C. (2026). Biomechanical analysis of the push-up exercise in university male student-athletes from different specializations: a sport-based comparative study. *Retos*, *75*, 557–571. https://doi.org/10.47197/retos.v75.118076

Yang, L., Gao, B., Chen, Y., Xu, Q., Zhou, J., & Tang, Q. (2025). Comparing The Effects of Maximal Strength Training, Plyometric Training, and Muscular Endurance Training on Swimming-Specific Performance Measures: A Randomized Parallel Controlled Study in Young Swimmers. *Journal of Sports Science and Medicine*, *24*, 128–141. https://doi.org/10.52082/jssm.2025.128

Zhang, S., Huang, W., Soh, K. G., Luo, S., Li, L., & Wang, X. (2025). Effects of core strength training on the technical skill performance of striking combat sport players: a systematic

https://journal.mutiarahatimoeslem.id/index.php/cores/index
P-ISSN: XXX-XXX E-ISSN: XXX-XXX (Vol. 2 No. 1)
DOI: 10.64131/cores.v2i1.89

Research Article

review. *PeerJ, 13*, e19615. https://doi.org/10.7717/peerj.19615

Zhao, M., Liu, S., Han, X., Li, Z., Liu, B., Chen, J., & Li, X. (2022). School-Based Comprehensive Strength Training Interventions to Improve Muscular Fitness and Perceived Physical Competence in Chinese Male Adolescents. *BioMed Research International*, *2022*(1). https://doi.org/10.1155/2022/7464815