

Research article

Effectiveness Of Developing A Model Of Punches And Kick Speed Exercise For Karate Martial Arts

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Citation: Santos M.H.D., Yusmawaty, Samsudin, Hezron Alhim Dos Santos H.A.D., Kamaruddin I., Hasnah, Pratama H.G., Wibawa J.C., Prasetyo Y.D. – Effectiveness Of Developing A Model Of Punches And Kick Speed Exercise For Karate Martial Arts *Balneo and PRM Research Journal* 2025, 16(4): 916

Academic Editor(s):
Constantin Munteanu

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Viorela Bembea

Production Officer:
Camil Filimon

Received: 29.10.2025
Published: 30.12.2025

Reviewers:
Andreea Suci
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Publisher's Note: Balneo and PRM Research Journal stays neutral with regard to jurisdictional claims in published maps and institutional affiliations.



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Abstract: The purpose of this study was to measure the effectiveness of the punch and kick speed training models developed in karate athletes. The development of the model is based on the characteristics of martial arts taking into account the age of the athlete 15-17 years. The research method only used one group of pretest posttests, which tested the training model that had been developed to prove its effectiveness in increasing the speed of punches and kicks. The instrument developed by the author measures the speed of martial arts punches and kicks. Involving all athletes aged 15-17 years with a sample of 65 male athletes. The results of the study proved that there was an increase in the average speed of punches and kicks with a significance of $p < 0.05$, and there was an increase in the average speed of punches and kicks with a minimum pretest score of 1.04 seconds and a maximum score of 0.55 seconds. Meanwhile, the results of the minimum posttest value are 0.64 seconds and the maximum value is 0.23 seconds. So it can be concluded that the development of a punch and kick speed training model can increase movement speed, so that it can be an alternative applied in the training process for athletes aged 15-17 years.

Keywords: Effectiveness, Speed Training, Martial Arts, Punches, Kick

1. Introduction

The development of adolescents' interest from year to year in sports achievements, especially in karate martial arts, affects the views of coaches, parents and all stakeholders related to athletes' achievements to care about the importance of maintaining the physical and psychological condition of athletes in order to produce maximum performance. The ability to maintain physical condition can be improved according to each sport [1]. An athlete's concern for his or her achievements begins by trying to carry out a training program, an updated training model and maintaining an athlete's lifestyle. There are basic karate movement skills, such as horse stance, blocks, punches, and kicks [2]. There are two types or groupings of movements in karate: kata (movement) and kumite (fighting). But to complete both categories, everyone must master the basics of Karate [3]. The kumite karate category is a part of martial arts that involves whole-body contact [4]. The competition rules in this sport place a high priority on the safety of competitors during the match. Kime is used in karate martial arts movements [5]. Many elements of physical condition such as strength, flexibility, speed, and explosiveness influence this kinematics [6]. Based on the findings [7] This HITT exercise can be used

as a strategy to increase the strength of athletes' leg muscles, such as karateka. Because muscle strength is one of the components of physical condition that is important for karate athletes. In other sports such as fighting, Athlete's physical conditioning skills such as leg strength and waist flexibility need to be developed in the training program [8]. When these physical condition elements are used together for one or two actions during a fight, the result is maximum kime [9]. Word and kumite movements are a combination of several basic movements (kihon) into a series of beautiful movements in words and into attacks and defense in kumite. In karateka, both kihon, kata and kumite involve most of the physical components in the sport. Especially for the kumite category, it involves physical components such as speed, agility, flexibility, explosiveness, strength, endurance, and coordination. However, in kumite it is dominant to use speed during the match.

Speed plays an important role in developing the potential to become an accomplished athlete at both national and international levels. In the kumite category, when 2 karatekas meet, they will compete with hitting, kicking, and parrying movements, which in doing these movements require a component of speed and precision. Speed in punching and kicking as well as speed in responding to attacks from the opponent is very necessary for a martial arts fighter. The process of obtaining points 1, 2 and 3 in kumite also has several categories besides speed, such as movement, enthusiasm, and sportsmanship. The speed possessed by karate athletes certainly cannot be obtained by practicing in a short time. The training carried out by martial arts athletes requires a very long time and process. Athletes should be prepared from childhood to adulthood, starting from the introduction of basic movements, learning to train, training for their specialties, training for competitions to the stage of training for champions [10]. This is influenced by the movements that are carried out requiring the correct movement in form and strong and fast in the implementation of the movement. In developing speed (kohai), coaches pay close attention to the concept of movement automation, namely speed in responding to attacks from the opponent. The fast and intense movements of the karatekas who apply the concept of movement automation are done with exercises that repeat certain movements several times thus strengthening the connection between the stimulus and the response. This shows that the speed of movement of karateka is affected by its strength, reaction time and flexibility.

Training carried out on the physical component of speed cannot be done alone (walking alone) but needs to be supported by other physical components. Research conducted by [11] It is recommended to be able to do speed training interspersed with strength and endurance training. The speed trained also needs to be supported by the development of the physical components of each athlete. The age of the athlete also affects the physical component, especially the athlete's speed. Altit, who is 15-17 years old, is in the training phase to compete so the training program given to athletes needs to maximize every physical component [12]. An important factor in earning points for the kumite category is the speed with which karateka performs attacks. Attacks and parries that are carried out at a good speed will have an impact on the achievements of the karateka itself. This situation is also very unfortunate because there is no specific martial arts speed training model that can be used by each style to increase speed that is in accordance with the characteristics of movements in karate and can be mastered quickly. In addition to effective athlete training coaching, high-quality training methods are also needed to support athlete training [13].

The exercises used to form speed so far are still general and have not specialized with the martial arts branch of karate which is in accordance with the development of sports science and tends to estimate the results of the exercises given. The training provided tends to be monotonous and not varied, thus making martial arts athletes slow in developing speed. Research findings by [14] that it is important for the trainer to

measure the strength and speed of the execution of the technique in karateka. In general, the speed training used in this martial art still uses general training like sports in general and does not specialize in martial arts itself and based on observations in the field, there appears to be a lack of initiative from trainers in developing a speed training model. Meanwhile, in martial arts, the speed component is very much needed in all movements, both the basic karate movements themselves and the movements during matches, especially in the kumite/fighting category. Data shows that there are still many dojos that are not able to compete at the national level. Obstacles in meeting the needs of athletes to be able to excel in participating in karate competitions between age groups, in addition to needs such as the source of strength of the coach who arrives at the moment is trusted Athletes are introduced to who are able to achieve achievements, minimum training in creating training programs that are in accordance with the martial arts of karate and how to handle emotions and the knowledge of coaches also affect the quality athletes produced [15]. Therefore, improving physical components in particular needs to be given special emphasis in training models and innovations to help martial arts athletes achieve speed.

This research focuses on the speed problems faced by martial arts athletes participating in the kumite branch. The author researches the problem of punch and kick speed. In karate, speed is a major factor [16] Discuss the ups and downs of karate competitors' performances during training and competitions at the dojo. This research is very important because it will provide information for the researchers themselves, karate instructors, and athletes who want to increase their speed to create quality teams to achieve maximum success [17]. This makes the researcher need to see the effectiveness of developing a punch and kick training model that has been specially developed for karate martial arts at the age of 15-17 years can help in improving exercise. The study also acts as a guide for future studies that want to increase the speed of karate martial arts athletes by developing new exercise techniques and equipment.

2. Materials and methods

Study Design

This experimental study used a one group design before and after. Subjects were selected using purposive sampling technique. Samples were selected to carry out a training development model to increase the speed of karate athletes' punches and kicks. Before the treatment was carried out, the sample was first given a pretest, after which the research sample was given a training model treatment for 3 weeks with training details that have been written in Table 1 and after that a posttest was carried out.

Sample

Sampling used total sampling because the population size was not large and less than 100. Therefore, sixty-five healthy male karate athletes from the Inkanas dojo in Bone Regency and the Inkanas dojo in Makassar City, South Sulawesi participated in this study. To determine whether the volunteers could meet the needs of this study, inclusion and exclusion criteria were established. Samples must have a normal body mass index and be between 15-17 years old. In addition, samples who were not athletes were excluded and not included in this study. A total of 65 research volunteers underwent pretests and posttests. This research was approved by the Research, Deputy Director for Academic Affairs University xxxxxxxx No. 3335/UN 39.6.1.Ps/LT/2023, 26 July 2023. Written informed consent forms were obtained from all participants, confirming their voluntary participation

Research Instruments

Facilities and tools: 4x4 mat, pole (place for punch and kick sensors), measuring tool for speed of movement and reaction speed on punches and kicks punches and kicks,

writing tools to record test results. Officers: Test result recorder, monitoring screen for speed of movement and reaction speed sensors on punches and kicks. Implementation: The testee stands in a kamae position right in front of the designated pole and has been fitted with a target and a speed and reaction speed measuring device for punches and kicks, the speed and reaction speed test-ing device for punches and kicks is ensured to be installed on the target, at the command (light) that appears on the speed and reaction speed measuring device for punches and kicks, the testee begins to punch or kick (according to the move-ment whose speed will be measured), The test is carried out as many as 3 repetitions of the movement and the results of the fastest speed test from among the 3 repetitions become the speed data of the testee. All samples underwent predeter-mined training and were closely supervised by researchers and the team. Because there are certified trainers who have provided direct training on the training model that has been created. So that all samples get direct supervision in the training carried out. In addition, there is also an application of this training development model that is used so that it can be a guideline in conducting speed training for martial arts athletes, especially in punches and kicks. App access https://dojo-speed.vercel.app/model_latihan

Tabel 1. Exercise Intervention Model Details

No.	Name of Variation of Exercise/Form of Speed Movement Exercise		
1	Combination of sprint and tsuki	10	Throw Ball: Dodge + Attack Tsuki
2	Age uke + nidan tsuki	11	4 Cardinal Directions + Tsuki
3	Ude uke + nidan tsuki	12	Catching the Bekel Ball
4	Combination of blocks (1 count of 3 blocks in 1 breath)	13	Hand Touch 1 time to 2 times then Punch
5	Combination of sprint and kick	14	Hand Touch 1 time to 2 times then Punch
6	Leg lift movement variation + maegery	15	4 Cardinal Directions + Geri
7	Variation of leg lift + mawashi gery	16	Kicking the Bekel Ball
8	Kamaete position Maegery movement 3x in 1 count	17	Foot Touch 1 time to 2 times then kick
9	Kamaete position Mawashi movement 3x in 1 count		

Procedure

The procedure used was a speed-of-motion skill test instrument for punches and kicks. The initial and main speed test instruments were designed based on the athlete evaluation concept:

- Purpose: to measure the speed of karate martial arts athletes' punches and kicks.
- Facilities and tools: 4x4 karate mat, pole (where the punch and kick sensors are), punch and kick speed measuring device, writing instruments to record test results,
- Officers: Test result recorder, speed sensor screen monitor.
- Implementation: The testee stands in the kamae position right in front of the pole that has been determined and has been fitted with a target, the distance to attack the testee is according to the length of the testee's legs, the speed of movement test tool is ensured to be attached to the testee's hands/feet, on cue, the testee starts punch-ing or kicking (according to the movement whose speed will be measured), The test is carried out 3 times with 3 repetitions of the movement and the fastest speed test results from the 3 repetitions become the testee's speed data.

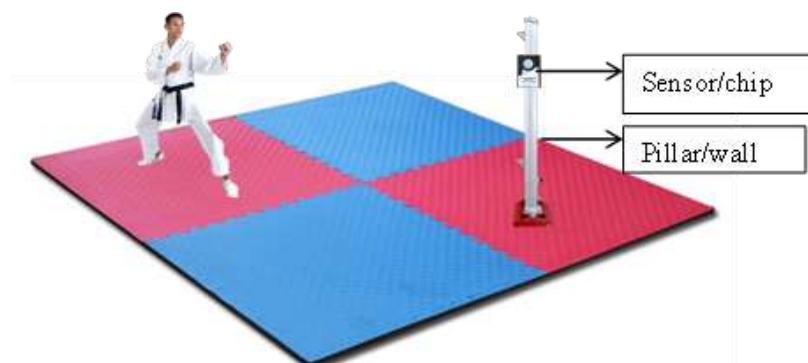


Figure 1. Implementation of Speed Test
Source: personal documentation

Statistical analysis

The effectiveness of the developed training model was assessed using statistical analysis. Pre- and post-test data regarding the punching and kicking speed results of karate athletes were collected and tabulated. Data were analyzed using paired-sample t-tests to compare the results before and after the intervention. A significance level of $p < 0.05$ was used to determine statistical differences. In addition to p-values, effect sizes (e.g., Cohen's d) were used to help quantify the practical impact of the intervention. Descriptive statistics, including means and standard deviations, were also calculated to provide a comprehensive picture of the improvement in punching and kicking speed of martial arts athletes.

Periodization of Exercise																												
Karate Sports																												
Athlete	Training Goals																											
	Karate Sports Prestasi							Test							Physical Preparation							Technical Preparation						
	Performance Enhancement							Movement Speed							Speed							Stroke Speed						
								Reaction Speed														Kick Speed						
Sunday	1							2							3													
Stages	General Preparation																											
Physical Components	Speed																											
Technical	Basic Techniques																											
Meetings/Days	1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7							
High Intensity																												
Medium Intensity																												
Low Intensity																												
Rest																												
Exercise Variations	1 Peak							1 Peak							2 Peaks													

Figure 2. Model Of Stroke Speed And Kick For Karate Martial Artists Aged 15-17 Years

3. Results

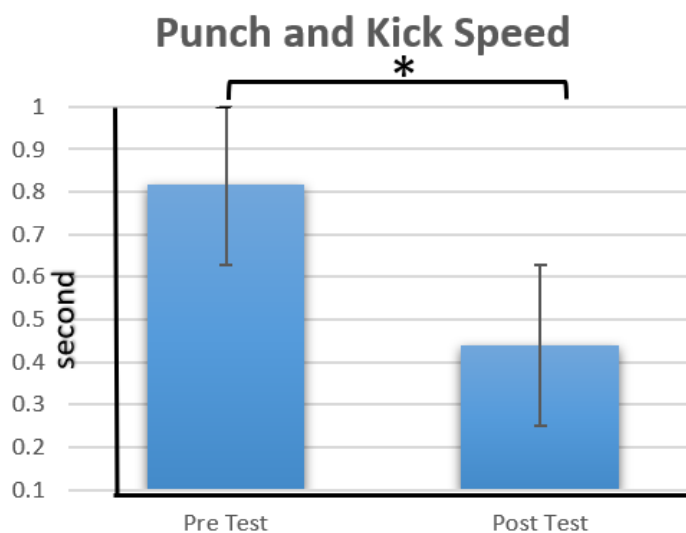
This section presents data and provides information about Descriptive Statistics Table 2. Data is presented with minimum, maximum, average and standard deviation values.

Table 2. Descriptive Statistics

	N	Mean	Std. Deviation
Pre Test	65	0.816 seconds	0.12493
Post Test	65	0,439 seconds	0.11323
Effect Size	3.157093.		

Effectiveness Test

The effectiveness of the developed model on martial artists aged 15-17 years. The following are the results of the initial abilities of martial artists aged 15-17 years who were used as research subjects before and after treatment with the development of a punch and kick speed training model with a bar diagram.

**Figure 2.** Pre-Test and Post-Test Results of the Punching and Kicking Speed Training Model (seconds)

Based on the results of the data analysis, the average pretest value of kicks and punches was 0.8161 seconds and the average posttest value of punches and kicks was 0.4397 seconds. Based on Figure 2, there is an increase in speed, which means in units of speed in seconds if the pretest score is higher than the posttest score. And the lower the seconds obtained, the better or faster the speed. And this study proves this. After analyzing the data in the study, the researcher then tested the effectiveness of developing a punch and kick speed training model on martial arts athletes aged 15-17 years as follows:

Table 3. Results of the Effectiveness Test of the Punching and Kicking Speed Training Model

Difference Test Method	Group	P
Paired <i>t</i> -test	(pre-test and post-test)	0.000*

Based on the analysis of paired sample test data, it is known in Table 3 that there is a significant difference in the value of $p = 0.000 < 0.05$, thus it can be concluded that the development of the year training model can increase the speed of martial arts. Karate punches and kicks are very effective to be applied in the training process for ages 15-17 years. If you look at table 1, the magnitude of the impact is 3.157093 which is in the very large category if Cohen's effect size classification $1.30 \leq ES$.

4. Discussion

The purpose of this study was to determine how the training method affects the increase in the speed of punches and kicks of martial arts athletes. Based on the results of the study, it was proven that the training that had been given had a significant impact on increasing the speed of punches and kicks of martial arts athletes ($p < 0.05$). A well-prepared training model arranged using training periodization will have a significant impact on athletes aged 15-17 years. In line with research conducted by [18] revealed that the speed training program provides a significant effect in improving athlete abilities when compared to traditional training. Ages that have entered the train to compete phase should no longer be trained with ordinary models that do not have targets and goals because it will affect the performance of the karateka itself for regional, national and international achievements.

Speed in punching and kicking is essential in karate because combining speed with maximum strength produces explosive power that significantly impacts the target. In sports, reaction time can be viewed as the ability to respond quickly with proper posture and control to stimuli such as movement, sound, or sight. In many cases, speed is more important than full speed [19]. According to Smith [20], preferred reaction time (CRT) is the shortest interval required to respond to a stimulus presented as an alternative among a number of other stimuli. The effectiveness test of the model, as shown in the results of this study, indicates that this speed training model can be applied to martial arts athletes aged 15-17 who are periodically in the Long Term Athlete Development (LTAD) phase [21], namely the training-to-compete phase. In this phase, karateka are required to train to achieve maximum speed.

This punch and kick speed model aims to increase speed both in terms of movement speed and in terms of the reaction speed of karate athletes. In line with this, research conducted by [22] stated that increasing the speed level is the key to the process in this sport. Karateka needs to be supported by speed training not only at the age of 15-17 but also since the age of 9-10 years, training is also applied to increase their speed. This is in line with the principle of readiness to practice, namely the material and dosage of training must be adjusted to the age of the athlete based on the principle of readiness to practice, age is very closely related to the readiness of the physiological and psychological conditions of each athlete. The point is that coaches must consider and pay attention to the growth and development stages of each athlete.

This training model is significantly able to increase the speed of karate athletes shown in the punch and kick test. This is because the combination of training used in this model has implemented specific karate punch and kick training, namely starting from Kizami Tsuki, Gyaku Tsuki punches and Mae Geri, Mawashi Geri kicks. This combination also pays attention to the stance technique used by athletes so that in its application it can be effective and efficient. The stance when responding to the opponent's movement or touch also greatly affects the speed of karate athletes in responding to these stimuli. This is in line with research conducted by [21] which states that the speed of the punch is greatly influenced by the maximum pressure (correct stance) on each foot. Therefore, the variations used in this training model consider the use of the right stance so that karateka can display maximum movements.

This was also expressed by [23] who showed that speed-based training will also affect muscle strength and power which has implications for athlete performance. The training model we have developed is also based on speed which will indirectly impact other physical conditions that support the movement. Based on the data collected

through this paper, it can be concluded that this training model for "increasing" the speed of punches and kicks in karateka aged 15-17 years is appropriate. This was obtained through various trials conducted to obtain a better model.

However, in this proving process, this is a preliminary study and because we did not use a control group in conducting the test, further experimental studies are needed. So in the research we have done, we still cannot truly prove that the training model has a real impact on speed because there was no comparison group that we have done, but this is only a preliminary study of the training model we are developing. Of course, from the existing stages, further research is needed to investigate the effects of the developed training model with a comparison group or control group. This will truly prove the effects. This deficiency is supported by [24] that training programs must follow the concept of periodization, be well-structured and planned based on the sport so that the athlete's energy and muscle systems can adapt to the specifics of the sport. The study found that good [25] results in the development of explosive strength of the muscles of the lower extremities of schoolchildren aged 12-14 years appeared after 6 weeks of online training in vinyasa yoga, when the training regime was observed five days a week for 30 minutes.

The results of the development of these training models yielded 17 speed training models that can be used as current training models for karateka balediri athletes aged 15-17 years. Among them are 9 training models for movement speed training and 9 training models for movement speed and reaction speed for punches and kicks. The training models we developed are still in their early stages. However, they can be an option for young karate athletes in implementing training aimed at increasing speed. With the methods and variations of these training models, they can be attractive to young athletes as an alternative training model to improve physical speed abilities. However, we also recognize that due to the limitations of our research, we do not yet know for certain which training models are best for increasing speed. Therefore, further research is needed to prove which training models are effective in increasing speed.

The exercise model that we have developed in detail does focus on increasing the speed of punches and kicks. However, in addition, the impact of physical performance also increases as the training progresses. So that the training and training model that we have developed can also be carried out on other athletes, for example taekwondo, pencak silat, and other martial arts athletes. Because physical performance physiologically can be improved through the exercise model that we have developed. So this can also have an impact on improving the physical performance of other martial arts sports.

5. Conclusions

The exercise method that has been developed by researchers has been shown to be effective in increasing the speed of punches and kicks in karate martial artists aged 15-17 years. However, due to the limitations of the researchers, there was no control group in this study, therefore more research is needed to prove it. This research is still early as a test of the exercise method model carried out.

6. Limitation

This research is limited to a pilot study, meaning it is limited in terms of proving its impact and influence. This research is still in the training model trial phase, so we recognize that our conclusions are still limited. This study is limited by the lack of a control group, randomization, and blinding. Furthermore, we only examined the effectiveness of the training model on punching and kicking speed, so a more in-depth analysis of how the training model affects speed is needed, using a control group as a compar-

ison. This study was also conducted for only three weeks. We recognize that this requires further verification to demonstrate a real impact of the training model we have created. Furthermore, molecular biomarkers, such as those that measure the function of white muscle fibers, are also important as undeniable laboratory data. This is crucial to provide concrete evidence of increased punching and kicking speed in athletes.

Author Contributions: All authors did a joint research design. The first author is involved in the process of data collection, writing and interpretation of the data as well as approval of the final draft. The second author is involved in the process of data collection, writing and interpretation of data and approval of the final draft. Third, the author of data interpretation and critical review of the original draft as well as approval of the final draft. The fourth author is the interpretation of the data and critical review of the original draft as well as the approval of the final draft. The fifth author is the interpretation of the data and critical review of the original draft as well as the approval of the final draft. Sixth author is the interpretation of the data and critical review of the original draft as well as the approval of the final draft. Seventh author is the data collection, writing and interpretation of data and approval of the final draft. Eight author is the writing and interpretation of data and approval of the final draft. All authors contribute to the discussion of the results and preparation of the manuscript. Ninth author is the data collection, writing and interpretation of data and approval of the final draft.

Institutional Review Board Statement: This research was approved by the Research, Deputy Director for Academic Affairs University xxxxxx No. 3335/UN 39.6.1.Ps/LT/2023, 26 July 2023.

Informed Consent Statement: Any research article describing a study involving humans should contain this statement. Please add "Informed consent was obtained from all subjects involved in the study." OR "Patient consent was waived due to REASON (please provide a detailed justification)." OR "Not applicable." For studies not involving humans. You might also choose to exclude this statement if the study did not involve humans.

Written informed consent for publication must be obtained from participating patients who can be identified (including by the patients themselves). Please state "Written informed consent has been obtained from the patient(s) to publish this paper" if applicable.

Acknowledgments: I would like to thank Bone Regency and the Inkanas dojo. We are grateful for the help of all participants who participated in the research and all lecturers who helped this research.

Conflicts of Interest: The authors declare that they have no conflict of interest.

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