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Quality in Sport. 2026;51:68483. eISSN 2450-3118.

https://doi.org/10.12775/QS.2026.51.68483

Quality in Sport. eISSN 2450-3118

Journal Home Page
https://apcz.umk.pl/QS/index

MATUSIAK, Filip and BRZOZA, Klaudia. Comparative Effectiveness of Foam Rolling and Percussive Therapy in Post-Exercise Recovery: A Literature Review. Quality in Sport. 2026;51:68483. eISSN 2450-3118. https://doi.org/10.12775/QS.2026.51.68483

The journal has been awarded 20 points in the parametric evaluation by the Ministry of Higher Education and Science of Poland. This is according to the Annex to the announcement of the Minister of Higher Education and Science dated 05.01.2024, No. 32553. The journal has a Unique Identifier: 201398. Scientific disciplines assigned: Economics and Finance (Field of Social Sciences); Management and Quality Sciences (Field of Social Sciences).
Punkty Ministerialne z 2019 - aktualny rok 20 punktów. Załącznik do komunikatu Ministra Szkolnictwa Wyższego i Nauki z dnia 05.01.2024 Lp. 32553. Posiada Unikatowy Identyfikator Czasopisma: 201398. Przypisane dyscypliny naukowe: Ekonomia i finanse (Dziedzina nauk społecznych); Nauki o zarządzaniu i jakości (Dziedzina nauk społecznych).
The authors declare that there is no conflict of interest regarding the publication of this paper.
Received: 20.01.2026. Revised: 05.02.2026. Accepted: 06.02.2026. Published: 20.02.2026.

Comparative Effectiveness of Foam Rolling and Percussive Therapy in Post-Exercise Recovery: A Literature Review

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Abstract

Background: Foam rolling (FR) and percussive therapy (PT) are common recovery techniques, but direct comparisons of their effects on physiological outcomes are scarce. These techniques—mechanical compression versus high-frequency vibration—trigger different patterns of recovery.

Aim: This literature review aims to compare the effects of FR and PT on the recovery of range of motion (ROM), muscle soreness, and physical performance in active populations.

Methods: Twenty peer-reviewed studies, including randomised controlled trials (RCTs), reviews, and meta-analyses, were analysed. The outcomes examined included joint range of motion (ROM), pain intensity, blood lactate clearance, and neuromuscular performance.

Results: Both modalities significantly increase ROM. PT demonstrated higher levels of acute flexibility improvements in several studies, with up to an 11.4% increase in the range of motion for the hamstring muscle. FR was found to effectively reduce delayed onset muscle soreness (DOMS) at 48 and 72 hours post-exercise. Pearcey et al. (2015) reported that FR maintains neuromuscular efficiency by increasing voluntary activation, thereby accelerating the return to baseline performance. FR also showed advantages in metabolic recovery by improving local blood flow and blood lactate clearance. There was no evidence that either technique used during a warm-up improved acute performance; furthermore, PT occasionally induced transient negative effects due to neural inhibition. The improper use of PT may lead to severe complications, such as rhabdomyolysis.

Conclusions: PT is superior for acute flexibility improvements and reductions in muscle stiffness, while FR performs better for metabolic recovery, neuromuscular efficiency, and soreness management. Treatment modalities should be individualised, with an emphasis on functional recovery rather than acute performance.

Keywords: Foam rolling, Percussive therapy, Massage gun, Delayed onset muscle soreness (DOMS), Range of motion (ROM), Lactate clearance.

1. Introduction

Recovery after exercise is an important determinant of athletic performance, prevention of injury, and long-term training adaptations. High-intensity exercise often leads to exercise-induced muscle damage (EIMD), which is the structural damage to muscle fibres and the surrounding extracellular matrix. The physiological stress commonly presents in the form of delayed onset muscle soreness (DOMS), which is manifested by local inflammation, stiffness and temporary decrease in range of motion (ROM), or muscular power (Leabeater et al., 2024; Michalak et al., 2024). As a result, athletes and practitioners are always seeking efficient modalities for recovery that can enhance muscle function and minimize soreness.

In recent years, self-myofascial release (SMR) techniques have become increasingly popular as a cost-effective, portable alternative to manual therapy administered by professional therapists. Of these, foam rolling (FR) has become a common practice in warm-up and recovery protocols. FR involves the use of gravitational force to exert pressure on a specific muscle group through a cylindrical foam roller. Potential mechanisms of FR include the mechanical disturbance of fascial adhesions and the modulation of the central nervous system to increase pain tolerance (Alonso-Calvete et al., 2021). Research suggests that FR can enhance blood flow and improve arterial function, which may facilitate the removal of metabolic waste products, such as lactate, after high-intensity exercise (Kasahara et al., 2024).

Concomitant with the increasing use of FR, percussive therapy (PT) administered by handheld devices colloquially termed “massage guns” has gained widespread popularity in sport performance environments (Skinner et al., 2023). In contrast to the broad pressure used in FR, PT applies localized, high-frequency rhythmic pulses and vibrations to soft tissue. This percussive, mechanical force combines the benefits of traditional massage and vibration for deep muscle treatment. It has been shown in previous work that PT can accelerate the recovery of ROM and reduce the stiffness through its effect on the viscoelastic properties of tissue, as well as potentially through Golgi tendon organ activity (Ferreira et al., 2023; Sams et al., 2025).

These recovery technologies have been adopted much more quickly than they have been accompanied by robust, comparative guidelines. Consequently, practitioners are often left uncertain as to which modality – foam rolling or percussive therapy – provides them better results for post-exercise recovery. This review aims to assess the comparative evidence regarding their effects on range of motion, muscle soreness and performance recovery. The objective is to reveal which tool is most effective in facilitating recovery from exercise-induced muscle damage.

2. Methods

The primary purpose was to locate and synthesize peer-reviewed evidence on the effects of FR compared with PT on recovery- and performance-related outcomes.

Search Strategy: A comprehensive literature search was conducted across several electronic databases (Medline, Scopus, Web of Science, and Cochrane Library) for evidence relating to these questions. To capture the latest advances in percussion modalities, we searched up to late 2025. The following keywords and Boolean operators were used: ("foam rolling" OR "self-myofascial release") AND ("percussive therapy" OR "massage gun" OR "percussion massage") AND ("recovery" OR "DOMS" OR "range of motion (ROM)" OR "performance").

Inclusion and Exclusion Criteria: The publications for inclusion in the review were based on a number of predetermined criteria. First, the studies had to include healthy human subjects who were physically active (exercise trained or recreationally active). Second, the studies had to use foam rolling and/or percussion as a primary intervention. Third, the studies were required to have measured outcomes related to post-exercise recovery such as range of motion, muscle soreness, blood lactate clearance, or performance recovery (e.g., jump height and sprint velocity). Fourth, the literature reviewed needed to be peer-reviewed primary research (e.g., randomised controlled trials and crossover designs) or high-level evidence synthesis (e.g., systematic reviews, meta-analyses). Conversely, studies were excluded if they focused on clinical populations with chronic musculoskeletal pathologies, used static stretching as the sole comparison, or provided insufficient data on intervention protocols. One individual case report was also considered in the analysis, in response to new safety questions on the use of percussive therapy.

Data Extraction and Synthesis: In total, twenty publications were included in the analysis. A standardized form was used to collect the data, including information about author(s), publication year, participants' characteristics, intervention procedures (duration of the protocols, frequency and intensity) and outcomes. Because of the variation in methodology and heterogeneity in study design from acute changes in flexibility to synthesis of evidence in meta-analyses, a qualitative synthesis was conducted. The findings were stratified according to various physiological or perceptual recovery measures to contrast the two modes.

3. Results

3.1. Detailed Study Characteristics and Demographics

From RCTs and controlled human trials, the literature review included a broad range of study designs. The participant populations were varied, including highly trained athletes as well as recreationally active individuals. For instance, Nevin et al. (2025) concentrated on elite college American football players (NCAA/NAIA), while Pernigoni et al. (2024) focused on female basketball players participating in the Lithuanian second division. Similarly, other studies, (e.g., Bartik and Pacholek 2025, Michalak et al. 2024), tested apparently healthy, physically active male students.

The studies were reported with varying numbers of participants, ranging from 8 to 79. Post-intervention follow-up or the end of treatment was observed in virtually all but one study by Chen et al. (2021), which concentrated on a single elite female athlete. The mean age of participants ranged from 19 to 25 years; however, Sams et al. (2025) offered a more comprehensive view, including individuals up to 75 years (mean age 48.6). This age distribution provides a valuable illustration of how the impact of foam rolling (FR) and percussive therapy (PT) affects various groups of participants with diverse age groups and levels of athletic development.

3.2. Impact on Flexibility and Range of Motion (ROM)

ROM was evaluated as a primary outcome measure in nearly all analysed studies, and both modalities demonstrated significant acute flexibility gains.

Performance of Percussive Therapy: The effect of percussive therapy (massage guns) demonstrated a similarly strong efficacy in improving ROM. Skinner et al. (2023) observed an

11.4% increase in passive straight leg raise (PSLR) ROM after a short (120 s) application of PT to the hamstring muscles. This was confirmed by Sams et al. (2025), who examined eight distinct protocol configurations and found that both constant speed (2100 rpm) and increasing speed protocols (1750 to 2400 rpm) led to significant improvements in hip flexion (5.8%) and ankle dorsiflexion (5.6%). Nevin et al. (2025) also reported similar results; they compared PT to manual stretching and found that PT produced only slightly lower ROM improvements than traditional stretching in football players.

Foam Rolling and Comparative Outcomes: Positive results were also found for FR, although they were not always as strong as PT outcomes. Bartik and Pacholek (2025) directly compared foam rolling to percussive therapy, reporting that both treatments led to greater increases in hamstring flexibility, but the Active Knee Extension (AKE) test score increased significantly only in the percussive massage group compared to the foam rolling group ($p < 0.01$). In contrast, Ormeno and Driller (2025) observed that FR improved left-side ankle dorsiflexion mobility to a small extent ($d = 0.23$) before a pre-exercise warm-up, whereas the massage gun was unable to produce significant gains under this protocol. Nakamura et al. (2024) investigated the addition of heat to PT, and concluded that although PT increased dorsiflexion ROM independently, "heat + PT" resulted in a notable enhancement of flexibility compared with PT alone.

3.3. Perceptual Recovery and Muscle Soreness (DOMS)

The efficacy of these modalities in mitigating exercise-induced muscle damage (EIMD) and delayed onset muscle soreness (DOMS) was inconsistent among the analysed studies.

Foam Rolling as a Pain Modulator: Michalak et al. (2024) conducted a large study with 60 men and found that foam rolling led to significantly reduced perceived pain on the Visual Analogue Scale (VAS) at 48 and 72 hours post-exercise compared to a control group. Notably, the texture of the roller (smooth vs. serrated) did not significantly influence the pain-relieving effects; according to the study mechanical pressure applied by rolling appears to be the driving factor. Pernigoni et al. (2024), however, observed no differences between FR and a placebo (sham) intervention in basketball players, which may cast doubt on the influence of the placebo effect on perceptual recovery.

The Dynamics of Percussive Therapy: The PT response seems to be highly individual. Trainer et al. (2022) found that the acute effect of PT on posterior shoulder muscles differed among participants who had a positive and negative response to vibration. Lower-aversion participants tended to think the therapy was more "comfortable" and had better perception outcomes as a group. In contrast, Leabeater et al. (2024) found that a 5-minute intervention with the massage gun resulted in a slight increase in muscle soreness immediately and 4 h after exercise (d = -0.35 to -0.48), and high-intensity vibration may transiently sensitize the tissue.

3.4. Neuromuscular Performance: Power, Strength, and Agility

Multiple studies reported no significant performance gains, and in certain cases, even a detrimental effect on physical metrics was observed after the intervention.

Acute Changes in Performance: Ormeno and Driller (2025) reported that inclusion of FR or PT as part of the warm-up protocol had negative effects on countermovement jump (CMJ) height and a reduction in the reactive strength index (RSI), when compared to dynamic warm-up. In addition, PT negatively impacted 20m sprint performance (d=0.34), indicating an increase in sprint time. Bartik and Pacholek (2025) corroborated these findings, demonstrating that neither acute enhancement in explosive leg press power nor improvements in side-hop test performance occurred after using either tool. Szymczyk et al. (2022) also concluded that PT did not improve drop jump (DJ) performance despite altering tendon characteristics.

Recovery Over the Long Term: However, in terms of long-term recovery, results are more promising. Michalak et al. (2024) reported that acute power may not increase, but the use of FR, resulted in significantly fewer athletes remaining below baseline levels at 72 hours of recovery. This was attributed to reduced perceived pain and enhanced metabolic recovery, suggesting that FR may facilitate a more efficient return to baseline performance over time.

3.5. Physiological and Tissue-Specific Markers

Some studies, in addition to subjective responses, offered objective physiological measures of the effects of these modalities.

Metabolic Clearance and Blood Flow: Kasahara et al. (2024) and Michalak et al. (2024) both reported that foam rolling significantly enhanced blood lactate clearance post-exercise ($p < 0.001$). Specifically, Kasahara et al. (2024) found a decrease in lactate by 7.3 ± 3.0 mmol/L in the rolling group, compared to the control. Alonso-Calvete et al. (2021) observed that blood flow velocity immediately increased at the femoral artery level, as measured by Doppler ultrasonography. This response likely facilitates a more efficient clearance of these metabolites.

Tissue Mechanics and MRI Outcomes: Skinner et al. (2023) confirmed using myotonometry that muscle stiffness decreases by approximately 6% following PT, whereas mechanical stress relaxation time increases by about 6.3%. These findings demonstrate alterations in the viscoelastic properties of the muscle-tendon unit. Shu et al. (2021) used Magnetic Resonance Imaging (MRI) following a half-marathon and demonstrated that T2 relaxation times of the hamstrings were affected by FR. This indicates reduced exercise-induced muscle edema as well as altered fluid dynamics within the tissue.

3.6. Safety and Adverse Events

Despite being considered safe, the literature suggests that percussive therapy has the potential to cause serious injury. Chen et al. (2021) documented a severe case of rhabdomyolysis in a 25-year-old athlete, after her coach used a massage gun for 10 minutes on her thighs. This case highlights the risks associated with prolonged, high-intensity exposure, particularly when employing high-frequency percussive devices without proper regulation of duration and pressure.

4. Discussion

4.1. Interpretation of Flexibility Gains

The results of this review indicate that foam rolling and percussive therapy are effective for range of motion (ROM) enhancement; however, they likely function through separate primary mechanisms. Early systematic evidence from Cheatham et al. (2015) had already indicated the effectiveness of SMR in increasing joint ROM, a fact that has been reinforced by the recent works on percussive modalities. The even greater flexibility gains reported in studies that employed percussive therapy, such as Bartik and Pacholek (2025) and Skinner et al. (2023), may be correlated with high-frequency oscillation (usually 30–40 Hz). Vibration affects the Golgi tendon organs and decreases muscle spindle sensitivity, which increases “stretch tolerance”. In contrast, foam rolling operates through mechanical and thixotropic processes: facilitating movement by decreasing the viscosity of fascia, which is then able to slide over tissue layers more effectively.

4.2. The Recovery vs. Performance Paradox

An important point to note in this review is the repeated theme that FR or PT do not appear to enhance acute performance (e.g., power, speed, agility) when included in a warm-up. Indeed, Ormeno and Driller (2025) propose a potential "dampening" effect on the neuromuscular system, which may temporarily impair the muscle’s capacity to store and release elastic energy. This is a significant consideration: while these devices are effective for post-training relaxation, the neural inhibition they induce could negate any advantages of increased range of motion (ROM) if applied immediately prior to explosive activities.

4.3. Metabolic and Physiological Restoration

Metabolic and functional recovery may be the most supported benefits of foam rolling. The recovery-promoting effects presented in this review are consistent with the meta-analysis by Wiewelhove et al. (2019) who reported that rolling reduces muscle soreness and facilitates a reliable return to baseline performance levels. Thus, by enhancing local blood flow (as demonstrated by Alonso-Calvete et al., 2021), foam rolling functions as a form of active-passive recovery. This is further supported by Pearcey et al. (2015), whose evidence suggests that the mechanical action of rolling helps maintain neuromuscular efficiency during the recovery phase, allowing athletes to return to their baseline performance levels more rapidly than through passive rest alone.

4.4. Perceptual recovery and Individual preferences

The reduction of Delayed Onset Muscle Soreness (DOMS) via foam rolling is one of the most consistent outcomes in the literature. While Michalak et al. (2024) emphasized immediate pain-relieving effects, Pearcey et al. (2015) highlighted the importance of a 72-hour recovery window and demonstrated that FR can mitigate the impact of acute damage through continuous implementation. This stands in contrast to the more variable results of percussive therapy; while PT is highly effective in reducing acute stiffness, its ability to modulate the long-term inflammatory response, which contributes to DOMS, is less well-supported than that of foam rolling. Individual preferences, such as the “comfort factor” described by Trainer et al. (2022), remain key for PT adherence.

4.5. Safety Considerations and Practical Recommendations

The case report by Chen et al. (2021) is a critical reminder that percussive therapy is not without risk. Rhabdomyolysis following a 10-minute massage gun session suggests that “more is not always better.” Extrapolating from the protocols applied in the high-quality studies included in this review (e.g., Skinner et al., 2023; Sams et al., 2025), a duration of 60–120 seconds per muscle group may be sufficient for ROM gains while minimizing the risk of tissue trauma.

4.6. Limitations and Future Research

Although the quality of the included trials was high, heterogeneity in ‘dosage’ (frequency, amplitude, and duration) remains a significant challenge. Most research focuses on short-term physiological responses rather than chronic adaptations. Future research should establish standardized prescription guidelines for various sports and determine whether chronic use leads to muscular architectural adaptations and a reduction in athletic injury risk.

5. Conclusion

The evidence presented in this review indicates that both foam rolling (FR) and percussive therapy (PT) represent valid, non-invasive tools for improving flexibility and post-training recovery. However, they exhibit distinct differential effects depending on the specific recovery outcome pursued.

In terms of acute flexibility, percussive therapy appears to offer a slight advantage over traditional foam rolling. Several studies, such as Bartik and Pacholek (2025) and Skinner et al.

(2023), indicate that the high-frequency vibrations delivered by massage guns can achieve a greater increase in range of motion (ROM) in shorter periods of time, possibly as a consequence of a reduction in muscle spindle sensitivity, and an increase in stretch tolerance. In contrast, foam rolling is better suited for metabolic recovery and the management of delayed onset muscle soreness (DOMS). FR has been shown to increase arterial blood flow and improve the removal of lactate (as shown by Kasahara et al. 2024 and Alonso-Calvete et al. 2021), making it a preferred option for athletes after high-intensity anaerobic exercise.

A critical observation in this review is the "recovery-performance paradox". While both tools are great for recovery, they should be used with caution as part of a warm-up prior to a workout. Reports of acute performance decreases in power output and sprint speed (Ormeno & Driller, 2025) are an indication that the neuromuscular relaxation induced by these tools may not be compatible with the explosive tasks associated with athletic competition. Practitioners should emphasize dynamic stretching for performance warm-ups and reserve FR and PT for post-exercise recovery to maximize physiological benefits without compromising power.

In addition, safety remains a paramount priority regarding percussive therapy. The documentation of adverse events, such as rhabdomyolysis (Chen et al., 2021), demonstrates the need for standardized guidelines. Most protocols (60-120 seconds per muscle group) appear to be safe and effective; however, excessive pressure or duration may cause tissue trauma.

In conclusion, the choice between foam rolling (FR) and percussive therapy (PT) should be evidence- and goal-based. Foam rolling is ideal for metabolic clearance and pain reduction, while percussive therapy provides superior benefits in terms of flexibility gains targeted at specific muscle groups, resulting in a significant reduction in muscle stiffness. Further research should focus on longitudinal follow-up studies to identify whether ongoing use of this equipment leads to chronic adaptations in muscle architecture and effective injury prevention.

Disclosure

Authors do not report any disclosures.

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Conceptualization: Filip Matusiak, Klaudia Brzoza
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All authors have read and agreed with the published version of the manuscript.

Funding statement:
The study did not receive special funding.

Institutional Review Board Statement:
Not applicable.

Informed Consent Statement:
Not applicable.

Data Availability Statement:
Not applicable.

Conflict of Interest Statement:
The authors declare no conflict of interest.

Declaration on the use of AI: In preparing this work, the authors used Gemini for the purpose of improving language and readability, text formatting, and verification of bibliographic styles. After using this tool/service, the authors have reviewed and edited the content as needed and accept full responsibility for the substantive content of the publication.

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