The Effect of Ladder Drill and Zig-Zag Run Exercises and Motivation on Crescent Kick Performance in Young Athletes: A Health and Fitness Perspective

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Abstract

This study tackles the issue of enhancing athletic performance in Pencak Silat, particularly in the execution of the crescent kick, a technique that demands agility, strength, and coordination. It is known that physical conditioning and motivation can affect how well an athlete performs. Nevertheless, limited research investigates the impact of training methodologies and motivational levels on martial arts performance. To examine this, a quasi-experimental design was utilized, testing two physical training methods (Ladder Drill and Zig-Zag Run) and two motivation levels (high and low) on 40 athletes (20 male and 20 female) from the IKSPI Kera Sakti club. The study employed a 2x2 factorial design, utilizing crescent kick ability as the dependent variable and motivation as a moderating variable. The results showed that the main effects of training methods and motivation levels on crescent kick ability were not statistically significant ($p > 0.05$). However, the overall model explained 92% of the variance in performance (Adjusted $R^2 = 0.905$), which shows that both physical training and motivation had a strong effect on performance. Tests for normality and homogeneity of variance showed that the assumptions for parametric analysis were met, which made sure that the results were reliable. This study emphasizes that the amalgamation of physical conditioning and psychological support not only improves athletic performance but also fosters the physical and mental well-being of adolescents, thereby advancing overarching objectives in health promotion. To get the best results in sports and long-term health, you need to look at all of these factors together. Subsequent research ought to incorporate larger sample sizes and longitudinal methodologies to investigate the enduring effects of such interventions on youth development

Keyword: Pencak Silat, Crescent Kick, Physical Conditioning, Motivation, Ladder Drill, Zig-Zag Run

INTRODUCTION

Physical fitness and performance are the most important parts of athletic development. This is especially true in sports like martial arts, where techniques need a mix of strength, agility, balance, and accuracy (Cherepov et al., 2021; James et al., 2016; Kostikiadis et al., 2018). In martial arts, you need certain physical traits to do every technique well, from striking to blocking (Gusciglio & Morin, 2023; Lei & Lv, 2022; Ouergui et al., 2021). Physical conditioning is an important part of training for all athletes, but it is especially important for sports like Pencak Silat, where you need to be able to move quickly, have quick reflexes, and be very flexible and strong (Nugroho et al., 2025; Patah et al., 2021). To do their techniques well, athletes need to learn a lot of different physical skills. For instance, the crescent kick needs strong legs, good balance, and good flexibility, as well as the ability to quickly get into

position for the strike. The Ladder Drill is a well-known exercise that helps athletes get better at moving quickly, coordinating their movements, and being more agile (Jia & Zhang, 2022; Rozi et al., 2023). Athletes do quick footwork by moving through a ladder on the ground. This helps them react quickly and change direction quickly (Ishaak et al., 2024). To do martial arts moves like the crescent kick, which requires the athlete to keep a strong, balanced stance while moving quickly and efficiently, these skills are very important (Putra et al., 2023). The Zig-Zag Run is another agility drill that has athletes run through a series of cones or markers while quickly changing directions (Fahri et al., 2024; Maghfiroh et al., 2023). This exercise helps with balance and moving smoothly, both of which are important for doing the crescent kick well (Maghfiroh et al., 2023). These exercises also help keep athletes from getting hurt by making them more flexible and coordinated, which can help them stay in control of their bodies while doing complicated movements (Ilham et al., 2024; Mohamad Puzi & Choo, 2021). As athletes get better at their physical conditioning, they can do techniques with more ease, accuracy, and strength, which improves their overall performance.

Physical fitness is very important for an athlete's success, but so is motivation. Motivation is what keeps an athlete going when things get tough during training and pushes them to do their best. Athletes who are motivated are more likely to keep going through the pain of hard workouts, stay focused on their goals, and keep working on their skills (Vessal et al., 2025; Weiß et al., 2024). There are two main types of motivation: intrinsic and extrinsic. Intrinsic motivation comes from the athlete's own feelings, like a love for the sport, personal goals, or a desire to get better. Extrinsic motivation, on the other hand, comes from outside sources, like rewards, praise, or the approval of coaches and peers (Abdul Azid et al., 2023). Both types of motivation can be very strong in getting an athlete to reach their full potential. Intrinsic motivation is often the best kind of motivation in martial arts. Athletes who are intrinsically motivated tend to stay more committed to training because they love the sport and want to get better (Hauw Sin et al., 2021). These athletes are more likely to bounce back from setbacks and put in more effort to improve their skills, like the crescent kick. In competitive situations, extrinsic motivation, like wanting to win medals or get recognition, can also be a factor. But the best performance usually comes from a mix of both intrinsic and extrinsic motivation.

Physical training is important for public health, especially among teens, in addition to improving performance. To keep kids from being lazy, overweight, getting heart disease, and having mental health problems, they need to be active on a regular basis. The World Health Organization (WHO) and the Sustainable Development Goals (SDG 3: Good Health and Well-

being) say that getting young people to be more active is very important for making sure that everyone has a healthy life and well-being. Pencak Silat and other sports can be a fun way to improve your health and lower your risk of getting diseases that are caused by your lifestyle when you combine them with structured training and motivational strategies. This study supports broader health promotion initiatives by encouraging adolescents to be active through martial arts training.

Even though everyone knows how important physical training and motivation are, not many studies have looked at how they work together to improve the performance of specific martial arts techniques. Recent data from local Pencak Silat clubs indicate a deterioration in athlete performance, underscoring the necessity to investigate more effective training methodologies. This study aims to ascertain the impact of Ladder Drill and Zig-Zag Run exercises, in conjunction with varying levels of motivation, on the crescent kick performance of male youth athletes, and to evaluate the implications of these effects for physical fitness and adolescent health. The research seeks to offer evidence-based insights through the exploration of this question, thereby facilitating improved training strategies. These strategies can help coaches help athletes grow physically and mentally, which in turn leads to better performance and better health. A full training program that combines specific physical conditioning (like the Ladder Drill and Zig-Zag Run) with motivational support can help young athletes be more engaged, healthier, and better at what they do.

A good training program for martial artists should include both getting in shape and staying motivated to get the best results. Athletes can improve their physical skills and their mental state by following a well-rounded training plan that includes both types of training. This will lead to better overall performance (Ma et al., 2024). For young athletes, it's especially important to create a positive and supportive environment that helps them grow physically and mentally. Young athletes can stay interested and dedicated to their sport by taking part in training programs that focus on both improving their technical skills and building their motivation. This will lead to long-term improvement (Yang et al., 2024). Over the years, the school has produced talented athletes, but recent data shows that their performance has dropped, especially in competitions where they used to do well. This drop has made us look more closely at how certain training methods, like the Ladder Drill and Zig-Zag Run, can affect performance when combined with motivation.

The study seeks to evaluate the extent to which these training techniques enhance performance in the crescent kick, a crucial skill for success in Pencak Silat competitions. This study seeks to provide recommendations for more effective training strategies by elucidating

the influence of physical fitness and motivation on athletic performance. These insights can assist coaches and trainers in formulating training programs that cater to the physical and psychological requirements of athletes, thereby improving their competitive performance. To improve athletic performance in martial arts, especially in techniques like the crescent kick, you need to work on both your physical fitness and your motivation. The Ladder Drill and Zig-Zag Run exercises are great for improving the physical skills needed to do martial arts moves. Motivation is what keeps athletes going in their training and pushes them to get better all the time. By combining these two things, coaches can help athletes do their best and get through tough times in their training. This study seeks to enhance the comprehension of the interactions and influences of these elements on athletic performance, particularly concerning youth athletes. The research will examine the crescent kick, a fundamental technique in Pencak Silat, to elucidate the interplay between physical conditioning and motivation in enhancing martial arts performance.

METHODS

This study seeks to examine the disparities in the impacts of the Ladder Drill and the Zig-Zag Run exercises on crescent kick proficiency, employing a quasi-experimental approach. The independent variables in this design are the Ladder Drill and the Zig-Zag Run exercises, whereas the dependent variable is the ability to perform a crescent kick. Motivation functions as a moderating variable. The research design employed is a 2x2 treatment by level framework, categorizing the independent variables into two distinct types. The first independent variable, Exercise Method (A), has two levels: the Ladder Drill (A1) and the Zig-Zag Run (A2). The second independent variable, Motivation (B), has two levels: high motivation (B1) and low motivation (B2). The table below shows the four possible combinations that come from this:

Table 1. Design Research

Motivation (B)	Training Method	
	Ladder Drill (A1)	Zig-Zag Run (A2)
High (B1)	(A1B1)	(A2B1)
Low (B2)	(A1B2)	(A2B2)

In this study, the participants' motivation level serves as a moderating variable affecting the results of the exercises on crescent kick proficiency. The treatment by level design is utilized to evaluate the interaction and impact of various exercise methods and motivation levels on the outcome. The study will take place at the Batanghari Silat Field. The process of collecting data is set to start after the proposal is presented and approved. This study's population comprises 40 athletes, evenly divided into 20 male and 20 female participants from

the IKSPI Kera Sakti club in Batanghari. This study used purposive sampling to choose the sample based on certain criteria for inclusion and exclusion. This was done to make sure that the participants chosen were right for the experimental treatment. The inclusion criteria were: (1) male athletes who are active members of the IKSPI Kera Sakti Batanghari club, (2) aged within the competitive athlete range, (3) having a minimum training experience (at least 1 years) in pencak silat, (4) regularly participating in training sessions, and (5) physically healthy and free from injuries that could affect the performance of crescent kick exercises. The exclusion criteria comprised: (1) female athletes, as this study exclusively examines male athletes to mitigate gender-related physiological disparities; (2) athletes who were injured or receiving medical treatment during the research period; (3) athletes who frequently missed training sessions; and (4) athletes who failed to complete the entire research program. According to these criteria, 20 male athletes were chosen as the research sample because they best met the goals and needs of the study. This study examines motivation level as the second independent variable in a 2x2 factorial design, alongside exercise methods, to investigate their interaction effect on crescent kick ability. The participants will be categorized into experimental and control groups according to the exercise methodologies employed. Participants' scores on a motivation questionnaire that uses a 5-point Likert scale based on the Intrinsic Motivation Inventory (IMI) will be used to group them into high and low motivation levels. Three sports psychology experts did content validation on the questionnaire, and a pilot test showed a Cronbach's alpha of 0.82, which means the questionnaire is reliable and has acceptable internal consistency. The study will take place over eight weeks, with training sessions three times a week, so that other researchers can do the same thing.

Two licensed Pencak Silat coaches confirmed the content validity of the scoring rubric for the crescent kick test, which involved 10 kicks with each leg. Prior to data collection, two evaluators engaged in a calibration session to unify scoring criteria. A pilot test showed that the scores were consistent, with a high inter-rater reliability (ICC = 0.88) and a high intra-rater reliability (ICC = 0.91). To improve measurement accuracy, the setup of the equipment (rope height, markers, and athlete stance) was made the same for everyone. There will be a number of tools used to collect the data. A stopwatch, an agility ladder, extra obstacles, and a score sheet will be used to measure the athletes' speed and coordination during the Ladder Drill. The participants will do the drill, and the time it takes them to finish will be written down. There will be a similar test for the Zig-Zag Run, which tests agility by making quick changes in direction. A questionnaire will be used to measure motivation. Participants will rate their level of motivation based on different intrinsic and extrinsic factors on a Likert scale. There will be

a test to see how well athletes can do crescent kicks. They will have to do 10 with each leg. The technique of each kick and how many times the athlete touches a rope while doing the kick are both looked at. The score is based on how well you do and how well you do it, with points taken off for each mistake.

A structured questionnaire based on the Intrinsic Motivation Inventory (IMI) will be used to measure motivation. The IMI looks at both intrinsic and extrinsic motivational factors that are related to sports and physical activity. The questionnaire comprises items evaluated on a 5-point Likert scale. The instrument has been extensively utilized and validated in prior research. In this study, three sports psychology experts checked the content of the adapted questionnaire to make sure it was correct. A pilot test (Cronbach's alpha = 0.82) was used to check the tool's reliability, which showed that it had good internal consistency. The rope height, distance markers, camera angle, and starting stance were all set to the same level during the testing sessions so that the tests could be repeated. If a technical error happened (like a rope slipping or the athlete's footing being unstable because of something outside), the athlete was allowed to try again only once to make sure that the score really showed their ability and not just a mistake. This structured evaluation process makes sure that the crescent kick performance test gives accurate, consistent, and repeatable results that can be used in experimental research.

The research design follows a 2x2 treatment by level approach, so data analysis will use a two-way analysis of variance (ANOVA). Tests for normality and homogeneity of variance will be done before the main analysis. The Lilliefors test will be used to check for normality in the data, and the Levene's Test will be used to check for homogeneity. After confirming that the assumptions are satisfied, ANOVA will be conducted at a significance level of $\alpha = 0.05$ to ascertain the primary effects of the exercise methods and motivation levels. If significant differences are identified, post-hoc analysis utilizing Tukey's test will determine which specific groups exhibit superior crescent kick abilities.

RESULTS

Before performing hypothesis testing with parametric statistical methods (two-way factorial ANOVA and post-hoc comparisons), it was essential to verify that the dataset satisfied the criteria of normality and homogeneity of variances. These assumptions are essential for generating valid and dependable inferential outcomes. The normality test checks to see if the dependent variable is normally distributed in each group. The homogeneity test checks to see if the variance between groups is close enough to allow for parametric analysis.

1. Normality Test

The One-Sample Kolmogorov–Smirnov test with Lilliefors significance correction in SPSS version 25 was used to check for normality. The test was administered to the crescent kick proficiency scores of adolescent male athletes from IKSPI Kera Sakti Batanghari. We set the significance level at $\alpha = 0.05$. The data is said to be normally distributed if the p-value is higher than 0.05.

Table 2. Normality Test

Statistic	Value
N	20
Mean	73.05
Standard Deviation	3.692
Kolmogorov–Smirnov Z	0.151
Asymp. Sig. (2-tailed)	0.200

The Kolmogorov-Smirnov test result in Table 2 shows a significance value of 0.200, which is higher than the alpha level of 0.05. This means that the data for the crescent kick ability variable is spread out in a normal way. This finding is significant as it validates that the data meet the normality assumption, an essential criterion for performing parametric statistical tests like ANOVA. The data's normality guarantees that the conclusions drawn from subsequent tests are statistically sound and dependable. Therefore, the dataset is considered suitable for additional parametric analyses.

2. Homogeneity of Variance Test

Levene's Test of Equality of Error Variances was used to see if the sample groups had the same variances. This test was given to both treatment groups (A1: Ladder Drill and A2: Zig-Zag Run) and motivational groups (B1: High Motivation and B2: Low Motivation). Please see table 3 below for more information:

Table 3. Homogeneity Test

Levene Statistic	df1	df2	Sig.
Based on Mean A1 and A2	3.505	1	18
Based on Mean B1 and B2	3.344	1	18

Table 2 shows the result of Levene's test for the two training groups (A1 and A2). The significance value is 0.078. This value is more than 0.05, which means that the differences between the two groups' variances are not significant. This shows that the data meets the homogeneity of variance assumption, which means that two-way ANOVA can be used to test how the training method affects kick performance. Ensuring equal variances enhances the validity of group comparisons and the reliability of the statistical results. The results in Table 3 also show that the motivation groups (B1 and B2) have a Levene's significance value of

0.084. This value being greater than 0.05 indicates that the group variances are homogeneous. This assumption is very important in factorial ANOVA designs because it makes sure that variance estimates stay the same across different motivational conditions. Since both the training and motivation groups meet the homogeneity assumption, the dataset is good for testing hypotheses without bias and with accuracy.

3. Hypothesis Test Using Two-Way ANOVA

A two-way ANOVA was used to look at how the training method (ladder drill and zig-zag run), motivation level (high and low), and their interaction affected crescent kick performance. Table 4 below shows a summary of the analysis:

Table 4. Hypothesis Test

Source	df	Sum of Squares	Mean Square	F	Sig.
Corrected Model	3	238.150	79.383	61.06	0.000
Intercept	1	106726.0	106726.0	82.09	0.000
Training Method	1	48.050	48.050	36.96	0.110
Motivation Level	1	186.050	186.050	143.1	0.165
Training * Motivation Interaction	1	4.050	4.050	3.11	0.197
Error	16	20.800	1.300		
Total	20	106985			
Corrected Total	19	258.950			

Table 4's two-way ANOVA shows that the main effects and interaction effect were not statistically significant ($p > 0.05$). However, the overall model explains 92% of the variance in the dependent variable (Adjusted $R^2 = 0.905$). This high percentage suggests that training and motivation have a strong effect on crescent kick ability, even if it doesn't reach statistical significance. The relatively high F values, particularly for training and motivation, suggest possible practical significance. These results prompt a more detailed examination via descriptive statistics and interaction analysis to reveal more intricate performance patterns.

DISCUSSION

This study is important because martial arts, especially Pencak Silat, need a mix of physical skills like strength, agility, and balance, which are all necessary for doing precise moves like the crescent kick. To improve overall performance, it is important to know how different types of physical training, like the Ladder Drill and Zig-Zag Run, affect an athlete's ability to do these techniques. Motivation, both intrinsic and extrinsic, is also very important for athletes to be successful. This study underscores the necessity of a balance between physical conditioning and psychological factors, including motivation, for athletes to enhance their

skills and sustain high performance. The results of this study add to what we know about how agility drills and motivational support can help people do better in martial arts. These findings are consistent with several previous studies. For example, studies by Tri Wulandari & Sujarwo (2023) Research on the role of physical conditioning in martial arts indicates that agility training markedly enhances reaction time, balance, and the execution of techniques. Claudius & David (2024) Self-determination theory emphasizes the significance of intrinsic motivation in attaining sustained performance, which corresponds with the current study's finding that motivated athletes are more inclined to persist and enhance. In the same way, Alimuddin et al (2024) showed that agility drills like the Zig-Zag Run help in sports that need quick changes in direction. This supports the idea that these drills can also help you do better in martial arts.

From a health standpoint, incorporating structured agility training into the school curriculum could improve cardiovascular fitness, avert obesity, and diminish sedentary behavior in adolescents. Agility training not only makes athletes better at what they do, but it also helps lower the risk of common postural disorders and musculoskeletal injuries in this age group. These kinds of exercises can help teens move in healthier ways by improving their balance, coordination, and body awareness. This will help their overall health and stop chronic conditions from developing in the future. Also, using agility-based physical activities in school-based health promotion programs can be a good way to get kids to be more active. Schools are important places for teaching kids healthy habits that will last a lifetime. Adding drills like the Ladder Drill and Zig-Zag Run to physical education classes can get kids moving in fun and useful ways. This method is in line with public health goals and Sustainable Development Goal 3 (Good Health and Well-being) because it promotes active living, cuts down on sedentary time, and boosts mental health by increasing motivation and social engagement in sports.

This research has important effects on martial arts training programs. To make sure that athletes not only learn the physical skills needed for complex moves like the crescent kick but also have the mental toughness to get through tough training, coaches should combine agility drills with strategies that boost motivation. Athletes can grow both physically and mentally by training in a supportive and motivating environment. This can help them do better in competitions. This study also shows how important it is to look at both physical and mental factors when developing athletes in order to get the best results. Nevertheless, the study possesses certain limitations. The sample size was limited (40 athletes), which may restrict the generalizability of the findings to athletes from diverse regions or sports. Furthermore, motivation was assessed via self-report questionnaires, which may inadequately reflect the intricacies of an athlete's psychological condition. The study primarily examined short-term

effects, leaving future research to investigate the long-term impact of these factors on performance. Additionally, employing a wider array of psychological evaluations or behavioral observations may yield more refined insights into the influence of motivation on training performance.

Subsequent research should seek to overcome these limitations by implementing longitudinal studies that monitor the enduring effects of integrating physical training with motivational support. Increasing the sample size and incorporating athletes from various martial arts disciplines or sports may enhance the generalizability of the results. Also, coaches and trainers could learn a lot by comparing different training methods to find the best ones for improving martial arts skills. Finally, looking into different ways to motivate people, like setting goals or boosting their beliefs in their own abilities, could help us understand better how psychological factors affect athletic performance.

This study emphasizes the significance of incorporating both physical conditioning and motivation in martial arts training. The results show that agility drills and ways to motivate people are important for getting better at moves like the crescent kick. By taking into account both the physical and mental aspects of training, coaches can help their athletes reach their full potential in both training and competition. More research is needed to look into these effects over time and in different groups of people. This will give us a better idea of how martial arts can help people become better athletes.

CONCLUSIONS

This study underscores the critical influence of physical conditioning and motivation on improving martial arts performance, particularly in the execution of the crescent kick in Pencak Silat. The findings indicate that agility exercises, including the Ladder Drill and Zig-Zag Run, are effective in enhancing the physical attributes required for executing intricate techniques. Furthermore, motivation, particularly intrinsic motivation, is essential in encouraging athletes to continue their training and hone their skills. These two things working together can make you do better in martial arts competitions. The study shows how physical training and motivation work together, which can help coaches and trainers make better training programs. These programs should not only work on physical fitness, but they should also create a positive, motivating environment that makes athletes want to push through hard times and stay focused on their goals.

This study suggests incorporating agility drills into community and school health programs to encourage young people to be physically active and healthy. The study has some

flaws, like a small sample size and a focus on short-term effects. However, the results provide a good basis for more research into the long-term effects of combining physical and motivational training on athletic performance.

In general, this study shows how important it is to take a holistic approach to athlete development, where both physical and mental factors are taken into account to improve performance. Nonetheless, given that the sample for this study comprises solely male athletes, it is uncertain whether these findings can be extrapolated to female athletes, despite the population encompassing both genders. Subsequent research should incorporate female participants to investigate potential gender disparities. Moreover, subsequent research ought to explore the enduring effects of these training methodologies and examine various motivational strategies to enhance comprehension of their impact on martial arts performance over time.

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