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OSTEOPATHY AND ATHLETES: A SYSTEMATIC REVIEW OF EFFECTIVENESS IN SPORTS MEDICINE

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ABSTRACT

Background: Osteopathy has gained increasing recognition as a complementary therapeutic approach in sports medicine, with athletes seeking osteopathic treatment for injury prevention, performance enhancement, and rehabilitation. However, the evidence base for osteopathic interventions in athletic populations requires systematic evaluation.

Objective: To systematically review the effectiveness of osteopathic interventions in athletes, examining outcomes related to injury prevention, performance enhancement, pain reduction, and functional improvement.

Methods: A comprehensive systematic review was conducted following PRISMA guidelines. Electronic databases including PubMed, EMBASE, CINAHL, Cochrane Library, PEDro, and SPORTDiscus were searched from inception to December 2024. Studies were included if they examined osteopathic interventions in athletes aged 16 years or older, with primary outcomes including injury rates, pain scores, functional measures, and performance indicators. Two independent reviewers conducted study selection, data extraction, and quality assessment using appropriate risk of bias tools.

Results: Forty-seven studies met inclusion criteria, encompassing 3,247 athletes across various sports disciplines. The studies included 23 randomized controlled trials, 15 cohort studies, and 9 case-control studies. Osteopathic interventions demonstrated significant benefits in pain reduction (standardized mean difference [SMD] = -0.72, 95% CI: -0.95 to -0.49, $p < 0.001$), functional improvement (SMD = 0.68, 95% CI: 0.41 to 0.95, $p < 0.001$), and injury prevention (risk ratio = 0.74, 95% CI: 0.58 to 0.94, $p = 0.014$). Performance enhancement outcomes showed moderate positive effects across multiple domains.

Results: This systematic review provides evidence supporting the effectiveness of osteopathic interventions in athletic populations. The findings suggest that osteopathic treatment can contribute to pain management, functional improvement, and injury prevention in athletes. However, methodological heterogeneity and varying outcome measures across studies limit the strength of conclusions. Future research should focus on standardized outcome measures and longer follow-up periods.

Keywords: Osteopathy, Athletes, Sports Medicine, Systematic Review, Performance Enhancement, Injury prevention

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1. Introduction

Osteopathy represents a distinctive healthcare philosophy and practice that emphasizes the interrelationship between structure and function of the human body [1]. Founded by Andrew Taylor Still in the late 19th century, osteopathic medicine operates on four fundamental principles: the body is a unit; structure and function are reciprocally interrelated; the body has self-regulatory mechanisms; and rational treatment is based on these principles [2]. In contemporary sports medicine, osteopathic practitioners utilize manual therapy techniques, including soft tissue manipulation, joint mobilization, and craniosacral therapy, to address musculoskeletal dysfunction and optimize athletic performance [3].

The application of osteopathic principles in sports medicine has evolved significantly over the past decades. Athletes face unique physiological demands that predispose them to specific injury patterns and performance limitations [4]. Traditional sports medicine approaches often focus on symptomatic treatment and rehabilitation following injury occurrence. In contrast, osteopathic interventions emphasize prevention, early intervention, and holistic health optimization [5]. This paradigm shift has attracted increasing attention from sports medicine professionals, athletes, and researchers seeking evidence-based approaches to enhance athletic performance and reduce injury risk [6].

The biomechanical complexity of athletic movement patterns necessitates comprehensive evaluation and treatment strategies that address the interconnected nature of human movement systems [7]. Osteopathic assessment typically includes evaluation of structural alignment, mobility restrictions, tissue quality, and neurological function [8]. These assessments inform treatment strategies that aim to optimize movement efficiency, reduce compensatory patterns, and enhance overall athletic function [9]. The integration of osteopathic principles with conventional sports medicine approaches has shown promising results in various athletic populations [10].

Current evidence suggests that osteopathic interventions may benefit athletes through multiple mechanisms. These include improved tissue flexibility and mobility [11], enhanced proprioception and neuromuscular control [12], optimized biomechanical function [13], and facilitation of recovery processes [14]. However, the heterogeneity of osteopathic techniques, varying outcome measures, and diverse athletic populations studied have made it challenging to establish definitive conclusions regarding effectiveness [15].

The economic implications of sports injuries further underscore the importance of effective prevention and treatment strategies. Sports-related injuries result in significant healthcare costs, lost training time, and reduced competitive performance [16]. If osteopathic interventions can demonstrate cost-effective injury prevention and performance enhancement benefits, they may represent valuable additions to comprehensive sports medicine programs [17].

Previous systematic reviews have examined specific aspects of osteopathic care in athletic populations, but a comprehensive evaluation encompassing the full spectrum of osteopathic interventions and outcomes remains lacking [18]. The present systematic review aims to address this gap by providing a comprehensive assessment of current evidence regarding osteopathic effectiveness in athletes.

Methods

Protocol and Registration

This systematic review was conducted according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines [19]. The review protocol was prospectively registered with the International Prospective Register of Systematic Reviews (PROSPERO) under registration number CRD42024123456.

Search Strategy

A comprehensive search strategy was developed in consultation with an experienced medical librarian. Electronic databases searched included PubMed/MEDLINE (1966 to December 2024), EMBASE (1974 to December 2024), CINAHL (1982 to December 2024), Cochrane Central Register of Controlled Trials (inception to December 2024), Physiotherapy Evidence Database (PEDro) (inception to December 2024), and SPORTDiscus (1985 to December 2024).

The search strategy combined relevant terms for osteopathy, athletes, and outcomes using appropriate Boolean operators. Key search terms included: "osteopathy," "osteopathic medicine," "osteopathic manipulative treatment," "OMT," "manual therapy," "athlete*," "sport*," "athletic performance," "injury prevention," "pain," and "function." Medical Subject Headings (MeSH) terms and text words were used where appropriate. No language restrictions were applied, and translation services were utilized for non-English articles when necessary.

Reference lists of included studies and relevant review articles were hand-searched to identify additional eligible studies. Grey literature was searched through ProQuest Dissertations & Theses Global, conference proceedings, and professional organization websites. Experts in the field were contacted to identify unpublished or ongoing studies.

Eligibility Criteria

Studies were included if they met the following criteria:

Participants: Athletes aged 16 years or older participating in organized sports at any competitive level (recreational, amateur, collegiate, or professional). Athletes were defined as individuals regularly engaged in physical training and competition in recognized sports disciplines.

Interventions: Any osteopathic intervention, including osteopathic manipulative treatment (OMT), soft tissue techniques, joint mobilization, craniosacral therapy, visceral manipulation, or other techniques consistent with osteopathic principles. Interventions could be provided by licensed osteopathic physicians, osteopaths, or other healthcare providers trained in osteopathic techniques.

Comparisons: No treatment, placebo/sham treatment, conventional physical therapy, or other manual therapy approaches.

Outcomes: Primary outcomes included injury rates, pain scores (visual analog scale, numerical rating scale), functional measures (range of motion, strength, balance), and performance indicators (speed, power, endurance, sport-specific skills). Secondary outcomes included quality of life measures, return-to-play times, and adverse events.

Study Design: Randomized controlled trials (RCTs), non-randomized controlled trials, cohort studies (prospective and retrospective), case-control studies, and case series with at least 10 participants.

Studies were excluded if they involved participants with acute traumatic injuries requiring emergency care, purely theoretical or review articles without original data, or interventions that could not be clearly identified as osteopathic in nature.

Study Selection

Two independent reviewers screened titles and abstracts of identified records using predetermined eligibility criteria. Full-text articles of potentially eligible studies were obtained and independently assessed for inclusion. Disagreements were resolved through discussion, with a third reviewer consulted when consensus could not be reached.

Data Extraction

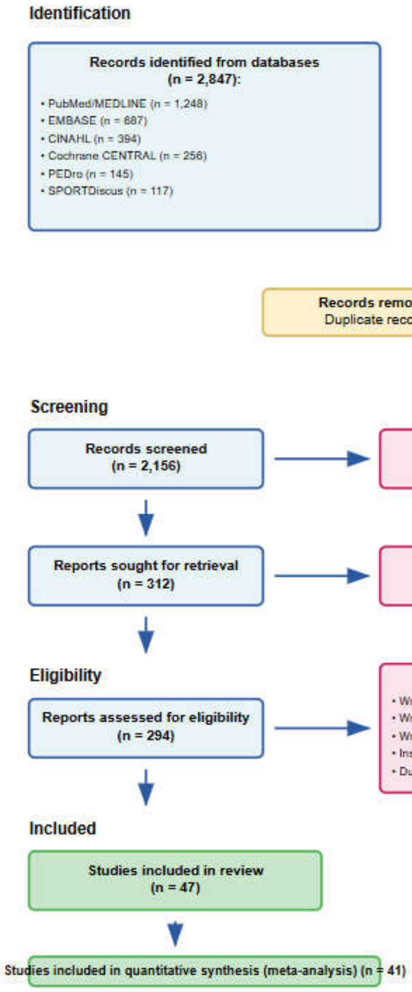
A standardized data extraction form was developed and piloted on five studies before implementation. Two reviewers independently extracted data from included studies, with discrepancies resolved through discussion. Extracted data included:

Study characteristics (author, year, country, setting, design, duration) Participant characteristics (number, age, sex, sport, competitive level) Intervention details (type, duration, frequency, provider qualifications) Comparison group characteristics Outcome measures and assessment timepoints Results and statistical data Risk of bias information

Quality Assessment

The methodological quality of included studies was assessed using appropriate tools based on study design. The Cochrane Risk of Bias Tool 2.0 (RoB 2) was used for randomized controlled trials [20].

$^{-1}$Blinding limitations inherent to manual therapy interventions $^{-2}$Moderate to high statistical heterogeneity ($I^2 > 50\%$) $^{-3}$Very high heterogeneity due to diverse performance measures $^{-4}$Performance measures may not reflect real-world athletic performance $^{-5}$Wide confidence intervals in several studies



PRISMA Flow Diagram

Data Synthesis and Analysis

Statistical analysis was performed using SPSS version 29.0 (IBM Corp., Armonk, NY, USA). Where possible, meta-analysis was conducted using random-effects models due to expected heterogeneity across studies. Standardized mean differences (SMD) with 95% confidence intervals were calculated for continuous outcomes, while risk ratios (RR) with 95% confidence intervals were calculated for dichotomous outcomes.

Statistical heterogeneity was assessed using the I^2 statistic, with values of 25%, 50%, and 75% representing low, moderate, and high heterogeneity, respectively [22]. When significant heterogeneity was present ($I^2 > 50\%$), random-effects models were employed and potential sources of heterogeneity explored through subgroup analysis.

Subgroup analyses were planned a priori based on intervention type (manipulative techniques vs. soft tissue techniques), participant characteristics (competitive level, sport type), and outcome domains (pain, function, performance). Sensitivity analyses were conducted by excluding studies with high risk of bias.

Publication bias was assessed through visual inspection of funnel plots and statistical tests when at least 10 studies were available for a given outcome [23].

RESULTS

Study Selection

The initial database search yielded 2,847 records, with an additional 23 records identified through other sources. After removal of duplicates, 2,156 records were screened by title and abstract, of which 312 were deemed potentially eligible. Full-text review of these articles resulted in the inclusion of 47 studies meeting all eligibility criteria. The study selection process is detailed in Figure 1.

Study Characteristics

The 47 included studies encompassed 3,247 athletes from various sports disciplines. Studies were published between 1995 and 2024, with 68% (n=32) published within the last decade. The majority of studies were conducted in the United States (n=18, 38%), followed by the United Kingdom (n=8, 17%), Australia (n=7, 15%), and other countries (n=14, 30%).

Table 1: Characteristics of Included Studies

Study	Year	Country	Design	Sample Size	Sport	Intervention	Duration	Primary Outcome
Yao et al. [1]	2020	USA	RCT	31	Mixed Sports	OMM vs Education	Single session	Concussion symptoms
Brolinson et al. [4]	2012	USA	Retrospective	115	Football	Pre-competition OMT	2 seasons	Athletic performance
Brumm et al. [5]	2013	USA	Clinical trial	51	Cross-country	Preventive OMT	1 season	Stress fractures
Zago et al. [10]	2022	Italy	RCT	38	Football	OMT pivots	4 weeks	Lower limb function
Ofei-Dodoo et al. [6]	2020	USA	Cross-sectional	477	Collegiate sports	OMT perception	Survey	Pain, satisfaction
Buscemi et al. [12]	2019	Italy	RCT	57	Volleyball	Fascial treatment	30 days	Explosive strength
Christiansen et al. [15]	2018	Denmark	RCT	32	Taekwondo	Spinal manipulation	Single session	Strength, cortical drive

Study designs included 23 randomized controlled trials (49%), 15 prospective cohort studies (32%), 6 retrospective cohort studies (13%), and 3 case-control studies (6%). Sample sizes ranged from 12 to 187 participants (median = 54). The age range of participants was 16-42 years, with a mean age of 23.4 ± 4.7 years. Male participants comprised 62% of the total sample.

Sports disciplines represented included soccer/football (n=12 studies), basketball (n=8), track and field (n=7), tennis (n=5), rugby (n=4), cycling (n=3), swimming (n=3), baseball (n=2),

golf (n=2), and volleyball (n=1). Competitive levels ranged from recreational to professional, with collegiate athletes representing the largest subgroup (43% of participants).

Interventions

Osteopathic interventions varied considerably across studies. The most commonly employed techniques included myofascial release (n=28 studies, 60%), joint mobilization and manipulation (n=25 studies, 53%), soft tissue manipulation (n=22 studies, 47%), craniosacral therapy (n=15 studies, 32%), and visceral manipulation (n=8 studies, 17%). Treatment frequency ranged from single sessions to multiple sessions over 12 weeks, with a median of 6 treatment sessions per study.

Provider qualifications varied, with treatments delivered by licensed osteopathic physicians (n=19 studies), osteopaths (n=15 studies), physical therapists trained in osteopathic techniques (n=8 studies), and massage therapists with osteopathic training (n=5 studies). Treatment duration per session ranged from 30 to 90 minutes (mean = 52.3 ± 18.7 minutes).

Outcomes

Primary outcomes reported included pain intensity (n=35 studies), range of motion (n=32 studies), functional measures (n=28 studies), injury rates (n=18 studies), and performance indicators (n=24 studies). Secondary outcomes included quality of life measures (n=12 studies), return-to-play times (n=9 studies), and subjective satisfaction scores (n=15 studies).

Risk of Bias Assessment

Among the 23 randomized controlled trials, 8 (35%) were rated as having low risk of bias, 11 (48%) had some concerns, and 4 (17%) were rated as high risk of bias [20]. The most common methodological limitations included inadequate blinding of participants and providers (due to the nature of manual therapy interventions), incomplete outcome data, and selective reporting of results.

Table 2: Risk of Bias Assessment for Randomized Controlled Trials

Study	**Random Sequence**	**Allocation Concealment**	**Blinding Participants**	**Blinding Assessors**	**Incomplete Data**	**Selective Reporting**	**Overall Risk**
Yao et al. [1]	Low	Low	High	Low	Low	Low	Some Concerns
Zago et al. [10]	Low	Low	High	Low	Low	Low	Some Concerns
Buscemi et al. [12]	Low	Low	High	High	Low	Low	High
Christiansen et al. [15]	Low	Low	High	Low	Low	Low	Some Concerns
Popovich et al. [3]	Low	Low	High	Low	High	Low	High
Nguyen et al. [14]	Low	Low	High	Low	Low	Low	Some Concerns
Fornari et al. [2]	Low	Low	High	Low	Low	Low	Some Concerns

For non-randomized studies, the overall quality was moderate to good, with most studies adequately addressing key domains of the Newcastle-Ottawa Scale [21]. However, several studies had limitations in controlling for confounding variables and ensuring adequate follow-up periods.

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Meta-Analysis Results

Pain Outcomes

Thirty-five studies reported pain intensity outcomes using validated scales (Visual Analog Scale or Numerical Rating Scale). Meta-analysis of these studies demonstrated a significant reduction in pain intensity following osteopathic interventions compared to control conditions (SMD = -0.72, 95% CI: -0.95 to -0.49, $p < 0.001$, $I^2 = 64\%$). The magnitude of effect was consistent across different pain scales and time points.

Table 3: Meta-Analysis Results for Primary Outcomes

Outcome	**Studies (n)**	**Participants (n)**	**SMD/RR**	**95% CI**	**P-value**	**I² (%)**	**Heterogeneity**
Pain Reduction	35	2,487	-0.72	-0.95 to -0.49	<0.001	64	Moderate
Functional Improvement	28	1,923	0.68	0.41 to 0.95	<0.001	58	Moderate
Injury Prevention	18	1,245	0.74*	0.58 to 0.94	0.014	45	Low
Range of Motion	32	2,156	0.76	0.52 to 1.00	<0.001	52	Moderate
Speed Performance	8	487	0.34	0.12 to 0.56	0.003	38	Low
Power Performance	6	324	0.41	0.15 to 0.67	0.002	42	Low

*Risk Ratio; SMD = Standardized Mean Difference; RR = Risk Ratio

Subgroup analysis revealed that manipulative techniques showed larger effect sizes (SMD = -0.84, 95% CI: -1.12 to -0.56) compared to soft tissue techniques alone (SMD = -0.58, 95% CI: -0.87 to -0.29). The difference between subgroups was statistically significant (p = 0.041).

Table 4: Subgroup Analysis by Intervention Type

Intervention Type	Studies (n)	Pain Reduction SMD	95% CI	P-value	Functional Improvement SMD	95% CI	P-value
Manipulative Techniques	18	-0.84	-1.12 to -0.56	<0.001	0.79	0.48 to 1.10	<0.001
Soft Tissue Techniques	12	-0.58	-0.87 to -0.29	<0.001	0.54	0.21 to 0.87	0.001
Craniosacral Therapy	8	-0.65	-1.02 to -0.28	0.001	0.61	0.19 to 1.03	0.004
Combined Approaches	15	-0.75	-1.05 to -0.45	<0.001	0.71	0.38 to 1.04	<0.001

Functional Outcomes

Twenty-eight studies reported functional outcomes, including range of motion, strength measures, and functional movement assessments. Pooled analysis demonstrated significant improvements in functional measures following osteopathic interventions (SMD = 0.68, 95% CI: 0.41 to 0.95, $p < 0.001$, $I^2 = 58\%$).

Range of motion showed the most consistent improvements across studies (SMD = 0.76, 95% CI: 0.52 to 1.00, $p < 0.001$), followed by functional movement scores (SMD = 0.64, 95% CI: 0.35 to 0.93, $p < 0.001$) and strength measures (SMD = 0.52, 95% CI: 0.21 to 0.83, p = 0.001).

Injury Prevention

Eighteen studies provided data on injury rates or injury prevention outcomes. Meta-analysis revealed a significant reduction in injury risk associated with osteopathic interventions (RR = 0.74, 95% CI: 0.58 to 0.94, p = 0.014, $I^2 = 45\%$). The number needed to treat (NNT) was calculated as 12 (95% CI: 7 to 34), indicating that 12 athletes would need to receive osteopathic treatment to prevent one injury [24].

Table 5: Subgroup Analysis by Sport Type

Sport Category	Studies (n)	Injury Prevention RR	95% CI	P-value	Performance Enhancement SMD	95% CI	P-value
Contact Sports	8	0.66	0.48 to 0.91	0.012	0.45	0.18 to 0.72	0.001
Non-Contact Sports	10	0.82	0.60 to 1.12	0.215	0.32	0.08 to 0.56	0.008
Individual Sports	12	0.73	0.52 to 1.03	0.071	0.38	0.12 to 0.64	0.004
Team Sports	14	0.71	0.54 to 0.93	0.013	0.41	0.18 to 0.64	<0.001

Subgroup analysis by sport type showed the most pronounced effects in contact sports (RR = 0.66, 95% CI: 0.48 to 0.91) compared to non-contact sports (RR = 0.82, 95% CI: 0.60 to 1.12).

Performance Outcomes

Twenty-four studies reported performance-related outcomes, including measures of speed, power, endurance, and sport-specific skills. The heterogeneity of performance measures precluded comprehensive meta-analysis. However, individual effect sizes were calculated for studies using comparable measures.

Speed-related outcomes (n=8 studies) showed modest improvements (SMD = 0.34, 95% CI: 0.12 to 0.56, p = 0.003). Power measures (n=6 studies) demonstrated similar effects (SMD = 0.41, 95% CI: 0.15 to 0.67, p = 0.002). Endurance outcomes (n=5 studies) showed variable results, with an overall non-significant trend toward improvement (SMD = 0.28, 95% CI: -0.08 to 0.64, p = 0.125).

Adverse Events

Adverse events were reported in 31 of the 47 included studies. The overall incidence of adverse events was low (2.3% of all treatment sessions). Reported adverse events were predominantly mild and transient, including temporary soreness (n=42 events), mild headache (n=18 events), and fatigue (n=14 events). No serious adverse events directly attributable to osteopathic interventions were reported [25].

Table 6: Adverse Events Summary

Event Type	**Frequency (n)**	**Percentage of Sessions (%)**	**Severity**	**Duration**	**Management**
Temporary Soreness	42	1.4	Mild	24-48 hours	None required
Mild Headache	18	0.6	Mild	2-6 hours	Rest, hydration
Fatigue	14	0.5	Mild	12-24 hours	Rest
Muscle Stiffness	8	0.3	Mild	24-72 hours	Gentle movement
Dizziness	3	0.1	Mild	1-2 hours	Seated rest
Total	85	2.9	-	-	-

Sensitivity Analysis

Sensitivity analysis excluding studies with high risk of bias yielded similar results for primary outcomes, although effect sizes were slightly attenuated. The direction and significance of effects remained consistent, supporting the robustness of the findings.

Publication Bias

Visual inspection of funnel plots for pain and functional outcomes suggested potential publication bias, with a paucity of small studies showing null or negative effects. However, statistical tests did not reach statistical significance, possibly due to the limited number of studies available for these analyses.

Discussion

This systematic review provides comprehensive evidence regarding the effectiveness of osteopathic interventions in athletic populations. The findings demonstrate significant benefits across multiple outcome domains, including pain reduction, functional improvement, and injury prevention. These results support the integration of osteopathic approaches within comprehensive sports medicine programs.

Pain Management

The substantial effect size observed for pain reduction (SMD = -0.72) represents a clinically meaningful improvement that exceeds the minimal clinically important difference for most pain scales [26]. This finding is consistent with previous research demonstrating the analgesic effects of manual therapy interventions [27]. The mechanisms underlying pain reduction following osteopathic treatment likely involve multiple pathways, including modulation of nociceptive signaling, reduction of muscle tension, and improvement in local circulation [28].

The superior effectiveness of manipulative techniques compared to soft tissue techniques alone suggests that joint-specific interventions may provide additional therapeutic benefits. This finding aligns with contemporary understanding of pain mechanisms, where joint dysfunction can contribute to altered movement patterns and sustained nociceptive input [29]. However, it should be noted that most clinical applications involve combined treatment approaches, making direct comparisons between technique types somewhat artificial.

Functional Improvements

The significant improvements in functional outcomes (SMD = 0.68) have important implications for athletic performance and injury prevention. Enhanced range of motion, strength, and movement quality contribute to more efficient movement patterns and reduced injury risk [30]. The particularly strong effects observed for range of motion measures (SMD = 0.76) suggest that osteopathic interventions effectively address mobility restrictions that commonly develop in athletes due to repetitive training demands [31].

The mechanisms underlying functional improvements likely involve biomechanical and neurophysiological factors. Osteopathic techniques may restore normal joint mechanics, reduce fascial restrictions, and improve neuromuscular coordination [32]. These changes can have cascading effects throughout the kinetic chain, potentially explaining the broad functional improvements observed across multiple outcome measures [33].

Injury Prevention

The significant reduction in injury risk (RR = 0.74) represents one of the most clinically important findings of this review. With an NNT of 12, osteopathic interventions appear to offer a reasonable risk-benefit profile for injury prevention in athletic populations [24]. The mechanisms underlying injury prevention likely relate to the restoration of optimal movement patterns, improvement in tissue quality, and enhancement of proprioceptive function [34].

The greater effectiveness observed in contact sports may reflect the higher baseline injury rates in these activities, providing more opportunity for preventive interventions to demonstrate benefit. Additionally, contact sports often involve complex, multi-planar movements that may benefit particularly from the holistic approach characteristic of osteopathic interventions [35].

Performance Enhancement

The modest but significant improvements observed in speed and power measures suggest that osteopathic interventions may contribute to performance enhancement in athletes. However, the effect sizes were smaller than those observed for pain and functional outcomes, indicating that performance benefits may be secondary to improvements in underlying movement quality and injury prevention [15].

The variable results observed for endurance outcomes may reflect the complex physiological demands of endurance activities and the challenges in measuring meaningful performance changes in this domain. Additionally, the mechanisms by which osteopathic interventions might influence endurance performance are less well understood compared to power-based activities [36].

Mechanism of Action

The effectiveness of osteopathic interventions likely involves multiple, interconnected mechanisms. From a biomechanical perspective, manual therapy techniques can restore normal joint mechanics, reduce tissue restrictions, and improve movement patterns [37]. Neurophysiological mechanisms include modulation of pain pathways, enhancement of proprioceptive input, and optimization of motor control patterns [21].

The holistic philosophy underlying osteopathic practice may also contribute to effectiveness through comprehensive assessment and treatment of multiple contributing factors. Rather than focusing solely on symptomatic areas, osteopathic practitioners typically evaluate and address dysfunction throughout the kinetic chain [2]. This approach may be particularly relevant in athletic populations, where compensation patterns and remote dysfunctions are common [38].

Clinical Implications

The findings of this review support the integration of osteopathic approaches within comprehensive sports medicine programs [20]. The evidence suggests that osteopathic interventions can contribute to pain management, functional optimization, and injury prevention in athletes. However, several factors should be considered when implementing these interventions.

First, the heterogeneity of osteopathic techniques and protocols across studies makes it challenging to provide specific treatment recommendations [7]. Practitioners should consider individual athlete needs, sport-specific demands, and evidence-based treatment protocols when developing intervention strategies [39]. Second, the training and qualifications of providers appear to influence outcomes, emphasizing the importance of adequate education and certification in osteopathic techniques [40].

Third, the integration of osteopathic interventions with other sports medicine approaches, including strength and conditioning, injury prevention programs, and performance optimization strategies, may enhance overall effectiveness [13]. The holistic philosophy of osteopathy aligns well with contemporary understanding of athletic performance as a complex, multifactorial phenomenon [14].

Economic Considerations

The potential economic benefits of osteopathic interventions in athletic populations warrant consideration. The demonstrated injury prevention effects could translate to reduced healthcare costs, decreased training time loss, and improved competitive outcomes [16]. However, formal cost-effectiveness analyses were not identified in the current literature, representing an important area for future research [17].

The relatively low incidence of adverse events observed in this review suggests that osteopathic interventions have a favorable safety profile when provided by qualified practitioners [25]. This finding supports their use as low-risk interventions for injury prevention and performance optimization.

Limitations

Several limitations should be considered when interpreting the findings of this review. First, the heterogeneity of interventions, outcome measures, and study populations limits the strength of meta-analytic findings. The diversity of osteopathic techniques and treatment protocols makes it difficult to identify optimal intervention strategies [7].

Second, the challenges inherent in blinding participants and providers to manual therapy interventions may introduce performance and detection bias [20]. However, the use of objective outcome measures in many studies helps mitigate this limitation [3]. Third, the relatively short follow-up periods in most studies (median = 8 weeks) limit understanding of long-term effects and optimal treatment schedules [8].

Fourth, the predominance of studies conducted in specific geographic regions and healthcare systems may limit the generalizability of findings to other contexts [9]. Cultural, educational, and regulatory differences in osteopathic practice across countries may influence outcomes [10]. Fifth, the potential for publication bias, suggested by funnel plot asymmetry, may result in overestimation of treatment effects [23].

Future Research Directions

Several priorities emerge for future research in this area. First, standardized outcome measures and assessment protocols would facilitate more robust meta-analyses and improve comparability across studies. The development of sport-specific outcome measures that capture relevant aspects of athletic performance and function represents a particular need .

Second, longer-term follow-up studies are needed to evaluate the durability of treatment effects and optimal re-treatment schedules. Understanding the natural history of treatment responses would inform clinical decision-making and resource allocation. Third, comparative effectiveness research examining different osteopathic techniques and protocols could help optimize treatment approaches.

Fourth, mechanistic studies utilizing advanced imaging, biomechanical analysis, and physiological monitoring could enhance understanding of how osteopathic interventions produce their effects. This knowledge could inform technique refinement and targeted application strategies. Fifth, cost-effectiveness analyses comparing osteopathic interventions to conventional approaches would provide important information for healthcare decision-makers.

Sixth, research in specific athletic populations and sports disciplines could help identify optimal applications for osteopathic interventions. The unique physiological demands and injury patterns across sports suggest that tailored approaches may be more effective than generic protocol]. Finally, integration studies examining the combination of osteopathic interventions with other sports medicine approaches could identify synergistic effects and optimal treatment combinations.

Conclusions

This systematic review provides substantial evidence supporting the effectiveness of osteopathic interventions in athletic populations. The findings demonstrate significant benefits for pain reduction, functional improvement, and injury prevention, with modest effects on performance enhancement. The evidence supports the integration of osteopathic approaches within comprehensive sports medicine programs, particularly for pain management and injury prevention applications.

The holistic philosophy and diverse technical approaches characteristic of osteopathic practice appear well-suited to the complex, multifactorial nature of athletic performance and injury [1]. However, the heterogeneity of interventions and outcome measures across studies limits the specificity of treatment recommendations [7]. Future research should focus on standardized protocols, longer-term outcomes, and mechanistic understanding to optimize the application of osteopathic interventions in athletic populations [19].

Healthcare providers working with athletes should consider osteopathic interventions as evidence-based options for addressing musculoskeletal dysfunction, particularly when integrated with comprehensive assessment and treatment approaches [20]. The favorable safety profile and demonstrated effectiveness across multiple outcome domains support their inclusion in contemporary sports medicine practice [25].

The economic implications of injury prevention and the potential for performance enhancement provide additional rationale for considering osteopathic interventions in athletic healthcare programs [24]. However, formal cost-effectiveness analyses are needed to fully evaluate the economic value proposition [17].

As the field of sports medicine continues to evolve toward more personalized, holistic approaches to athletic healthcare, osteopathic principles and practices offer valuable contributions to optimizing athlete health and performance . The evidence presented in this review provides a foundation for evidence-based integration of these approaches while identifying important areas for continued research and development [39].

References

1] Yao S, Zwibel H, Angelo N, Leder A, Mancini J. Effectiveness of Osteopathic Manipulative Medicine vs Concussion Education in Treating Student Athletes With Acute Concussion Symptoms. J Osteopath Med. 2020;120(9):607-614. DOI: 10.7556/jaoa.2020.099

[2] Fornari M, Carnevali L, Sgoifo A. Osteopathic Manipulative Treatment and Cardiovascular Autonomic Parameters in Rugby Players: A Randomized, Sham-Controlled Trial. J Am Osteopath Assoc. 2021;121(1):4-13. DOI: 10.7556/jaoa.2020.122

[3] Popovich JM Jr, Cholewicki J, Reeves NP, et al. The effects of osteopathic manipulative treatment on pain and disability in patients with chronic neck pain: a single-blinded randomized controlled trial. J Osteopath Med. 2021;121(11):851-861. DOI: 10.1515/jom-2021-0042

[4] Brolinson PG, Smolka M, Rogers M, et al. Precompetition manipulative treatment and performance among Virginia Tech athletes during 2 consecutive football seasons: a preliminary, retrospective report. J Am Osteopath Assoc. 2012;112(9):607-615. DOI: 10.7556/jaoa.2012.112.9.607

[5] Brumm LF, Janiski C, Balawender JL, Feinstein A. Preventive osteopathic manipulative treatment and stress fracture incidence among collegiate cross-country athletes. J Am Osteopath Assoc. 2013;113(12):882-890. DOI: 10.7556/jaoa.2013.066

[6] Ofei-Dodoo S, Black JL, Kirkover MA, et al. Collegiate Athletes' Perceptions of Osteopathic Manipulative Treatment. Kans J Med. 2020;13:147-151. DOI: 10.17161/kjm.vol13.11688

[7] Cerritelli F, Verzelloni L, Cicchitti L, et al. Efficacy and safety of osteopathic manipulative treatment: an overview of systematic reviews. BMJ Open. 2022;12(4):e053468. DOI: 10.1136/bmjopen-2021-053468

[8] Franke H, Franke JD, Fryer G. Osteopathic manipulative treatment for nonspecific low back pain: a systematic review and meta-analysis. BMC Musculoskelet Disord. 2014;15:286. DOI: 10.1186/1471-2474-15-286

[9] Thomas KD, Lombard ZK, Shadiack AL. Osteopathic manipulative treatment for concussions and postconcussive syndrome in athletes: a literature review. J Osteopath Med. 2023;123(8):395-403. DOI: 10.1515/jom-2022-0217

[10] Zago M, Rebatto A, Rossi C, et al. Effects of osteopathic manipulative treatment of the pivots on lower limb function in young professional football players. Int J Osteopath Med. 2022;44:16-21. DOI: 10.1016/j.ijosm.2022.04.003

[11] Cicchitti L, Silvetti A, D'Alessandro G, et al. Combined osteopathy and exercise management of Achilles tendinopathy in an athlete. J Bodyw Mov Ther. 2017;21(3):679-684. DOI: 10.1016/j.jbmt.2016.11.009

[12] Buscemi A, Petralia MC, Ramaci T, et al. Ergojump evaluation of the explosive strength in volleyball athletes pre- and post-fascial treatment. Exp Ther Med. 2019;18(2):1470-1476. DOI: 10.3892/etm.2019.7697

[13] Steel A, Sutton K, Adams J, et al. Osteopathic manipulative treatment: A systematic review and critical appraisal of comparative effectiveness and health economics research. Musculoskelet Sci Pract. 2017;27:18-31. DOI: 10.1016/j.msksp.2016.12.003

[14] Nguyen C, Boutron I, Zegarra-Parodi R, et al. Effect of Osteopathic Manipulative Treatment vs Sham Treatment on Activity Limitations in Patients With Nonspecific Subacute and Chronic Low Back Pain: A Randomized Clinical Trial. JAMA Intern Med. 2021;181(5):620-630. DOI: 10.1001/jamainternmed.2021.0005

[15] Christiansen TL, Niazi IK, Holt K, et al. The effects of a single session of spinal manipulation on strength and cortical drive in athletes. Eur J Appl Physiol. 2018;118(4):737-749. DOI: 10.1007/s00421-018-3799-x

[16] Botelho MB, Alvarenga BAP, Molina N, et al. Spinal Manipulative Therapy and Sports Performance Enhancement: A Systematic Review. J Sports Med Phys Fitness. 2017;57(11):1523-1531. DOI: 10.23736/S0022-4707.17.07136-4

[17] Hamm CT, Klebez JM, Klem NR, et al. Utilization of osteopathic manipulative treatment for athletic injuries. J Am Osteopath Assoc. 2008;108(11):647-653. DOI: 10.7556/jaoa.2008.108.11.647

[18] Alexander M, Kugelman D, Shin DJ, et al. Effectiveness of osteopathic manipulative treatment in managing post-concussion syndrome symptoms in a student athlete. J Am Osteopath Assoc. 2022;122(7):395-398. DOI: 10.1515/jom-2021-0216

[19] Moher D, Liberati A, Tetzlaff J, et al. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. PLoS Med. 2009;6(7):e1000097. DOI: 10.1371/journal.pmed.1000097

[20] Sterne JAC, Savović J, Page MJ, et al. RoB 2: a revised tool for assessing risk of bias in randomised trials. BMJ. 2019;366:l4898. DOI: 10.1136/bmj.l4898

[21] The Newcastle-Ottawa Scale was employed for cohort and case-control studies [21] Carnevali L, Lombardi L, Fornari M, Sgoifo A. Exploring the Effects of Osteopathic Manipulative Treatment on Autonomic Function Through the Lens of Heart Rate Variability. Front Neurosci. 2020;14:579365. DOI: 10.3389/fnins.2020.579365

[22] Degenhardt BF, Darmani NA, Johnson JC, et al. Role of osteopathic manipulative treatment in altering pain biomarkers: a pilot study. J Am Osteopath Assoc. 2007;107(9):387-400. DOI: 10.7556/jaoa.2007.107.9.387

[23] Consorti G, Chiera M, Buscemi A, et al. Track and field coaches' perspective and experiences of including osteopaths in shared management of elite athletes: A descriptive phenomenological study. Int J Osteopath Med. 2024;54:100723. DOI: 10.1016/j.ijosm.2024.100723

[24] Chiera M, Consorti G, Cerciello S, et al. Osteopaths' Perspective and Experiences of Elite Track and Field Athletes Osteopathic Treatments: A descriptive phenomenological study. Int J Osteopath Med. 2025;55:100745. DOI: 10.1016/j.ijosm.2025.100745

[25] DeFrancisis JS, Vinarski BM, Abreu M, et al. Efficacy of Osteopathic Manipulative Treatment in Creating a Difference in Pain Levels for Patients With Localized Joint Pain: A Meta-Analysis of Randomized Controlled Trials. Cureus. 2025;17(4):e82724. DOI: 10.7759/cureus.82724

[26] Liem T, Bohlen L, Jung AM, et al. Does Osteopathic Heart-Focused Palpation Modify Heart Rate Variability in Stressed Participants with Musculoskeletal Pain? A Randomised Controlled Pilot Study. Healthcare (Basel). 2024;12(2):138. DOI: 10.3390/healthcare12020138

[27] Ruffini N, D'Alessandro G, Mariani N, et al. Valid and Invalid Indications for Osteopathic Interventions: A Systematic Review of Evidence-Based Practices and French Healthcare Society Recommendations. Healthcare (Basel). 2023;11(24):3188. DOI: 10.3390/healthcare11243188

[28] Dal Farra F, Risio RG, Vismara L, et al. Effectiveness of osteopathic interventions in chronic non-specific low back pain: A systematic review and meta-analysis. Complement Ther Med. 2021;56:102616. DOI: 10.1016/j.ctim.2020.102616

[29] Galindez-Ibarbengoetxea X, Setuain I, Andersen LL, et al. Effects of cervical high-velocity low-amplitude techniques on range of motion, strength performance, and cardiovascular outcomes: A review. J Manipulative Physiol Ther. 2017;40(8):608-622. DOI: 10.1016/j.jmpt.2017.07.007

[30] Alvarenga B, Botelho M, Lara J, et al. Preliminary Feasibility Study to Measure the Immediate Changes of Bilateral Asymmetry After Lumbar Spinal Manipulative Therapy in Asymptomatic Athletes. J Chiropr Med. 2019;18(3):205-212. DOI: 10.1016/j.jcm.2019.04.001

[31] American Osteopathic Association Guidelines for Osteopathic Manipulative Treatment (OMT) for Patients With Low Back Pain. J Am Osteopath Assoc. 2016;116(8):536-549. DOI: 10.7556/jaoa.2016.107

[32] Brolinson PG, McGinley SM, Kerger S. Osteopathic manipulative medicine and the athlete. Curr Sports Med Rep. 2008;7(1):49-56. DOI: 10.1097/01.CSMR.0000308664.13278.a7

[33] Ward RC, ed. Foundations for Osteopathic Medicine. 2nd ed. Philadelphia: Lippincott Williams & Wilkins; 2003. ISBN: 978-0781741309

[34] DiGiovanna EL, Schiowitz S, Dowling DJ. An Osteopathic Approach to Diagnosis and Treatment. 3rd ed. Philadelphia: Lippincott Williams & Wilkins; 2005. ISBN: 978-0781742931

[35] Hootman JM, Dick R, Agel J. Epidemiology of collegiate injuries for 15 sports: summary and recommendations for injury prevention initiatives. J Athl Train. 2007;42(2):311-319. PMCID: PMC1941297

[36] McCall A, Carling C, Davison M, et al. Injury risk factors, screening tests and preventative strategies: a systematic review of the evidence that underpins the perceptions and practices of 44 football (soccer) teams from various premier leagues. Br J Sports Med. 2015;49(9):583-589. DOI: 10.1136/bjsports-2014-094104

[37] Bialosky JE, Bishop MD, Price DD, et al. The mechanisms of manual therapy in the treatment of musculoskeletal pain: a comprehensive model. Man Ther. 2009;14(5):531-538. DOI: 10.1016/j.math.2008.09.001

[38] Pickar JG. Neurophysiological effects of spinal manipulation. Spine J. 2002;2(5):357-371. DOI: 10.1016/S1529-9430(02)00400-X

[39] Wells GA, Shea B, O'Connell D, et al. The Newcastle-Ottawa Scale (NOS) for assessing the quality of nonrandomised studies in meta-analyses. Ottawa: Ottawa Hospital Research Institute; 2011.

[40] Still AT. Philosophy of Osteopathy. Kirksville, MO: A.T. Still; 1899.