



The Application of Rhythmic Step Training to Improve Leg Muscle Strength in Long Jump Athletes in East Kalimantan

Egenius Welafret Weda¹, Naheria², Gyta Krisdiana Cahyaningrum³, Jance Jacob Sapulate⁴, Muchamad Samsul Huda⁵

^{1,2,3,4,5} Pendidikan Jasmani/Fakultas Keguruan Dan Ilmu Pendidikan, Universitas Mulawarman, Samarinda, Indonesia

Abstract

The long jump is one of the events in athletics that requires good physical ability, especially leg muscle strength as the main factor in producing maximum thrust. Optimal leg muscle strength plays an important role in determining an athlete's jumping distance. However, based on observations in the field, the leg muscle strength of long jump athletes is still not optimal, so an appropriate training method is needed to improve this ability. One form of training that can be applied is step rhythm training, which emphasizes regularity of tempo, frequency, and coordination of steps in the initial phase leading up to the push-off. This study aims to determine the increase in leg muscle strength through the application of step rhythm training in long jump athletes in East Kalimantan. This study used a quantitative approach with a pre-experimental design through a one-group pretest-posttest design. The study population consisted of 32 long jump athletes from several districts/cities in East Kalimantan, with a sample of 12 senior athletes selected using purposive sampling. Data collection techniques used the Standing Broad Jump test to measure leg muscle strength before and after the application of step rhythm training. Data were analyzed using descriptive statistics and the Paired Sample t-Test inferential test after conducting the Shapiro–Wilk normality test. The results showed that the pretest mean value of 4.90 increased to 5.75 on the posttest. The Paired Sample t-Test results showed a significance value of 0.000 (Sig. < 0.05), indicating a significant increase after the application of step rhythm training. Thus, the application of step rhythm training can increase the leg muscle strength of long jump athletes in East Kalimantan.

Keywords: *Rhythmic Step Training, Leg Muscle Strength, Long Jump, Athletics.*

Correspondence author: Egenius Welafret Weda, Universitas Mulawarman, Indonesia.

Email:



Jurnal Pendidikan Jasmani (JPJ) is licensed under a [Creative Commons Attribution-ShareAlike 4.0 International License](https://creativecommons.org/licenses/by-sa/4.0/).

INTRODUCTION

Sports are physical activities that play a strategic role in shaping the quality of human resources, both in terms of health, fitness, and achievement. Sports activities not only serve to maintain physical and mental condition, but also become a means of character building and optimal development of individual potential (Syahriannor et al., 2024). In the context of performance development, sports are seen as a planned process that requires scientific support, appropriate training methods, and systematic program management (Wahyudin et al., 2025). One of the sports that forms the basis for various other sports is athletics. Athletics is known as *the mother of sport* because fundamental movements such as walking, running, jumping,

and throwing form the foundation for various forms of sporting activities (Cika Sinta Anggraeni¹, Rhama Nurwansyah², 2021; Zikri et al., n.d.).

Among the events contested in athletics, the long jump is a discipline that requires a combination of physical ability, technique, and high movement coordination. The long jump aims to achieve the longest possible jump distance through the stages of approach, takeoff, flight, and landing (PAIT1 & SUKENDRO², 2022). The success of the jump is largely determined by the quality of the takeoff phase, as this is when the horizontal speed from the run-up is converted into vertical thrust. Therefore, the strength and explosive power of the leg muscles are key components in supporting an athlete's performance. Leg muscles such as *the quadriceps femoris*, *hamstrings*, *gluteus maximus*, and calf muscles (*gastrocnemius* and *soleus*) play an important role in generating explosive force during the takeoff (Buckthorpe & Stride, 2019; Sutriawan & Syafruddin, 2024).

Physiologically, muscle strength is the ability of a muscle or group of muscles to perform maximum contraction when faced with a load (Nurulita & Sukanto, 2023). This strength does not appear instantly, but rather through a systematic, progressive, and continuous training process (Anggia, 2019). Training principles such as overload, specialization, individualization, and progressivity must be applied to ensure optimal physiological adaptation (Puspodari, 2020). In the context of improving long jump performance, various forms of physical training such as plyometrics, circuit training, and progressive weight training have been proven to contribute to increased strength and power in the leg muscles (Nurul Istiqomah, Shahibah Yuliani, 2025; Yayan Gozali, Donny Setiawan, 2024).

One relevant training approach to improve the quality of the push-off is step rhythm training. This exercise emphasizes the regularity of tempo, frequency, and stride length in the initial phase, helping athletes achieve precise and stable balance. Step rhythm training has been shown to influence movement efficiency and control of biomechanical load during physical activity (Futrell et al., 2020; Tudor-locke et al., 2019). Additionally, step rhythm training developed as sensorimotor training can also improve coordination and optimal involvement of the lower extremity muscles (Jee, 2022). Thus, this training not only plays a role in technical aspects but also provides strength and explosive power stimuli to the leg muscles.

Based on field observations, long jump athletes in East Kalimantan still face challenges in leg muscle strength, which affects the maximum results of their jumps. Although their initial speed is relatively good, their thrust during the takeoff phase is not yet optimal, so their jump distances have not reached their full potential. This condition indicates the need for more specific, targeted, and athlete-based training methods. Given the importance of leg muscle

strength in determining long jump performance, the application of step rhythm training is seen as a potential alternative to significantly improve the quality of the takeoff.

Based on the above description, this study focuses on the application of step rhythm training to improve leg muscle strength in long jump athletes in East Kalimantan. Theoretically, this study is expected to enrich the study of rhythm-based training methods in athletics. Practically, the results of this study are expected to serve as a reference for coaches in developing more effective and measurable training programs to support the improvement of long jump athletes' performance at the regional and national levels.

METHOD

This study uses a quantitative approach with a pre-experimental design. A quantitative approach was chosen because the study focuses on data in the form of measurement results that are analyzed using statistical techniques to determine whether there are changes after treatment. The design used is a One Group Pretest–Posttest Design, which is an experimental design involving one group without a control group. In this design, the same group is given an initial measurement (pretest) before the treatment and a final measurement (posttest) after the treatment, so that the difference in results before and after the training can be determined.

The research procedure was carried out in three main stages. The first stage was an initial measurement (pretest) to determine the initial condition of the athletes' leg muscle strength before the exercise program was given. The second stage was the implementation of a step rhythm exercise program that was given regularly during the research period in accordance with the predetermined exercise program design. The third stage is a final measurement (posttest) using the same instruments as in the pretest to see the increase in leg muscle strength after the treatment was given. The measurement data were analyzed using the Paired Sample t-Test statistical test to determine whether there was a significant difference between the results before and after treatment.

The population in this study consisted of all long jump athletes in East Kalimantan, totaling 32 athletes spread across several districts/cities, namely Berau, Tenggarong, Balikpapan, Samarinda, Bontang, East Kutai, North Penajam Paser, West Kutai, Paser, and Mahakam Ulu. According to (Dinilhaq et al., 2025), the population is a generalization area consisting of objects or subjects with certain characteristics determined by researchers to be studied and concluded.

The sampling technique used was purposive sampling, which is a technique for determining samples based on certain considerations relevant to the research objectives (Degree et al., 2017). The research sample consisted of 12 senior long jump athletes selected

using purposive sampling. This technique was used by considering the suitability of the subjects' characteristics to the research requirements, such as athletes who actively participated in training and had experience participating in championships. The sample consisted of 7 male athletes and 5 female athletes from several regions in East Kalimantan.

The data collection technique in this study used tests and measurements. The instrument used was the Standing Broad Jump test to measure leg muscle strength. Measurements were taken twice, before the application of the step rhythm exercise (pretest) and after the application of the step rhythm exercise (posttest). Each athlete performed several jump trials, and the best result was recorded as the final measurement value.

The research procedure was carried out in several stages, namely initial measurements to determine the strength of the athletes' leg muscles, followed by the application of programmed step rhythm training, and concluded with final measurements to determine the improvement in ability after the training was given.

Data analysis techniques use descriptive and inferential statistical analysis. Descriptive analysis is used to describe the mean, minimum, maximum, and standard deviation of the measurement results. Before conducting hypothesis testing, the data is first tested for normality using the Shapiro–Wilk test. Next, hypothesis testing is conducted using the Paired Sample t-Test to determine the increase in leg muscle strength between the pretest and posttest results.

RESULTS AND DISCUSSION

Result

This study aims to determine the effect of step rhythm training on leg muscle strength improvement in long jump athletes in East Kalimantan. Data collection was conducted through pretest and posttest using the Standing Broad Jump instrument to measure leg muscle strength before and after training.

Table 1. Descriptive Statistics of Leg Muscle Strength

Test	N	Min	Max	Mean	Std. Deviasi
Initial Measurement (<i>Pretest</i>)	12	5	5	4.90	0.253
Final Measurement (<i>Posttest</i>)	12	5	6	5.75	0.306

Based on Table 1, the average leg muscle strength in the pretest was 4.90 with a standard deviation of 0.253. After step rhythm training, the average increased to 5.75 with a standard deviation of 0.306. The minimum and maximum values in the posttest also showed an increase compared to the pretest. Descriptively, these data show an increase in leg muscle strength after the treatment was given.

Table 2. Distribution of Leg Muscle Strength Categories

Score interval	Pre-test (Person)	Post-Test (Person)	Category
$\leq 5,25$	11	0	Insufficient
$5,26 < 5,51$	1	3	Adequate
$5,51 < 5,76$	0	4	Good
$\geq 5,76$	0	5	Very Good
Number	12	12	

Based on Table 2, which shows the distribution of leg muscle strength categories, in the pre-test results, most athletes were in the Poor category (≤ 5.25), totaling 11 people, and 1 person was in the Fair category ($5.26 < 5.51$), while no athletes were in the Good ($5.51 < 5.76$) or Very Good (≥ 5.76) categories. After receiving step rhythm training, the post-test results showed a clear improvement, with no athletes remaining in the Poor category, 3 athletes in the Fair category, 4 athletes in the Good category, and 5 athletes reaching the Very Good category. Descriptively, this shift in distribution from lower categories to higher categories indicates an improvement in leg muscle strength across the entire research sample after receiving treatment.

Table 3. Normality Test (Shapiro Wilk)

Variabel	Significance value	Conclusion
Leg Muscle Strength (Pretest)	0.342	Normal
Leg Muscle Strength (Posttest)	0.250	Normal

Based on Table 3, the significance value for leg muscle strength data in the pretest was 0.342 and in the posttest was 0.250. Both values are greater than 0.05 (Sig. > 0.05), so it can be concluded that the data in both measurements are normally distributed. With the assumption of normality fulfilled, the data is suitable for further parametric statistical analysis, namely the Paired Sample t-Test to examine the difference between the pretest and posttest results.

Table 4. Hypothesis Testing (Paired Sample T-Test)

Variable	Mean	Sig (2-tailed)
Leg Muscle Strenght (Pre-test)	4,90	0,000
Leg Muscle Strenght (Post-test)	5,75	

Based on Table 4, the average leg muscle strength value in the pre-test was 4.90 and increased to 5.75 in the post-test. The results of the Paired Sample t-Test showed a significance value (Sig. 2-tailed) of 0.000. Because the significance value is less than 0.05 ($0.000 < 0.05$), there is a significant difference between the pre-test and post-test results. Thus, it can be concluded that the application of step rhythm training has a significant effect on increasing the leg muscle strength of long jump athletes in East Kalimantan.

Discussion

The results of the study indicate that the application of step rhythm training has a significant effect on increasing leg muscle strength. The increase in the average value from 4.90 to 5.75 shows that the training provided is able to effectively stimulate muscle adaptation. Physiologically, muscle strength is the ability of a muscle or group of muscles to perform maximum contraction against a certain load (Nurulita & Sukamto, 2023). Strength adaptation occurs when training is carried out systematically and continuously in accordance with training principles.

The step rhythm training applied in this study emphasizes the regularity of tempo, frequency, and stride length in the initial phase leading up to the push-off. Step rhythm regulation plays a role in improving movement efficiency and biomechanical control during physical activity (Futrell et al., 2020; Tudor-locke et al., 2019). Through structured repetition of movements, leg muscles such as the quadriceps femoris, hamstrings, gluteus maximus, gastrocnemius, and soleus are optimally stimulated to generate explosive force during the push-off phase (Buckthorpe & Stride, 2019; Sutriawan & Syafruddin, 2024).

In addition, training was conducted in accordance with the principles of overload and progressivity as described by (Puspodari, 2020), namely that a gradual increase in training load is necessary to encourage physiological adaptation. In line with the opinion of (Anggia, 2019), repeated and measured training will improve athletes' physical abilities, including leg muscle strength.

The results of this study are also consistent with the concept that leg muscle strength is a major component in generating maximum thrust in the long jump. Without adequate strength support, initial speed cannot be optimally converted into vertical thrust. Therefore, increasing leg muscle strength through step rhythm training contributes significantly to the quality of the takeoff phase.

Thus, the findings of this study reinforce that step rhythm training not only functions as a technical exercise in regulating the initial rhythm, but is also effective in improving athletes' physical capacity, particularly leg muscle strength. Consistent and programmed application of this training can be an alternative coaching strategy to improve the performance of long jump athletes in East Kalimantan.

CONCLUSION

Based on the results of research and data analysis that has been conducted, it can be concluded that the application of step rhythm training has a significant effect on increasing leg

muscle strength in long jump athletes in East Kalimantan. This is demonstrated by an increase in the average leg muscle strength score from 4.90 in the pretest to 5.75 in the posttest, as well as the results of the Paired Sample t-Test, which showed a significance value of 0.000 (Sig. < 0.05). These findings prove that step rhythm training conducted in a structured, measured, and continuous manner can effectively stimulate muscle adaptation, thereby improving athletes' push-off ability during the takeoff phase. Thus, step rhythm training can be recommended as an effective training method to support the improvement of leg muscle strength and enhance the performance of long jump athletes.

ACKNOWLEDGMENT

The author would like to express his deepest gratitude to all those who have provided support in the implementation of this research. Special thanks go to Mrs. Naheria, S.Pd., M.Pd. as the supervisor who has provided direction, guidance, and motivation during the process of preparing and conducting this research. The author would also like to thank the Faculty of Teacher Training and Education at Mulawarman University, particularly the Physical Education Study Program, for the academic support and facilities provided. High appreciation is also expressed to the East Kalimantan long jump athletes who were willing to be research subjects and actively participated during the data collection process. May all the assistance, support, and cooperation that has been given be rewarded appropriately and contribute positively to the development of science, especially in the field of athletics.

REFERENCES

- Anggia, O. (2019). Survei Efektivitas Latihan Pada Ekstrakurikuler Sepak Bola Di Smp Negeri 4 Dedai. *Jurnal Ilmu Keolahragaan*, 2(1), 1. <https://doi.org/10.26418/jilo.v2i1.32625>
- Buckthorpe, M., & Stride, M. (2019). Clinical Commentary Assessing And Treating Gluteus Maximus Weakness – A Clinical Commentary. *Clinical Commentary*, 14(4), 655–669. <https://doi.org/10.26603/ijst20190655>
- Cika Sinta Anggraeni¹, Rhama Nurwansyah², A. K. Y. R. (2021). *Tingkat Pengetahuan Pembelajaran Atletik Lari Jarak Pendek Pada Siswa Sekolah Menengah Atas Kelas XII*. 7(8). <https://doi.org/10.5281/zenodo.5804633>
- Degree, T. H. E., Masters, O. F., Science, O. F., & Sport, I. N. (2017). *Post Graduate Program Directorate Track And Field Events Result Success Comparison Among The Selected Addis Ababa Second Division Athletics Clubs By Desalegn tegegn Track And Field Events Result Success Comparison Among The Selected Addis Ababa Second Divi*. June.
- Dinilhaq, N. A., Amelia, Y., Arini, A., & Hidayatullah, R. (2025). *Populasi dan Sampel dalam Penelitian Pendidikan : Memahami Perbedaan , Implikasi , dan Strategi Pemilihan yang*

Tepat.

- Futrell, E. E., Gross, K. D., Reisman, D., Mullineaux, D. R., & Davis, I. S. (2020). Transition to forefoot strike reduces load rates more effectively than altered cadence. *Journal of Sport and Health Science*, 9(3), 248–257. <https://doi.org/10.1016/j.jshs.2019.07.006>
- Jee, Y. (2022). Effects of Rhythm Step Training on Physical and Cognitive Functions in Adolescents : A Prospective Randomized Controlled Trial. *Healthcare*, 10(1), 2.
- Nurul Istiqomah, Shahibah Yuliani, N. S. (2025). Jurnal dunia pendidikan. *Jurnal Dunia Pendidikan*, 5(April), 67–78. <http://jurnal.stokbinaguna.ac.id/index.php/JURDIP/article/view/2083>
- Nurulita, R. F., & Sukamto, A. (2023). 1605-Article Text-5885-1-10-20231130. 4(November), 208–215.
- PAIT1, P. S., & SUKENDRO2. (2022). Pengaruh Latihan Sprint Pendek dan modifikasi Box Skip Terhadap Kemampuan Lompat Jauh pada Siswa SMP Negeri 19 Kota Jambi. 04(01), 37–47.
- Puspodari. (2020). Tingkat Volume Oksigen Maksimal Atlet Cabor Konsentrasi Unggulan Senam Puslatkot Kota Kediri Dalam Menghadapi Pekan Olahraga ProvinsI 2022. *Jurnal Kejaora: Jurnal Kesehatan Jasmani Dan Olah Raga*, 5(November), 62–65.
- Sutriawan, A., & Syafruddin, M. A. (2024). Pengaruh Latihan Calf Raise terhadap Peningkatan Hasil Lompat Jauh. *Jurnal Dunia Pendidikan*, 5(3), 672–677. <https://jurnal.stokbinaguna.ac.id/index.php/JURDIP/index>
- Syahriannor, M., Warni, H., & Rahmadi, R. (2024). Upaya meningkatkan power otot tungkai melalui latihan single leg hop dan double leg hop pada atlet lompat jauh pasi hulu sungai selatan. *Multilateral: Jurnal Pendidikan Jasmani Dan Olahraga*, 23(4), 221. <https://doi.org/10.20527/multilateral.v23i4.20935>
- Tudor-locke, C., Aguiar, E. J., Han, H., Ducharme, S. W., Jr, J. M. S., Barreira, T. V, Moore, C. C., Busa, M. A., Lim, J., Sirard, J. R., Chipkin, S. R., & Staudenmayer, J. (2019). *Walking cadence (steps / min) and intensity in 21 – 40 year olds : CADENCE-adults*. 1–11.
- Wahyudin, Marlina, Hasnawati, Wafiah, A., Basri, M., & Suwardoyo, U. (2025). *Memahami Teknologi Augmented Reality (Ar) Dan Virtual Reality (Vr) Untuk Pemula*. 1–23.
- Yayan Gozali , Donny Setiawan, G. F. 3. (2024). Efektivitas Latihan Plyometric Dalam Meningkatkan Kekuatan Dan Kelincahan. *Jurnal Olahraga Dan Kesehatan Indonesia (JOKI)*, 2, 94–99. <https://jurnal.stokbinaguna.ac.id/index.php/JOK>
- Zikri, A., Kes, M., Juita, A., Pd, S., & Pd, MRamadi, D. (n.d.). *Tungkai Dengan Hasil Lompat Jauh Gaya Jongkok Siswa Kelas Vii Smp Negeri 4 Pekanbaru Tungkai Dengan Hasil Lompat Jauh Gaya Jongkok Siswa Kelas Vii Smp Negeri 4 Pekanbaru. X*, 1–13.