



The effects of shuttle run and three corner drill on the agility of soccer players in soccer academy

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Abstract: Football is a game that is played by kicking the ball to get the ball into the opponent's goal. The game of soccer requires speed and agility. This study aims to determine the effects of shuttle runs and three corner drills on agility and to compare the effect of those exercises on the agility of twenty soccer players in the Soccer Academy. This experimental research employed the two groups of pretest-posttest design. The population used is a Kalasan soccer academy player with a total of 20 players. The sample used is the entire population and will be divided into two groups with an ordinal pairing technique. The soccer players' agility was assessed using the Illinois agility test in the pretest and post-test. Shuttle run and three corner drill exercises were carried out 16 times (3 times a week). Based on the results of data analysis, the average pretest score of the shuttle run group is 17.99, while the post-test average score is 16.15. Then, the average scores of the three corner drill groups are 18.08 and 16.32, respectively in the pretest and post-test. The pretest and post-test scores of both groups were compared, and the differences were 1.84 seconds for the shuttle run and 1.76 seconds for the three-corner drill. This study concludes that the shuttle run and three corner drill are both significantly effective in improving agility because those exercises are not significantly different, but the shuttle run works better than the three corner drill in improving agility.

Keywords: agility, exercise, shuttle run, soccer, three corner drill

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INTRODUCTION

Agility is the main factor in team sports because it significantly affects players' movement when exercising. Agility can also serve as a benchmark to distinguish someone's level of movement skills. Sheppard & Young (2006) define agility as "a rapid whole-body movement with change of velocity or direction in response to a stimulus." Therefore, agility is present because of a stimulus to change the speed or direction of the body. On the one hand, Young et al. (2021) explain that during sports games, agility requires a reaction to a stimulus that is usually generated from the opponent's movements before a change of direction or speed occurs.

Šimonek & Horička (2020) point out that agility is the main point of complex motor skills in team sports. Among all sports, soccer requires the most complex motor skills (8.25 points out of 10 points), basketball (8.13), tennis (7.75), ice hockey (7.63), badminton (7.38), squash (7.25), volleyball (7.00), and ice skating (6.88). The assessment is based on the ability to stop, change direction quickly, and speed up in response to external cues.

The physical condition of soccer players includes leg power, speed, coordination, agility and endurance, (Nasrulloh et al., 2021). Players' agility plays an important role in soccer because it is an intensive interval sport. During a game of soccer, the players need to sprint, accelerate, and run around in a short time (Horika & Šimonek., 2021). Padrón-Cabo et al (2020) argue that soccer players should be able to effectively do dynamic movements while controlling the ball, for example by passing, kicking, dribbling, heading, and doing complex dynamic movements without the ball such as modulating speed running and changing direction, accelerating, decelerating, as well as jumping in response to a condition caused by unexpected balls, teammates, or opponents. In addition, Paul et al



(2016) state that soccer players should observe the entire field and keep on responding to changes in play. It is possible that soccer players do not plan their actions, for example by sprinting. In a soccer game, there may be 1,300 changes in a no-ball condition that require players to make more than 700 turns and then move at different angles.

Haripriya & Narayan (2021) conducted a study that aimed to determine the relationship between agility and functional performance of 24 recreational soccer players. It was found that there was a significantly positive correlation in terms of statistics between agility and functional performance. The result indicates that better agility may result in better functional performance. Therefore, soccer players with a low level of agility will not be able to compete in functional performance against opponents who have good agility when running to control the ball or when running with no ball.

Based on observation and preliminary research, soccer players in Kalasan Soccer Academy had a low level of agility when running with or without a ball. Moreover, during the interview, the coaches stated that the low level of agility might occur because the training program was focused more on soccer tactics than on skill improvement, including agility. Agility should be improved to enhance soccer players' functional performance. A shuttle run may become the best solution to improve agility. A study by Haryono et al. (2021) aimed to investigate the effects of shuttle run and ladder drill exercises on 22 soccer players of Macan Putih Soccer Academy in Kediri. The study found that shuttle running significantly affected the players between the age of 15 and 17 years old.

In addition to the shuttle run, three corner drills can improve soccer players' agility. Fadillah et al. (2020) conducted a study that aimed to examine whether or not there was an effect of three corner drills on the agility of futsal players in state junior high school SMP Negeri 1 Barabai. It was found that the highest score was 19.85 seconds, and the lowest score was 16.80 with an average score of 18.33 seconds. Meanwhile, in the post-test, the highest score was 18.62 seconds, the lowest score was 15.49 seconds, and the average score was 17.01 seconds. These results indicated that there was an effect of three corner drill exercises on agility.

These previous studies show that shuttle run and three corner drill may improve agility, so the researchers tried to examine the effects of shuttle run and three corner drill exercises on agility and compare the effectiveness of both exercises on soccer players Soccer Academy

METHODS

This experimental research employed the two groups of pretest-posttest design. The soccer training was conducted in Raden Ronggo court in Kalasan, Sleman. This research was carried out from December 2021 to January 2022. It involved twenty soccer players that were grouped using the ordinal pairing technique into two groups (Group A and Group B) after the pretest was conducted. The instrument used in the test, the Illinois agility test, is reliable (0.82) and valid (0.93). Then, a t-test with a significance level of 5% was completed during this research.

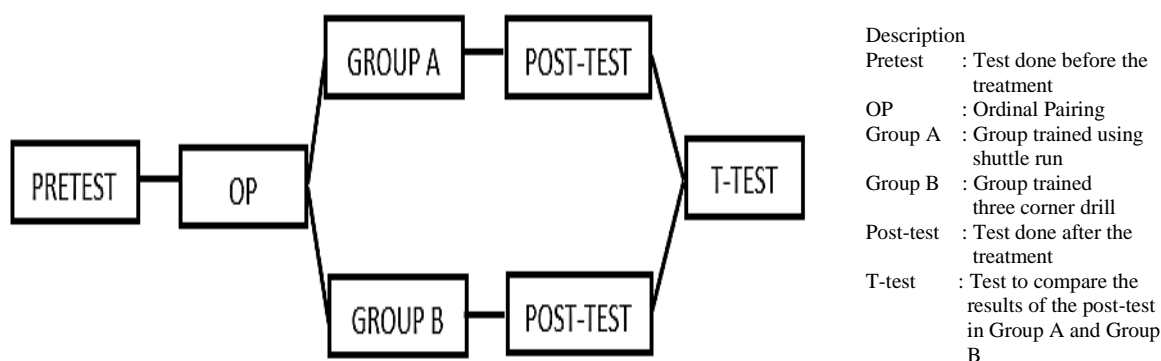


Figure 1. Research Design

During the research, Group A did a shuttle run, while group B did three corner drills. Both exercises were done 16 times (three times per week) on Tuesdays, Thursdays, and Saturdays. The soccer players in group A did 4-8 sets of shuttle run exercises consisting of 1-3 repetitions/set. Meanwhile, group B did three corner drill exercises in 4-8 repetitions/set. The break for each interval was 2-5 minutes. To assess agility, the Illinois agility test was employed during the pretest and post-test. Before hypothesis testing was conducted, the Kolmogorov Smirnow test was used to examine whether the data were in a normal distribution. ANOVA was used in the homogeneity test. Then, paired t-test was done using SPSS version 20.0 for windows to compare the data obtained from the pretest and post-test done with both groups. At last, the average scores of both groups were compared.

RESULTS AND DISCUSSION

As many as twenty male soccer players in Kalasan Soccer Academy participated in this research as there were no drop-out subjects. The results of the prerequisite test, namely normality and homogeneity tests are presented in Tables 1 and 2. The results show that all the data are normally distributed and homogenous.

Table 1. The Result of Normality Test

Group		P	Sig.	Conclusion
Group A	Pretest	0.200	0.05	Normal
	Posttest	0.135	0.05	Normal
Group B	Pretest	0.200	0.05	Normal
	Posttest	0.200	0.05	Normal

Based on Table 1, the result of the normality test, all pretest and post-test data obtained from both groups have a p-value greater than 0.05 (Sig.). It indicates that all the data are in the normal distribution, so further data analysis may be conducted using parametric statistics.

Table 2. The Result of the Homogeneity Test

Group	df1	df2	Sig.	Conclusion
Pretest	1	18	0.751	Homogenous
Posttest	1	18	0.095	Homogenous

Based on Table 2, the results of the homogeneity test show that the pretest and post-test have p-value > 0.05 (Sig.), so the data are homogeneous. Thus, based on the data, hypothesis testing was performed using parametric statistics. Paired-sample t-test and independent t-test were performed using SPSS 20 software. The hypothesis testing was done to examine the effects of the shuttle run and three-corner drill and to compare the effects of both exercises.

Table 3. The Result of T-test on Pretest and Posttest Data of Group A

Group	Mean	Gap	%	t ht	t tb	P
Pretest	17.99	1.84	10.23%	13.572	2.262	0.000
Posttest	15.16					

Based on Table 3, the results of the t-test from the pretest and post-test data obtained from group A show that the value of the t-count is 13.572 and the value of the t-table is (df = 9) of 2.262 with a p significance value of 0.000. Thus, t-count is greater than t-table (13.572 > 2.262) at the significance value of 0.000 < 0.05. This indicates that there is a significant difference between the agility values before and after giving the shuttle run exercise to the subject. The increase in agility is shown by the gap in the average score (posttest score subtracted from the pretest score). A difference of 1.84 points is equivalent to an increase in agility of 10.23%. The results of hypothesis testing for group B are presented in Table 4 below.

Table 4. The Result of T-test on Pretest and Posttest Data of Group B

Group	Mean	Gap	%	t ht	t tb	P
Pretest	18.08	1.76	9.73%	7.830	2.262	0.000
Posttest	16.32					

Based on Table 4, the result of the t-test on data obtained during the pretest and post-test in group B shows that the t-count is 7.830 and the t-table is (df = 9) 2.262 with a p significance value of 0.000. Based on these results, t-count is greater than t-table ($7.830 > 2.262$) with significance value of $0.000 < 0.05$. It is concluded that there is a significant difference between pretest and posttest data. The increased agility can be seen in the data of the pretest average score of 18.08 which is subtracted by the posttest average value of 16.32 ($18.08 - 16.32$) then the difference value is 1.76 or equivalent to 9.73%. The percentage shows the value of increasing the agility ability of group B. To find the result of comparing the effectiveness of both exercises, the t-test is done on the post-test score of both groups. The result is presented in Table 5 below.

Table 5. The Result of the T-test on Posttests of Groups A and B

Group	Mean	%	Gap	t ht	t tb	P
Posttest A	16.15	10.23%	0.17	0.450	2.101	0.095
Posttest B	16.32	9.73%				

The results of the t-test of post-test on subjects with shuttle run and three corner drill treatments showed a t-count value of 0.450 and a t-table value (df = 18) of 2.101 with a p significance value of 0.095. The t-count < t-table ($0.450 < 2.101$) and sig. $0.095 > 0.05$ means that there is no significant difference between the results of agility improvement in the shuttle run and the three corner drill exercises. However, based on the gain of the two exercises, the subjects with the shuttle run exercise showed a greater agility increase than those with the three-corner drill treatment.

Shuttle Run Improves Agility

Improved agility is the result of muscle strength and power in the lower extremities which increase with close-distance sprinting exercises and movements to change the direction of the body. When doing these exercises, there will be a repetition of acceleration which is characteristic of rapid changes in direction and is considered an action strength (Polito et al., 2017). According to Fathoni & Rachman (2020), the shuttle run exercise is oriented to footwork and speed based on the fast-running movements by changing the direction and position of the body which also trains body balance as a component of agile motion to improve agility.

In line with the results of this study which showed an increase in agility caused by the shuttle run training program, Haryono et al. (2021) conducted a study that aimed to determine the effect of shuttle run and ladder drill exercises on the agility of 20 students at Macan Putih Soccer Academy in Kediri. The results of the agility test in the experimental group with shuttle run (10 students) showed an average score of 17.34 seconds for the pretest and 17.12 seconds for the post-test. The results of both pretest and posttest which show a difference of 0.22 seconds indicate that shuttle run has a significant effect on improved agility.

According to Haryono et al. (2021), shuttle run exercise can improve agility because when doing the shuttle run, isometric contractions occur to keep the legs and feet moving because of isotonic, isometric, and isotonic contractions which in turn occur when reducing running speed to change direction. Eccentric contractions occur when the hip, knee extensors, and hip extensors slow down the momentum of the body moving forward and move the body to a new position. Performing shuttle runs during training will make the body adapt to improve agility.

Fahlefi et al. (2020) conducted a study to determine whether there were differences in the effect of shuttle run and ladder drills on increasing agility in the 30 futsal players divided into two groups with a four-week training program. The results of the research on the shuttle run group (15 futsal players) measured using the Illinois agility test showed an average agility score of 17.46 (posttest) and 16.77 (pretest) with a difference of 0.69. The significance value of $0.001 < \alpha < 0.05$ indicated that the shuttle run affected the Futsal players' agility.

Shuttle run aims to train body movement and speed, particularly in the lower extremities. The shuttle run exercise increases muscle contraction and adaptation of the nervous system in producing motion so that it will provide changes in muscle fibres that make the muscle respond more effectively to movement thus making it easier for the body to make changes in direction quickly. Then, repeated and systematic exercises will increase the agility that football players need.

Three Corner Drill Improves Agility

Yuliawan & Sugiyanto (2014) point out that drill training only focuses on one training material, and it is supposedly done repeatedly. Yudistira et al. (2018) conducted a study that aimed to determine the effect of ladder drill, three corner drill, and the difference of their effects on the agility of 30 football players for eight weeks or 16 treatments. In the group with the three-corner drill treatment, the results of the pretest using the Illinois agility test showed a mean value of 18.988 for 30 subjects, while the mean value in the posttest was 13.728. This means there is a gap of 5.26 points. The results of hypothesis testing with a t-test based on the pretest and posttest concluded that there was an effect of three corner drills on agility. Thus, the three-corner drill training program was able to improve agility.

Subekti et al. (2020) revealed the reason that three corner drills can increase agility. Three corner drills will increase muscle elasticity and joint range of motion, particularly in the lower extremities, resulting in joint flexibility and widening the footstep. In addition, when performing the three-corner drill, dynamic balance is also trained because it requires the body to be in a balanced position when running at speed. Agility will improve along with the increase in muscle elasticity, joint range of motion, and dynamic balance.

Shuttle Run is better than Three Corner Drill

The results of the comparison between the shuttle run and three corner drill in this study show that both of them have no significant difference. However, based on the gap between the pretest and post-test scores of the two exercises, the shuttle run (1.84) is better in increasing agility than the three-corner drill with a value of 1.76. This result is in line with the findings of Zakiuddin et al. (2019) study that concluded that the shuttle run was more effective than three corner drills in increasing the agility of 30 football extracurricular students at the Muhammadiyah Gisting Junior High School. The research subjects were divided into two groups (15 students in the shuttle run group and 15 students in the three-corner drill group). The average pretest score of the students before the treatment was 17.1533 seconds and the post-test was 16.0867 seconds with a difference of 1.06667. Meanwhile, in the three-corner drill, the average pretest score was 17.1733 and the post-test was 16.5400 with a difference of 0.63. These results indicate that the shuttle run is more effective than the three-corner drill.

According to Teixeira et al. (2018), the angle of body direction change in a shuttle run is 180°. Meanwhile, when performing three corner drill, someone forms an angle of 45°-90° because the corner points are like the letter L. It is related to the angle when changing direction. Schreurs et al. (2017) conducted a study that was aimed at investigating the effect of different angles of change in body direction (45°, 90°, 135°, and 180°) on knee kinematics and kinetics. The results of his research show that the difference in the angle of change in the direction of the body will also produce differences in knee kinematics and kinetics with an image of the knee flexion momentum getting smaller when making a greater change in body direction. This means that changing the direction of the body at an angle of 180° will produce a smaller knee flexion than that at an angle of 90° or 45°.

Changing body direction with a greater knee angle will require greater quadriceps muscle strength, and making a greater body direction change will require more braking and translation skills (Schreurs et al., 2017). This means that when doing a shuttle run with a direction change angle of 180°, it requires greater muscle strength in the front and better braking and translation skills than when doing a sprint three corner drill with a change in angle of 45° to 90°.

The angle of change in body direction is the reason why a shuttle run is more effective than a corner drill. Moving to change the direction of the body on the shuttle run will train the strength of the quadriceps muscles, braking skills, and translation skills to improve speed and power abilities compared to the three corner drill (L-shaped). This is a factor in the difference in training results to improve agility because according to Dos'Santos et al. (2018), muscle strength in the lower extremities, quality of fast force production, and force skills when braking or pushing the body have been identified as physical abilities related to one's agility.

When doing the shuttle run, apart from the lower extremity muscles, the upper extremity muscles are also more involved during a 180° change of direction as the back, abdominal, and arm muscles become active during decelerations and accelerations. The more muscles are actively involved during exercise, the more changes are produced such as speed, strength, and power due to the routine program

that is carried out. This is positively correlated with an increase in agility because it is closely related to the elements. Although the advantage of the change of angles is greater, there is also a greater chance of injury. Schreurs et al. (2017) stated that someone who changes the direction of the body with a large angle will experience a more knee varus/valgus moment so they are at greater risk of ACL (anterior cruciate ligaments) injury. Cortes et al. (2011) point out that the knee extension moment decreases more on the 180° task than on the 45° task, but the varus/valgus moment increase is somehow unfavourable for the knee load.

Agility involves the ability to move and the capacity to run fast while stopping and starting to run again immediately (Kovacikova & Zemková, 2020). According to Nasution & Suharjana (2015), the level of difficulty in developing agility is higher than in developing other elements of physical fitness because agility is a manifestation of other physical fitness, namely speed, strength, and balance. Therefore, when people try to improve their agility, they need to plan the training method that includes elements to improve agility.

An effective effort to improve agility had been done by Alp & Baydemir (2019). They provided 36 male soccer players from U19 and U17 teams with quick strength training for eight weeks (three times each week). The teams were divided into two, namely control and experimental groups. The results of the Illinois test showed that quick strength training was effective in improving the agility performance of the experimental group. Furthermore, Milanović et al. (2013) combined training that focuses on quick strength, speed, and agility in a training called speed, agility, and quickness (SAQ). The training was done for twelve weeks with U19 soccer players. During the research, the team was divided into control and experimental groups each consisting of 66 players. The results show that SAQ was effective in improving agility when players perform with or without the ball. Azmi & Kusnanik (2018) also conducted a study on SAQ, but they focused more on speed, agility, and acceleration. It was found that conducting SAQ training for eight weeks might improve soccer players' speed, agility, and acceleration. SAQ training may improve soccer players' performances and improve their strength during high-speed movement activities, for example fast slowing down performance, body changing performance, and planned speed performance.

CONCLUSIONS

Based on the results of this study, it is concluded that shuttle runs and three-corner drills are significantly effective in improving agility. The comparison of the effects between shuttle run and three corner drill does not show a significant difference. However, the difference between the pretest and post-test scores of the two types of training shows that the shuttle run improves agility better than three corner drills. Furthermore, researchers will try to conduct research with different sample numbers and ages, especially in the golden age of developing physical components

REFERENCES

- Alp, M., & Baydemir, B. (2019). The effects of quick strength training on agility performance in soccer. *Universal Journal of Educational Research* 7(4), 1001-1006. <https://doi.org/10.13189/ujer.2019.070411>
- Azmi, K., & Kusnanik, N. W. (2018). Effect of exercise program speed, agility, and quickness (saq) in improving speed, agility, and acceleration. *Journal of Physics: Conference Series*. <https://doi.org/10.1088/1742-6596/947/1/012043>
- Cortes, N., Onate, J., & Lunen, B. V. (2011). Pivot Task Increases Knee Frontal Plane Loading Compared with Sidestep and Drop-Jump. *Journal of Sports Sciences*. 29(1), 83-92. <https://doi.org/10.1080/02640414.2010.523087>
- Dos'Santos, T., Thomas, C., Comfort, P., & Jones, P. A. (2018). Comparison of Change of Direction Speed Performance and Asymmetries Between Team-Sport Athletes: Application of Change of Direction Deficit. *Sports*. 6(4), 1-15. <https://doi.org/10.3390/sports6040174>
- Fadillah, M., Kusaini, H. M., Dirgantoro, E. W., & Hamid, A. (2019). The effect of three corner drill training against futsal playback probability. *Advances in Social Science, Education and Humanities Research*. 407, 96-97.

- Fahlefi, P. M. I., Multazam, A., Rahmanto, S., & Rahim, A. F. (2020). Perbandingan Shuttle Run Exercise dan Ladder Drill Exercise terhadap Kelincahan pada Pemain Futsal. *Physiotherapy Health Science (PhysioHS)*. 2(2), 62-68. <https://doi.org/10.22219/physiohs.v2i2.15195>
- Fathoni, A., & Rachman, H. A. (2020). Effect of Sprint Training Exercise, Shuttle Run and Prevention on Base Softball Running Speed Among High School Students. *Acta Facultatis Educationis Physicae Universitatis Comenianae*. 60(1), 32-43. <https://doi.org/10.2478/afepuc-2020-0003>
- Haryono, F., Amiq, F., & Fitriady, G. (2021). Pengaruh Latihan Shuttle Run dan Ladder Drill terhadap Peningkatan Kelincahan (Agility) Siswa Sepakbola. *Sport Science and Health*. 3(7), 479-485. <https://doi.org/10.17977/um062v3i72021p479-485>
- Horicka, P., & Simonek, J. (2021). Age-Related Changes of Reactive Agility in Football. *Physical Activity Review*. 9(1), 16-23. <https://doi.org/10.16926/par.2021.09.03>
- Kovacikova, Z., & Zemková, E. (2020). The Effect of Agility Training Performed in the Form of Competitive Exercising on Agility Performance. *Research Quarterly for Exercise and Sport*. 1-8. <https://doi.org/10.1080/02701367.2020.1724862>
- Milanović, Z., Sporiš, G., Trajković, N., James, N., & Šamija, K. (2013). Effects of a 12 Week SAQ Training Programme on Agility with and without the Ball among Young Soccer Players. *Journal of Sports Science and Medicine*. 12(1), 97-103.
- Nasrulloh, A., Sumaryanto, S., Prasetyo, Y., Sulistiyono, S., & Yuniana, R. (2021). Comparison of Physical Condition Profiles of Elite and Non-Elite Youth Football Players. *MEDIKORA*, 20(1), 73-83. <https://doi.org/10.21831/MEDIKORA.V20I1.39547>
- Nasution, I. E., & Suharjana. (2015). Pengembangan Model Latihan Sepak Bola Berbasis Kelincahan Dengan Pendekatan Bermain. *Jurnal Keolahragaan*. 3(2), 178-193.
- Nurhadi, F. I., Suherman, W. S., Prasetyo, Y., & Nasrulloh, A. (2022). Pengaruh latihan beban kombinasi dengan latihan aerobik terhadap berat badan dan persentase lemak tubuh pada remaja overweight The effect of weight training combined with aerobic exercise on body weight and body fat percentage in overweight adolescents. 18(2), 8-17
- Padrón-Cabo, A., Rey, E., Kalén, A., & Costa, P. B. (2020). Effects of Training with an Agility Ladder on Sprint, Agility, and Dribbling Performance in Youth Soccer Players. *Journal of Human Kinetics*. 73, 219-228. <https://doi.org/10.2478/hukin-2019-0146>
- Paul, D. J., Gabbett, T. J., & Nassis, G. P. (2016). Agility in Team Sports: Testing, Training, and Factors Affecting Performance. *Sports Med*. 46, 421-442. <https://doi.org/10.1007/s40279-015-0428-2>
- Polito, L. F. T., Carneiro, Y. D. M., Moscaleski, L. A., Junior, A. J. F., Zanetti, M. C., Pinto, C. G. D. S., Dias, H. M., Nunes, H. R., & Lima, S. I. D. (2017). Shuttle Run Agility Test in Soccer Athletes of Under – 10 Category with Dry and Wet Conditions Field. *International Journal of Sports Science*. 7(2), 45-49. <https://doi.org/10.5923/j.sports.20170702.04>
- Priya, S., Haripriya, S., & Tej, N. (2021). Relationship Between Agility and Functional Performance in Recreational Football Players. *International Journal of Physical Education, Sports and Health*. 8(3), 363-366.
- Schreurs, M. J., Benjaminse, A., Lemmink, K. A. (2017). Sharper Angle, Higher Risk? The Effect of Cutting Angle on Knee Mechanics in Invasion Sports Athletes. *Journal of Biomechanics*. 63, 144-150. <https://doi.org/10.1016/j.jbiomech.2017.08.019>
- Sheppard, J. M., & Young, W. B. (2006). Agility Literature Review: Classifications, Training and Testing. *Journal of Sports Sciences*. 24(9), 919-932. <https://doi.org/10.1080/02640410500457109>
- Šimonek, J., & Horička, P. (2020). *Agility in Sport*. Cambridge Scholars Publishing.

- Subekti, M., Adiatmika, I. P. G., & Sundari, L. P. R. (2020). Three Corner Drill Training in Improving Agility of Participants of Soccer Extracurricular. *Global Journal For Research Analysis*. 9(10), 152-153. <https://doi.org/10.36106/gjra>
- Teixeira, A. S., Arins, F. B., Lucas, R. D. D., Carminatti, L. J., Dittrich, N., Nakamura, F. Y., Loturco, I., & Guglielmo, L. G. A. (2018). Shuttle-Run Interval Training With More Directional Changes Induces Superior Gains In Shuttle Sprint Performance In Female Professional Futsal Players. *Human Movement*. 19(5), 40-51. <https://doi.org/10.5114/hm.2018.79623>
- Young, W., Rayner, R., & Talpey, S. (2021). It's Time To Change Direction On Agility Research: A Call To Action. *Sports Medicine – Open*. 7(12), 2-5. <https://doi.org/10.1186/s40798-021-00304-y>
- Yudistira, I. G. N. A., Darmawan, G. E. B., & Kusuma, K. C. A. (2018). Pengaruh pelatihan ladder drill dan three corner drill terhadap kelincahan pemain sepakbola. *E-journal Universitas Pendidikan Ganesha*. 9(1), 1-11.
- Yuliawan, D., & Sugiyanto, FX. (2014). Pengaruh Metode Latihan Pukulan Dan Kelincahan Terhadap Keterampilan Bermain Bulutangkis Atlet Tingkat Pemula. *Jurnal Keolahragaan*. 2(2), 145-154.
- Zakiuddin, A. R. Husin, S., & Sitepu, A. (2019). Pengaruh Latihan Shuttle Run dan Lari the Corner Drill terhadap Kelincahan. *JUPE: Physical Education UNILA*. 7(1), 1-10.