

# Effects of Plyometric Zig-Zag Run and Single Leg Speed Hop Exercises on Agility and Leg Muscles Explosive Power in Futsal Players

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## ABSTRACT

**Background:** Futsal is a ball game played by each of 5 people. With the aim of putting the ball into the opponent's goal. Agility and explosive power are required, plyometrics are used to increase lower body muscle power and increase explosive power by training muscles to perform more movements in a shorter time. This study aimed to determine the effects of plyometric zig-zag run and single leg speed hop exercises on increasing agility and leg muscle explosive power in futsal players.

**Subject and Method:** This was a quasi experiments with no control group. The study was carried out in Kendal, Central Java, from May to June 2023. Total sample of 21 futsal players was selected simple random sampling. The dependent variable was leg muscle agility and explosive power. The independent variables were plyometric zig-zag run and single leg speed hop exercises. Leg muscle agility was measured using the agility t-test. Leg muscle explosive power was measured using standing broad jump test. The data were tested using paired t-test.

**Result:** Mean score of leg muscle agility after plyometric zig-zag run was faster (Mean= 9.86 sec.; SD= 0.58) than before (Mean= 10.03 sec.; SD= 0.53),  $p < 0.001$ . Mean score of leg muscle explosive power after single leg speed hop exercises was higher (Mean= 217.05 cm; SD= 12.46) than before (Mean= 200.67 cm; SD= 10.89),  $p < 0.001$ .

**Conclusion:** Plyometric zig-zag run improves leg muscle agility. Single leg speed hop exercises improves leg muscle explosive power.

**Keyword:** exercise, plyometric, zig-zag run, single leg speed hop, agility, muscle explosive power

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## BACKGROUND

Sport is a form of planned and structured physical activity that involves repetitive body movements and is aimed at improving physical fitness. Article 2 National sports are organized based on Pancasila and the 1945

Constitution of the Republic of Indonesia. Article 3 National sports function to develop physical, spiritual and social abilities and shape the character and personality of a dignified nation (Ilham et al., 2021).

Even though the sport of futsal has been around for a long time, Indonesian people only became aware of it in 2000. Currently, futsal has become a popular sport among people from various walks of life, including children, adults and women. Futsal can be used as a way to pass the time and avoid boredom with daily activities. However, not many people have made futsal a professional sport, as evidenced by the many events organized by government agencies, educational institutions, as well as at national and international levels (Gunawan et al., 2016).

Futsal is a ball game played by two groups, each consisting of 5 people. By dribbling the ball with your feet, the aim is to put the ball in the opponent's goal. Futsal is a game similar to soccer that is played on a smaller field. Each team is allowed to have reserve players apart from the five main players. Unlike other indoor soccer matches, the futsal field is defined by lines, not nets. (Kota & Aceh, 2015). According to (Hawindri, 2016) there are five basic futsal techniques, phasing, holding the ball (control), chipping, dribbling and shooting.

Futsal requires good physical condition to play. Flexibility, endurance, muscle strength, speed, agility, balance, coordination, accuracy and fast reaction time. (Purnomo & Irawan, 2021). Athletes must master the techniques in exercising. One of the abilities that must be possessed to improve sports performance is mastering jumping and agile techniques (Wahyuni et al., 2021).

Agility is an athlete's ability to overcome resistance with a high contraction speed (Wora, 2017). Agility is overall defined as the ability to move and control the body as quickly as possible during acceleration, deceleration, and changes in direction (Mardiato & Perdana, 2021). The Agility Test (T-Test) is used to assess a person's

agility performance. A test site with a length of 10 m and a width of 5 m is arranged with four cones like the letter T on the field. The other four cones are installed in the middle with a distance of 3.3 m. The subjects were arranged to start and finish lines. Subjects were instructed to circle the field as quickly as possible (özmen & aydoğmuş, 2017).

Explosive power is the most important aspect in sports because it is one of the elements that must be present in most sports. As a result, this is related to the results of each individual and group performance in sports (Sunardi et al., 2019). The Standing broad jump test is used to measure the explosive power of the leg muscles by jumping as far as possible with two legs at the same time, while repulsion (leg muscle explosive power) is used as a substitute for starting. measuring explosive movements of the body (lower limbs) (Sports & Jambi, 2019).

Plyometrics are used to increase lower body muscle power and increase explosive power by training muscles to perform more movements in a shorter time (Ersey, 2008). The majority of plyometric movement patterns are based on strength chains that primarily involve the hip and leg muscles. The center of strength that plays an important role in all sports movements is the movement of the hip and leg muscle groups (Control et al., 2018).

## SUBJECT AND METHOD

### 1. Study Design

This was a quasi experiment study carried out in Kendal, Central Java, from May to June 2023.

### 2. Population and Sample

A sample of 21 male futsal players aged 17-21 years old was selected using simple random sampling.

### 3. Study Variables

The dependent variable is leg muscle agility and leg muscle explosive power. The independent variables were zig-zag run and single leg speed hop.

**4. Operational Definition of Variables**

- a. Zig-zag running is a running agility exercise that involves taking different paths using cones as obstacles quickly and requires high balance control. Repeated zig-zag running is necessary for players to become more adept at performing agility movements.
- b. Single leg speed hop exercise is a training activity that aims to train the explosive power of the leg muscles. Futsal players are directed to run on one leg with maximum jumps, done repeatedly.
- c. Leg muscle agility is the ability to move and control the leg as quickly as possible during acceleration, deceleration, and changes in direction.
- d. Leg muscle explosive power is a combination of the elements of strength and speed.

**5. Study Instruments**

Leg muscle agility was measured using the agility t-test (second). Leg muscle explosive power was measured using standing broad jump test (cm).

**6. Data analysis**

Mean difference of leg muscle agility and leg muscle explosive power scores between group, before and after intervention were examined using paired t test.

**7. Research Ethics**

This research was supported by an ethical permission letter, including informed consent, and confidentiality that was signed during the research process. The ethical permission letter for this research was obtained from the Research Ethics Committee Educational Installation at TK.II Hospital 04.05.01 dr. Sodjono, Magelang, Indonesia, No. 211/EC/VI/2023.

**RESULT**

Table 1 shows the results of the analysis before and after intervention. Mean score of leg muscle agility after plyometric zig-zag run was faster (Mean= 9.86 sec.; SD= 0.58) than before (Mean= 10.03 sec.; SD= 0.53),  $p < 0.001$ . Mean score of leg muscle explosive power after single leg speed hop exercises was higher (Mean= 217.05 cm; SD= 12.46) than before (Mean= 200.67 cm; SD= 10.89),  $p < 0.001$ .

**Table 1. Difference in mean value of the effect of zig-zag run and single leg speed hop training on agility using paired t-test**

Variables	N	Mean	SD	Min.	Max.
<b>Leg muscle agility</b>					
Before plyometric zig-zag run	21	10.03	0.53	9.04	10.88
After plyometric zig-zag run	21	9.86	0.58	8.87	10.80
<b>Leg muscle explosive power</b>					
Before single leg speed hop exercises	21	200.67	10.89	180	220
After single leg speed hop exercises	21	217.05	12.46	200	246

**DISCUSSION**

There are several exercises in plyometric training that can increase agility, leg strength, acceleration and muscle explosive power. There are several types of plyometric training, namely bounding, hoping, jumping, leaping, skipping, and ricochets (Teguh

Wibowo et al., 2021). Although plyometric training has been shown to increase agility and explosive power, little scientific information is available to determine whether plyometric training actually improves agility (Miller et al., 2006).

Zig-zag running is a running agility exercise that involves taking different paths quickly and requiring high balance control. Repeated zig-zag running is necessary for players to become more adept at performing agility movements (Sporiš et al., 2011). According to (Hisdal et al., 2013) speed is supported by explosive power aimed at fast breaks, dribbling and passing. Zig-zag run exercise significantly increases agility (Ahmad, 2018). Zig-zag is a movement that begins at one location, moves to the next, and ends by turning. It may be claimed that zig-zag run preparation is a sort of agility preparation employing poles and stakes. Having a good level of agility, the foot speed to change the position of the foot to determine the direction of the ball when dribbling the ball is also good, so when moving on the supporting foot, it will be simpler to support and detect the direction of the ball.

Single leg speed hop exercise has a significant influence on the explosive power of leg muscles, because players are directed to run on one leg with maximum jumps, the exercise is carried out repeatedly. This method also develops explosive leg and hip muscles, including the gluteal muscles, hamstrings, quadriceps and gastrocnemius at high speed and full strength. Performing rapid and repetitive jumps not only enhances leg muscle strength but also boosts leg muscle speed. This results in a direct correlation between the increase in explosive power of the leg muscles and improvements in both leg muscle strength and speed (Poomsalood and Pakulanon, 2015; Yatindra et al., 2017).

This study found that leg muscle agility was faster after plyometric zig-zag run. Leg muscle explosive power was higher after single leg speed hop exercises.

This study aligns with Widnyana et al. (2014), emphasizing that plyometric training primarily targets the explosive power of leg muscles. Consequently, the subsequent enhancement in muscle capacity contributes to heightened speed and strength capabilities in athletes. According to Alfi et al. (2019), consistent and structured training, coupled with the mastery of challenging movements, facilitates the transition from difficulty to ease. This can serve as a reliable benchmark for enhancing agility and explosive power in leg muscles, particularly in sports that heavily rely on these skills, such as futsal.

#### **AUTHOR CONTRIBUTION**

Dhiki Fadhilah Ilmi as the main researcher with the chosen theme, then conducted research and then analyzed the data and then wrote the research results. Wahyuni as a research member who assisted in preparing the publication manuscript.

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#### **CONFLICT OF INTEREST**

There is no conflict of interest in this study.

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