

EFFECTIVENESS OF FLEXIBILITY EXERCISES IN IMPROVING THE PERFORMANCE OF THE DOUBLE HURIGI KICK IN ACEH'S PON HAPKIDO ATHLETES

Latifah Hanum^{*1}, Habib Rizki², Icut Rahayu³, Arifa Rizal M⁴, Angga Rizki Pratama⁵
^{1,2,3,4,5}Physical Education, Faculty of Teacher Training and Education, Universitas Bina Bangsa Getsempena, Indonesia

* Corresponding Author: latifah@mahasiswa.bbg.ac.id

ARTICLE INFO

Article history:

Received : Mar 05, 2026

Revised : May 25, 2026

Accepted : Jun 28, 2026

Available online : Jun 30, 2026

Kata Kunci:

latihan fleksibilitas, dwi hurigi, performa tendangan, atlet Hapkido, olahraga prestasi.

Keywords:

flexibility training, Dwi Hurigi, kicking performance, Hapkido athlete, competitive sports.

ABSTRAK

Double hurigi kick is a Hapkido technique that requires good hip joint flexibility, coordination, balance, and precision of movement. Initial observations indicate that the double hurigi kicking ability of athletes at the Aceh National Hapkido Sports Week is not optimal, especially in performing hip joint rotation. This study aims to analyze the effectiveness of flexibility training in improving the double hurigi kicking performance of athletes at the Aceh National Hapkido Sports Week. The study used a quantitative approach with an experimental method through measurements before and after treatment. The sample consisted of six Aceh Hapkido athletes selected using a saturated sampling technique. The treatment was given for fourteen meetings in the form of flexibility training that

included dynamic stretching, static stretching, and stretching with the help of a partner. Flexibility was measured using a sitting reach test, while kicking performance was assessed using a double hurigi kicking technique assessment scale. Data were analyzed using a paired difference test. The results showed an average increase in kicking performance from 2.3333 before treatment to 3.0000 after treatment, with a significance value of 0.025 which is smaller than 0.05. The novelty of this research lies in the application of a specific flexibility training program to improve the performance of the dwi hurigi technique in Hapkido athletes at the National Sports Week level, a practice that has received limited empirical research. Thus, flexibility training effectively improves the performance of dwi hurigi kicks in Acehnese Hapkido athletes.

This is an open access article under the [CC BY-NC](https://creativecommons.org/licenses/by-nc/4.0/) license.

Copyright © 2026 by Author. Published by Universitas Bina Bangsa Getsempena



INTRODUCTION

Hapkido is a martial art that demands integrated physical abilities and technical mastery, particularly in movements involving the legs as the main part of the attack. One technique that has a high level of difficulty is the *dwi hurigi kick*. Executing this technique requires coordination of movement, balance, leg strength, and the ability of joints and muscles to move within an adequate range. In the context of martial arts, the quality of a

kick is determined not only by the power generated, but also by speed of movement, technical mastery, joint mobility, and body flexibility. A study (Corcoran et al., 2024) of various kicking techniques in martial arts shows that kicking performance is influenced by several factors, including technical mastery, lower body strength, flexibility, effective mass, and target characteristics. Therefore, flexibility is one of the relevant physical condition components to support the execution of complex kicking techniques such as *dwi hurigi*.

Flexibility relates to an athlete's ability to generate the required range of joint motion during sporting activities. This ability becomes increasingly important in martial arts, which involve frequent pelvic rotation, leg elevation, body position changes, and kicks at high targets. (Aybüke Yılmaz & Ateş, 2025) explain that martial artists who use kicking techniques require adequate range of motion to execute the technique efficiently without compromising on power and speed. Broader findings also indicate that stretching exercises can increase joint range of motion. Stretching exercises provide significant increases in range of motion, with static stretching and proprioceptive neuromuscular facilitation showing greater increases in range of motion than some forms of dynamic or ballistic stretching (Konrad et al., 2024). This strengthens the physiological basis for the notion that flexibility training can be an important component of training programs for sports requiring large amplitudes of motion.

The urgency of implementing flexibility training becomes even more apparent when linked to the characteristics of kicks, which require hip mobility and leg coordination. (Paramitha et al., 2020) found that sixteen sessions of flexibility training improved the accuracy of *dollyo chagi* kicks in taekwondo athletes. Furthermore, research on martial arts athletes has shown that certain stretching methods can produce immediate changes in flexibility. Stretching with proprioceptive neuromuscular facilitation improved flexibility in *kickboxing* athletes, although other physical performance responses may differ depending on the type of activity performed after the stretching. (Eken & Bayer, 2022). These findings indicate that flexibility cannot be viewed simply as a general supporting component, but needs to be specifically designed to suit the technical characteristics and performance needs of each sport.

This issue is relevant to the condition of the Aceh National Hapkido Sports Week athletes who were the subjects of this study. Based on initial observations in the study, the athletes' *dwi hurigi* kicking ability was still suboptimal even though they had practiced the technique for at least five months. The problems observed were primarily related to incomplete hip rotation, which affected kick quality. This condition is important to address

because the *dwi hurigi technique* requires good pelvic mobility for effective movement sequences. Research on Hapkido training programs also demonstrates the relevance of flexibility and leg function. A twelve-week Hapkido training program resulted in significant changes in flexibility and leg muscle function, including hip extension and flexion (Park et al., 2021) . However, this study was conducted on elementary school students and focused on general leg fitness and function, so it does not directly explain the effectiveness of flexibility training on the performance of specific kicking techniques in competitive athletes.

The research gap in this study lies in the limited number of studies specifically examining flexibility training interventions on the performance of *the dwi hurigi technique* in competitive Hapkido athletes. Previous research has focused primarily on taekwondo and kickboxing, or examined flexibility as part of general physical conditioning. In fact, a systematic review (Afonso et al., 2024) of 300 stretching studies in athletes showed that research focused primarily on acute effects, with chronic interventions accounting for less than a fifth of the studies analyzed. Elite athletes are also significantly underrepresented in these studies. In the field of kicking biomechanics, a systematic review (Aybüke Yılmaz & Ateş, 2025) also showed that research is still concentrated on taekwondo kicking techniques, particularly *the dollyo chagi* , with kicking performance primarily assessed through aspects of hip joint torque, ground reaction force, distal segment velocity, joint coordination, and energy transfer. Thus, empirical evidence regarding flexibility interventions specifically directed at *dwi hurigi* in Hapkido still needs to be strengthened.

This gap has also been identified in the thesis that serves as the basis for this article, namely the lack of specific evidence regarding the impact of flexibility on the *dwi hurigi ability* of Hapkido athletes participating in the National Sports Week. Based on this, *the novelty* of this study lies in the application of flexibility training specifically directed to improve the performance of *dwi hurigi kicks* in athletes participating in the Aceh National Sports Week Hapkido. Another novelty is the use of a series of exercises that include dynamic stretching, static stretching, and stretching with the help of a partner in a structured intervention program. In this study, flexibility training treatment was given fourteen times before the final measurement of kicking ability. This focus provides a more specific contribution compared to previous studies that mostly discuss flexibility in other martial arts or evaluate physical ability in general.

Based on the description, increasing flexibility is one of the important aspects to be studied as part of the effort to improve the quality of the *dwi hurigi technique* in Hapkido

athletes. Intervention-based research on athletes at the National Sports Week level is needed so that the relationship between flexibility training and technical performance is not only based on biomechanical assumptions or findings from other martial arts, but also obtains empirical evidence in the context of Hapkido. Therefore, this study aims to analyze the effectiveness of flexibility training in improving the performance of *dwi hurigi kicks* in athletes at the Aceh National Hapkido Sports Week. The results of the study are expected to provide a scientific basis for coaches in developing flexibility training programs that are more specific, systematic, and in accordance with the demands of the *dwi hurigi technique*.

RESEARCH METHODS

Study This use approach quantitative with method experiment For analyze effectiveness exercise flexibility to performance kick *bi hurigi* in Aceh Hapkido athletes . Implementation study conducted on August 9 to 20, 2024 at the center exercise Aceh Hapkido athletes . Measurements done before and after giving treatment so that change performance kick athlete can compared to based on condition beginning and conditions after follow a training program flexibility .

Subject study consists of on six Aceh Hapkido athletes who participated preparation for the National Sports Week . Determination sample use technique sample saturated , namely all over athletes who fulfill characteristics subject study made into sample . Each athlete follow series research consisting of on measurement beginning , giving treatment exercise flexibility , and measurement end .

Implementation study consists of on six twelve meeting . Meeting First used For measurement beginning ability kick *bi hurigi* , then four twelve meeting next used For giving exercise flexibility , and meetings sixth twelve used For measurement end . Training program flexibility covers stretching dynamic , static stretching , stretching with help friends , and combination from third form stretching said . Before core training , athletes do heating , while core activities in the form of exercise flexibility implemented during not enough more three tens minutes on each session .

Data collection was carried out through measurement flexibility and performance kick *bi hurigi* . Flexibility athlete measured use test *sit and reach* , whereas performance kick measured use scale evaluation standard technique *bi hurigi* . Instrument supporters study includes kick targets , forms assessment and field test . Assessment kick based on successful targets achieved , namely kick to the body area to get two points , kick to the head area get three points , kicks rotate to the body area to obtain four points , and kicks rotate to the

head area earn five points . Each athlete given two chances do kicks and results best used as research data .

Result data measurement analyzed in a way descriptive For get mean and deviation values standard , then to be continued with analysis inferential using a difference test in pairs For know difference performance kick *bi hurigi* before and after giving exercise flexibility . Analysis done use device Statistical Package for the Social Sciences software version 15. Statistical decisions set based on level significance of five percent . If mark significance more small from level said , practice flexibility stated give significant influence to performance kick *bi hurigi* in Aceh Hapkido athletes .

RESULTS AND DISCUSSION

Research Result

This study involved six Acehnese Hapkido athletes who underwent a series of measurements before and after flexibility training. Initial measurements were taken to determine the initial performance of the *dwi hurigi kick* . The athletes were then given fourteen flexibility training sessions, followed by a final measurement. Kicking performance was assessed through two trials, with the best score used as the research data.

Measurement results showed a change in the performance of the *double -kick* after flexibility training. In the initial measurement, two athletes scored 3 and four athletes scored 2. After participating in the flexibility training program, all athletes scored 3. Thus, four of the six athletes experienced an increase in kicking scores, while two athletes maintained their scores obtained in the initial measurement.

Table 1. Comparison of *double kick performance* before and after flexibility training

No.	Athlete	Before practice	After practice
1	Grace	3	3
2	Yulianto	2	3
3	Rahmi	3	3
4	Cindy	2	3
5	Haris	2	3
6	Tiara	2	3

Individual data showed that score changes primarily occurred in athletes who initially scored 2. Yulianto, Cindy, Haris, and Tiara improved from 2 to 3, while Rahmat and Rahmi scored 3 both before and after the treatment. These results indicate a trend toward improved and more equitable kicking performance after athletes participated in the flexibility training program.

Descriptive statistical analysis shows that the average score of the *dwi hurigi kick performance* before being given flexibility training was 2.3333 with a standard deviation of 0.51640. After being given flexibility training, the average score increased to 3.0000 with a

standard deviation of 0.00000. The average difference between the measurements before and after treatment was 0.66667 points.

Table 2. Descriptive statistics of *double kick performance*

Measurement	Number of athletes	Average	Standard deviation	Standard error
Before practice	6	2.3333	0.51640	0.21082
After practice	6	3.0000	0.00000	0.00000

The average increase from 2.3333 to 3.0000 indicates that the performance of the *double- kick* after flexibility training was higher than before treatment. Furthermore, the standard deviation, which changed from 0.51640 to 0.00000, indicates that all athletes achieved the same score, namely 3, in the final measurement.

To determine whether the difference was statistically significant, a paired difference test was conducted between the measurement results before and after flexibility training. The analysis results showed an average difference of negative 0.66667 when calculated from the pre-score minus the post-score, with a standard deviation of 0.51640 and a standard error of 0.21082. The test statistic value was negative 3.162 with 5 degrees of freedom and a significance value of 0.025.

Table 3. Results of the test of the difference in performance of the *double kick*

Comparison	Average difference	Standard deviation	Standard error	Test statistics	Degrees of freedom	Significance
Before after	-0.66667	0.51640	0.21082	-3,162	5	0.025

The significance value of 0.025 is smaller than the significance level of 0.05. These results indicate that there is a significant difference between the performance of the *dwi hurigi kick* before and after the provision of flexibility training. By observing the increase in the average score from 2.3333 to 3.0000, flexibility training is declared effective in improving the performance of the *dwi hurigi kick* in the Aceh Hapkido athletes who were the subjects of the study.

In addition to kicking performance results, the thesis also reports a significance value of 0.001 for flexibility measurements, while the significance value for *double kicking ability* is 0.025. Both values are below the 0.05 significance level, thus supporting the existence of changes after the flexibility training program. Overall, the research findings show that structured flexibility training is followed by an increase in *double kicking performance* in Acehnese Hapkido athletes.

Discussion

The results of the study showed that flexibility training effectively improved the performance of the *dwi hurigi kick* in athletes at the Aceh Hapkido National Sports Week.

The average kick performance score increased from 2.3333 before training to 3.0000 after training, while the results of the difference test obtained a statistical value of negative 3.162 with a significance value of 0.025. This value indicates a significant difference between kick performance before and after athletes underwent a flexibility training program. These results indicate that flexibility is a component of physical condition that plays a role in supporting the quality of kick execution, especially in techniques that require a large range of motion in the legs and pelvis.

Improved kicking performance following flexibility training can be explained by the increased ability of joints to move through a wider range of motion. Regular stretching exercises can increase joint range of motion, allowing limbs to move with greater amplitude and freedom when performing sporting skills. A meta-analysis of 77 studies showed that stretching exercises provide significant increases in range of motion, with static stretching and proprioceptive neuromuscular facilitation producing greater improvements than some forms of dynamic or ballistic stretching in long-term programs (Konrad et al., 2024). This is relevant to the *dwi hurigi technique*, as athletes require a wide range of motion in the pelvis and leg when lifting, rotating, and directing the leg toward the target.

Hip flexibility is becoming increasingly important because kicking quality in martial arts is closely related to the ability of the legs and pelvis to achieve optimal movement positions. Athletes with better kicking quality were found to have significant differences in lower extremity range of motion, hip flexion, knee extension, kick angle, and pelvic tilt compared to athletes with lower kicking quality (Lee et al., 2024). These results reinforce the findings of this study because the initial problems of Acehnese Hapkido athletes were primarily related to imperfect hip rotation, which affected the execution of the *dwi hurigi kick*. Thus, increased flexibility can provide better range of motion for the pelvis, making it easier for athletes to position their legs in the appropriate position when kicking.

dwi hurigi performance is also in line with research in other martial arts with similar kicking movement characteristics. Flexibility training over sixteen sessions has been shown to improve the accuracy of *dollyo chagi* kicks in taekwondo athletes, thus flexibility can be viewed as one aspect of physical condition that supports the accuracy of kicking techniques (Paramitha et al., 2020). The similarity of these results suggests that the benefits of flexibility training are not limited to the ability to achieve a wider range of motion, but can contribute to the execution of kicking techniques that require coordination between pelvic rotation, leg movement, balance, and foot placement towards the target.

The training program in this study used a combination of dynamic stretching, static stretching, and peer-assisted stretching, delivered in a structured manner over fourteen sessions. The use of these various forms of stretching provided different stimuli to the muscular and joint systems. Regular static stretching had a significant positive effect on increasing flexibility, while a chronic stretching program produced greater changes in flexibility than a single session (Ingram et al., 2025) . Long-term stretching can also reduce muscle stiffness and improve the ability of muscle tissue to undergo length changes during movement (Takeuchi, K et al., 2023) . These adaptations allow athletes to perform a wider range of movements, thus supporting the execution of kicking techniques that require high mobility.

Static stretching and proprioceptive neuromuscular facilitation exercises also have a strong physiological basis for use in developing athlete flexibility. Chronic stretching has been shown to increase range of motion, while proprioceptive neuromuscular facilitation and static stretching have been shown to be effective in developing flexibility over the long term (Konrad et al., 2024) . This may explain why the combination of training methods in this study was able to produce changes in kicking ability. Athletes not only receive active movement stimulation through dynamic stretching but also receive stimulation to increase stretch tolerance and range of motion through static stretching and the assistance of a training partner.

Hapkido, as a martial art, also requires the development of flexibility along with other components of physical conditioning. A twelve-week Hapkido training program has been shown to produce significant changes in flexibility, strength, muscular endurance, and cardiorespiratory endurance, as well as changes in lower extremity muscle function (Polii et al., 2024) . These findings demonstrate that flexibility is a component that can be significantly developed through structured Hapkido training. In the context of this research, providing more specific flexibility training could be a strategy to strengthen the physical components directly required in *dwi hurigi* .

Kick quality in martial arts is not primarily determined by a single physical component, but rather by the interaction of technical ability, lower-body strength, flexibility, motor coordination, and body mass utilization. Lower-extremity flexibility and strength are factors that influence the speed and force generated in various martial arts kicking techniques (Corcoran et al., 2024) . Therefore, the improvement in *dwi hurigi performance* after flexibility training in this study does not imply that flexibility is the sole determinant of kicking success. Flexibility is better understood as a supporting component

that enables athletes to utilize their strength, coordination, speed, and technique more effectively within the required range of motion.

Hip mobility plays a strategic role in kicking because energy transfer in martial arts techniques occurs through the coordination of body segments from the proximal to the distal parts. Biomechanical analysis of kicking techniques shows that hip joint torque, ground reaction force, distal segment velocity, joint coordination, and energy transfer are the main factors influencing kick quality. Hip mobility training and proximal-to-distal movement coordination training are recommended to increase movement output while reducing unnecessary joint loading (Aybüke Yılmaz & Ateş, 2025) . This is particularly relevant to *dwi hurigi* , which requires rapid hip rotation and leg coordination to produce precise kick trajectories.

Improved performance after repeated training also reflects the principle of training adaptation. An athlete's physical performance develops through systematic training stimuli of adequate duration. Training duration is positively related to an athlete's physical capacity, so consistent training is a crucial factor in developing physical fitness and sports performance (Pranata et al., 2024) . In this study, athletes underwent fourteen flexibility training sessions before the final measurements. This repetitive training pattern provides an opportunity for the neuromuscular system, muscle tissue, and joints to adapt to the stretching stimulus.

The research findings also showed that before the treatment there were four athletes with a score of 2 and two athletes with a score of 3, whereas after the treatment all athletes obtained a score of 3. The standard deviation which was originally 0.51640 to 0.00000 indicates that the final results of all athletes became homogeneous with the same score. This condition indicates that flexibility training mainly provides changes in athletes who have lower initial scores. This is in line with evidence that individuals with lower initial flexibility can achieve greater flexibility improvements after participating in a stretching program than individuals who have better flexibility from the start (Ingram et al., 2025) .

Overall, the results of this study strengthen the evidence that flexibility is a crucial component in supporting kicking techniques in martial arts. The novelty of this study lies in the application of a specific flexibility training program to the performance of *double kicks* in Hapkido athletes at the National Sports Week level. Previous studies have focused more on kicking techniques in taekwondo and other martial arts, while studies of kicking biomechanics are still largely dominated by taekwondo techniques (Aybüke Yılmaz & Ateş, 2025) . Thus, this study extends the application of evidence regarding the role of flexibility

to the context of *double kick techniques* in Hapkido and provides a practical basis for coaches to incorporate flexibility training as part of a kicking technique improvement program.

Despite showing significant results, the study findings need to be interpreted considering the sample size of only six athletes and the study's implementation, which ultimately compared the same group of athletes before and after treatment. Therefore, the study results provide initial evidence regarding the effectiveness of flexibility training in athletes at the Aceh National Hapkido Games, but generalization to a broader population of Hapkido athletes still requires research with a larger sample size, comparison group, more specific hip range of motion measurements, and kick biomechanical analysis.

CONCLUSIONS AND SUGGESTIONS

Conclusion

Based on the research results, flexibility training effectively improves the performance of the *dwi hurigi kick* in athletes at the Aceh Hapkido National Sports Week. This is indicated by an increase in the average kick score from 2.3333 before treatment to 3.0000 after treatment and a significance value of 0.025 which is smaller than 0.05. These findings indicate that providing structured flexibility training can help athletes improve motor skills that support the implementation of the *dwi hurigi kick*, especially in the aspects of flexibility, coordination, balance, and quality of kicking movements.

Suggestion

Hapkido coaches are advised to incorporate flexibility training in a structured and consistent manner as part of their training program, especially before core technique training, to support improved *dwi hurigi kick performance*. Further research is recommended to involve a larger sample size, use a comparison group, extend the duration of the intervention, and examine other factors such as strength, speed, balance, coordination, and hip joint mobility to obtain a more comprehensive picture of the factors that influence the quality of Hapkido kicks. The suggestion of using flexibility training and examining other factors is also in line with the recommendations stated in this thesis.

REFERENCES

Afonso, J., Andrade, R., Rocha-Rodrigues, S., Nakamura, F. Y., Sarmiento, H., Freitas, S. R., Silva, A. F., Laporta, L., Abarghoueinejad, M., Akyildiz, Z., Chen, R., Pizarro, A., Ramirez-Campillo, R., & Clemente, F. M. (2024). What We Do Not Know About Stretching in Healthy Athletes: A Scoping Review with Evidence Gap Map from 300 Trials. In *Sports Medicine* (Vol. 54, Number 6). Springer International Publishing.

- <https://doi.org/10.1007/s40279-024-02002-7>
- Aybüke Yılmaz, E., & Ateş, O. (2025). Taekwondo Kicks At the Center of Biomechanical Research: a Systematic Review. *Kinesiology*, 57(2), 289–307. <https://doi.org/10.26582/k.57.2.13>
- Corcoran, D., Climstein, M., Whitting, J., & Del Vecchio, L. (2024). Impact Force and Velocities for Kicking Strikes in Combat Sports: A Literature Review. *Sports*, 12(3), 1–17. <https://doi.org/10.3390/sports12030074>
- Eken, Ö., & Bayer, R. (2022). Acute effects of proprioceptive neuromuscular facilitation stretching, massage and combine protocols on flexibility, vertical jump and hand grip strength performance in kickboxers. *Pedagogy of Physical Culture and Sports*, 26(1), 4–12. <https://doi.org/10.15561/26649837.2022.0101>
- Ingram, L. A., Tomkinson, G. R., d’Unienville, N. M. A., Gower, B., Gleadhill, S., Boyle, T., & Bennett, H. (2025). Optimising the Dose of Static Stretching to Improve Flexibility: A Systematic Review, Meta-analysis and Multivariate Meta-regression. *Sports Medicine*, 55(3), 597–617. <https://doi.org/10.1007/s40279-024-02143-9>
- Konrad, A., Alizadeh, S., Daneshjoo, A., Anvar, S. H., Graham, A., Zahiri, A., Goudini, R., Edwards, C., Scharf, C., & Behm, D. G. (2024). Chronic effects of stretching on range of motion with consideration of potential moderating variables: A systematic review with meta-analysis. *Journal of Sport and Health Science*, 13(2), 186–194. <https://doi.org/10.1016/j.jshs.2023.06.002>
- Lee, J., Ji, H., Yoo, H., Lee, J.-H., & Jung, S. (2024). Comparison of Lower-Extremity Range of Motion according to Sidekick Quality in Taekwondo Poomsae Athletes. *Journal of Musculoskeletal Science and Technology*, 8(1), 42–48. <https://doi.org/10.29273/jmst.2024.8.1.42>
- Paramitha, S. T., Rosadi, T. Y., Ramadhan, M. G., & Suwanta, D. M. (2020). The Influence of Flexibility Training on the Accuracy of the Dollyo Chagi Kick in Taekwondo Martial Arts. *International Conference on Sport Science, Health, and Physical Education*, 21(Icsshpe 2019), 317–320. <https://doi.org/10.2991/ahsr.k.200214.084>
- Park, T.S., Kim, J.S., & Kim, J. (2021). The impact of perceived hapkido service quality on exercise continuation and recommendation intentions, with a focus on Korean middle and high school students. *Sustainability (Switzerland)*, 13 (6). <https://doi.org/10.3390/su13063389>
- Polii, G., Berhimpong, M., Pangemana, M., Studi, P., Keolahraga, I., Kesehatan, J., & Rekreasi, D. (2024). Cardiopulmonary Endurance Profile of Hapkido Club Members Esa Keter Martialart Academy Minahasa 2024 Martialart Academy by using Multi-Stage Fittestest or Bleep Test. knowing the maximum oxygen intake of an athlete (NATIONAL, 2016). *Jurnal Praba: Jurnal Rumpun Kesehatan Umum*, (4). <https://doi.org/https://doi.org/10.62027/praba.v2i4.173>
- Pranata, D. Y., Hidayatullah, F., Sulaiman, Sumartiningsih, S., Pramono, H., & Setiawaty, H. (2024). Health and fitness study of Semarang soccer players: the role of VO2 max, body mass index, age and length of training. *Retos*, 61, 400–404. <https://doi.org/10.47197/retos.v61.108184>
- Takeuchi, K., Nakamura, M., Konrad, A., & Mizuno, T. (2023). Long-term static stretching can decrease muscle stiffness: A systematic review and meta-analysis. *Scandinavian Journal of Medicine & Science in Sports*, 33(8), 1294–1306. <https://doi.org/10.1111/sms.14402>