Journal Physical Education, Health and Recreation; Vol. 12, No. 2 (2026) 101-108
ISSN-E: 25489208- ISSN-P:25489194
Published by Study Program Physical Education, Health and Recreation
State University of Medan
Email: jpehrjournal@gmail.com

The Effect of Hollow Sprint Training on Lower-Limb Muscle Endurance in Futsal Players

Khairul Azmi Lubis[1*], Albadi Sinulingga[2]

[1]Department of Sport Education, Faculty of Sports Sciences and Health, State University of Medan, Medan, Indonesia

*Corresponding Author: Khairul Azmi Lubis, e-mail: khairulazmilubis42@gmail.com

ABSTRACT

Endurance is the ability and ability of the body to perform sports activities for a long time without experiencing significant fatigue. The players are required to have a good level of endurance. The demand is based on the duties and responsibilities as a futsal player who must continue to move. So, the problem that arises is the lack of leg muscle endurance in YPSA FA futsal players. This study aims to determine the results of the hollow sprint training method on leg muscle endurance of futsal players. This research is a type of quantitative research using a descriptive approach. The research design uses a one group pretest-postest design. The sample in this study was 12 players with sample selection using purposive sampling technique. Data analysis techniques using the T-test. The result of this study is that there is a significant effect of hollow sprint training on leg muscle endurance in YPSA FA futsal players.

Keywords: Hollow Sprint Training, Leg Muscle Endurance, Futsal

INTRODUCTION

Futsal is a sport that requires a high level of physical ability, particularly lower-body strength to support sprinting, rapid changes of direction, kicking, and holding off opponents. Futsal is a team sport that demands a high level of physical fitness, involving endurance, speed, strength, and agility (Lestari & Herawati, 2024). Every futsal player needs these abilities to score goals and win matches. Even after a match, they must maintain their performance (Sinulingga et al., 2023). Good lower-body endurance results in strong and fast kicks, thereby increasing the likelihood of scoring goals (Sanjaya et al., 2023). The objective of this sport is to score as many goals as possible against the opposing team. During each 2x20-minute half, futsal players are required to move continuously, quickly, and dynamically. This aligns with the statement by (Lhaksana, 2011) that the futsal court's specific dimensions foster a fast-paced and dynamic game. The sport is played with five players per team, one of whom must serve as the goalkeeper.

Therefore, lower-body endurance is one of the essential abilities that futsal players must possess. According to (Bompa, 2012), futsal a sport closely related to soccer focuses on the lower-body muscles, which involve the physical fitness components of strength, endurance, agility, and power. Endurance is the body's ability and capacity to perform athletic activities over an extended period without experiencing significant fatigue. Players are required to possess a high level of endurance. This requirement stems from the duties and responsibilities of futsal players, who must remain constantly in motion (Royana, 2017). This is supported by the view of (Barasakti & Faruk, 2019) that physical conditioning is a critical factor in enhancing performance.

Journal Physical Education, Health and Recreation; Vol. 12, No. 2 (2026) 101-108
ISSN-E: 25489208- ISSN-P:25489194
Published by Study Program Physical Education, Health and Recreation
State University of Medan
Email: jpehrjournal@gmail.com

However, futsal players often face the problem of low lower-body muscular endurance, which affects their performance on the field. Players tend not to perform at their best during matches and practices because their lower-body muscular endurance is inadequate. Therefore, a training program must be developed to address this issue (Lubis et al., 2024).

Based on field observations, the researchers conducted a lower-body muscle endurance test on YPSA FA futsal players using the Wall Sit Test. The results showed that 5 out of 12 players had lower-body muscle endurance in the "insufficient" category. Thus, the issue identified is a lack of lower-body muscle endurance among YPSA FA futsal players. This will undoubtedly affect the performance of both the individual players and the team. Futsal is a team sport that requires balanced abilities from every player to improve the team's performance. According to (Kharisma & Faruk, 2022), futsal is a complex sport in which performance depends on the players' physical condition. Optimal physical condition can have a positive impact on supporting gameplay and enhancing performance.

One exercise method that can increase lower-body muscle strength is the hollow sprint. According to (Widiastuti et al., 2022), the hollow sprint (an accelerated sprint) begins with a slow running motion. Furthermore, (Bompa & Haff, 2019) note that intensive acceleration training stimulates type 2A (Fast Oxidative) muscle fibers to adapt to high workloads in a short period of time. This results in improvements not only in strength and speed but also in the muscles' ability to repeatedly generate power in short intervals which is the essence of lower-body muscular endurance. Furthermore, (Reilly & Williams, 2003) noted that sprint training with a structured interval pattern can improve muscle metabolic efficiency. This is because the muscles are trained to adapt to high oxygen demands, enabling them to resist fatigue for longer periods, which has a positive impact on muscular endurance.

Based on the above discussion, this study aims to determine the effects of the hollow sprint training method on the lower-body muscular endurance of futsal players. These findings are expected to provide deeper insights into how this training can positively contribute to improving the lower-body muscular endurance of futsal players, thereby enabling its broader implementation in the development of futsal training programs in various settings.

METHOD

This study is a quantitative study using a descriptive approach, which provides an overview of the results of variable calculations through simple statistical analyses. This type of research is quantitative. Quantitative research is research that requires the use of numbers, beginning with data collection, data interpretation, and the presentation of results (Siyoto & Sodik, 2015). Descriptive research, on the other hand, is research aimed at providing a description, explanation, and validation of the phenomenon under study (Muhammad, 2021). The research design employed a one-group pretest-posttest design. The study was conducted by administering a pretest to determine the baseline condition, followed by the application of a treatment aimed at improving the lower-body muscle endurance of futsal players.

The focus of this study is on the lower-body muscle endurance of futsal players. The researcher investigated whether there was an increase in lower-body muscle endurance in futsal players after they were given the hollow sprint training method as a treatment. To determine this, comparative data analysis was required; the researcher employed a one-group pretest-posttest design to determine whether there was a significant increase in lower-body muscle endurance among futsal players in each sample group.

This study was conducted at the YPSA FA futsal field in the city of Medan from September 14, 2024, to September 12, 2024. The population for this study consisted of all YPSA FA futsal players. According to (Barlian, 2016), a population is the totality of values

Journal Physical Education, Health and Recreation; Vol. 12, No. 2 (2026) 101-108
ISSN-E: 25489208- ISSN-P:25489194
Published by Study Program Physical Education, Health and Recreation
State University of Medan
Email: jpehrjournal@gmail.com

associated with specific characteristics of a set of objects whose properties are to be studied. The population constitutes the domain of generalization for subjects or objects possessing specific qualities and characteristics defined by the researcher for study. The population in this study consists of all 34 YPSA FA futsal players. The sample used for this study comprised 12 players. According to (Barlian, 2016), a sample is a subset of the population. The sample was selected using purposive sampling, meaning only players who met the researcher's criteria were included in the sample. The criteria for the sample in this study were: 1) male; 2) aged 14–15 years; 3) able to participate in 16 training sessions.

RESULTS AND DISCUSSION

Result

In an effort to improve the lower-body muscle endurance of futsal players, a training program consisting of 16 sessions was designed. The pretest and posttest results were analyzed using SPSS version 29 with a t-test and will be explained in detail in the following discussion:

1. Pretest

After the researcher collected data from the experimental group, the researcher administered a pretest to the experimental group. The test administered was the wall sit test, performed in three sets during a single testing session involving 12 participants. The pretest was conducted to determine each participant's muscle endurance. Before beginning the test, participants were given the opportunity to warm up thoroughly to prevent injury. The researcher then administered the treatment, which consisted of hollow sprint exercises. In this activity, the researcher played a direct role in administering the test and was assisted by two fellow researchers. The researcher did this to ensure that the data obtained accurately reflected the conditions encountered in the field and was collected quickly. The pretest results are presented in the table below:

Table 1. Pretest Result

No	Player's Initials	Wall Sit Test	
		Pretest Results	Category
1	ASH	02,30	Excellent
2	AD	01,50	Good
3	AS	01,15	Fair
4	KHB	02,00	Good
5	RAP	02,45	Excellent
6	AZ	00,55	Poor
7	MRP	01,40	Good
8	DAS	01,20	Fair
9	MH	02,20	Good
10	AR	00,50	Poor
11	FG	01,10	Fair
12	RF	02,10	Good

Table 2. Frequency Distribution of the Pretest

Category	Frequency	Percentage (%)	Valid Percentage
Excellent	2	17	17
Good	5	41	41
Fair	3	25	25

Journal Physical Education, Health and Recreation; Vol. 12, No. 2 (2026) 101-108
ISSN-E: 25489208- ISSN-P:25489194
Published by Study Program Physical Education, Health and Recreation
State University of Medan
Email: jpehrjournal@gmail.com

Poor	2	17	17
Total	**12**	**100**	**100**

Based on the statistical analysis, the pretest results for the 12 participants were as follows: 2 participants were categorized as "excellent" (17%), 5 participants were categorized as "good" (41%), 3 participants were categorized as "fair" (25%), and 2 participants were categorized as "poor" (17%). The data above indicates that the lower-body muscle endurance of the 12 participants is still low; therefore, the researcher designated these 12 participants as the experimental group, which will undergo a treatment consisting of a 16-session hollow sprint training program.

2. Posttest

After the researcher administered the hollow sprint training intervention over 16 sessions to the experimental group, the next step was to conduct a posttest on the experimental group. The test administered was the wall sit test, which was performed by 3 participants at a time during a single testing session involving 12 participants. The final test was conducted to determine the lower-body muscle endurance of each participant. Before beginning the test, participants were given the opportunity to warm up thoroughly to prevent injury. During this activity, the researcher played a direct role in administering the test and was assisted by two fellow researchers. The researcher took this approach to ensure that the data collected accurately reflected the conditions encountered in the field and was gathered quickly. The posttest results are presented in the table below:

Table 3. Posttest Result

No	Player's Initials	Wall Sit Test	
		Pretest Results	Category
1	ASH	02,74	Excellent
2	AD	02,04	Excellent
3	AS	01,68	Good
4	KHB	02,40	Excellent
5	RAP	02,92	Excellent
6	AZ	01,53	Good
7	MRP	01,94	Good
8	DAS	01,42	Fair
9	MH	02,18	Excellent
10	AR	01,47	Fair
11	FG	02,22	Excellent
12	RF	02,04	Excellent

Table 4. Frequency Distribution of the Posttest

Category	Frequency	Percentage (%)	Valid Percentage
Excellent	7	58	58
Good	3	25	25
Fair	2	17	17
Poor	0	0	0
Total	**12**	**100**	**100**

Journal Physical Education, Health and Recreation; Vol. 12, No. 2 (2026) 101-108
ISSN-E: 25489208- ISSN-P:25489194
Published by Study Program Physical Education, Health and Recreation
State University of Medan
Email: jpehrjournal@gmail.com

Based on the statistical analysis, the posttest results for the 12 participants were as follows: 7 participants (58%) were classified as "very good," 3 participants (25%) were classified as "good," and 2 participants (17%) were classified as "fair." The data above indicates that the lower-body muscle endurance of the 12 participants improved compared to their pre-treatment levels following a 16-session hollow sprint training program.

Table 5. Pretest and Posttest Data

No	Player's Initials	Wall Sit Test	
		Pretest	Posttest
1	ASH	02,30	02,74
2	AD	01,50	02,04
3	AS	01,15	01,68
4	KHB	02,00	02,40
5	RAP	02,45	02,92
6	AZ	00,55	01,53
7	MRP	01,40	01,94
8	DAS	01,20	01,96
9	MH	02,20	02,18
10	AR	00,50	01,89
11	FG	01,10	02,22
12	RF	02,10	02,04

Tabel 6. Results of the Descriptive Analysis

	N	Min.	Max.	Mean.	Std. Dev.
Pretest	12	0,50	2,45	1,54	66,815
Posttest	12	1,42	2,92	2,05	48,187

Based on the descriptive statistical data above, the pretest standard deviation is 66.815 > 48.187, which is the result of the posttest standard deviation.

3. Data Analysis

Normality Test

The normality test aims to determine whether the distribution of the variable under test is normal. This normality test uses the Shapiro-Wilk test, and the calculations were performed using SPSS version 29 on a Windows 10 computer, with the criterion that the data is normally distributed if the significance value is > α = (0.05). The results of the normality test for the variables in this study are presented in the following table:

Tabel 7. Normality Test Results

	Statistik	Shapiro-Wilk	Sig.
Pretest	0,929	12	0,365
Posttest	0,947	12	0,599

Based on the table above, the results of the data analysis using the Shapiro-Wilk test show that the significance level, or P-value, for the pretest is 0.365 for 12 participants. The pretest P-value of 0.365 is greater than the significance level of 0.05. This means that the data comes from a normally distributed population. The

Journal Physical Education, Health and Recreation; Vol. 12, No. 2 (2026) 101-108
ISSN-E: 25489208- ISSN-P:25489194
Published by Study Program Physical Education, Health and Recreation
State University of Medan
Email: jpehrjournal@gmail.com

significance level or P-value for the posttest is 0.599 for 12 students. The posttest P-value of 0.599 is greater than the significance level of 0.05. This means that the data comes from a normally distributed population.

Homogeneity Test

The homogeneity test is used to determine whether two variances are homogeneous or not. To determine whether the data in this study are homogeneous, Levene's test was used. The results of Levene's test are presented in the following table:

Table 8. Homogeneity Test Result

	Levene Statistik	**Signifikansi**
Posttest	2,335	0,141

The table above shows that the significance value is 0.141, with a Levene's value of 2.335 (>0.05). Based on the explanation above, it can be concluded that the data is homogeneous, or that the significance value is >0.05.

Hypothesis Testing

Hypothesis testing aims to determine the significance of the difference between the pre- and post-treatment periods using a paired-sample t-test.

Table 9. Hypothesis Test Result

	Rata-rata (mean)	**Std. Dev.**	**Signifikansi**
Pretest-Posttest	-51,083	10,714	0,001

Since the Sig. (2-tailed) value is 0.001 < 0.05, the researcher can conclude that there is a significant difference between leg muscle endurance in the pretest and posttest data. This is due to the hollow sprint exercise intervention.

Discussion

In this study, based on the results of the training program and data analysis including normality tests, homogeneity tests, and hypothesis testing it can be concluded that hollow sprint training has a significant effect on the lower-body muscular endurance of YPSA FA futsal players. Training is a structured and planned activity designed to enhance a player's abilities in support of performance and to improve basic technical skills in futsal. A player is required to undergo a series of training programs designed by the coach.

To achieve the maximum performance expected of a player or sports team, training planning and programming are necessary. Training activities must be planned and implemented within a training program. Training programs can be divided into three categories: long-term, medium-term, and short-term programs. Training programs are further subdivided into four training cycles: annual, monthly, weekly, and daily training programs (Budiwanto, 2012).

Circuit training is a type of interval training program in which strength training is combined with aerobic exercise, which also incorporates the benefits of flexibility and physical strength. "Circuit" here refers to several exercise stations or stations located within an area that must be completed quickly. Each participant must complete one station before moving on to the next (Budiwanto, 2012). According to (HB & Wahyuri, 2018), muscular endurance is the ability of muscles to perform repeated contractions without becoming fatigued. Therefore, a person with good muscular endurance can easily move quickly, dynamically, and repeatedly without experiencing excessive fatigue. The pre-test aimed to assess the participants' lower-

Journal Physical Education, Health and Recreation; Vol. 12, No. 2 (2026) 101-108
ISSN-E: 25489208- ISSN-P:25489194
Published by Study Program Physical Education, Health and Recreation
State University of Medan
Email: jpehrjournal@gmail.com

body muscular endurance before the experiment, while the post-test was conducted to determine the extent of any significant improvements resulting from the experiment.

The initial test data showed that the average lower-body muscle endurance pretest score was 1.54 standard deviations from 66.815, with the highest score falling into the "very good" category and the lowest into the "poor" category. Next, lower-body muscle endurance was assessed after performing hollow sprint exercises over 16 sessions, three times a week for 5 weeks. After conducting the final post-test for lower-body muscle endurance, the data obtained will be analyzed to determine whether the hollow sprint training administered to YPSA FA. To analyze the data, the author used IBM SPSS Statistics 29. Before conducting the paired-sample t-test, a normality test must first be performed to ensure the data follows a normal distribution. The normality test used was the Shapiro-Wilk test. In the Shapiro-Wilk normality test, the criterion for data to be normally distributed is a significance value > 0.05. Based on the data analysis results, the significance value or P-value for the pretest was 0.365 for 12 participants. The pretest P-value of 0.365 is greater than the significance level of 0.05. This means that the data come from a normally distributed population.

After conducting the normality test, a homogeneity test will be performed next. The homogeneity test is considered to indicate homogeneity if the significance value is < 0.05. Based on the analysis of the data obtained, the significance value is 0.141, with a Levene's value of 0.141 (≥0.05). Based on the explanation above, it is concluded that the data are homogeneous, or that the significance value is >0.05. After conducting the homogeneity test, a paired-sample t-test will be performed. The paired-sample t-test shows that the Sig. (2-tailed) value of 0.001 is < 0.05; therefore, the researcher can conclude that there is a significant difference in lower-body muscle endurance between the pretest and posttest data. This means that hollow training has a significant effect on the lower-body muscle endurance of YPSA FA participants.

CONCLUSION

The results of this study indicate that hollow sprint training has a significant effect on lower-body muscle endurance in YPSA FA futsal players. The following recommendations can be made based on these findings: YPSA FA futsal players or staff who still lack lower-body muscle endurance can improve it by performing regular independent training. For YPSA FA futsal coaches or trainers, this hollow sprint exercise can be incorporated as part of a training program to improve lower-body muscle endurance in futsal players on other teams or among the next generation of young players.

REFERENCES

Barasakti, B. A., & Faruk, M. (2019). Analisis Kondisi Fisik Tim Futsal Jomblo Fc U-23 Ponorogo. *Jurnal Prestasi Olahraga*, *1*(1), 1–8.

Barlian, E. (2016). *Metodelogi Kuantitatif dan kualitatif*. Padang: Sukabinas Press.

Bompa, T. O. (2012). *Theory and Methodol of Training*. Kendall/Hunt Publishing Company.

Bompa, T. O., & Haff, G. G. (2019). Periodization: Theory and Methodology of Training. In *Human Kinetics* (5th ed., Vol. 51, Issue 4). Human Kinetics. https://doi.org/10.1249/01.mss.0000554581.71065.23

Budiwanto, S. (2012). *Metodologi Latihan Olahraga*. Universitas Negeri Malang. http://scioteca.caf.com/bitstream/handle/123456789/1091/RED2017-Eng-8ene.pdf?sequence=12&isAllowed=y%0Ahttp://dx.doi.org/10.1016/j.regsciurbeco.2008.06.005%0Ahttps://www.researchgate.net/publication/305320484_SISTEM_PEMBETUNGAN_TERPUSAT_STRATEGI_MELESTARI

HB, B., & Wahyuri, A. S. (2018). *Pembentukan Kondisi Fisik* (Vol. 11, Issue 1). http://scioteca.caf.com/bitstream/handle/123456789/1091/RED2017-Eng-8ene.pdf?sequence=12&isAllowed=y%0Ahttp://dx.doi.org/10.1016/j.regsciurbeco.2008.06.005%0Ahttps://www.researchgate.net/publication/305320484_SISTEM_PEMBETUNGAN_TERPUSAT_STRATEGI_MELESTARI

Kharisma, C., & Faruk, M. (2022). Analisis Kondisi Fisik Tim Futsal Maestro Putri Tulungagung. *Jurnal Prestasi Olahraga*, *5*(5), 96–102.

Lestari, S., & Herawati, I. (2024). Pengaruh Latihan Agility Ladder Drill Metode Lateral Run Dalam Meningkatkan Kelincahan Pada Pemain Futsal. *Journal of Sport Science and Fitness*, *9*(2), 88–94. https://doi.org/10.15294/jssf.v9i2.74046

Lhaksana, J. (2011). *Taktik & Strategi FUTSAL Modern*. BE CHAMPION. https://books.google.co.id/books?id=ANtjCgAAQBAJ

Lubis, K. A., Supriadi, A., & Siregar, S. (2024). The Effect of Harvard Step-Test and Shuttle Run-Test Training on Increasing Exercise Pulse Frequency in Junior High School Students. *Journal of Physical Education, Sport, Health and Recreations*, *13*(3), 427–435.

Muhammad, R. (2021). *Metode Penelitian*. Cipta Media Nusantara. https://books.google.co.id/books?id=Ntw_EAAAQBAJ

Reilly, T., & Williams, A. M. (2003). *Science and Soccer*. Routledge. https://books.google.co.id/books?id=ax4GBYlonK0C

Royana, I. F. (2017). Analisis Kondisi Fisik Pemain Tim Futsal Upgris. *Jendela Olahraga*, *2*(2), 2–19. https://doi.org/10.26877/jo.v2i2.1860

Sanjaya, E., Setyagraha, E., & Rahman, A. (2023). Tingkat Daya Tahan Otot Tungkai Atlet Sepakbola Maggangka Fc Tahun 2022. *Ilara*, *14*(1), 19–24.

Sinulingga, A., Pasaribu, A. M. N., Bangun, S. Y., Ningrum, D. T. M., & Mahyudi, Y. V. (2023). Plyometric Exercise and Speed on the Power of Sabit Kick in Pencak Silat. *International Journal of Human Movement and Sports Sciences*, *11*(3), 591–597. https://doi.org/10.13189/saj.2023.110311

Siyoto, S., & Sodik, Al. (2015). *Dasar Metodologi Penelitian* (1st ed.). Literasi Media Publishing.

Widiastuti, Hasyim, Taufik, M. S., Muslim, B. A., Suharti, Solahuddin, S., Juditya, S., & Karisdha. (2022). Comparison of Hollow Sprint and Interval Training in Increasing Speed of 100 M Sprint Test. *International Journal of Human Movement and Sports Sciences*, *10*(1), 79–84. https://doi.org/10.13189/saj.2022.100111