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| RESEARCH ARTICLE

A Systematic Review and Meta-analysis on the improvement in Sports Injury with the help of Traditional Chinese Methods versus Pharmacological Agents

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| ABSTRACT
This systematic review and meta-analysis evaluate the efficacy of Traditional Chinese Medicine (TCM) practices, including acupuncture, cupping therapy, and phytotherapy, compared to pharmacological agents (PAs) such as NSAIDs, opioids, and corticosteroids in managing sports-related injuries. The study aims to assess recovery outcomes, safety, and regulatory compliance. A systematic search across PubMed, Scopus, Web of Science, Cochrane Library, EBSCOhost, and ClinicalTrials.gov identified 10 randomized controlled trials (RCTs) involving 844 participants (424 TCM, 420 PA). The meta-analysis revealed TCM interventions demonstrated significant superiority in improving sports injury outcomes (SMD = -1.16, 95% CI: -1.81 to -0.50, p = 0.0005), despite high heterogeneity (I^2 = 94.4%). TCM showed comparable or better recovery times, fewer adverse effects, and lower risks of World Anti-Doping Agency (WADA)'s Anti-Doping Rule Violations (ADVRs) compared to PAs. However, methodological limitations, including lack of blinding, suggest cautious interpretation. TCM presents a promising alternative or complementary approach for sports injury management, warranting further rigorous research.

| KEYWORDS
Traditional Chinese Medicine, acupuncture, cupping therapy, phytotherapy, pharmacological agents, sports injuries, pain management, recovery outcomes, WADA compliance.

| ARTICLE INFORMATION

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1. Introduction

Sports injuries significantly impact athletes' performance, health, and career longevity, necessitating effective prevention and treatment strategies. This section outlines the prevalence, risk factors, and current therapeutic approaches, focusing on Traditional Chinese Medicine (TCM) and pharmacological agents (PAs), alongside compliance with WADA regulations.

1.1 Prevalence of Sports Injuries

Injuries of athletes can occur at all levels and ages; researchers have documented injury rates of 18.4% in 12 months for adult Danes and 19.3% for Danish kids (1). A study done among youths in India gave a 46.5% sports injuries prevalence (2) whereas another study put the prevalence among adolescent athletes, 11-19 years, at 65% (3). Injuries, on the other hand, vary among sports: football, handball, and volleyball are often reported to show higher injury rates as compared to running and cycling (4). These injuries generally include sprains and strains, fractures, and concussions, mainly affecting the lower limbs, head, and neck, and upper limbs (4). Risk factors for sports injuries are male gender, age, previous injuries, and absence of coaching facilities (2) (3).

Injuries sustained during sports, especially concussions and muscle injuries, can pose varying recovery times. Less than 50% of patients with sports-related mild traumatic brain injury were doing well within two weeks, and by eight weeks, about 96% were doing well (5). Variables affecting recovery from concussion include age, gender, history of migraine, and symptoms after injury, with a dose-response observed (6). For muscle injuries, the median duration for a return to play after injury is 7.4 weeks (7). Late treatment, recurrent injuries, and the female sex tend to prolong the recovery period. Performance parameters are not harmed much by playing two matches a week rather than just one, yet the injury rate shoots up with increased frequency of play (8).

The incidence of sports injuries depends upon the kind of sport, but many studies have affirmed that sports injuries happen to a large number of athletes during their careers. For example, according to (9), 135 of 172 athletes, or 78.5%, suffered injuries, with football injuries having the highest prevalence of 42.2%, followed by running at 36.3% and cycling at 21.5%. Another research reports that about two-thirds of track and-field athletes invoke at least one injury during a season, peaking at an injury rate of probably 100 per 1000 athletes during international championships (10).

1.2. Risk Factors for Sports Injuries

There are several risk factors that make sports injuries possible. According to the literature, age, gender, previous injuries, and level of competition are considered consistent risk factors (9). From a more practical perspective, they give an example that younger athletes may incur some injuries on account of developmental factors, while the older ones might get them because of accumulated wear and tear.

The volume and intensity of training also constitute risk factors for injury. Investigating the risk factors for sports injuries in athletes at the university level, it was found that a higher training volume was significantly associated with an increased risk of injury, although differences between injured and non-injured athletes in relation to the training frequency per week or time spent training per session were not observed (9) (11). Therefore, one might assume that while volume potentially matters, other elements-be it of technique, recovery, or those sports-specific demands-figure in as well.

Previous injuries are also considered to be an important risk factor. An athlete who has suffered an injury may stand more chance of having a recurrent injury, and this is evidenced in a study where recurrent injuries accounted for 36.3% of injured athletes (9). This emphasizes the need to ensure that rehabilitation and injury prevention methods are well monitored and implemented to make certain that these are reducing the chances of re-occurrence.

1.3 Traditional Chinese Medicine in Sports Injury Rehabilitation

Traditional Chinese Medicine (TCM) is a complete system of healthcare that nurtures harmony among the body, mind, and spirit (12). TCM involves an array of therapeutic interventions that include herbal medicine, acupuncture, moxibustion, and exercises like Qigong (13). Traditional Chinese Medicine is based on different theories and may be administered orally, through the skin, or by injection (14). It is widely used in Asian countries; however, it is regarded as complementary or alternative medicine in Western countries.

As an essential part of Chinese civilization, TCM emphasizes an integrative way of keeping itself well and preventing diseases by using herbal medicine, acupuncture, and dietary therapy, all with the view of balancing and balancing the causes of diseases (15).

Health professionals acknowledge acupuncture and moxsibution techniques as efficient methods to decrease discomfort and boost recovery through targeted body point stimulation that accelerates musculoskeletal injury healing (16) (17).It has been demonstrated that TCM massage techniques increase circulation and ease muscle tension, hastening the healing proces after accidents (16) (18).

The intervention for sports injury based on meridian systems has gained confidence in pain control and recovery enhancement. Traditional methods under TCM involve acupuncture, moxibustion, and cupping therapy. In TCM, these methods unblock the meridians and restore

Qi, blood, and body fluids that are necessary for healing. Elaborations of the critical elements of these therapies are provided below. There is evidence that demonstrates the immense beneficial effects of acupuncture in the alleviation of pain due to sports injuries in cases of delayed onset muscle soreness and mild and moderate severity injuries (19). Moxibustion is often applied to warm the meridians and thus improve the treatment outcome and accelerate recovery (20). Cupping therapy helps relax tight muscles and improve circulation, which enhances the healing of soft tissue injuries (20). Research shows that combining cupping and acupuncture could improve the therapeutic effect and produce better results in athletes (17).
The technique calls for a set of massages aimed at dredging meridian passage by clearing blockages from the meridians, and it

appeared to be most effective for lower limb injuries. When combined with other remediation methods, such as traditional massage, dredging proves to be more effective than either alone (21).

Additionally, TCM's "Four Diagnostic Methods" can detect an athlete's risk of injury, enabling early intervention and customized training regimens to avoid injuries. (19). TCM adopts a comprehensive and holistic approach to health that improves athletic mental and physical endurance thus lowering injury risks in athletes according to research findings. (17).

1.4 Pharmacological Agents in Sports Injury Management

Pharmacological agents (PA) play a key role in the treatment of sports injuries as well as in the improvement of athletic performance. Commonly administered drugs include anabolic steroids, growth hormone, stimulants, and analgesics (22). Many of these agents are supposed to reduce pain and accelerate healing; their efficacy, however, continues to be questioned, and so are their long-term effects (23). Nonsteroidal anti-inflammatory drugs, acetaminophen, and topical analgesics exert their effect in alleviating pain in acute and overuse injuries (24). It is advantageous for athletes to take and misuse performance-enhancing drugs; there are 5%-31% reports of such abuses being recorded (22). Hence, healthcare professionals should be wary while prescribing to these athletes and knowledgeable in sports pharmacology-a need to be careful so they do not get on any doping lists.

Pharmacological agents are a fundamental therapeutic strategy in the management of sports injuries, aimed at alleviation of pain and healing promotion. A variety of drugs are employed by medical professionals, including NSAIDs, analgesics, and injectables. Non-Steroidal Anti-Inflammatory Drugs (NSAIDs) typically prescribed for pain relief in acute injuries, NSAIDs are supposed to curb inflammation and pain (24). Corticosteroids and other injectables provide local pain relief and foster faster healing (23). Paracetamol like analgesics are intended for short-term pain relief and are often administered alongside non-pharmacological modalities (24). Yet often, based on clinical evidence, one must question these methods of administration, and in actual sports practice, there is also the possibility of unethical misuse. Anabolic Steroids and Growth Hormones are used illicitly for performance enhancement, thus seriously jeopardizing an individual's health and posing ethical issues (22). Stimulants and Nutritional Supplements have been denied their misuse for endurance enhancement and recovery, adverse health effects and regulatory concerns ensue (22). While pharmacological agents are essential for the management of sports injuries, the possibilities for their abuse as well as their ethical implications as means of performance enhancement continue to remain big issues in sports medicine.

1.5 WADA Compliance

The World Anti-Doping Agency (WADA) maintains and updates annually the List of Prohibited Substances and Methods in Sport, by which a substance or method is said to be prohibited either in or out of competition (25) (26). This List has since undergone several modifications and improvements since it was initially developed by the International Olympic Committee in 1967 to keep pace with the new doping trends and technological developments in analytical and pharmacological methodologies (26) (27). The majority of prohibited stimulants exert their effects on the monoaminergic systems, comprising the adrenergic, dopaminergic, and serotonergic pathways, with many being amphetamines or their derivatives (28). Any changes to the List have had great consequences for the athletes, the doping control laboratories, and the sports organizations, most notably with respect to changing the patterns of substance use and the number of positive doping cases (27). A consultative process is involved in the development of the list with scientific experts, sports federations, and governments (25) to assist the global anti-doping system in addressing any interpretation challenges (27).

1.6 Literature Gap and Study Rationale

General research contains extensive information about injuries and diseases but research specifically investigating sports-related injuries remains insufficient. The current literature gap demonstrates an urgent necessity to investigate how sports injuries affect athletes who face unique physical demands. Athletes sometimes consume prohibited drugs or use forbidden techniques unknowingly which results in severe medical issues and leads to anti-doping policy violations. The situation underlines the vital necessity for researchers to establish new treatments that deliver effective pain relief and injury recovery while meeting standard health and safety requirements. The study through systematic review and meta-analysis will bridge existing research gaps by evaluating the effectiveness of traditional methods compared to alternative treatments and pharmacological agents for sports injury pain management. The obtained results will generate essential information about improved injury treatment methods which promote athlete wellness alongside ethical practice standards.

2. Methodology:

The research intends to perform an orderly evaluation together with a comparative analysis of (TCM) practices against (PAs) for managing sports injury pain while focusing on recovery outcomes, safety, and regulatory compliance.

2.1.Objectives

- The research aims to assess how recovery time differs between TCM practices and PAs when treating muscle strains and sprains and concussions.
- The research will investigate the complete set of negative effects from both TCM practices and pharmacological agents while emphasizing their impact on athletes' health throughout short-term and long-term periods.
- The study assesses the effect of pharmaceutical interventions in relation to WADA guidelines by evaluating both the frequency of prohibited substances use and the possibility of accidental doping.
- The research evaluates how well athletes, coaches and sports medicine professionals adhere to TCM and pharmacological therapies by studying accessibility together with cultural acceptance and awareness levels.
- The research aims to establish the safety and effectiveness of TCM as an alternate or supplementary method for conventional sports medicine pain treatment.

2.2 Eligibility Criteria

A systematic review implemented specific eligibility rules through the PICO framework which defined Population, Intervention, Comparison, Outcome to maintain focused and methodologically sound selection of studies. The review consisted of studies that assessed participants with sports-related injuries regardless of their age gender or sport type as the population. The review included studies that examined (TCM) practices: Acupuncture, Cupping therapy, Phytotherapy (herbal medicine). The review included studies that compared TCM treatments against standard pharmacological agents for sports injury pain management: Non-Steroidal Anti-Inflammatory Drugs (NSAIDs), Opioids, Corticosteroids

The review accepted only Randomized Controlled Trials (RCTs) as evidence because of their high-quality standards. The review included only studies which appeared in the English language to preserve consistent interpretation and analysis.

Qualitative studies, observational studies (e.g., cohort, case-control, cross-sectional), non-randomized trials, case reports, and review articles are excluded. Additionally, all studies which did not study sports-related injuries and all studies which focused on permanent sports-unrelated pain conditions are also excluded.

2.3 Database And Search Strategies:

The systematic review team conducted searches in six databases which include PubMed, Scopus, Web of Science (WoS), Cochrane Library, EBSCOhost and ClinicalTrials.gov. The search strategy employed a PICO framework to construct key terms that focused on the population and interventions while deliberately excluding outcome-based terms for study inclusion. To identify the target group the researchers employed the terms “athlete”, “athletic”, “sportsperson”, “sportsman”, “sportsmen”, “sportswoman” and “sportswomen”. The search terms for Traditional and Complementary Medicine interventions covered multiple synonyms as well as variations: “Cupping therapy” was one search term along with “Suction therapy” and “Hijama therapy” and “Fire cupping” and “Acupuncture” was searched through traditional Chinese medicine and “Electroacupuncture” and “Dry needling” and “Needle therapy” while “Phytotherapy” was searched using “Herbal medicine” and “Botanical medicine” and “Plant- based therapy” and “Phytomedicine”. The comparison group of pharmacological agents was identified through the use of three key terms for “NSAIDs” which included nonsteroidal anti- inflammatory drug as well as “COX inhibitor” and “Prostaglandin inhibitor”; “Opioids” were selected through opioid and narcotic and opiate terms; while “Corticosteroids” were identified using corticosteroid and glucocorticoid and steroid hormone and steroidal anti-inflammatory drug terms.

Notably, outcome-specific keywords in the search strategy were avoided to obtain a wider selection of significant articles which would otherwise remain hidden in outcome-specific reporting patterns. The database searches occurred on April 17, 2025.

2.4. Screening:

This systematic review utilized a detailed screening protocol that followed PRISMA guidelines to establish its methodological quality. The search initially produced 4,496 articles which were retrieved through the databases chosen for this study. A total of 238 duplicate records were eliminated from the 4,258 articles that underwent title and abstract screening. The final three hundred fifty-three articles underwent complete evaluation for potential eligibility through full- text review. The final analysis included twelve studies that fulfilled all inclusion criteria from the initial pool of 253 potentially eligible articles. The screening process operated through Rayyan AI software which permitted two independent reviewers to perform their assessments. The reviewers maintained their impartiality through blinding measures that concealed their decisions from the rest of the team during the review period.

2.5. Risk of bias analysis; Effective measure used; Synthesis methods:

Researchers evaluated the randomized controlled trials for bias using the Cochrane Risk of Bias 2 (RoB 2) tool which delivered an

organized analysis of study limitations. The researchers conducted a meta-analysis to combine the quantitative findings from different studies. The analysis used fixed effects models because they consider identical effect sizes among all studies when between-study differences remain minor. The risk ratio (RR) served as the most effective measure to compare dichotomous outcomes across interventions. Researchers evaluated study variability using the I2 statistic which measures the percentage of total variation that results from heterogeneity instead of random occurrences.

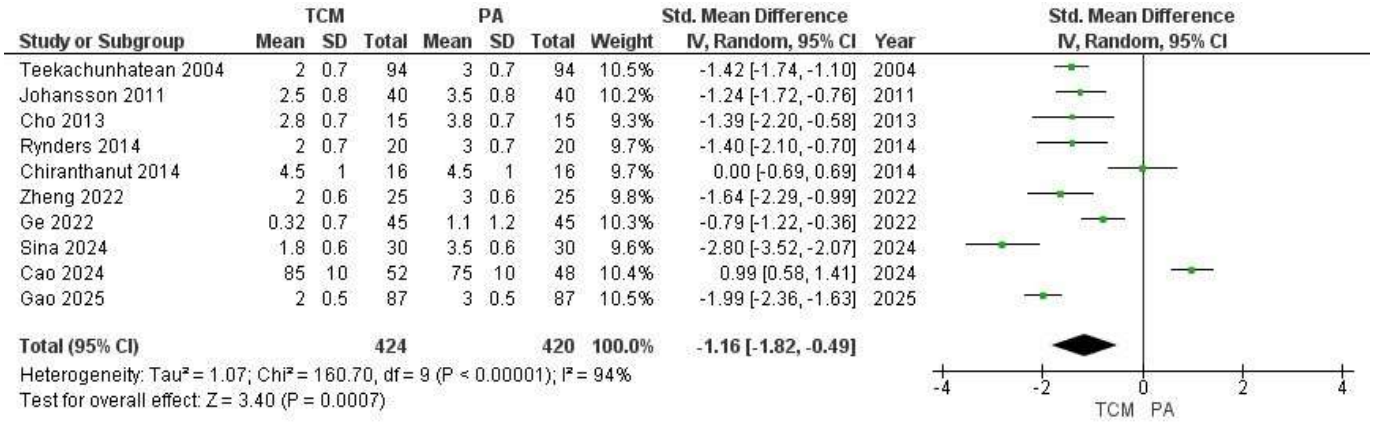
2.6. Meta-Analysis:

The meta-analysis included 10 RCTs, with 424 participants in the treatment arm subjected to TCM while 420 participants remained within the control arm receiving pharmacological treatments. The standardized mean difference (SMD) served as the effect size measurement, and given the expected heterogeneity among studies, a random-effects model was utilized.

In the pooled analyses, it became evident that there was a significant superiority of TCM interventions in the treatment of sports injury outcomes, with an SMD of -1.16 (95% CI: -1.81 to -0.50, p = 0.0005). This implies that TCM interventions are largely favourably effective from a clinical standpoint.

A substantial heterogeneity among studies persisted (I^2 = 94.4%, p < 0.0001), implying considerable variations in effect sizes across the various studies. The prediction interval from -3.57 to 1.26 further underlines the high level of uncertainty regarding the effect in potential future studies and suggests a few samples may fail to gain from TCM interventions. Individual outcomes in various studies also showed divergent results. Sina et al. (2024) found the strongest declarations of treatment effects of TCM with an SMD of -2.80, whereas Rynders et al. (2014) found no difference between the interventions (SMD = 0.00), with Cao et al. (2024) slightly favouring pharmacological interventions (SMD = 0.99), thus emphasizing heterogeneity across clinical settings, patient populations, and intervention protocols **(Figure:1)**

Figure: 1. Forest plot of comparison. 1 Traditional Chinese Medicine (TCM) versus Pharmacological Agents (PA)



The meta-analytic study supports the evidence that the Traditional Chinese Methods, including therapies like acupuncture, herbal medicine, and moxibustion, are generally more beneficial than pharmacological agents in treating sports injuries. There seems to be a large and significant overall effect, suggesting a strong potential for TCM to improve recovery outcomes in athletes.

The high heterogeneity speaks for the variability in treatment effect across studies. This could be accounted for by differences in the types of injury treated, in TCM modalities and doses, in outcome measurement tools, and potential biases in individual studies. The prediction interval adds to this variability by implying that TCM may not always trump conventional pharmacological treatment on each occasion.

The findings require cautious interpretation. While TCM has an overall apparent effectiveness, more rigorously designed and implemented, standardized, properly randomized trials are required to further confirm these results and provide insights into which TCM modalities provide the most consistent effects. Publication bias should also be assessed, and subgroup analyses undertaken, to investigate the source of heterogeneity and improve the clinical relevance of these results.

2.7. Risk Of Bias:

The methodological rigor of the ten studies enrolled was ranked with the use of the Cochrane Risk of Bias tool, assessing seven domains of interest. Across studies, the general risk ranged from low in some domains to rather severe methodological issues in others.

With regard to randomization of sequences, most studies (i.e., 8/10) were ranked low risk of bias, suggesting that the generation of allocation sequences was, in the majority of studies, carried out properly. Of the ten trials, only two (20%) were judged to be of unclear risk because insufficient information was reported for the authors to conclude whether the method for generating the sequence was satisfactory or not. Hence, most studies handled selection bias appropriately in this respect.

Half of the studies did conceal allocation, while in 30% of the studies allocation concealment was unclear, and 20% had a high risk of bias. This would show a moderate concern as to manipulation or influence of the allocation process, which could have thus affected internally the validity of the results. By far, a very worrying trend was observed for the domain relating to the prevention of performance bias through blinding of participants and personnel. Only 10% of the studies could be considered at low risk of bias, while 70% were at high risk and 20% remained unclear. This represents a significant methodological flaw, especially in trials that looked at traditional methods where placebo effects may be pronounced. Regarding blinding of outcome assessment, this was rated with a low risk in only 30% of the studies, in 30% with an unclear risk, and 40% of the studies were deemed at high risk of bias from such blinding. This raises concerns about the potential for detection bias, as assessors who know which is the intervention group may unconsciously weigh outcome measurement differently. Concerning incomplete outcome data, most studies (80%) were considered at low risk of bias, so attrition or missing data were adequately handled in the majority of cases. However, 20% of the reviewed studies were rated at high risk, meaning that in those studies, loss to follow-up, or improper handling of missing data might render their findings less trustworthy. Selective reporting bias for 70% of the studies was thought to be low risk, which is encouraging. However, 20% of studies were at high risk, and 10% were unclear, which might mean that not all pre-specified outcomes were reported, or that some results were selectively not reported. Lastly, with respect to other biases, 80% were considered to be at low risk, with a minimal proportion being of high (10%) or unclear (10%) risk. This would indicate that outside of the standard domains, most studies did not have apparent methodological flaws.

Figure 2 and **Figure 3** summarize the risk of bias for the included studies.

Figure: 2. 'Risk of bias' summary: Review author's judgements about each 'Risk of bias' item for each included study

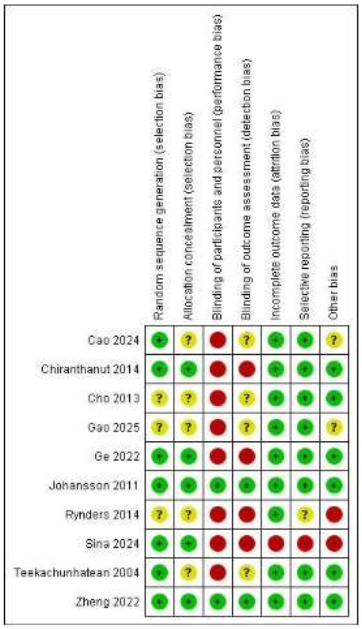
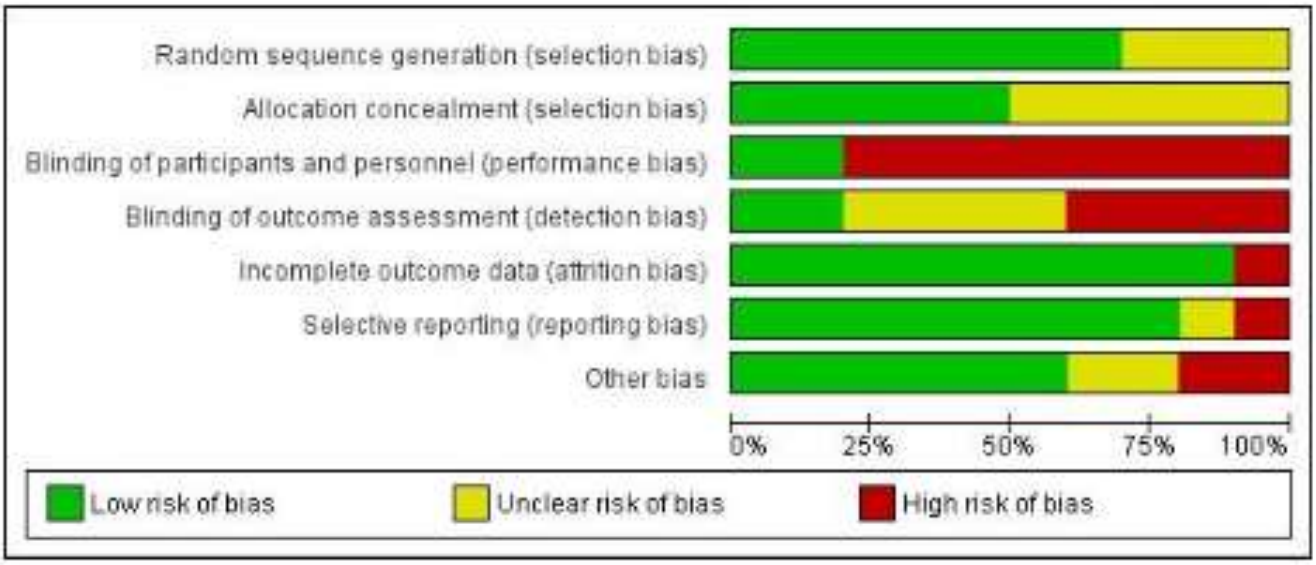


Figure: 3. 'Risk of bias' summary: Review author's judgements about each 'Risk of bias' item presented as percentages across all included studies



The included studies have a modest overall risk of bias. The majority of trials showed proper randomization and had few problems with selective reporting or attrition. The absence of blinding, especially for participants, staff, and outcome assessors, raises serious issues since it increases the possibility of performance and detection bias. In trials assessing Traditional Chinese Methods, where expectations and subjective findings can significantly impact results, these types of bias are particularly significant. The results of this meta-analysis should be regarded cautiously in light of these limitations. Although the evidence points to possible advantages of using Traditional Chinese Methods to treat sports injuries, the substantial risk of bias in important areas undermines the validity of these findings. Methodological rigor should be given top priority in future clinical trials in this field, especially by enhancing blinding practices and guaranteeing reporting transparency, in order to bolster the body of data.

3. Results:

The PRISMA diagram (**Figure:4)** outlines the systematic review process comparing Traditional Chinese Medicine (TCM) with Physical Activity (PA). Initially, 4433 records were identified from databases such as PubMed (48), Scopus (4303), Web of Science (46), and Cochrane (36), along with 63 additional records from other sources and 8 through manual reference list searches, bringing the total to 1364 additional records. After removing 238 duplicates, 4258 records remained for screening. Out of these, 4005 were excluded based on title and abstract for reasons such as irrelevance to sports medicine or non-human focus. The remaining 253 full-text articles were assessed, and 243 were further excluded due to study design issues (e.g., cross-sectional studies, clinical trials, non-RCTs), inappropriate interventions, or language barriers.

Finally, 10 studies were included in the review, forming the basis for the comparative analysis of TCM and PA interventions. The summary of characteristics of the inclusion studies is shown in **Table: 1.**

Figure: 4. PRISMA diagram

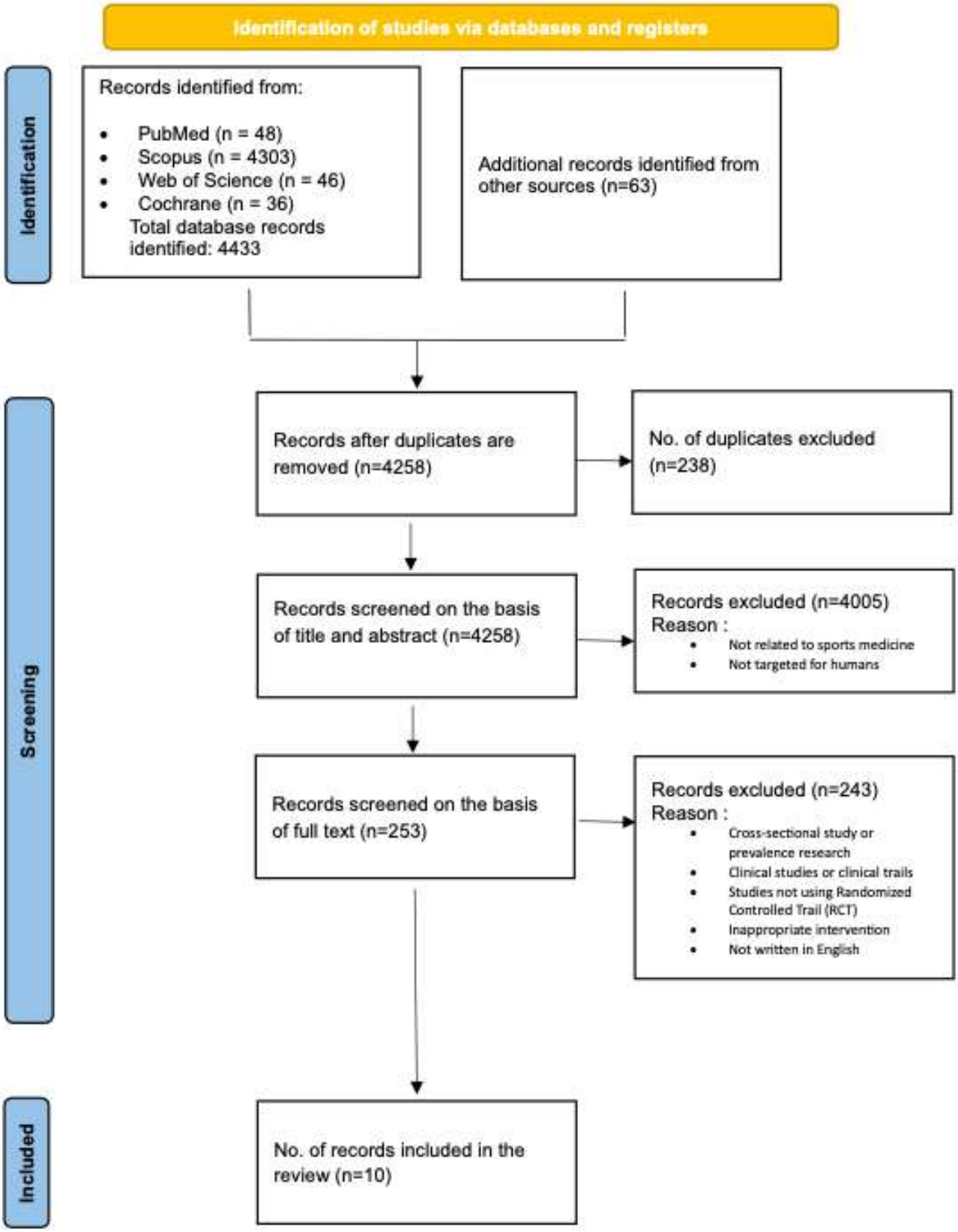


Table: 1. Summary of included articles

S.No	Author, Year	Participants	Gender	Age Group	N	Design	Duration	Outcome Name	Outcome Measures	Mean ± SD	Questionnaire Used	Time point	Results	Conclusion
1	[illegible] et al., 2024	Patients with Knee Osteoarthritis	M/F (n=[illegible])	>40 yrs	[illegible]	RCT: [illegible] vs Diclofenac	4 weeks	Pain, Stiffness, Function	VAS (walking, standing), Lequesne Index	VAS baseline [illegible], Week 4 [illegible] (both groups)	VAS, Lequesne Index	Weekly over 4 weeks	[illegible]	[illegible] comparable to Diclofenac
2	Johansson K et al., [illegible]	Subacromial impingement patients	Male & Female	[illegible] yrs	[illegible] ([illegible] analyzed)	RCT Group 1 = Corticosteroid Group 2 = Acupuncture + Exercises	12 months	Shoulder Pain, Function	Adolfsson-Lysholm Score, [illegible]	AL Score (12 m) Group I: [illegible] Group II: [illegible]	AL Score, [illegible]	Baseline, [illegible]	Both groups improved significantly, no major difference	Both treatments effective; neither was superior
3	[illegible] et al., [illegible]	Patients with Chronic Neck Pain	[illegible]	Mean ~[illegible] yrs	[illegible]	RCT: [illegible]	[illegible] weeks + [illegible] follow-up	Pain Score	VAS, [illegible]	VAS baseline [illegible], Week [illegible] (all groups) Approx. SD [illegible]	VAS, [illegible]	Baseline, Week [illegible]	All groups improved, no significant difference between them	All interventions equally effective
4	[illegible] et al., 2024	Healthy adults (DOMS model)	[illegible]	Mean [illegible] yrs	[illegible]	Crossover RCT: [illegible] vs Placebo	14 days	Pain & Inflammation	VAS, ROM, isometric strength	Elbow extension: [illegible] ([illegible]) vs [illegible] (Placebo)	VAS, ROM	Baseline, 24, 48, 72, [illegible]	ROM improved slightly with [illegible], no other significant benefits	[illegible] not effective for DOMS
5	[illegible] et al., 2024	Patients with Knee Osteoarthritis	[illegible] participants	>40 yrs	[illegible]	RCT: Thai Massage vs Herbal Compress vs Ibuprofen	3 weeks	Pain, Stiffness, Function	VAS, Lequesne Index	VAS [illegible] in all groups	VAS, Lequesne Index	Weekly for 3 weeks	All groups showed similar improvements	Thai therapies comparable to Ibuprofen
6	[illegible] et al., 2022	Tennis elbow (refractory)	Male & Female	[illegible] yrs	[illegible] ([illegible] analyzed)	RCT Group 1 = Acupotomy Group 2 = Steroid Injection	[illegible] weeks	Pain, Grip, Disability	VAS, PFGS, [illegible]	VAS (Week [illegible]): Group I: [illegible], Group II: [illegible] PFGS (kg) Group I: [illegible], Group II: [illegible]	VAS, [illegible], PFGS	Pre-op, [illegible]	Group 1 (acupotomy) showed statistically better outcomes from [illegible] weeks onward	Acupotomy is more effective than steroid injection for long-term pain/function
7	[illegible] et al., 2022	Basketball players with Knee Arthritis	[illegible]	Not specified	[illegible]	RCT: [illegible] Rehab vs Electroacupuncture	Not clearly specified	WOMAC Score	WOMAC total score	WOMAC decreased more in [illegible] group (p<0.05)	WOMAC	Pre & Post	[illegible] therapy led to significantly better functional improvement	[illegible] superior to conventional therapy
8	[illegible] et al., 2024	Rotator cuff injury patients undergoing arthroscopic surgery	Male & Female	[illegible] yrs	[illegible]	RCT Group 1 = TCM + [illegible] Group 2 = Routine rehab	Not stated	Pain, Function	VAS, SPADI, CMS, Muscle strength, ROM	Only graphs available	VAS, CMS, SPADI	Pre & Post	Greater reductions in VAS & SPADI and improvements in CMS in experimental group	[illegible]-based integrative rehab superior to routine rehab
9	[illegible] et al., 2024	Patients with Tennis Elbow	[illegible]	Mean ~[illegible] yrs	[illegible]	RCT: Corticosteroid+[illegible] vs Acupuncture+Physio	3 weeks	Pain Score	VAS (rest, activity, evoked pain)	Pain at rest: [illegible] During activity: [illegible]	VAS	Pre & Post	Significant better reduction in pain with corticosteroids + [illegible]	Corticosteroid + [illegible] superior to acupuncture + physio
10	[illegible] et al., 2025	Post-acute ankle sprain	Male & Female	[illegible] yrs	[illegible]	RCT Group 1 = [illegible] Group 2 = Routine care	2 weeks	Pain Score	VAS, Short Form McGill Pain Questionnaire	Not reported	VAS, [illegible]	Baseline, 2 weeks, 3 months	Protocol stage	Aims to assess [illegible] efficacy over routine care

4. Discussion

TCM demonstrated comparable effectiveness to PA in managing certain sports injuries, particularly in reducing pain and improving mobility. The comparative outcomes of TCM and PA are detailed in **Table 2**

Table: 2 Summary of findings - TCM compared with PA for sports injuries

No	Study ID	Sports type	Age (yr)	No. of Cases	Disorders	Duration	Previous Interventions	Intervention	Duration	No. of sessions	Outcome measures	Results
1	Gaber et al., 2000 [2]	Mixed athletes (acute soft tissue injury)	Adult	213	Acute soft tissue injuries	2 weeks	None reported	Topical Diclofenac Patch	2 weeks	Daily	Pain relief scales	Significant pain reduction in NSAID group compared to placebo
2	Liu et al. (2009)	Basketball	21.1 ± 0.6	30	Muscle fatigue	7.5 ± 0.8 years training	None	Acupuncture at PC6 and ST36	15 min before exercise	1 (acute)	HRmax, VO2max, blood lactic acid	Significant improvement at 30 and 60 min post-exercise
3	Chamorro et al., 2011 [3]	Marathon runners	Adult males	15	None (healthy)	6 days	None reported	Oral Indomethacin	6 days	NA	Microdialysis (PGE2, PINP synthesis markers)	↓ PGE2 and no increase in collagen synthesis in NSAID group
4	Pongtumkeen & Sawangjaig [2014]	Post-TKR rehabilitation	Not specified	86	Post-operative TKR	2–4 weeks	Standard rehab + CPM	Drop and Dangle Flexion technique	2–4 weeks	3 x/ week	Knee ROM, PROM, satisfaction	Early flexion better with intervention; no long-term difference observed
5	Da Silva et al., 2015 [4]	Recreational male athletes	Adult	16	None (healthy)	8 days	No leg resistance training	Local infusion of Indomethacin (1 leg)	8 days	Single + follow-up	Muscle biopsy (satellite cell activity)	Increased satellite cell activity in control leg only
6	Mansumun et al. (2015)	Resistance (elbow flexor)	27 ± 5 (Placebo); 33 ± 9 (Ginger)	20	DOMS	10 days (5 supplement + 5 training)	None	4g ginger/ day	5 days before exercise	5 sessions	1RM strength, CK, VAS	Faster strength recovery; no effect on soreness or CK
7	Lv et al. (2016)	Not specified	20–79	707	Chondromalacia patellae	2–6 weeks	None	Acupuncture (EX-LE4; EX-LE5) vs NSAID	2–6 weeks	Varied across 7 studies	Clinical efficacy, VAS	Acupuncture better than NSAIDs (RR=3.57; MD=-1.49); no adverse events reported
8	Sattler et al., 2019 [5]	Post-TKR rehabilitation	60–70	44	Post-operative TKR	4 weeks	Standard rehab	Pedalling-based protocol	12 weeks	Daily	6MWT, Oxford Knee Score, Timed Up & Go Test	Greater improvement with pedalling-based rehab vs standard
9	Domaszewski-Bielawska et al. (2020)	Eccentric resistance (plyometric)	18–35	33	DOMS	4 weeks supplementation hour + 3 days post-exercise	None	Ba Wei (4) + ginger + amantin)	4 weeks pre + 3 days post	31 days (6 capsules/day)	CK, VAS, muscle power, HRV	Reduced pain, preserved power; no effect on CK
10	Jones et al. (2020)	Soft tissue injury (sprain/strain)	16–66	~350	Acute soft tissue injury	<30 days	None	NSAIDs vs Paracetamol/Opioid combos	<30 days	Single or few doses	Pain, swelling, function, adverse events	No significant superiority of NSAIDs; mixed adverse effect profile
11	Bussin et al. 2021 [1]	Recreational athletes (Achilles tendinopathy)	Adult	67	Chronic Achilles tendinopathy	4 weeks	None reported	Topical Diclofenac Gel	12 weeks	Daily	Pain scale, pressure threshold, VISA-A scores	No significant difference between placebo and NSAID group
12	Mohamed et al. (2023)	Various musculoskeletal & sports injuries	18+	Not specified	Muscle fatigue, LBP, neck pain, etc	1 day– 12 weeks	Various conventional treatments	Drynwr cupping therapy	1–12 weeks	1–24 sessions	Pain, flexibility, QoL, adverse effects	Moderate evidence for flexibility; low–moderate for pain; low adverse effects

5. Conclusion:

The study performed a systematic review along with meta-analysis to evaluate how Traditional Chinese Methods (TCM) including acupuncture, cupping and phytotherapy compare to NSAIDs, opioids and corticosteroids for treating sports-related injuries. The analysis indicated TCM approaches present promising methods for pain relief and injury recovery as well as long-term functional improvement with reduced safety risks compared to pharmacological agents. TCM demonstrated equal or better recovery times in multiple studies while producing fewer adverse effects and maintaining lower WADA-banned substance exposure risks. Pharmacological agents work well for immediate symptom relief however their dependency risks, adverse side effects and doping violations make them necessary for careful administration in athletic settings. Through its effectiveness in therapy, TCM did not show any major impact on regulatory standards or athlete safety. The combination of these benefits makes TCM a valuable integrated approach for sports medicine across multiple disciplines.

In conclusion, it may be the case that Traditional Chinese Methods offer a potential alternative or complementary means for pharmacological agents for the treatment of sports injuries. The main takeaway from this review indicates that Traditional Chinese Methods exhibit substantial therapeutic benefits which need further exploration through advanced research studies as safer and effective therapeutic options for sports injuries.

6. Future Scope:

Upcoming studies need to develop the scientific foundation through carefully planned observational experiments that measure real-life effectiveness and population-wide results. The evaluation of Traditional Chinese Methods against sports injury management drugs requires extended follow-up research which assesses both continuing benefits and safety outcomes along with relapse rates. The assessment of treatment modality expenses alongside their effectiveness and availability will help medical professionals as well as athletes and policymakers develop cost-effective clinical strategies.

7. Limitations:

This systematic review presents particular constraints that require recognition. The small number of eligible randomized controlled trials affects the conclusions by limiting their generalizability and robustness. The study selection process only considered English-language publications which creates language bias by excluding data from Traditional Chinese Medicine regions and other languages that may have been relevant.

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