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# The Effect of Quick Strength Training on the Agility and Leg Power of Futsal Junior Athletes

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**Abstract** This research aimed to examine the effect of Quick Strength Training (QST) on agility and leg power. It used experimental methods with a pre-test-post-test design. A purposive sampling technique was used with several criteria. Before the treatment was executed, the 11 participants in each group were tested for their agility with the side step test and leg power with vertical jump. The 11 participants in the experimental group performed QST training program for 42 days or six weeks and the focus was carried out with an intensity of three times a week, then in the other control group, there were 11 participants, as a CON, who did not do any physical activities for 6 weeks. After six weeks of treatment, the 22 participants performed side step and vertical jump as a post-test. There was an increase in the average of their agility; CON test before treatment and test after treatment QST test before treatment and test after treatment (p=0.007). The increase in leg strength in participants is also a record for a result; CON test before treatment and test after treatment and QST pre-test with post-test (p=0.000). Agility test before treatment has similarities between CON and QST (p=0.171), but there was a post-test agility difference between CON and QST (p=0.538). There was also a difference in the pre-test leg power between CON and QST (p=0.061), and there was a post-test leg power difference between CON and QST (p=0.001). The results showed that QST increased futsal athletes' agility and leg power.

**Keywords** Quick Strength, Agility, Leg Power

## 1. Introduction

Futsal is a sport that has the same characteristics as football. The only differences are the size of the field, the type and size of the ball, game duration and number of players. Because the field size is smaller, the intensity of the game is very high. Futsal athletes need to have the ability to quickly dribble and change directions to stay in control of the ball. The game requires the athletes to move fast and change direction precisely, which is characterized as agility [1], [2]. Aside from agility, the athletes should have leg power to run fast and kick. Performing such agility optimally with leg power is determined by the athletes' good physical condition. It requires good quality of the local muscles of the limbs that can be improved through strength training. Strength training is a method of exercise that can improve several physical components, including agility and leg power. Strength training and power training can be integrated to improve muscle strength, power and speed [4].

Lower muscle strength training, for instance, has a significant effect on the agility, leg power and neuromuscular adaptation of football athletes [3]. Furthermore, core strength training can increase the power, speed and agility of football athletes [5]. The core muscle part has a d ominant role for soccer athletes and has an important role in the components of human motion [6]. These studies become the basis that strength training can increase agility and leg power. The use of weight training methods that are often done by trainers today tends to use classic methods. In a similar vein, circuit methods are also often done. However, these methods tend to be at the stage of anatomical adaptation aimed at stimulating muscles to receive weights. Strength training circuit, on the other hand, has a more significant effect than plyometric agility [7].

The main objectives of physical preparatory training are to increase athletes' functional potential and develop their bio-motor abilities to the highest standards [8]. Speed is a complex ability because in general, speed is an ability that allows a soccer player to move as quickly as possible at the level of specific resistance [9]. Agility is an important quality in most field sports. In badminton, for example, agility demonstrates the ability to move the legs quickly and precisely is part of the abilities that can be used in the ability to move [10]. It is the ability to maintain and control a correct body position while quickly changing direction [11], [12]. Acceleration is a part that cannot be taken lightly, and has an important position and can be collaborated with footsteps and speed [13], [14]. movement speed, acceleration, agility, and dexterity skills are some of the important parts in the components of the game of football that must always be considered [14]. Findings suggested that the peak of muscle strength was of great significance in the human lower body in soccer games, success in the game is supported by components of physical movement which include the lower extremities [15]. Due to the shared characteristics between futsal and soccer, futsal then can also be speed, acceleration and agility are part of the group and category in question.

Previous related studies have investigated the effect of Quick Strength Training (QST) on agility, particularly of football athletes [16]. Other studies focused on the analysis of movement ability, speed and agility have a dominant position on motion activity in games and matches [15], [17]. A programmed quick strength training was shown to be effective in increasing agility. This was demonstrated in a study in which the experimental group performed quick strength exercises for 8 weeks, giving a greater impact compared to the group conditioned as a control on football athletes with measurements on the agility component [18], [19]. Similarly, a short-term agility training program (3 weeks duration) improved agility test results among young professional soccer players [20]. Other studies revealed that both squat and plyometric trainings were necessary for improving hip and thigh power production as measured by vertical jump [21]. To sum up, these studies exhibited that the components of agility included balance, coordination, power and speed [22].

This study focused on junior futsal players who often struggled to improve their agility. Improvement in their agility is necessary due to a variety of reasons. The players have to be able to gain acceleration and to be accurate in passing and shooting, all of which require leg power. To improve their performance, accurate training programs with the right number of sessions and quality training are crucial. The success of such programs is significantly influenced by the right types and methods of strength training, such as Quick Strength Training (QST).

The literature has indicated that the use of circuit method in QST and its effect on agility and leg power is still under exploration. Thus, this research aimed to discover the effect of Quick Strength Training (QST) on futsal athletes' agility and leg power. It put the emphasis on the implementation of programmable QST with circuit method as the training method to improve their agility and leg power.

## 2. Materials and Methods

This study aimed to discover the effect of Quick Strength Training (QST) training on agility (AG) and Leg Power (LG) of futsal athletes aged between 17 and 19 years old. This study used experimental methods with a pre-test-posttest design. The 22 futsal athletes formed into two conditions, where the first condition is called an experiment with a total of 11 people, while the other 11 athletes were put into a control group. Before the treatment, both groups performed initially an AG test using sidestep test and an LG test using Vertical Jump test.

The experimental group normally went under a 6-week QST for 18 meetings. The frequency of the training was 3 times a week every Monday, Wednesday and Friday, while the group did the training every other day After 18 exercises, the final test with the same test parameters was carried out.

*Participant*

The population in this study consisted of all members of Futsal Academy Ligasu-ABAA of 48 athletes. A purposive sampling technique with several criteria was used. The criteria were as follows: (1) male, (2) aged from 17-19 years, (3) Training duration of at least 1 year, and (4) willingness to be included as research participants with parents' consents related to COVID-19 situation. Twenty-two athletes met the criteria and became the sample. The characteristics of the 22 athletes that were randomly selected as the object of this study were: 18.05 ± 0.84 years of age; 63.18 ± 5.36 kg of body weight; and 168.22 ± 5.14 cm of height. All participants were controlled during the treatment by maintaining a balanced nutrition, prohibiting any use of supplements, and keeping them from getting injured during treatment so that the test was not interrupted. All participants received the same

QST program during the training period. To measure their agility, the side step test was used [23], and to measure their leg power, the vertical jump test was used [24].

*Sidestep Test Implementation*

Participants stood in the middle of the field with 1 meter wide and the point of 60 c m. Participants performed activities starting from the middle point and did a sideways right-left jumping movement with a distance of 30 cm for 1 minute. Score was recorded based on the correct number of returns obtained by the participants.

*Vertical Jump Test Implementation*

Standing on the side wall to reach the specified place without jumping, then followed by a jump as high as possible to get optimal results, the distance from the initial achievement without a prefix and the second with a jump is the result that is recorded.

*Experimental design*

The 22 are irregularly divided into two conditions called groups. The first was the QST experimental group consisting of 11 participants with age =18.09±0.83; body weight = 64.82 ± 4.69 kg; height = 168.82 ± 4.77 cm). The second group was the control groups (CON) consisting of also 11 participants with age = 18 ± 0.89); body weight = 61.55 ± 5.70 kg; height = 167.64 ± 5.66 cm. Before the treatment was conducted, all of the participants were tested for their agility using the side step test as well as their leg power using the vertical jump test. The 11 participants in the experimental group performed QST-Circuit Training (CT) program three meetings in one week and carried out for six weeks. Design of the QST CT program is explained in table 1 and figure 1.

CT program consisted of 8 stations, namely; (1) Alternate Side Lunges (ASL), (2) Explosive Step Up (ESU), (3) Quick Step Side (QSS), (4) Scissors Jump (SJ), (5) Lateral Step In-Out (LSIO), (6) Quick Squat Jump (QSJ), (7) Side to Side Jump (SSJ), and (8) High Knee Run (HKR). The other 11 pa rticipants in the control group (CON) did not carry out activities or treatment as in the experimental group, but did physical activities such as the usual training model given. in this context, there is no manipulation of new training models. Afterwards, the 22 participants performed side step test and vertical jump test as a post-test. The data analysis technique used SPSS program and previously it is necessary to carry out normality and homogeneity tests with a significant level of $p<0.05$.

**Table 1.** The 6-Week QST-CT program

| Week | Variable | QST/Number of Station (1-8) |
|---|---|---|
| **1-2** | Intensity | **80%** |
| | Number of repetitions | **8 sec** |
| | Number of set | **4** |
| | Interval (set/Station) | **90-120 sec/30 sec** |
| **3-4** | Intensity | **90%** |
| | Number of repetitions | **8 sec** |
| | Number of set | **5** |
| | Interval (set/Station) | **90-120 sec/30 sec** |
| **5-6** | Intensity | **100%** |
| | Number of repetitions | **8 sec** |
| | Number of set | **5-6** |
| | Interval (set/Station) | **90-120 sec/30 sec** |

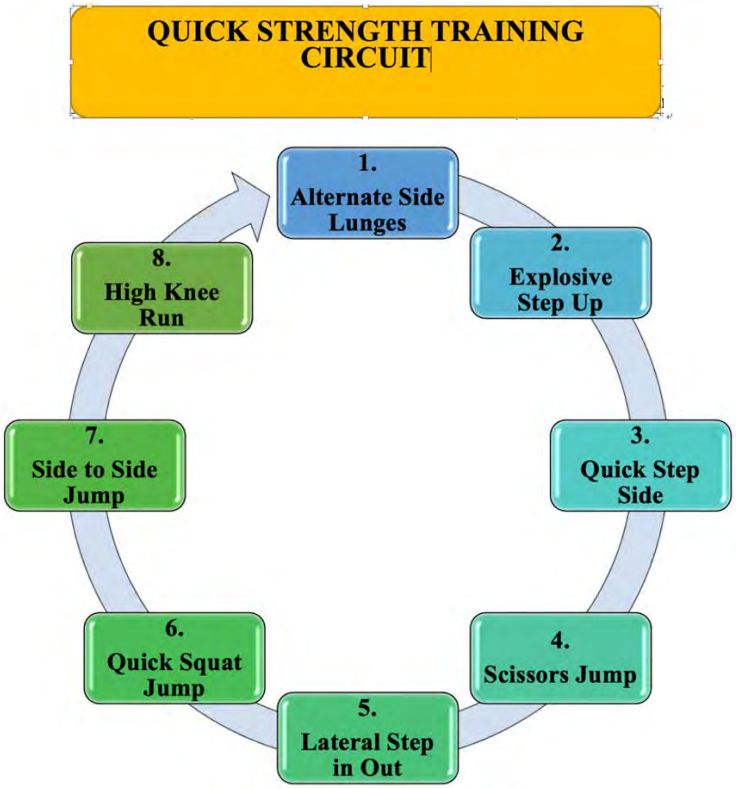


**Figure 1.** Implementation of QST-CT

## 3. Result

The agility (AG) pre-test data showed the average score of the control group; QST (47.00±4.54); (46.36±4.15) with a score ranging from 42-55;40-53. The description of the pre-test leg power (LP) data showed the average score of the control group; QST of (48.00±6.05 cm); (53.36±5.59 cm) with a score ranging from 41-60 cm; 47-65 cm. A description of the pre-test data is shown in table 2.

Table 3 shows the results of tests carried out before treatment on AG. There is no difference or has the same results in the average value of the test that was carried out before the intermediate treatment CON (47.00±4.54) and QST (46.36±4.15) (p=0.171). However, there was a difference in the post-test average score of CON (48.18±4.31) and QST (48.91±4.25) (0.538) on AG. For the results of the AG on the CON pre-test mean ± SD and post-test mean ± SD, the results obtained are (p = 0.007). Furthermore, for the results of the AG on the QST pre-test mean ± SD and post-test mean ± SD, the results obtained were (p = 0.000).

There was a difference in the pre-test average score between CON (48.00±6.08) and QST (53.36±6.56) (p=0,061). Furthermore, there was a d ifference in the post-test average score of CON (50.55±6,67) and QST (62.55±7.48) (p=0,002 on LP. For the results of the LP on the CON pre-test mean ± SD and post-test mean ± SD, the results obtained are (p = 0.000). Furthermore, for the results of the AG on the QST pre-test mean ± SD and post-test mean ± SD, the results obtained were (p = 0.000).

Based on the results of calculations using the ShapiroWilk test, it c an be concluded that there is significance in the LP pre-test score data (sig = 0.125) and LP post-test (sig = 0.202). Thus, it can be concluded that the data is a normally distributed sample on the grounds that the significance level is more than 0.05. Based on the results of the calculation of the homogeneity test (Levene test), it is obtained that the significance value on the average LP test before treatment and test after treatment data is 0.733, provided that probability and significance of more than 0.05, it can be said that the population has the same variance. Furthermore, the mean difference test was carried out paired sample t test interpretation 1 based on the pair 1 output, the Sig. (2-tailed) of 0.000 <0.005, it can be concluded that there is a difference in the average pre-test LP and post-test LP.

**Table 2.** Conditioning Program– an Overview of In-season Training (6-week QST intervention)

| Session | Monday | Tuesday | Wednesday | Thursday | Friday | Saturday | Sunday |
|---|---|---|---|---|---|---|---|
| Afternoon (4 – 6 FM) | QST | Basic Technique | QST | Day of rest | QST | Advance Technique /Games | Days of rest |

*QST: Quick Strength Training

**Table 3.** Data description of the pre-test

| AG | CON | QST | P-value |
|---|---|---|---|
| pre-test mean±SD | 47.00±4.54 | 46.36±4.15 | 0,171 |
| post-test mean±SD | 48.18±4.31 | 48.91±4.25 | 0,538 |
| P-value | 0,007 | 0,000 | |
| LP | CON | QST | P-value |
| pre-test mean±SD | 48,00±6,08 | 53,36±6,56 | 0,061 |
| post-test mean±SD | 50,55±5,67 | 62,55±7,48 | 0,002 |
| P-value | 0,000 | 0,000 | |

# 4. Discussion

The first findings showed that there was an increase in AG after implementing QST CT for 6 weeks. Improved QST exercise results on AG were shown in the pre-test average scores of the pre-test of 47.00±4.54 with the post-test 48.18±4.15 and tested a significant level of -3.36 with a significant level of $p<0.05$. The findings of this study provided information on the rapid rhythmic QST CT that stimulated rapid muscle contraction in various positions, both in direction changes and body position. Many strength training methods are proven to improve the neuromuscular work system for young futsal athletes [25] both separately and in the combination of weight training with plyometric [26]. The positive response of QST exercise also had an effect on increasing AG after performing 8 weeks of exercise [18]. This study was slightly different from other studies, as it c onducted the application of quick strength exercises with the circuit method for 6 weeks. However, QST can also be done by implementing a circuit method.

A decrease in lactic acid levels and an increase in bicarbonate and muscle phosphate buffers can be done by doing disabled and optimal exercises [27]. The combined exercise took a form of QST with the characteristics of weight strength training with fast rhythm. The 6-week QST CT program directly affected the improvement of the futsal athletes' agility [28]. This was in accordance with the results of several studies. They showed that plyometric exercises increased LP, while QST significantly improved soccer athletes' vertical jump and agility [29]. Other studies also revealed that the resistance training increased sets with 4-8 repetitions for 6 weeks was agility [30], and fast rhythm strength training with a variety of movements increased agility quickly [31].

These results became the basis for the implementation of the fast motion programmatic circuit strength exercise. The second finding of this study suggested that there was a significant effect of QST on LP. This is evident from the mean difference test Interpretation of Paired Sample t test 1 based on pair 1 output, the Sig value is obtained. (2-tailed) of 0.000 <0.005, it can be concluded that there is a difference in the average pre-test LP and post-test LP. This research is similar to our previous research that investigated Speed, Agility and Quickness (SAQ) circuit training to improve kick speed and agility of taekwondo junior athletes [32].

This was seen in the results from the data analysis demonstrating that the average score of the pre-test was 53.36±6.56 while that of the post-test was 62.55±7.48 and tested a significance level of -6.53 with a significant level of $p<0.05$. The findings in this study are in line with the findings of previous studies [33]. Plyometric training programs had a more positive effect, as compared to a typical training program in terms of increased performance and strength [34], [35]. QST circuit rhythm fast was also a part of plyometric exercises and increased leg power [36], [37]. Resistance training method will be a correction and proven to be no better than power-band resistance training, it has a significant effect on the football player group in the context of physical performance [38].

Although the results showed that the exercise combining strength with speed increased agility and leg power, it was not common for all athletes. Age changes affected the content of the exercise due to changes in the physiological characteristics of the athletes. Therefore, it is necessary to adjust the contents of the training program, especially the volume, intensity, and type of exercise based on the initial condition [39]. QST with low-medium intensity (80%-100% 1 RM), 2-3.

Possible to increase leg power [40]. It is important for everyone to understand the possible advantages and

disadvantages of several methods of resistance and training. research in this regard has been widely carried out to improve performance and of course as part of efforts to minimize the risk of sports injuries [41].

## 5. Conclusions

The results of this study showed that QST increased agility and leg power. Fast rhythm strength exercises with a variety of movements improved agility quickly. In addition, QST fast rhythm circuit that is also a part of plyometric exercises increased leg power. Therefore, the QST-CT should be applied during special preparation stages for athletes. QST forms should be adapted to the characteristics of futsal sports.

Although this study showed a positive effect of QST-CT on agility and leg power, there may still be other influencing factors. This is because the sample is limited to only 22 people at the Futsal academy Ligasu-ABAA. Thus, it is necessary to conduct further research by other researchers with a larger sample and other variables.

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