



Boosting Explosive Power: The Impact of Squat Jump Training on Futsal Athletes

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Abstract

There are problems such as weakness in kicking, lack of accuracy in passing, low heading when jumping, kicks that are still lacking in power, dribbling still looks often shaky in futsal. This study aims to determine the effect of squat jump training on the results of leg muscle explosive power in SN Anjels Palembang Futsal athletes. A quasi-experimental method with a one group pretest posttest design. The sample consisted of 30 people, namely all SN Anjels Palembang futsal athletes. This research uses the data analysis technique Paired Sample T-Test. The results show that there is a significant influence of Squat Jump training on the results of leg muscle explosive power in SN Anjels Palembang futsal athletes with a calculated t of 15.546 and a t table of 2.045, with a significance value of $0.00 < 0.05$ with an increase percentage of 34.03 %. the table above it is known that the correlation coefficient value is 0.926 with a significance value (Sig.) of 0.000. A significance value of $0.000 < 0.05$ means that there is a relationship between the scores before and after Squat Jump Training and the Results of Leg Muscle Explosive Power in SN Anjels Palembang Futsal Athletes.

Keywords: explosive power, futsal athletes, squat jump training.



Introduction

Futsal is one of the most popular indoor sports that demands a combination of technical skills, tactical understanding, and high levels of physical fitness. Among the various physical components required, leg muscle explosive power plays a crucial role in supporting key performance aspects such as shooting, dribbling, passing accuracy, and jumping (Hardiyono, 2020; Kristanto, 2021). Explosive power can contribute to players in the form of fast and strong movements in the shortest possible time, this is certainly very important when switching from defense to attack (Iksan et al., 2023). Thus, increasing muscle explosive power is a top priority in improving the abilities of futsal athletes. The popularity of futsal among students in Indonesia, the results of field observations found several problems in the performance of futsal athletes. Common problems seen on the field are weak kicks, inaccurate passing, dribbling movements that are often shaky and unstable. The explosive power of muscle fitness is still considered low and has been identified as one of the main factors causing these problems to appear on the field, so it is necessary to have a type of training that can increase the explosive power of muscle fitness of futsal athletes effectively and efficiently so that with the expected increase in muscle power there will be an improvement in the game of futsal athletes. Several research results have linked leg muscle strength to the ability to play futsal, of course this needs to be studied further, such as the results of research, for example, Frayoga and (Frayoga & Afrizal, 2019) The results of the study stated that leg muscle power was significantly related to the accuracy of futsal athletes' challenges, (Jatra & Sarwaki, 2022) the results of other studies show positive results, namely, there is a relationship between shooting ability in soccer athletes. (Ekawati et al., 2021) emphasized its contribution to balance and stability during shooting.

Other studies also produce the same results that support the research results, namely that plyometric-based training methods can significantly increase lower leg explosive power, sprint speed, and agility in futsal players. Of course, squat jump training is a type of plyometric training, so the results of this study are in line with the results of the research (Andri Irawan, Nur Fitrianto et al., 2024; Fernández-Gavira et al., 2021; Hasan et al., 2021) However, most of these studies focus on professional or adult athletes, raising major questions about the impact on student or amateur futsal players, especially in Indonesia, particularly in the province of South Sumatra.

Squat jump training, one form of plyometric exercise, has been proven effective for increasing

leg muscle power. This exercise stimulates the stretch-shortening cycle, improving muscle elasticity and power output (Pratama & Erawan, 2019; Swari, 2021) It also has practical advantages: it requires no special equipment, can be done in limited space, and supports both strength and agility development (Maulidin et al., 2023). Many previous research results have analyzed squat jump exercises, but a gap was found in research that examined the specific effects of squat jump exercises on leg muscle explosive power among student and amateur futsal athletes, especially at the SN Angel Futsal club, Palembang.

Based on this gap, the present study aims to determine the effect of squat jump training on leg muscle explosive power in SN Angel futsal athletes in Palembang City. The novelty of this research lies in its focus on implementing a systematic squat jump training program with controlled duration and intensity, specifically tailored to student-level futsal players a context that has received little empirical attention in Indonesia. "Does squat jump training have a significant effect on leg muscle explosive power among SN Angel futsal athletes in Palembang City?" The hypothesis of this study states that: There is a significant effect of squat jump training on the leg muscle explosive power of SN Angel futsal athletes.

Methods

This study used a quasi-experiment research method with a one group pretest posttest design. experiment is judged based on the difference between the pretest and posttest (Dharma, 2013; Sugiyono, 2023)

Research Design

A one-group pretest-posttest design is a quasi-experimental research design involving a single group of participants who are measured before and after receiving a specific treatment. This design aims to assess the effectiveness of an intervention by comparing pretest and posttest results within the same group. The absence of a control group limits this study to whether this increase really occurred due to the effects of the treatment or the presence of external factors, even though the researcher's conducted observations over time. This design is also based on practical considerations, especially the limited number of participants. The total sample consisted of 30 amateur athletes and students, and dividing the population into two groups (experimental and control) would result in a smaller number of participants in each group, with the division of the population it can reduce the statistical results and

reliability of the research results, so the population was included in one experimental group and made a sample that received squat jump training, with tests carried out before and after treatment to measure any changes that occurred. However, the main limitation of this design lies in the absence of a control group, which makes it difficult to determine whether the observed changes are entirely due to the intervention.

Participants

The sample in this study amounted to 30 female futsal athletes with an age range of 17-25 years. This study employed a total sampling technique, in which the entire population was used as the research sample. There were no specific inclusion criteria for the participants, as the SN Angel club itself accommodates female players who are adolescents and young adults aged over 20 years.

Instrument

This study was conducted by comparing the pretest before being given the Squat Jump Exercise with the posttest after being given the Squat Jump Exercise. The instrument used in this study was Jump Df T.K.K-5414 Vertical Jump Meter reliability (R > .97). and validity (R > .95) (Aragon, 2021; Hakim et al., 2023).

Procedure

This study was conducted through several stages to determine the effect of squat jump training on the explosive power of leg muscles in SN Angels Palembang futsal athletes. The procedure is outlined as follows:

1. Preparation Stage: Prior to the treatment, the researcher communicated with the coaches and athletes of the SN Angel club to explain the purpose of the study. Letters of consent were obtained from the participants, and training equipment and a test instrument for muscle power, the Jump DF leg test, were prepared by obtaining a request for use from the Sriwijaya University Physical Education and Health Laboratory.

2. Pre-test: This was conducted to determine leg muscle power before treatment. In this stage, all participants underwent a leg muscle explosive power test using the Jump DF instrument at the Sriwijaya University Physical Education and Health Laboratory. The test was conducted under standardized conditions to ensure consistency across all participants.
3. Intervention (Treatment Phase): Participants participated in a structured squat jump training program designed to improve leg muscle explosive power. Training was conducted over 6 weeks, with 3 sessions per week, under the supervision of the research team and trainers. Each session consisted of 3 sets of 12-15 repetitions of squat jumps, performed at moderate to high intensity (approximately 70-85% of maximal effort), with 60-90 seconds of rest between sets. The exercises were applied progressively, with intensity adjusted to the participants' abilities to maximize explosive power while minimizing injury risk, with 3 sessions per week.
4. Posttest: After the training period has been carried out for 6 weeks, a post-test is then carried out with the same instrument as when conducting the pre-test, namely using the Jump DF test, which is carried out under the same conditions on the sample. The purpose of this post-test is to measure changes in explosive leg power due to the treatment in the form of squat jump training, so that it can be measured whether there is an increase or not after the treatment.

Data Analysis

Normality Test: The normality of the data was examined using the Kolmogorov-Smirnov test. This test was performed to determine whether the pretest and posttest data were normally distributed. A significance level of $\alpha = 0.05$ was

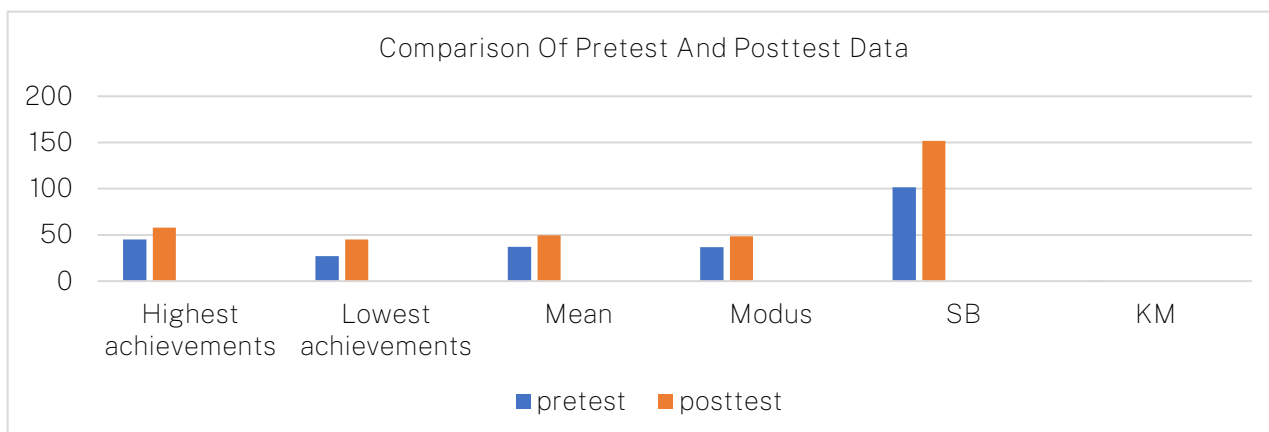
Table 1

Improvement of Pretest and Posttest Results of Squat Jump on Limb Muscle Explosiveness Results

Result	N	Highest achievements (cm)	Achievements Lowest (cm)	Mean	Comparison of mean pretest and posttest	Modus	SB	Km
Pretest	30	45	27	37.02	12.6	36.7	101.43	0.003
Posttest	30	58	45	49.62		48.58	151.88	0.006

Figure 1

Histogram of Pretest and Posttest Statistical Values of SN Angels Palembang Futsal Athletes



applied; if $p > 0.05$, the data were considered normally distributed, whereas $p < 0.05$ indicated a deviation from normality. Homogeneity Test: To verify that the sample groups originated from a homogeneous population, a homogeneity test was conducted using ANOVA on the pretest and posttest data. A significance level of $\alpha = 0.05$ was applied; if $p > 0.05$, the data were considered homogeneous, while $p < 0.05$ indicated heterogeneity. Ensuring homogeneity is important before conducting hypothesis testing. Hypothesis Test: After confirming that the data met the assumptions of normality and homogeneity, a paired-sample t-test was used to compare the mean pretest and posttest scores. This test was applied to examine the effect of the squat jump training on leg muscle explosive power. The significance level was set at $\alpha = 0.05$; results with $p < 0.05$ were considered statistically significant, indicating a significant difference between pretest and posttest performance, namely by comparing the mean between group 1 (pretest) and group 2 (posttest) (Budi, 2021; Sugiyono, 2023) the value of $t_{count} < t_{table}$, then H_0 is rejected, if $t_{count} > t_{table}$, then H_0 is accepted.

Results

The results in this study, the *pretest* data obtained the highest achievement in cm is 45 cm and the lowest is 27 cm, the average value is 37.02 which is included in the moderate category, mode 36.7, standard deviation 101.43, and the slope of the curve is 0.003 while the results of the *posttest* data obtained the highest achievement in cm is 58 cm and the lowest is 45 cm, the average value is 49.62 cm in the good category, mode 48.58 cm, standard deviation 151.88 and the slope of the curve is 0.006.

Table 1. shows the positive impact the training intervention has had on the athletes with regard to the squat jump. In the pretest, the participants had 27 cm and 45 cm as the lowest and highest scores, respectively, with a mean of 37.02 cm. After completing the squat jump training program, however, there was a remarkable improvement, with the highest score being 58 cm, the lowest 45 cm, and an average of 49.62 cm. The mean of 12.6 cm demonstrates a remarkable improvement in lower-limb explosive strength. The increase in the mean and mode values provides evidence of a reliable increase in performance for all participants. Furthermore, the increase in values of the standard deviation and the coefficient of variation provide evidence of a greater posttest score spread, which most likely reflects the individual training effect variances.

Data in Table 1 is complemented by Figure 1, depicting a unidirectional trend over the entire span of the squat jump score assessments. The majority of athletes improved the jump height during the training sessions, as evidenced by the histogram. This suggests that the squat jump exercises were effective in improving the lower limb muscle explosiveness of SN Angels Palembang futsal players.

In the Table 2 is known that the average pretest value is 37.02 < the average posttest value is 49.62 with 30 respondents. This means that descriptively there is a difference in the average score of leg muscle explosive power results for SN Angels Palembang Futsal Athletes.

In the Table 3 is known that the correlation coefficient value is 0.926 with a significance value (Sig.) of 0.000. A significance value of $0.000 < 0.05$ means that there is a relationship between the scores before and after Squat Jump Training and the Results of Leg Muscle

Table 2

Statistics

	Mean	N
Pretest	37.02	30
Posttest	49.62	30

Table 3

Correlation

	Correlation	Sig.
Pretest and Posttest	0.926	0.000*

Table 4

Paired Sample Test

	t	Sig.
Pretest and Posttest	-15.546	0.000*

Explosive Power in SN Anjels Palembang Futsal Athletes.

In the [Table 4](#) is known that the Sig value. (2-tailed) is $0.000 < 0.05$ so H_0 is rejected and H_a is accepted so it can be concluded that there is a difference in the average score before and after squat jump training on the results of leg muscle explosive power in SN Angels Palembang Futsal athletes.

Discussion

The current study shows that six weeks of squat jump training significantly enhances the lower-limb explosive power in female futsal athletes. This result aligns with the study’s objective, which aimed to determine if a structured plyometric intervention would improve the explosiveness of leg muscles in this specific population. From a biomechanical perspective, the efficacy of squat jump training can be attributed to changes involving the stretch-shortening cycle (SSC). The squat jump consists of an eccentric contraction followed by a rapid concentric contraction, which optimally achieves the storage and retrieval of elastic energy, enhances the neuromuscular coordination, and elevates the rate of force production. These changes are described in recent works ([Behm et al., 2025](#); [Stone et al., 2024](#); [Wenchao et al., 2025](#)) In contrast with recent studies, carried a 6-week plyometric training ([Shuai et al., 2025](#)) program with sprinters, showing a 28.5% improvement in squat jump power and the explosive gains retention after 2 weeks of detraining. ([Xiao et al., 2023](#)) analyzed the fast SSC plyometric training with female rhythmic gymnasts and reported important advancements in both fast and slow SSC strength qualities. ([Cao et al., 2024](#)) conducted a systematic review and meta-analysis

of female basketball players, demonstrating that the plyometric training, and plyometric training to improve vertical jump, linear sprint and COD performance in female soccer players ([Pardos-mainer et al., 2021](#)), physical training enhanced the thickness, pennation angle, and fascicle length of the muscles assessed. Furthermore, plyometric exercises serve as a valuable method for boosting tendon stiffness and enhancing lower body strength and jump performance([Ramírez et al., 2022](#)). The plyometric training program can increase muscle volume in the lower limbs and legs, increase the rate of force development, and shorten the jumping time, thereby enhancing explosive strength ([Huang & Huang, 2023](#)). Therefore, based on this study, squat jump training can improve explosive power in female futsal athletes.

Nonetheless, some limitations must be considered. First, it is difficult to isolate improvements as being due solely to squat jumps, as no control group is established (other changes such as regular training in futsal or maturation may also be a factor). Second, a single sample of 30 athletes from 1 club is bound to limit the generalizability of the findings. Third, though the 6-week time frame is long enough to produce short term changes, it is not enough to observe long term changes, a retention effect, or a plateau effect. In practical terms, these findings indicate that futsal coaches should incorporate squat jump-based plyometric training in their conditioning workouts, especially for the explosive training of actions that involve rapid accelerations, jumping, or powerful kicking. Since squat jumps require little to no equipment, they can be done in a variety of training situations. Recommendations for future investigations include: A comparison of squat jump

training to other plyometric strategies (such as depth jumps or bounding, or mixed plyometric protocols) for determining the best method to improve explosive power in futsal players. The performance of a larger sample randomized controlled trial that includes both males and females and different clubs, and the addition of biomechanical instruments (like force plates, EMG) to analyze neuromuscular adaptation.

Conclusions

The conclusion of this study is that there is an increase in explosive power of leg muscles due to the treatment of squat jump training carried out for 6 weeks on futsal athletes SN Anjels Palembang, with this finding it is hoped that squat jump training can be used as one type of training to increase leg muscle endurance so that it can improve the ability to play futsal. This study suggests that future research compares squat jump training with other plyometric training to determine which approach provides more significant results.

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With the contributions of all these parties, this study was able to be completed smoothly. The researcher hopes that this work can provide meaningful benefits for the development of training methods aimed at improving explosive power in futsal athletes.

References

- Andri Irawan, Nur Fitranto, M. H. H., Eko Prabowo, Dzulfiqar Diyananda, Slamet Sukriadi³, A. P., & Ihsani, S. I. (2024). Impact of plyometric training on sprint and agility performance in college - level futsal athletes: a comparative study using hurdle jumps and box jumps. *Polish Journal Of Physiotherapy*, 24(5), 50–55. <https://doi.org/https://doi.org/10.56984/8ZG020C68QJ>
- Aragon, Luis F. (2021). Evaluation of Four Vertical Jump Tests: Methodology, Reliability, Validity, and Accuracy. *Measurement In Physical Education and Exercise Science*, 15(32), 215–228. https://doi.org/https://doi.org/10.1207/S15327841MPEE0404_2
- Behm, D. G., Konrad, A., Nakamura, M., Alizadeh, S., Culleton, R., Anvar, S. H., Pearson, L. T., Ramirez-campillo, R., & Sale, D. G. (2025). A narrative review of velocity-based training best practice: the importance of contraction intent versus movement speed. 9, 1–9. <https://doi.org/https://doi.org/10.1139/apnm-2024-0136>
- Budi, D. (2021). Statistika Penelitian Menggunakan SPSS (Uji Validitas, Uji Reliabilitas, Regresi Linier Sederhana, Regresi Linier Berganda, Uji T, Uji F, R²). In *Guepedia*. Guepedia. <https://books.google.co.id/books?id=acpLEAAQBAJ>
- Cao, S., Wang, Z., Guo, J., Geok, S. K., Sun, H., & Liu, J. (2024). The effects of plyometric training on physical fitness and skill-related performance in female basketball players: a systematic review and meta-analysis. July. <https://doi.org/10.3389/fphys.2024.1386788>
- Dharma. (2013). *Metodologi Penelitian Keperawatan: Panduan Melaksanakan dan Menerapkan Hasil Penelitian*. Trans Info Media.
- Ekawati, F. F., Ismaryati, I., Rahayu, T. W., & Wijanarko, B. (2021). Meningkatkan Profesionalisme Guru Slb Melalui Pendampingan Permainan Adaptif Keterampilan Gerak Dasar Anak Berkebutuhan Khusus. *Jurnal Pengabdian Kepada Masyarakat*, 27(1), 28. <https://doi.org/10.24114/jpkm.v27i1.21452>
- Fernández-Gavira, J., Espada-Goya, P., Alcaraz-Rodríguez, V., & Moscoso-Sánchez, D. (2021). Design of educational tools based on traditional games for the improvement of social and personal skills of primary school students with hearing impairment. *Sustainability (Switzerland)*, 13(22). <https://doi.org/10.3390/su132212644>
- Frayoga, J., & Afrizal. (2019). Pengaruh Latihan Daya Ledak Otot Tungkai Terhadap Akurasi

- Shooting Pemain Futsal. *Jurnal Patriot*, 3(1), 919–931.
- Hakim, D. S., Setijono, H., & Kusnanik, N. W. (2023). Pengaruh Latihan Plyometric Standing Long Jump With Hurdle Hop dan Wave Squat terhadap Power dan Kekuatan Otot Tungkai. *BRAVO'S Jurnal Program Studi Pendidikan Jasmani Dan Kesehatan*, 11(1), 37–49. <https://doi.org/https://doi.org/10.32682/bravos.v11i1.2859>
- Hardiyono, O. &. (2020). Pengaruh Daya Ledak Otot Lengan, Daya Ledak Otot Tungkai dan Kekuatan Otot Perut Terhadap Hasil Smash Bola Voli Pada Siswa SMK Negeri 3 Palembang. *Jurnal Coaching Education Sport*, 1(1), 13–24.
- Hasan, S., Kandasamy, G., Alyahya, D., Alonazi, A., Jamal, A., Unnikrishnan, R., Muthusamy, H., & Iqbal, A. (2021). *Effect of Resisted Sprint and Plyometric Training on Lower Limb Functional Performance in Collegiate Male Football Players : A Randomised Control Trial*. 50 m, 1–12. <https://doi.org/https://doi.org/10.3390/ijerph18136702>
- Huang, H., & Huang, W. (2023). *applied sciences The Effect of Plyometric Training on the Speed , Agility , and Explosive Strength Performance in Elite Athletes*.
- Iksan, F., Syahrastani, Neldi, H., & Arnando, M. (2023). Kontribusi Daya Ledak Otot Tungkai dan Koordinasi Mata Kaki terhadap Kemampuan Shooting siswa SMA Pembangunan. *Jurnal Pendidikan Dan Olahraga*, 6(4), 41–46. <http://jpdo.pj.unp.ac.id/index.php/jpdo/article/view/1269>
- Jatra, R., & Sarwaki, S. (2022). Hubungan Power Otot Tungkai Dengan Kemampuan Shooting Sepakbola Pemain Uir Soccer School Pekanbaru Indonesia. *Indonesian Journal of Physical Education and Sport Science*, 2(1), 7–16. <https://doi.org/10.52188/ijpess.v2i1.206>
- Kristanto, K. T. (2021). *Squat Jump: Pengertian, Teknik, dan Manfaat*. Kompas.Com.
- Maulidin, M., Mujriah, M., & Amalia Rachman, I. N. (2023). Peningkatan vo2max atlet sprint 400 meter dengan metode latihan sirkuit 6 minggu. *Jurnal Porkes*, 6(2), 889–899. <https://doi.org/10.29408/porkes.v6i2.20959>
- Pardos-mainer, E., Lozano, D., Torrontegui-duarte, M., Cart, A., & Roso-moliner, A. (2021). *Effects of Strength vs . Plyometric Training Programs on Vertical Jumping , Linear Sprint and Change of Direction Speed Performance in Female Soccer Players : A Systematic Review and Meta-Analysis*. <https://doi.org/https://doi.org/10.3390/ijerph18020401>
- Pratama, M. I., & Erawan, B. (2019). Perbandingan Pengaruh Latihan Squat Jump dan Plyometric Jump to Box terhadap Peningkatan Power Otot Tungkai. *Jurnal Kepeleatihan Olahraga*, 11(2), 77–82. <https://doi.org/10.17509/jko-upi.v11i2.20309>
- Ramírez, M., Sánchez, A. B., García, P. E., Jiménez, F., & Vicén, J. A. (2022). *Effects of Plyometric Training on Lower Body Muscle Architecture , Tendon Structure , Stiffness and Physical Performance : A Systematic Review and Meta - analysis*. <https://doi.org/10.1186/s40798-022-00431-0>
- Shuai, C., Xiangyu, W., Zihao, L., & Xinqi, J. (2025). *Effects of Plyometric Training on Lower- Limb Explosive Power and Its Retention After Detraining in Sprinters*. 169. <https://doi.org/10.1177/15579883251363089>
- Stone, M. H., Hornsby, G., Mizuguchi, S., Sato, K., Gahreman, D., Duca, M., Carroll, K., Ramsey, M. W., Stone, M. E., & Haff, G. G. (2024). *The Use of Free Weight Squats in Sports : A Narrative Review — Squatting Movements , Adaptation , and Sports Performance : Physiological*. 1494–1508.
- Sugiyono. (2023). *METODE PENELITIAN KUANTITATIF KUALITATIF dan R&D*. CV Alfabeta.
- Swari, R. C. (2021). *Panduan Melakukan Squat Jump yang Baik dan Benar*. Hallosehat.
- Wenchao, R., Soh, K. G., Samsudin, S., Zhao, Y., Wang, X., & Zhang, X. (2025). *Effect of resistance training on kinetic and kinematic indicators in jump athletes : a systematic review*. 5. <https://doi.org/https://doi.org/10.1186/s13102-025-01249-5>
- Xiao, P., Ng, Y., Ler, H. Y., Low, J. Y., & Chan, K. Q. (2023). *Effect of fast stretch-shortening cycle plyometric training on lower limb strength qualities in rhythmic gymnasts*. 12(2), 61–65. <https://doi.org/10.4103/mohe.mohe>