Health Innovation Journal - Global

Effectiveness of IASTM Vs Stretching in Improving Tissue Flexibility among Athletes: A Systematic Review and Meta-Analysis

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To Cite: Tariq U, Ghafoor J, Fatima R, Khan M. Effectiveness of IASTM vs stretching in improving tissue flexibility among athletes: a systematic review and meta-analysis. HIJ Global. 2026;1(1): 09–20.

Received: 26 November 2026
Accepted: 28 February 2026
Published: 02 March 2026

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ABSTRACT

Background: Flexibility is critical for optimal athletic performance and injury prevention. While traditional stretching methods are commonly used to enhance tissue extensibility, Instrument-Assisted Soft Tissue Mobilization (IASTM) has emerged as a promising alternative. However, evidence comparing their relative effectiveness remains inconclusive.

Objective: To compare the effectiveness of IASTM versus stretching in improving tissue flexibility and reducing muscle stiffness among athletes.

Methods: A systematic literature search was conducted through PubMed, ScienceDirect, and Google Scholar up to October 2024. Randomized controlled trials involving athletes aged 15 years and above, comparing IASTM with stretching, and measuring outcomes such as range of motion (ROM) or muscle stiffness were included. Methodological quality was assessed using the Cochrane RoB 2 tool. Meta-analysis was performed using Review Manager 5.4.

Results: Eight studies met the inclusion criteria, and seven were included in the meta-analysis. IASTM demonstrated superior improvement in flexibility, with a pooled mean difference (MD = −1.03; 95% CI [−1.46, −0.60]; $p < 0.001$), indicating a significant advantage over stretching. Individual studies reported ROM gains of up to 21.8% and significant reductions in passive stiffness with IASTM. However, substantial heterogeneity was observed ($I^2 = 94\%$).

Conclusion: IASTM appears more effective than stretching in enhancing flexibility and reducing muscle stiffness in athletes. However, due to limited sample size and methodological variations, further high-quality studies are recommended to establish long-term efficacy and standardized protocols.

Keywords: *IASTM; Stretching; Flexibility; Range of Motion*

INTRODUCTION

Flexibility is defined as the capacity to move a joint through its entire range of motion (ROM) without limitation or pain, which is critical for physical fitness and has a significant impact on athletic performance. Flexibility is affected by gender, age, physical fitness, type of joint, tendon, ligament, and extensibility of muscles [1]. Flexibility is widely considered a fundamental component of athletic performance, as it contributes to optimal range of motion and neuromuscular coordination. However, evidence linking flexibility training directly to injury prevention remains inconclusive, with studies suggesting limited or context-specific benefits [2]. Adequate tissue flexibility enhances an athlete's range of motion (ROM), functional capacity, and neuromuscular coordination, all of which are critical for optimal performance and recovery [3].

Muscle stiffness is measured as the ratio of the muscle's change in force to its length. As muscular stiffness rises, the muscle's elasticity reduces, meaning that when force is applied to the muscle, it is difficult to extend, resulting in insufficient or limited range of motion. Flexible muscles can better react to stress, reduce muscle discomfort, and increase athletic performance, whereas a lack of muscle flexibility can result in restricted joint movement, an imbalance in strength, and an impact on everyday functioning and athletic performance. Although some authors have proposed a link between reduced flexibility and increased susceptibility to muscle strain injuries, this association remains inconclusive and context dependent [3,4]. Traditional stretching techniques, particularly static and dynamic stretching, have been widely employed to improve muscle length and joint mobility; however, evidence regarding their long-term efficacy in enhancing tissue extensibility remains inconclusive. A Cochrane systematic review by Harvey et al. (2017) reported high-quality evidence that stretching does not produce clinically important improvements in joint mobility among individuals without neurological conditions [5].

In recent years, Instrument-Assisted Soft Tissue Mobilization (IASTM) has emerged as a popular alternative intervention among physical therapists and athletic trainers. IASTM involves the use of specialized tools to apply controlled mechanical pressure to soft tissues, stimulating a healing response and enhancing tissue pliability [6]. The technique is thought to break down fascial restrictions, increase blood flow, and promote fibroblast activity, which can lead to improvements in tissue flexibility [7].

Despite growing interest, there remains a lack of consensus regarding the comparative effectiveness of IASTM versus conventional stretching methods in athletic populations. Some studies suggest that IASTM may produce superior improvements in ROM and flexibility due to its mechanical and neurological effects [8], while others report negligible differences when compared to stretching protocols [9]. This variation highlights the need for a comprehensive evaluation of existing literature.

METHODS

This systematic review was conducted and reported in compliance with the Preferred Reporting Items for Systematic Reviews (PRISMA) guidelines [10]. We aimed to comprehensively assess the existing evidence to compare the effects of IASTM versus stretching on tissue flexibility among athletes. The study was exempted from ethical review approval, and the protocol was registered a priori on PROSPERO [11].

Definitions

Instrument-Assisted Soft-Tissue Mobilization (IASTM) is a non-invasive therapy approach that improves myofascial tissue function using specialized tools. These tools, which come in a variety of shapes and materials, enable higher force application, reduce treatment duration, and decrease practitioner fatigue, helping diagnose and treat soft tissue conditions more effectively. Clinical results from IASTM are thought to be comparable to those from manual therapies such as myofascial release and deep friction massage [12].

A wide range of instruments with differing characteristics has been used by clinicians, including variations in manufacturer, materials (such as steel, bone, or stone), forms, sizes, and weights, reflecting differing clinical expertise and training backgrounds. RockBlades Mullet (RB), EDGE Mobility System (EM), Técnica Galán Ala (TG), Graston Technique (GT), and Fascial Abrasion Technique (FAT) Stick are examples of such tools [13–15].

In the context of physical activity, stretching is the process of fully extending one's muscles and tendons, encompassing a variety of postures and motions intended to improve range of motion, flexibility, and athletic performance. There are four fundamental types of stretches: ballistic, proprioceptive neuro-muscular facilitation (PNF), static, and dynamic, which form the foundation of other stretching styles described in the literature [16].

Literature Search

Electronic bibliographic databases PubMed, Google Scholar, and ScienceDirect were searched up to October 2024. Medical subject headings included in the search strategy were IASTM, Stretching, Athletes, and related entry terms. There were no restrictions on publication era, language, or country.

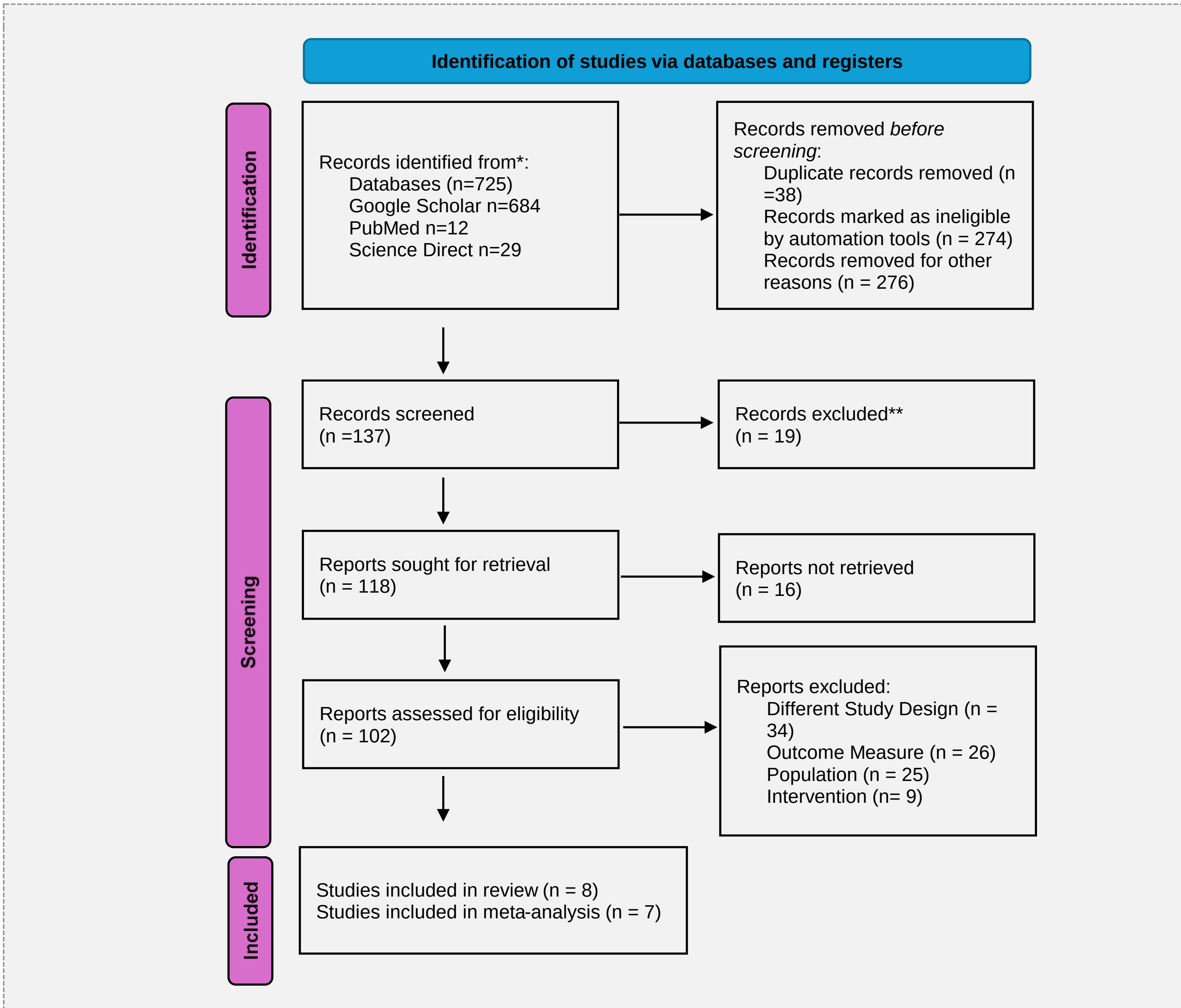
Study Selection

The condition under study was muscular tightness or reduced tissue extensibility, which is associated with various musculoskeletal disorders, including low back pain and cervical discomfort, that may negatively influence functional performance [17]; however, the causal relationship remains multifactorial and not fully established.

Titles and abstracts were screened, and full texts were obtained where abstracts were unavailable. Relevant full texts were assessed and only RCTs were eligible for inclusion. Eligible studies required participants above 15 years of age with reduced tissue extensibility, and either ROM, passive stiffness, or both measured post-intervention by a physical test (e.g., AKET) or other modality. Although the initial PROSPERO registration (CRD42024610293) specified ROM, quality of life (QoL), and pain visual analogue scale (VAS) as key outcomes, QoL and VAS were not consistently reported across eligible studies during screening. The final analysis therefore included only studies reporting passive stiffness and/or ROM, a decision made a priori during data extraction to reduce heterogeneity and preserve methodological consistency.

Exclusion criteria comprised specific pathological conditions such as infections, tumors, or fractures, and studies in which IASTM was not the primary intervention or was combined with other treatments such that its effect could not be isolated.

Figure 1. PRISMA Flow Diagram of Study Identification and Selection



Data Extraction

Articles meeting the pre-defined inclusion criteria were screened based on title, abstract, and full text where necessary, with at least two independent reviewers analyzing each article. Data were extracted regarding study characteristics (author, year, study design), participant characteristics (sample size, demographics), intervention details (IASTM and stretching protocols), and outcomes of interest (passive stiffness and ROM). The following data were extracted for each study: study type (randomized controlled/clinical trial); country, population, setting, and demographics of research subjects (gender, age, intervention protocol); inclusion and exclusion criteria; recruitment and completion rates; outcome measurements; and adjusted analyses performed. Extracted data are presented in Table 1.

Risk of Bias (Quality) Assessment

The methodological quality of each study was assessed independently by two reviewers using the Cochrane Risk of Bias 2.0 tool [18]. Discrepancies were resolved through discussion and, when necessary, by consulting a third reviewer. While RoB 2.0 provides a structured and widely used approach to evaluating bias across randomized trials, it has been reported to show variable inter-rater agreement (Kappa ranging from −0.15 to 0.45) [19]; its use therefore represents a potential limitation of this review. Standardized decision rules and study-specific calibration exercises were applied before formal scoring to enhance consistency. Bias was classified across five domains: randomization, deviation from intended intervention, missing outcome data, measurement of outcome, and selection of reported results, with each domain rated as high, low, or unclear risk. Publication bias was investigated by visual inspection of funnel plots generated through RevMan software [20].

Synthesis of Results

Mean and standard deviation data on ROM or passive stiffness at end of treatment were extracted as the a priori endpoints and expressed as mean differences (MDs) with 95% confidence intervals (CIs). Inter-study heterogeneity was assessed using Cochran's Q statistic (χ^2), with significance set at $p < 0.10$, and quantified using the I^2 statistic, where ≥50% indicates substantial heterogeneity. Meta-analysis of the main outcomes was conducted using the inverse-variance method, with results visually presented through forest and funnel plots generated in Review Manager 5.4 [21,22]. To account for statistical heterogeneity, a random-effects model was applied, incorporating the chi-squared test for Cochrane's Q statistic and I^2 calculations to evaluate the proportion of variance attributable to heterogeneity.

RESULTS

Search Results

A total of 725 records were identified through database searches, including Google Scholar (n = 684), PubMed (n = 12), and ScienceDirect (n = 29). After removing 38 duplicate entries and excluding 274 records via automation tools and 276 for other reasons, 137 records remained for screening. Of these, 19 were excluded based on title and abstract, and 118 reports were sought for full-text retrieval; however, 16 reports could not be retrieved, as full texts were unavailable through institutional or public databases and corresponding authors did not respond to repeated email requests. Titles and abstracts were screened to ensure that none of these studies clearly met the inclusion criteria based on available information, so their exclusion is unlikely to have significantly influenced the results.

From the remaining 102 full-text articles assessed for eligibility, 94 were excluded for reasons including different study design (n = 34), inappropriate outcome measures (n = 26), non-matching population (n = 25), and irrelevant intervention (n = 9). Ultimately, 8 studies were included in the qualitative review and 7 were deemed suitable for meta-analysis (Figure 1).

Study Characteristics

Seven studies were included in the meta-analysis, focusing on range of motion (ROM) and muscle stiffness outcomes, and all eight were incorporated into the systematic review. Results consistently showed favorable outcomes for IASTM over stretching in most cases (Table 1).

In Jin-yong Lim et al. (2022) [23], hip adduction ROM improved in both groups, with a greater gain observed in the stretching group. Jusdado-García & Cuesta-Barriuso (2021) [24] reported shoulder internal rotation and horizontal adduction ROM increasing more in the IASTM group than the stretching group. Simatou et al. (2020) [25] observed a 21.8 ± 12.0% improvement in hip adduction ROM in the IASTM group, exceeding gains in the stretching group over six weeks. Shinde et al. (2022) [26] found ankle ROM improvements favoring IASTM over stretching.

Osailan et al. (2021) [27] found significant increases in hip flexion ROM in both groups; IASTM additionally produced a significant increase in muscle power, though this outcome was outside the scope of the ROM/stiffness meta-analysis. Kim et al. (2018) [28] recorded a greater reduction in passive muscle stiffness with IASTM than stretching. Kang and Lee (2020) [29] reported a significant reduction in muscle stiffness with IASTM ($p < 0.001$) versus a non-significant change with stretching ($p = 0.194$).

Across the seven meta-analyzed studies, IASTM demonstrated consistently greater improvements in both ROM and muscle stiffness compared to stretching; one study favored stretching for ROM, but the overall trend supported IASTM as the more effective modality for enhancing flexibility and reducing stiffness in athletic and general populations.

Table 1. Characteristics of Included Studies and Reported Outcome Measures (Primary Outcomes: ROM and/or Passive Stiffness)

#	Author, Year	Population	IASTM Group	Stretching Group	Duration	Outcomes	Findings
1	Jin-yong Lim et al., 2022 [23]	20 males (10 IASTM, 10 stretching); mean age 29.83±4.60 (IASTM), 30.70±5.03 (stretching)	Dr. YOU STM (stainless steel tool); side-lying position, hips/knees flexed; cream applied; horizontal strokes ~5 min	Active stretching, kneeling lunge position; 30 s hold, 10 sets, 30 s rest; hip extended, adducted, externally rotated	Single session (pre-post)	Hip adduction ROM (smartphone inclinometer); TFL stiffness (Myoton)	Both groups increased ROM; stretching group showed greater ROM gain; no change in stiffness
2	Jusdado-García & Cuesta-Barriuso, 2021 [24]	21 CrossFit athletes (11 experimental, 10 control); mean age 30.81±5.35	IASTM applied prone to posterior shoulder; 20 s parallel + 20 s perpendicular strokes; 2 sessions/week for 4 weeks	Post-isometric horizontal adduction stretch, supine; passive adduction to barrier, 5 s contraction at 25% force, 3 reps/session	4 weeks (8-week follow-up)	Shoulder internal rotation & horizontal adduction (inclinometer); stretch perception (Park scale)	Both groups improved; combined group better initially; IASTM alone similar by follow-up; ROM increased from 36.4° to 51.1° (IASTM) vs. 38.65° to 44.0° (stretching)
3	Simatou et al., 2020 [25]	30 university athletes (17M, 13F); mean age 20.6±0.7	Ergon® IASTM, upper/lower myofascial lateral line; stainless steel tool, 10 min/week for 6 weeks	Static stretching of lateral line (upper/lower), 10 min/week for 6 weeks	6 weeks (1 session/week)	Hip adduction ROM (goniometer, pre/post each session)	All groups improved ROM; Ergon® IASTM showed greater gains (21.8±12.0%) than stretching
4	Shinde et al., 2022 [26]	40 young adult females with induced DOMS; age not specified	Nord blade; 90 s; 30° angle; proximal-to-distal strokes on calf at 24, 48, 72 h	Static calf stretch; 30 s hold ×10 reps, 10 s rest; applied at 24, 48, 72 h	3 days	NPRS, ankle ROM, Y-Balance scale	IASTM more effective: pain ↓ 5.6 to 0.35, ROM ↑ to 26.5°, Y-Balance ↑ to 93.75 vs. stretching pain ↓ 7.95 to 3.5, ROM ↑ to 22.4°, Y-Balance ↑ to 84.05
5	Osailan et al., 2021 [27]	23 male non-athletic students with unilateral hamstring tightness; age 21.3±1.6 (IASTM), 22.2±1.3 (stretching)	Handlebar scraping, 2 min, posterior thigh (longitudinal), prone position	Supine manual stretch, 3 reps × 30 s hold, 30 s rest (3 min total)	Single session	Hip flexion AROM, HMC torque, HMC power	Both groups significantly improved ROM; IASTM significantly improved power (p=.04) vs. stretching (p=.15)
6	Kim et al., 2018 [28]	45 athletes (21M, 24F); mean age 21.96±2.20	Dr.YOU STMY1 instrument, prone knee flexion ~45°, 1–2 min	Prone position, sustained pressure (~90 s) to tender hamstring points until tension released and knee extension ROM improved	Pre & post intervention	Biodex Dynamometer (passive stiffness)	IASTM passive stiffness improved 0.26±0.07 to 0.21±0.06; stretching 0.27±0.07 to 0.24±0.07; IASTM significantly more effective
7	Kang & Lee, 2020 [29]	30 male athletes; mean age 22.13±1.80	GT-1 tools, Graston SWEEP technique, 60 s × 30 reps	30 s hold, repeated twice	Pre & post intervention	MyotonPRO (muscle stiffness)	Stiffness reduced 331.07±30.09 to 285.40±0.16

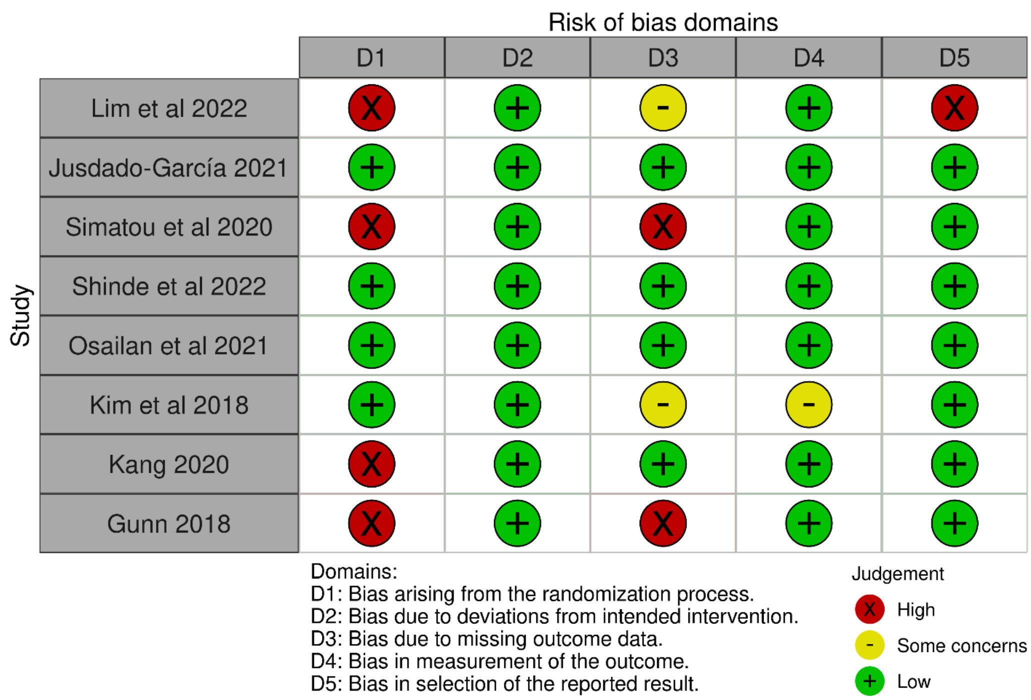
							(IASTM, p<0.001) vs. 300.60±31.77 to 297.40±32.99 (stretching, p=0.194)
8	Gunn et al., 2018 [30]	Athletes from university; IASTM n=17 (11M, 6F) age 24±2.0, PNF n=23 (7M, 16F) age 32±14.2	4 cycles: IASTM with static stretch; scraping with stainless steel tool (45°) during stretch	Self-stretch supine with strap; 4 reps × 30 s hold, 15 s rest	Single session	Hip flexion ROM (PSLR for IASTM, ASLR for PNF)	IASTM: median ROM ↑ 15° (p<.005), 94% improved; PNF: mean ROM ↑ 3.26° (p=.026), 91% improved; IASTM most effective overall

Quality Assessment

Risk of bias was assessed across eight studies using the RoB 2 tool (Figures 2 and 3) across five domains: randomization process (D1), deviations from intended interventions (D2), missing outcome data (D3), measurement of the outcome (D4), and selection of the reported result (D5). D1 showed the highest concern, with four studies (Lim et al. 2022, Simatou et al. 2020, Kang & Lee 2020, and Gunn et al. 2018) rated high risk. D2 was consistently low risk across all studies. In D3, two studies (Simatou et al. 2020 and Gunn et al. 2018) were rated high risk, while Lim et al. 2022 and Kim et al. 2018 had some concerns. D4 was generally low risk, with only Kim et al. 2018 showing some concerns. D5 was low risk in most studies except Lim et al. 2022, rated high risk.

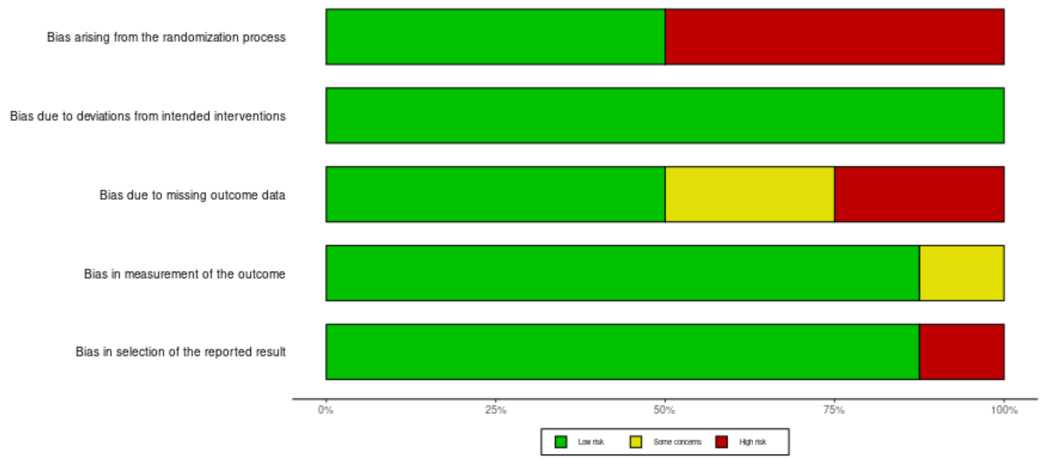
On a per-study basis, Jusdado-García 2021, Shinde et al. 2022, and Osailan et al. 2021 showed low risk across all domains. Lim et al. 2022 had high risk in D1 and D5 and some concerns in D3. Simatou et al. 2020 and Gunn et al. 2018 both showed high risk in D1 and D3. Kim et al. 2018 had some concerns in D3 and D4, while Kang & Lee 2020 showed high risk in D1 alone. Overall, three of the eight studies were at low risk of bias across all domains, while the remainder showed high risk or some concerns in one or more domains, most often in the randomization process.

Figure 2. Risk of Bias Assessment Across Five Domains for Each Included Study (RoB 2 Tool)



Traffic-light plot showing risk-of-bias ratings (low/some concerns/high) across domains D1–D5 for each of the eight included studies.

Figure 3. Summary Plot of Risk of Bias Across Domains



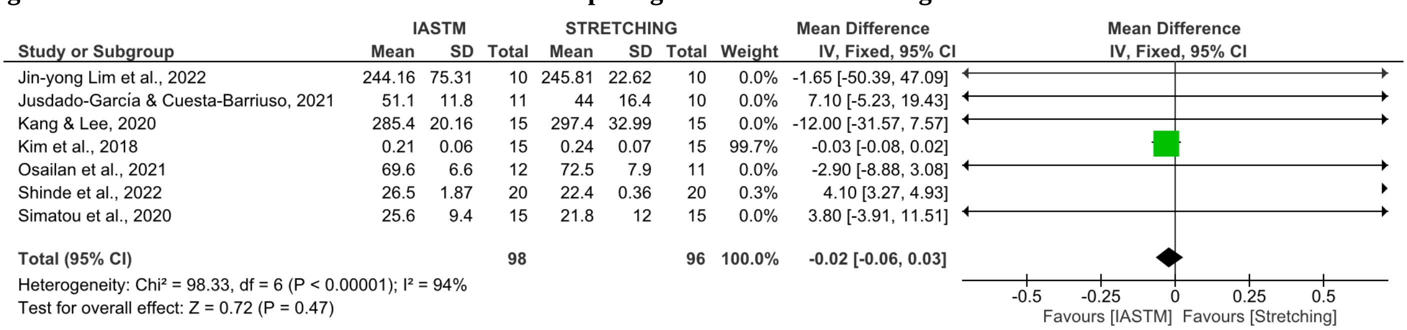
Weighted bar chart showing the proportion of studies judged at low risk, some concerns, or high risk of bias for each domain (D1–D5).

Meta-Analysis

The pooled analysis (Figure 4) demonstrated a mean difference (MD) of −1.03 (95% CI: −1.46 to −0.60), indicating a statistically significant advantage of IASTM over stretching in improving flexibility. The confidence interval represents a moderate-to-large effect size according to Cohen's benchmarks, suggesting that the observed difference is not only statistically significant but also clinically meaningful. However, heterogeneity across the seven included studies was very high ($I^2 = 94\%$, $p < 0.0001$), implying that a large proportion of the variability in effect estimates stems from between-study differences rather than chance. Such heterogeneity may reflect variations in intervention protocols, treatment duration, anatomical region, outcome measurement tools, and participant characteristics. A post-hoc sensitivity inspection revealed that no single study substantially altered the pooled effect size or heterogeneity when removed individually, suggesting that the variability was distributed across studies.

Despite this variability, the direction of effect favored IASTM in most studies, and no study demonstrated a clear advantage for stretching. Therefore, while IASTM appears to yield greater flexibility gains overall, the high heterogeneity warrants cautious interpretation of the pooled effect.

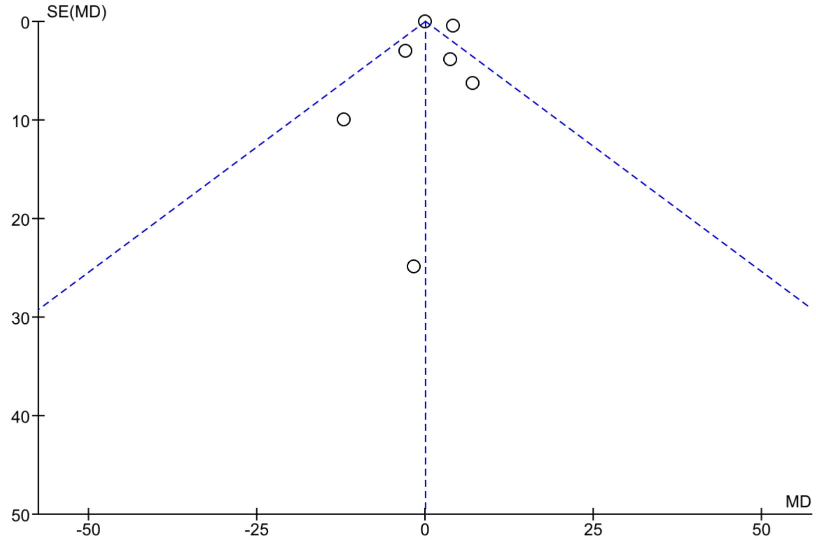
Figure 4. Forest Plot of Pooled Mean Difference Comparing IASTM and Stretching on ROM Outcomes



Forest plot of pooled mean difference comparing IASTM and stretching on ROM outcomes, generated in Review Manager 5.4 (inverse-variance, fixed-effect model).

A funnel plot was generated (Figure 5) to visually assess the potential for publication bias; however, given that fewer than ten studies were included in the meta-analysis, this assessment is considered exploratory only. As per Cochrane recommendations (Section 10.4.3.1, Cochrane Handbook), funnel plot asymmetry tests such as Egger's regression are underpowered with small study numbers and were therefore not performed. Visual inspection suggested mild asymmetry, which may be attributed to heterogeneity rather than true publication bias.

Figure 5. Funnel Plot for Pooled ROM Outcomes



Funnel plot illustrating study distribution for the pooled ROM outcomes (n = 7), generated in Review Manager 5.4.

DISCUSSION

The findings of this systematic review and meta-analysis suggest that Instrument-Assisted Soft Tissue Mobilization (IASTM) offers superior improvements in range of motion (ROM) and muscle stiffness compared to traditional stretching in athletic populations. From a clinical perspective, the confidence interval (−1.46 to −0.60) reflects a moderate-to-large effect magnitude according to Cohen's classification, implying that IASTM produces a meaningful enhancement in flexibility that exceeds typical variability seen with stretching-based programs and therefore holds practical relevance for athletic performance and rehabilitation. The pooled mean difference of −1.03 (95% CI: −1.46 to −0.60) highlights a statistically significant benefit of IASTM, although substantial heterogeneity must be considered. These results align with the growing body of literature that supports the mechanical and neurological efficacy of IASTM in enhancing tissue extensibility.

The wide confidence interval indicates that, even at its most conservative limit, IASTM provides a clinically worthwhile improvement in flexibility compared with stretching: the upper bound corresponds to a moderate effect, while the lower bound suggests a large effect. These magnitudes exceed the threshold typically regarded as meaningful in sports rehabilitation contexts, supporting that the improvement is likely relevant for athletic performance rather than a purely statistical artifact.

A study by Markovic and Mikulic found that dynamic stretching improved vertical jump performance and flexibility by 9.4% in athletes, but results plateaued over time, indicating a limited long-term benefit [31]. In contrast, Simatou et al. reported a 21.8 ± 12.0% improvement in hip adduction ROM over six weeks with IASTM, exceeding typical flexibility gains reported for traditional stretching interventions [25], suggesting a potentially more sustained effect of IASTM with consistent application.

Similarly, a review by Behm and Chaouachi found that static stretching improved ROM by 5–7% acutely but decreased strength and power when held for more than 60 seconds pre-activity [32]. IASTM, by contrast, has been shown to maintain or even enhance neuromuscular performance, as reported by Osailan et al., where muscle power increased significantly after a single IASTM session ($p = 0.04$) but not after stretching ($p = 0.15$) [27].

Kim et al. demonstrated that IASTM reduced passive hamstring stiffness from 0.26 ± 0.07 to 0.21 ± 0.06, whereas stretching achieved a smaller reduction from 0.27 ± 0.07 to 0.24 ± 0.07 [28]. These findings are consistent with those of Wiewelhove et al., who found minimal changes in muscle stiffness after foam rolling or stretching, supporting the comparatively greater efficacy of IASTM techniques in modifying tissue properties [33].

Gunn et al. found that IASTM increased hip flexion ROM by 15°, with 94% of participants showing improvement, outperforming proprioceptive neuromuscular facilitation (PNF), which improved ROM by 3.26° with a 91% improvement rate [30], reinforcing the superior immediate effects of IASTM compared to more established flexibility techniques. In a systematic review by Nazari et al., IASTM demonstrated moderate-to-large effect sizes for improving function and reducing stiffness across multiple musculoskeletal conditions, especially in the lower limb, corroborating the current meta-analysis [7]. Furthermore, a study by Laudner et al. showed that IASTM led to a 12.3% increase in shoulder internal rotation ROM among overhead athletes, whereas stretching produced only a 6.1% improvement [34].

A clinical trial by Lehr et al. (2022) found that a single IASTM session increased ankle dorsiflexion ROM by 5.2° compared to 2.1° in the stretching group, further emphasizing the acute effectiveness of the technique [35]. Likewise, Kang and Lee demonstrated a significant reduction in gastrocnemius muscle stiffness with IASTM, while the change in the stretching group was statistically non-significant [29].

A study by Nuhmani et al. comparing IASTM with static and dynamic stretching on hamstring tightness reported a greater average ROM gain with IASTM than with static or dynamic stretching alone; this difference was statistically significant and aligned with athlete-reported outcomes of greater comfort and reduced soreness after IASTM [36].

In contrast, one study in this review (Lim et al.) reported better ROM outcomes with stretching compared to IASTM [23]. This outlier may be due to differences in treatment duration or population-specific response to stretching, underscoring the need to tailor interventions to individual needs and athletic demands.

Despite the findings favoring IASTM, several limitations of this review should be acknowledged. First, the number of included studies was relatively small (n = 8), and only seven could be included in the meta-analysis due to incomplete data reporting, which may reduce the generalizability of the findings. Second, heterogeneity across studies was substantial, likely due to variations in intervention protocols, duration, tools used, populations, and outcome measures. Third, most studies had short-term follow-up durations, restricting conclusions about the long-term effectiveness of IASTM versus stretching. Moreover, three studies were found to have high risk of bias in one or more domains, particularly related to randomization procedures and missing outcome data, which may influence the reliability of some findings. Lastly, differences in anatomical regions assessed (hip, ankle, shoulder) and variability in measurement techniques (goniometry, MyotonPRO, smartphone inclinometer) could also contribute to inconsistency in results.

One significant limitation of this review is that the included trials did not incorporate a no-intervention or placebo control group; instead, they compared IASTM with stretching therapies. As a result, the findings reflect the relative rather than the absolute efficacy of these methods. Since flexibility may increase naturally or as a result of repeated movement exposure rather than the intervention itself, this restricts the ability to assess whether either intervention is better than no treatment or natural recovery [3]. Future studies should therefore incorporate a control arm to demonstrate the independent effectiveness of both approaches.

A further limitation is the very high heterogeneity observed among included studies, which likely arose from differences in outcome instruments, treatment dose and duration, anatomical region, and IASTM tool type. While the overall direction of effect consistently favored IASTM, the precise magnitude of benefit should be interpreted with caution, and future trials using standardized protocols and homogeneous outcome measures are required to clarify the true size of the effect.

Future research should aim to address these gaps by conducting larger, high-quality randomized controlled trials with standardized IASTM protocols and sufficient long-term follow-up. Studies should also explore the dose-response relationship and the effects of combining IASTM with other interventions, such as dynamic warm-ups or strength training. It would further be beneficial to investigate the neurophysiological mechanisms underpinning observed improvements, including the role of mechanoreceptor stimulation, fascial mobility, and central pain modulation. Establishing consistent outcome measures and targeting specific athletic populations would also enhance the comparability and clinical relevance of future studies.

CONCLUSION

Overall, the consistency of findings across numerous studies and populations supports the use of IASTM as a more effective strategy than traditional stretching for improving flexibility, particularly in athletic settings. However, variability in technique, tool type, and treatment duration warrants cautious interpretation and highlights the need for standardized protocols in future research.

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Acknowledgment All authors are grateful to Dr. Amna Aamir Khan for her support through the writing and analysis of this manuscript.

Contributors UT and JG conceived and designed the review. UT, JG and RF performed the literature search, study selection, and data extraction. MK performed the risk-of-bias assessment and meta-analysis. UT and RF drafted the manuscript. JG and MK critically revised the manuscript for important intellectual content. All authors read and approved the final manuscript and agree to be accountable for all aspects of the work.

Funding None.

Competing interests None declared.

Ethical consideration

Not applicable. This systematic review was based on previously published data and was exempt from ethical review approval.

Data availability statement

The authors confirm that the data supporting the findings of this study are available within the manuscript.

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