



The Effect of Massage Gun and Ice Bath on the Recovery of Young National Athletes: Feminine and Masculine Perspectives of Program Implementation from January to June 2025

Ridha Mustaqim^{1*}, Berliana², Hadiat Aliansyah³, Tian Kurniawan⁴, Tono Haryono⁵

^{1,2,3} Sports Coaching Education Study Program, Universitas Pendidikan Indonesia, Setiabudhi 229, West Java, 40154, Indonesia

^{4,5} Department of Sport Science, Universitas Pendidikan Indonesia, Setiabudhi 229, West Java, 40154, Indonesia

Abstract

Fatigue is a common consequence of high-intensity sports and cannot be resolved by rest alone, as it relates to energy metabolism. It can be categorized into physical and mental fatigue, with symptoms such as Delayed Onset Muscle Soreness (DOMS), muscle and joint pain, reduced flexibility, cramps, swelling, and inflammation. Recovery is therefore crucial in training, as it promotes cell regeneration, prevents injuries, and reduces lactic acid buildup, which serves as an indicator of fatigue. This study investigates the effects of ice bath and massage gun methods on recovery in young national taekwondo and gymnastics athletes. An experimental pretest-posttest control group design was applied to 18 purposively selected athletes training under the Ministry of Youth and Sports. Blood lactate levels were measured objectively through blood sampling, while pain perception was assessed subjectively using the Visual Analog Scale (VAS). Sport-specific fatigue patterns were considered, with taekwondo athletes showing predominantly lower-body DOMS (100% legs), while gymnastics athletes presented a balanced distribution (50:50). Results demonstrated that both recovery methods significantly reduced lactic acid levels, as reflected in lower VAS scores. In conclusion, ice bath and massage gun treatments provide effective recovery strategies to support performance maintenance in young athletes.

Keywords: *Massage Gun, Ice bath, Recovery, Feminine, Masculine*

Correspondence author: Ridha Mustaqim, Universitas Pendidikan Indonesia, 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

Fatigue is an inevitable phenomenon that occurs in every individual engaged in high-intensity sports activities. This condition cannot be fully overcome by resting alone, because fatigue is closely related to disturbances in the body's energy metabolism system, especially when energy supply during exercise is inadequate (Pahlevi et al., 2024). Fatigue itself can be categorized into two types: mental fatigue and physical fatigue. Mental fatigue generally arises from prolonged mental demands, such as focus and decision-making, while physical fatigue is more associated with repetitive muscular work and biomechanical stress (Vygotsky, 2020; Haryono et al., 2025). The effects of fatigue are evident in various sports, where biomechanical changes significantly alter performance. For instance, fatigue has been shown to impact the

accuracy and efficiency of complex motor skills such as the overhead badminton smash and baseball throwing mechanics (Rusdiana et al., 2020a; Rusdiana et al., 2020b).

Recovery plays a central role in athletic training programs, as it supports cellular regeneration after strenuous physical activity, while also preventing muscle cramps, injuries, and excessive lactic acid accumulation. Lactic acid, long considered a negative byproduct of anaerobic metabolism, is now understood to serve as both a marker of fatigue and a potential energy substrate if oxygen demands are met (Delextrat et al., 2013; Haryono et al., 2021). Nevertheless, before optimal recovery is achieved, athletes often report a range of post-exercise complaints such as Delayed Onset Muscle Soreness (DOMS), joint stiffness, decreased flexibility, muscle cramps, and localized swelling or inflammation (Leabeater et al., 2024). These symptoms are commonly observed in athletes undergoing high training volumes, including SLOPMPN athletes, where DOMS frequently occurs due to repetitive high-intensity movements across different sport-specific demands.

Furthermore, recent studies emphasize that fatigue not only reduces physical performance but also influences neuromuscular coordination and biomechanical efficiency. For example, fatigue in the lower extremities has been shown to alter landing biomechanics in volleyball athletes, increasing the risk of injury (Rusdiana et al., 2024). Similarly, anaerobic fatigue significantly disrupts technical execution in batting mechanics within softball (Haryono et al., 2024). These findings highlight the importance of structured recovery strategies—ranging from passive rest to targeted interventions such as sport massage, foam rolling, and massage gun application—which have been proven effective in accelerating fatigue recovery and restoring performance capacity (Pahlevi et al., 2024; Haryono et al., 2021).

Lactic acid itself is one indicator to measure a person's level of fatigue (Delextrat et al., 2013). Although often considered negative, lactic acid can actually be reused by the body as an energy source if oxygen needs are met, even though various recovery methods have been explained previously, athletes will generally experience a number of complaints before undergoing the recovery process. These complaints include Delayed Onset Muscle Soreness (DOMS), muscle and joint pain, decreased flexibility (Leabeater et al., 2024), fatigue and decreased energy, muscle tension and cramps, and swelling and inflammation. In SLOPMPN athletes, DOMS symptoms often appear due to the high intensity and volume of training performed, resulting in certain muscle fatigue, depending on the sport.

In Taekwondo, all athletes (100%) experience DOMS, especially in the legs, such as the semimembranosus, biceps femoris, gastrocnemius, soleus, sartorius, adductor longus, rectus femoris, and hamstring muscles, which are caused by the dominance of kicking

movements in training and matches. Meanwhile, in gymnastics athletes representing the feminine branch, DOMS occurs evenly, namely 50% in the upper body and 50% in the lower body. This is because gymnastics involves various movements that use the hands, such as *handstands*, *headstands*, *splits*, and running, with muscles that are often used including the biceps, triceps, deltoids, hamstrings, and others.

One method that can be used to overcome DOMS in athletes is the use of a massage gun, which has become very popular in recent years. This tool is effective in helping to relieve muscle tension and reduce DOMS symptoms during the recovery process (Efda & Ambardini, 2024).

Researchers will conduct experiments on the sport of Taekwondo, a masculine sport can be described as a strong, assertive, brave, independent, steadfast individual figure, a strong curiosity, self-esteem and self-confidence, dare to take risks, and so on. And in the sport of Gymnastics, which can be described as a feminine sport. Feminine gender roles show more warm traits in personal relationships, prefer to affiliate with others rather than dominate (Ferreira et al., 2023).

METHOD

This study employed an experimental method with a pretest-posttest control group design. The design allowed the researchers to objectively measure changes in blood lactate levels through blood sampling and subjectively assess pain perception using the Visual Analog Scale (VAS). The intervention protocols were standardized and tailored to the characteristics of the sports examined. In taekwondo (categorized as a masculine sport due to physical contact and combat), delayed onset muscle soreness (DOMS) predominantly occurs in the lower body (100% legs), while in gymnastics (categorized as a feminine sport due to the absence of physical contact), DOMS is more evenly distributed between the upper and lower body (50:50). These sport-specific characteristics were taken into consideration when applying recovery methods.

The population consisted of 30 female national young athletes, including 3 gymnasts and 27 taekwondo athletes. Using purposive sampling, a total of 18 athletes were selected as the study sample, consisting of 3 gymnasts and 15 taekwondo athletes from the National Potential Young Athlete Training Center (SLOMPN Programme).

The inclusion criteria were as follows:

1. Athletes were registered as young national athletes under the SLOMPN Programme.

2. Athletes had undergone routine training for a minimum of six months.
3. Athletes had been appointed as core team members scheduled to participate in upcoming competitions or tournaments (Ani et al., 2021).

The study began with a pretest, in which baseline measurements of blood lactate and pain perception (VAS) were collected. Following the pretest, the athletes underwent recovery interventions. Two recovery methods were compared: massage gun therapy and ice bath immersion. Both protocols were applied in a standardized manner, with predetermined parameters regarding duration and intensity. After the recovery intervention, a posttest was conducted to remeasure blood lactate levels and perceived pain.

The collected data were analyzed using SPSS version 29. A comparative test of influence was performed to evaluate the effectiveness of massage gun therapy versus ice bath immersion in reducing DOMS among gymnastics and taekwondo athletes. The level of significance was set at $p < 0.05$.

RESULTS AND DISCUSSION

Result

The results of the paired-samples analysis are presented in Table 1. Both recovery methods showed a significant reduction in blood lactate levels. The massage gun treatment decreased lactate concentration from $M = 7.23$ mmol/L ($SD = 0.99$) before treatment to $M = 3.13$ mmol/L ($SD = 0.71$) after treatment, with a mean reduction of 4.10 mmol/L ($p < .001$). Similarly, the ice bath treatment reduced lactate concentration from $M = 7.29$ mmol/L ($SD = 0.67$) to $M = 4.41$ mmol/L ($SD = 0.82$), with a mean reduction of 2.88 mmol/L ($p < .001$).

Table 1. Differences in Blood Lactate Levels Before and After Treatment (mmol/L)

Treatment	Before (M ± SD)	After (M ± SD)	Mean Difference	p
Massage Gun	7.23 ± 0.99	3.13 ± 0.71	4.10	< .001
Ice Bath	7.29 ± 0.67	4.41 ± 0.82	2.88	< .001

Table 2 shows the comparison of the magnitude of reduction between the two recovery methods. The analysis indicated no significant difference between the two groups at baseline ($p = .791$). However, post-treatment results demonstrated that the massage gun produced a significantly greater reduction in blood lactate levels ($M = 4.10$ mmol/L, $SD = 0.78$) compared to the ice bath ($M = 2.88$ mmol/L, $SD = 0.54$), ($p < .001$).

Table 2. Comparison of Blood Lactate Level Reductions Between Massage Gun and Ice Bath (mmol/L)

Treatment	Reduction (M ± SD)	p
Massage Gun	4.10 ± 0.78	< .001
Ice Bath	2.88 ± 0.54	

Discussion

The present study aimed to compare the effectiveness of massage gun and ice bath interventions in reducing blood lactate levels among national-level gymnastics and taekwondo athletes. The findings demonstrated that both recovery strategies significantly lowered post-exercise blood lactate concentrations, confirming their efficacy in facilitating recovery from high-intensity training. However, the massage gun treatment produced a significantly greater reduction compared to the ice bath, suggesting its superiority as a recovery modality.

The significant reduction in lactate concentration observed with massage gun treatment can be attributed to the percussive therapy mechanism, which stimulates local blood circulation, enhances oxygen delivery to muscles, and accelerates the clearance of metabolic by-products. Previous studies have highlighted that mechanical stimulation can improve muscle perfusion and facilitate recovery more efficiently than passive cooling interventions (Jaury, 2014; Kurniawan et al., 2020). This aligns with the present findings, as athletes in the massage gun group experienced nearly double the reduction in lactate levels compared with those in the ice bath group.

In contrast, ice bath treatment, while still effective, relies primarily on reducing tissue temperature and inflammatory responses rather than actively promoting lactate clearance. Although cold-water immersion is widely used to manage delayed-onset muscle soreness (DOMS) and limit secondary tissue damage, its effects on metabolic recovery appear less pronounced compared with active or mechanically-assisted methods (Justika & Sidik, 2017). This explains the smaller magnitude of lactate reduction in the ice bath group compared to the massage gun group.

These findings are consistent with recent evidence that highlights the importance of recovery modalities that enhance active circulation, such as massage and dynamic recovery exercises, in expediting metabolic clearance and restoring neuromuscular performance (Ningsih & Riani, 2021). The practical implication of this study is that massage gun therapy offers a time-efficient and effective strategy for athletes requiring rapid recovery between training sessions or competitions.

Nevertheless, several limitations should be noted. First, the study focused only on short-term lactate clearance, and future research should examine long-term performance outcomes such as strength restoration, muscle soreness, and injury prevention. Second, the sample was limited to gymnastics and taekwondo athletes, which may restrict the generalizability of the

findings to other sports. Future studies should involve diverse athletic populations and integrate additional biomarkers of recovery to provide a more comprehensive evaluation.

CONCLUSION

This study concludes that both massage gun and ice bath treatments are effective in reducing post-exercise blood lactate levels among young national-level athletes. However, the massage gun demonstrated a significantly greater effect compared to the ice bath, highlighting its superiority as a recovery strategy. The findings suggest that percussive therapy can provide athletes with faster metabolic recovery, potentially improving readiness for subsequent training or competition. Coaches, trainers, and sports practitioners are therefore encouraged to incorporate massage gun therapy as part of post-exercise recovery protocols, particularly in high-performance settings.

ACKNOWLEDGMENT

Thank you to the LPPM Universitas Pendidikan Indonesia, Bandung City, which has permitted us to collect data so that this research could run well.

REFERENCES

- Delextrat, A., Calleja-González, I., Hippocrate, A., & Clarke, N. D. (2013). Effects of sports massage and intermittent cold-water immersion on recovery from matches by basketball players. *Journal of Sports Sciences*, 31(1), 11–19. <https://doi.org/10.1080/02640414.2012.719241>
- Efda, K. D., & Ambardini, R. L. (2024). The effectiveness of sports massage and cold water immersion towards fatigue recovery and post-exercise stress level of sprinters at the Student Sports Education and Training Center (PLP). *International Journal of Multidisciplinary Research and Analysis*, 7(5), 2873–2882.
- Ferreira, R. M., Gama, M., Costa, L., Moreira, J., Peixoto, A., & Figueiredo, P. (2023). The effects of massage guns on performance and recovery: A systematic review. *Journal of Functional Morphology and Kinesiology*, 8(3), 1–20. <https://doi.org/10.3390/jfmk8030138>
- Haryono, T., Darajat, J., Rusdiana, A., Salman, S., & Gumilar, A. (2021). Sport Massage and Lactic Acid Recovery Time in Softball Athletes. *Jurnal Pendidikan Jasmani dan Olahraga*, 6(2), 189–194.
- Haryono, T., Kurniawan, T., Rusdiana, A., Hidayat, I. I., & Syahid, A. M. (2025). Biomechanical Transformation of Softball Batting Technique: The Effects of Mental Fatigue on Athlete Performance. *Jurnal Terapan Ilmu Keolahragaan*, 10(1), 38–42.

- Jaury, D. F. (2014). Gambaran nilai VAS (Visual Analogue Scale) pasca bedah seksio sesarea pada penderita yang diberikan tramadol. *E-Clinic*, 2(1), 1–7. <https://doi.org/10.35790/ecl.2.1.2014.6373>
- Justa, J., & Sidi, Z. (2017). Pengaruh metode repetisi dalam latihan plyometrik single-leg speed hop terhadap peningkatan power endurance tungkai pada cabang olahraga futsal. *Jurnal Kepeleatihan Olahraga*, 10(9), 1–11.
- Kurata, K. (2015). Pengaruh model pembelajaran inkuiri terbimbing berbasis lingkungan terhadap kemampuan pemahaman konsep dan karakter pada siswa kelas V SD. *Journal of Primary Education*, 4(2), 132–138.
- Kurniawan, R., Prabowo, E., & Yudhaprawira, A. (2020). Pelatihan terapi ice bath untuk recovery cabang olahraga futsal pada tim Cosmo Futsal Club Jakarta. *Jurnal Pengabdian Kepada Masyarakat UBI*, 3(1), 59–66. <https://doi.org/10.31599/jabdimas.v3i1.57>
- Leabeater, A. J., Cate, A. C., James, H., Huyab, M., & Deller, M. (2024). Under the gun: Percussive massage therapy and physical and perceptual recovery in active adults. *Journal of Athletic Training*, 59(3), 310–317. <https://doi.org/10.4085/1062-6080-0041.23>
- Ningsih, D. Y., & Rian, S. (2021). Hubungan nilai visual analogue scale (VAS) dengan aktivitas fisik pada penderita asam urat di Dusun Medalan Kecamatan Karangrayung Kabupaten Grobogan. In *Prosiding Seminar Nasional Unimus 4* (pp. 1338–1350).
- Pahlevi, R., Santoso, A., Widodo, F., Hakim, M., & Nurdiansyah, Y. (2024). Effectiveness of massage gun and foam roller methods on fatigue recovery in football athletes. *Jurnal Ilmu Keolahragaan*, 1(2), 682–692. <https://doi.org/10.31851/jik.v1i2.16339>.
- Pahlevi, R., Rusdiana, A., Haryono, T., Hidayat, I. I., & Kurniawan, T. (2024). Effectiveness of massage gun and foam roller methods on fatigue recovery in football athletes. *Halaman Olahraga Nusantara: Jurnal Ilmu Keolahragaan*, 7(2), 642–652.
- Rusdiana, A., Subarjah, H., Imanudin, I., Kusdinar, Y., Syahid, A. M., & Kurniawan, T. (2020a). Effect of Fatigue on Biomechanical Variable Changes in Overhead Badminton Jump Smash. *Annals of Applied Sport Science*, 8(S1). <http://aassjournal.com/article-1-895-en.html>
- Rusdiana, A., Darmawan, M., Syahid, A. M., & Kurniawan, T. (2020b). Biomechanical Analysis of an Overhead Baseball Throwing Movement Associated with a Cardiorespiratory Fatigue Effect. *Open Sports Science Journal*, 13, 66–72. <http://dx.doi.org/10.2174/1875399X02013010066>
- Rusdiana, A., Hidayat, I. I., Kurniawan, T., & Haryono, T. (2024). The Effect of Leg Muscle Fatigue on Landing Biomechanics in Volleyball Athletes. *Jurnal Muara Olahraga*, 7(1), 81–92.
- Vygotsky, L. (2020). *Mind in Society: The Development of Higher Psychological Processes*. Harvard University Press.