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# *The effect of drill exercise and reaction speed on the drive accuracy of beginner table tennis athletes*

**Suisdareni *, Tomoliyus**

Universitas Negeri Yogyakarta. Jalan Colombo No. 1, Yogyakarta 55281, Indonesia.

* Coressponding Author. E-mail: renisuisdareni@gmail.com

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***Abstract**: This study aimed to test (1) the differences of drill practice effect of a constant set of rising repetition and rising set of repetition continually on drive accuracy (forehand and backhand drive) for the beginner table tennis athletes, (2) the differences of the effect of high and low reaction speed on the drive accuracy (forehand and backhand drive) for the beginner table tennis athletes in Yogyakarta, and (3) the relation between drill practice and reaction speed on improving the drive accuracy (forehand and backhand drive) for the beginner table tennis athletes in Yogyakarta. This research used an experiment with a 2 x 2 factorial design. The sample was 20 beginner table tennis athletes in Yogyakarta, taken with random technique from a population of 38 athletes. The instrument for measuring reaction speed was the ruler drop test and for measuring the forehand and backhand drives was the precision of the drive accuracy. The data were analyzed using two-way ANOVA at significance level α = 0.05. The results of the study were as follows. (1) There were significant differences in the effect of a constant set of rising repetition and rising set of repetitions continually to drive accuracy (forehand and backhand drive) for the beginner table tennis athletes, as proven by the value of F = 7.538 and p = 0.014 <0, 05. The drill practice of a constant set of rising repetition was higher than the drill practice of a rising group of repetition always. (2) There was a significant difference effect of high and low reaction speeds to drive accuracy (forehand and backhand drive) for the beginner table tennis athletes, as proven by the value of F = 21.442 and p = 0.000 <0.05. High reaction speed was better than low reaction speed. (3) There was a significant relation between drill practice and reaction speed on improving punch drive accuracy (forehand and backhand drive) for beginner table tennis athletes, as proven by the value of F = 136.398 and p = 0.000 <0.05.*

***Keywords**: Drill Exercise, Reaction Speed, Drive Accuracy*

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## INTRODUCTION

Table tennis is one of the games favored by Indonesia's people in general and the people of the Special Region of Yogyakarta in particular. It shows that the table tennis branch is part of the life of the community. One example is the emergence of table tennis clubs and table tennis schools, which are fostering in an organizational forum; their activities have even been packaged in the schedule of routine club matches. It is hoped that table tennis clubs and table tennis schools in the Special Region of Yogyakarta can become a nursery for beginner table tennis athletes who have the talent and potential to be optimally developed. The training of beginner table tennis athletes is the development of early age athletes. It is hoped that these athletes will become a generation of student-athletes from the Special Region of Yogyakarta who are ready to compete with other regions. Maintaining and improving achievements in the national student sports week, regional student sports week, and national Student Sports Week are the goal of this coaching.

Playing table tennis are several necessary stroke skills, including forehand, backhand, drive, push, chop, block, service, and spin (Yulianto, 2015). In other hand, Playing table tennis is a difficult motor task that requires fast movements, accurate control and adaptation to task parameters (Mulling, K, Kober, J, and Peters, 2011) and the most dominant and most assertive blow technique skill in smashing is the forehand technique, which is the most powerful technique; besides that, the power used is more maximal than the backhand shot. The technical skills needed to attack are contained in the forehand technique, namely the forehand drive technique; this technique is often used to attack opponents playing.

In addition to forehand drives, there are several other technical skills in the forehand technique, namely forehand push, forehand chop, forehand block, and forehand spin. Likewise, the backhand technique also has several types of strokes, the same as the punch techniques in forehand technical skills such as backhand drive, backhand push, backhand chop, backhand block, backhand spin, and footwork techniques and tactics to win in each table tennis game (Mahendra, 2012). One of the essential methods in table tennis is the drive shot. The drive stroke is a technique of least friction force, which is done by moving the racket from the bottom upward, and the stew is closed. Of all the methods in table tennis, the driving technique that greatly influences all other hitting techniques is the primary drive stroke of all strokes in table tennis.

Table tennis requires motor performance which is quite difficult. Because this type of table tennis game has the characteristics of intermittent movement, the movement changes direction quickly and is responsive to the stimulus and table tennis is characterized by a shortest distance between the opponents and by faster actions and rellies (Malagoli, L.I, 2013; Tomoliyus & Sunardianta, 2020). The skill of returning the ball can be done by using forehand and backhand skills (Tomoliyus, 2012). A strike can generally be classified as a foul shot (resulting in a topspin ball). Table tennis forehand is the most frequently used stroke for smashes (Hodges, 2007). While the backhand drive is very useful in game play and would enhance a Table Tennis player's attack arsenal(Flores, Bercades, 2010). Further, backhand is hitting the ball with the palm of the hand holding the bet/racquet facing backwards, or the position of the back of the hand holding the bet/racquet facing forward (Sutarmin, 2007). Therefore, based on this explanation, playing table tennis with the drive accuracy technique can have an effect on reaction speed. These skills also affect reaction time. reaction time and total movement should be a major consideration for all athletes and especially for athletes in the sport of table tennis (Irianto, 2009). Then, reaction time is a critical success factor in almost all sports, especially table tennis (Sukadiyanto, 2011). In line with this, the main goals and objectives of training or training are to help athletes to improve their skills and achievements as much as possible (Harsono, 2015). In addition, the training method of practicing with a coach, practicing with other players, practicing alone, and using a ball throwing machine can also increase movement skills and reaction speed in playing table tennis (Hodges, 2007). This is reinforced by Simpson that the drive stroke can be played as an attacking shot or can also be controlled as desired (Simpson, 2007). Therefore, drive strokes need to be trained with effective training methods and a table tennis player also needs to master fast and precise forehand and backhand strokes (Yulianto, 2015). Accuracy is the ability to control free movement of a target (Sajoto, 1988). Furthermore, Thorndike (Atmaja, 2015) said that the repetition of this movement is intended to automate the movement so that a table tennis player will reflexively deal with attacks. Another method used is the drill method, where the athlete performs movements according to what the coach has instructed and does it repeatedly (Prayogo, H.Y dan Rachman, 2013).

The accuracy in determining the method can affect the level of achievement of the training objectives (Singh, 2012). Exercise is a systematic activity process that is carried out regularly, planned, and continuously with a certain system (Muthiarani & Lismadiana, 2021). One of the right techniques to use are forhand and backhand. Forehand and backhand drive are powerful strokes based on table tennis skills (Hodges, 2007). Likewise, Flores, Bercades, & Florendo stated that an essential technique in table tennis is the forehand and backhand drive methods to attack in table tennis (Flores, Bercades, 2010). In line with this opinion, Yuqiang, Xiaodong, & Dandan state, Table tennis forehand is an attack technique, and forehand loop drive technique was the primary attack technique in table tennis(Yuqiang, D, Xiaodong, Z, and Dandan, 2011). Based on these two opinions, it can be concluded that the forehand and backhand drive is basic strokes for coaching or teaching athletes because of the basic strokes in table tennis. Based on the results of interviews with the coach, table tennis athletes often make mistakes in driving. Frequently repeated mistakes such as his frequent hitting drive not over the net or hitting, then inaccurate drives and frequent passing of the opponent's court (out). In this case, it is clear that players often lose points and even add points for opponents. Then based on the data, only about 30% can hit backhand and forehand well in novice table tennis players, and 70% can't do the shot well. Based on some of these things, it will make it difficult to win the match. So, in this case, table tennis athletes' forehand and backhand drive abilities need special attention so that one of the factors that cause the decline does not decrease. One of the factors that cause defeat is that the speed of table tennis athletes' reaction is still low; players are still often late in anticipating shots from opponents so that players cannot return the ball properly. The accuracy of table tennis athletes is also lacking; the ball that is hit still often

leaves the opponent's court, which can be detrimental to the player himself. Aside from that analysis result of observations, reaction speed is an element of potential motion that plays a role in table tennis. The game of table tennis demands a fast rhythm of play to welcome and return the ball, so a table tennis player must have a high reaction speed. For players who have low hand reaction speed to adapt to table tennis characteristics, the application of training methods must be appropriate. Based on the above questions, it is necessary to examine the effect of drill training and reaction speed on the accuracy of drive strokes (forehand and backhand drive) for beginner table tennis athletes.

## METHODS

The design used in this study was an experimental method using a 2x2 factorial design and using observation and interview to collecting data. Observatioan this research to beginner Table Tennis Athletes and interviews to coachs in Yogyakarta. This method is validation, which tests the effect of one or more variables on other variables. The total population is 38 people. The number of samples is 20 people—sampling using random sampling technique using testing the reaction speed. The research instruments used in this study were: reaction speed test and table tennis drive accuracy test. This study's data analysis technique was SPSS 20, namely by using two-way ANOVA at the significance level $\alpha = 0.05$. Furthermore, to compare the average pairs of treatments used, the Tukey test (Sudjana, 2002). However, before arriving at the use of two-way ANOVA (two-way ANOVA), it is necessary to conduct prerequisite tests including (1) normality test, (2) variance homogeneity test, and (3) hypothesis testing.

The variable consisted of two manipulative independent variables: fixed sets of increased repetitions and increased sets of appointed reps and attributive independent variables, namely reaction speed. Then the dependent variable is the accuracy of the forehand and backhand drives. The definitions of the variables are as follows: a) Drills with sets of increasing fixed repetitions are drill exercises using the number of repetitions performed for several types of activities remains the same; b) A drill exercise with a fixed set of increasing reps is a drill exercise using the number of repetitions performed for several types of activities increases; c) Reaction speed is the shortest time to answer kinetically after receiving a stimulus; and d) Forehand and backhand drive accuracy is an athlete's ability to return a ball that moves freely with a forehand or backhand drive, then to direct and to place it precisely towards the target, which is the corner area of the table that has been marked and measured using the table tennis drive accuracy-test compiled by Tomoliyus (2016).

## RESULTS AND DISCUSSION

The research results are pretest and posttest data, which is an overview of each variable involved in the study. If displayed in diagrammatic form, the pretest and posttest data for the drive stroke accuracy (forehand and backhand drive) for table tennis athletes can be presented in the following figure.

### Prerequisite Test Results

The data normality test in this study used the Kolmogorov Smirnov method. Based on the statistical analysis on all pretest and posttest data, the drive strokes' accuracy (forehand and backhand drive) was obtained from the results of the data normality test with a significance value of $p > 0.05$, which means that the data were normally distributed.

The homogeneity test in this study is the Levene Test. Based on statistical analysis at the pretest, it was obtained a significance value of $0.448 \geq 0.05$. It means that the data group has a homogeneous variant. Likewise, the calculation results in the posttest obtained a significance value of $0.309 \geq 0.05$. It means that the data group has a homogeneous variant. Thus, the population has the same variant or homogeneity (*See in figure 1*).

### Hypothesis Test Results

The first hypothesis test, namely "There is a significant difference in the effect of fixed-repetition drill set training and fixed repetition of sets on the accuracy of the drive (forehand and backhand drive) for table tennis athletes." The p-value was 0.014. Because the p significance value is $0.014 < 0.05$, it means that Ho is rejected. Thus, there is a significant difference in increasing fixed repetition drill set exercises and fixed repetitions of sets on the accuracy of drive strokes (forehand and backhand drive) for table tennis athletes.

The second hypothesis test, namely "There is a significant difference in the effect of high and low reaction speed on the drive's accuracy (forehand and backhand drive) for table tennis athletes," obtained the p-value of 0.000. Because the significance value of p is 0.000 <0.05, it means that Ho is rejected. There is a significant difference in the effect of high and low reaction speed on the drive's accuracy (forehand and backhand drive) for table tennis athletes.

The third hypothesis test, namely "There is a significant interaction between drill training and reaction speed to the increase in the accuracy of the drive (forehand and backhand drive) for table tennis athletes." The p-value was 0.000. Because the significance value of p is 0.000 <0.05, it means that Ho is rejected. Based on this, it means that the hypothesis, which states that there is a significant interaction between drill training and reaction speed to the increased accuracy of drive strokes (forehand and backhand drive) for table tennis athletes, has been proven (*See in table 1*).

**Figure 1.** Bar Diagram of the Pretest and Posttest Drive Accuracy

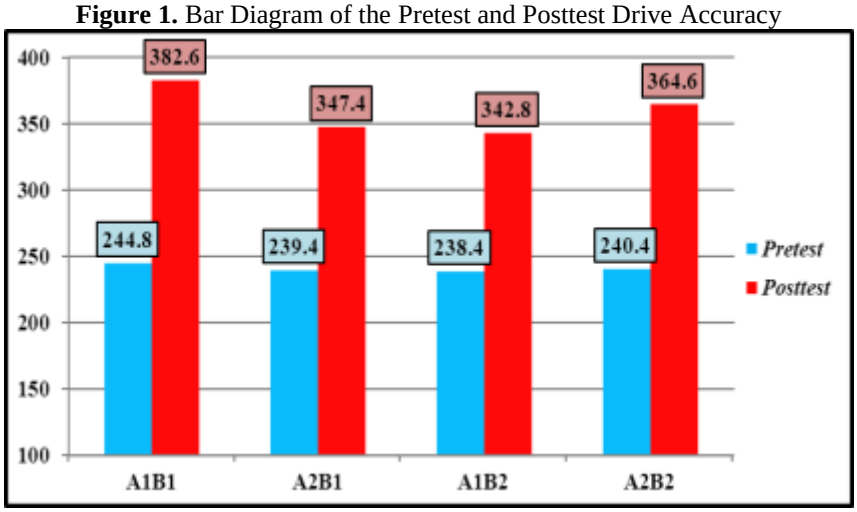


**Table 1.** Summary of Post Hoc Test Results

| Group | Interaction | *Mean Difference* | *Std Error* | *Sig* |
|---|---|---|---|---|
| A1B1 | A2B1 | 35.2000* | 3.45109 | .000 |
| | A1B2 | 39.8000* | 3.45109 | .000 |
| | A2B2 | 18.0000* | 3.45109 | .000 |
| A2B1 | A1B1 | -35.2000* | 3.45109 | .000 |
| | A1B2 | 4.6000 | 3.45109 | .556 |
| | A2B2 | -17.2000* | 3.45109 | .001 |
| A1B2 | A1B1 | -39.8000* | 3.45109 | .000 |
| | A2B1 | -4.6000 | 3.45109 | .556 |
| | A2B2 | -21.8000* | 3.45109 | .000 |
| A2B2 | A1B1 | -18.0000* | 3.45109 | .000 |
| | A2B1 | 17.2000* | 3.45109 | .001 |
| | A1B2 | 21.8000* | 3.45109 | .000 |

After testing that there is a significant interaction between drill training and reaction speed to the increased accuracy of the drive (forehand and backhand drive) for table tennis athletes, it is necessary to carry out further tests using the Tukey test. The Tukey test results can be seen in the table 1.The results of the paired analysis of variance with Tukey's continued test showed that ten pairs differed significantly, namely: teams (1) A1B1-A2B1, (2) A1B1-A1B2, (3) A1B1-A2B2, (4) A2B1-A1B1, (5) A2B1-A2B2, (6) A1B2-A1B1, (7) A1B2-A2B2, (8) A2B2-A1B1, (9) A2B2-A2B1, (10) A2B2-A1B2. In contrast, the other pairs stated that there was no difference, namely: pair (1) A2B1-A1B2, (2) A1B2-A2B1.

## DISCUSSION

Fixed-repetition drill set exercises increase, and repetition-increasing sets still significantly differ in the accuracy of the drive strokes (forehand and backhand drive) for table tennis athletes. Fixed repetition of drill sets increases better than drill sets, and increases appointed reps to the drive's accuracy (forehand and backhand drive) for table tennis athletes. The increase in ability that occurs is due to athletes' knowledge association at previous meetings with new knowledge, and the association is getting stronger when done repeatedly. Based on the law of exercise theory put forward by Thondrike (Rahyubi, 2012) which states that "the principle of the law of practice shows that the main principle in learning motion is repetition, the more often the subject matter is repeated, the more it will be mastered". The high repetitions will make the training very useful, and it will be great for developing the fast type of muscle fibers, which is one of the time each set spends. Thus, the body can adapt to carry out heavier workloads so that muscles and other biomotor components adapt to the workload being carried out.

Then there is a significant difference in the effect of high and low reaction speed on the drive's accuracy (forehand and backhand drive) for table tennis athletes. Athletes with high reaction speed are better than low reaction speed to drive accuracy (forehand and backhand drive) for table tennis athletes. The potential for movement must support the physical condition aspects of a person experiencing the training process. A potential activity that is a genetic factor takes part in influencing a person's success in mastering movement skills techniques trained, in this case, table tennis drive skills. Speed, especially the hands' reaction speed, is one of the elements in the potential for motion (Singh, 2012).

Table tennis is a game that demands a fast rhythm to welcome and return the ball, so ideally, a table tennis player must have the ability to have high hand reaction speed. Athletes who have high hand reaction speed abilities will quickly adapt to the characteristics of the game. In other words, an athlete with high hand reaction speed means having the ability to welcome and return the ball well when performing table tennis forehand and backhand drive techniques. According to Malagoli Table tennis is characterized by the shortest distance between the opponents and by faster actions and rellies (Malagoli, L.I, 2013). Regarding the speed of this reaction, Sukadiyanto states that reaction time is a determining factor for success in almost all sports(Sukadiyanto, 2011), so it needs to be adequately trained so that sportsmen can achieve high achievement. Based on the results above, there are several related discussions in this study, namely:

### 1. The difference in the effect of drill set exercises with fixed repetitions and sets increasing with fixed repetitions on the accuracy of drive strokes

Drill set exercises with increasing repetitions and increasing sets of repetitions still have a significant difference in effect on the accuracy of drive strokes (forehand and backhand drive) for table tennis athletes. The fixed-rep drill set exercise increased better than the fixed-rep drill set increased the accuracy of the drive (forehand and backhand drive) for table tennis athletes. The increase in ability that occurs is due to the association of knowledge gained by athletes at previous meetings with new knowledge and the association is stronger when done repeatedly. This is based on the theory of law of exercise proposed by Thondrike which states that "the principle of the law of exercise shows that the main principle in learning motion is repetition, the more often the subject matter is repeated, the more mastered it will be (Rahyubi, 2012). The high reps will make the training very effective and it will be great for developing the fast type of muscle fibers that are one of the time spent on each set. Thus the body's ability to adapt to a heavier workload so that muscles and other biomotor components adapt to the workload performed. This is reinforced by the research (Astrawan, I Putu, N Adiputra, 2016) showing that the results of increasing leg muscle strength and agility between the two groups before and after training were tested by t-independent, with a significance value of = 0.05. The p-values of leg muscle strength and agility in both groups before training were 0.90 and 0.78 ($p>0.05$) and after training with a value of $p = 0.00$ & 0.00 ($p<0.05$). It can be concluded that the footwork training of 10 repetitions of 2 sets is better than 5 reps 4 sets to improve leg muscle strength and agility.

### 2. Effect of high reaction speed and low reaction speed on the accuracy of the drive stroke

The significant difference in the effect of high and low reaction speed on the accuracy of the drive strokes (forehand and backhand drive) for table tennis athletes. Athletes who have a high reaction speed are better than a low reaction speed to the accuracy of the drive (forehand and backhand drive)

for table tennis athletes. This is very reasonable because aspects of the physical condition of a person undergoing the training process must be supported by the potential for motion. Movement potential which is a genetic factor takes part in influencing a person's success in mastering the movement skills that are trained in this case the table tennis drive skill. Speed, especially the speed of hand reaction is one of the elements in the potential for motion (Singh, 2012). Then, table tennis is characterized by a shortest distance between the opponents and by faster actions and rellies . What this means is that table tennis is a short distance game between players and requires speed. Regarding the speed of this reaction, Sukadiyanto states that "reaction time is a determining factor for success in almost all sports, so it needs to be trained properly so that high performance can be achieved by athletes (Sukadiyanto, 2011). Therefore, reaction time affects the accuracy of drives (forehand and backhand) for beginner table tennis.

**3. Interaction between drill practice and reaction speed on the accuracy of the drive**

The results of this study indicate that there is a significant interaction between drill training and reaction speed to increase the accuracy of the drive (forehand and backhand drive) for table tennis athletes. The group of athletes who have high reaction speed have a large increase in the accuracy of their drive (forehand and backhand drive) if they are trained with increased repetitions of fixed set exercises. The group of athletes who had low reaction speed had a better increase in the accuracy of their drive (forehand and backhand drive) if they were trained with fixed sets of increasing repetitions. From the description above, it can be assumed that there is an interaction between drill exercises (fixed sets of increased repetitions and increased sets of fixed repetitions) and reaction speed (high and low) on the accuracy of drive strokes (forehand and backhand drive) for beginner table tennis athletes.

Table tennis is a game that demands a fast rhythm to welcome and return the ball, so ideally, a table tennis player must have the ability to have high hand reaction speed. Athletes who have high hand reaction speed abilities will quickly adapt to the characteristics of the game. In other words, an athlete with high hand reaction speed means having the ability to respond and return the ball well when performing table tennis forehand and backhand drive techniques. From the description above, it can be concluded that the reaction time affects the accuracy of the table tennis forehand and backhand drives.
Then there is a significant interaction between drill training and reaction speed to increase the drive stroke accuracy (forehand and backhand drive) for table tennis athletes. The group of athletes who had high reaction speed had a massive increase in drive accuracy (forehand and backhand drive) when trained with increased repetition fixed sets. The group of athletes who had low reaction speed had better drive accuracy (forehand and backhand drive) when trained with sets of increased specified repetitions. From the description above, it can be assumed that there is an interaction between drill training (fixed sets of increasing reps and fixed sets of increasing reps) and reaction speed (high and low) on the accuracy of the drive (forehand and backhand drive) for table tennis athletes.

## CONCLUSION

The following conclusions are obtained. First, there is a significant difference in the effect of drill set exercises with increasing reps and increasing sets of fixed reps on the drive's accuracy (forehand and backhand drive) for table tennis athletes. Second, there is a significant difference in the effect of high and low reaction speed on the drive's accuracy (forehand and backhand drive) for table tennis athletes. Athletes with high reaction speed are better than low reaction speed to drive accuracy (forehand and backhand drive) for table tennis athletes and third, interaction between drill exercises (fixed sets of increased repetitions and increased sets of fixed repetitions) and reaction speed (high and low) on the accuracy of drive strokes (forehand and backhand drive) for beginner table tennis athletes.

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