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FROM ANCIENT WISDOM TO ATHLETIC CARE: GUGGULU AND TURMERIC FOR SPORTS-INDUCED INFLAMMATION AND RECOVERY

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ABSTRACT

The increasing emphasis on integrative approaches to sports medicine has highlighted the therapeutic potential of traditional remedies such as Guggulu (*Commiphora mukul*) and Turmeric (*Curcuma longa*). This review systematically evaluates their role in mitigating sports-induced inflammation and supporting athlete recovery. Using PRISMA-2020 guidelines, peer-reviewed trials and clinical studies were identified from PubMed, Scopus, and Google Scholar between 2016 and 2025. Out of 617 retrieved records, 21 studies met eligibility criteria. Findings reveal that curcumin, the principal compound of turmeric, demonstrates strong anti-inflammatory and antioxidant properties by downregulating NF-κB and pro-inflammatory cytokines while enhancing endogenous defense systems. These mechanisms are linked to reduced muscle soreness, lower biochemical markers of damage, and improved psychological resilience. Guggulu, rich in guggulsterones, complements these actions through COX and LOX inhibition, antioxidant modulation, and systemic recovery

support, particularly in lipid metabolism and oxidative balance. Together, they offer synergistic benefits for managing delayed onset muscle soreness (DOMS), enhancing muscle regeneration, and promoting overall recovery in athletes. By bridging traditional wisdom with contemporary evidence, Guggulu and Turmeric may provide safe, natural alternatives to conventional recovery strategies in sports medicine.

Keywords: Guggulu, Turmeric, Curcumin, Sports-Induced Inflammation, Athlete Recovery, Integrative Sports Medicine

INTRODUCTION:

The rising popularity of holistic health strategies has brought the connection between old herbal remedies and today's athletic healthcare into sharper focus. This trend shows a growing awareness that standard treatments might not be enough to handle sports-related inflammation and boost recovery, sparking renewed interest in age-old solutions like Guggulu and Turmeric. Historically, these herbs Guggulu from the Commiphora mukul plant and Turmeric from Curcuma longa have been noted for their anti-inflammatory qualities, playing important roles in healing practices across different cultures **[1, 2]**. Yet, despite this rich history, solid scientific evidence supporting their effectiveness in modern sports medicine is still lacking, especially for athletes pushing their physical limits. The problem of insufficient empirical support for using Guggulu and Turmeric to ease sports-induced inflammation and improve athlete recovery, suggesting a thorough qualitative and quantitative study of their effects **[3, 4]**. This research aims to systematically explore how Guggulu and Turmeric affect inflammatory markers and recovery results in athletes. It also seeks to gather personal stories from athletes who have tried these herbal treatments. Using a mixed-methods approach, the study hopes to create a complete picture of how these remedies might be used in today's athletic practices, providing evidence-based support for traditional knowledge in a contemporary setting. Looking into Guggulu and Turmeric is significant beyond just academic interest. It could improve recovery methods in sports medicine and encourage wider acceptance of integrative healthcare approaches. By linking ancient practices with modern science, this article aims to add to our current knowledge base and offer practical insights that can broaden therapeutic choices in sports therapy. The goal is to promote a deeper understanding of how traditional herbal remedies could be integrated into athletic care, addressing both the physiological needs of athletes and the cultural origins of these practices.

Generally speaking, this approach can offer a broader, more inclusive path forward.

STATEMENT OF THE PROBLEM

The study aims to systematically evaluate their effects and integrate traditional herbal knowledge with modern athletic care through mixed qualitative and quantitative research. The lack of solid scientific evidence supporting the effectiveness of Guggulu and Turmeric in managing sports-induced inflammation and enhancing athlete recovery.

RESEARCH OBJECTIVES

1. To systematically evaluate the anti-inflammatory effects and recovery benefits of Guggulu and Turmeric on sports-induced inflammation in athletes by analyzing clinical trials and biochemical markers.
2. To explore the biochemical mechanisms and bioactive compounds in Guggulu and Turmeric that modulate inflammatory pathways and contribute to enhanced recovery outcomes in athletic populations.
3. To gather qualitative data on athlete experiences and perceptions regarding the use of Guggulu and Turmeric in their recovery regimen, aiming to integrate traditional herbal knowledge with modern sports medicine practices for a holistic athletic care approach.

REVIEW QUESTION

How do Guggulu and Turmeric affect sports-induced inflammation and athlete recovery, and how can these traditional herbal remedies be integrated into modern athletic care through evidence-based validation, considering both biochemical effects and athlete experiences?

SIGNIFICANCE OF STUDY

This study holds significance in enhancing recovery strategies and broadening therapeutic options in sports medicine by providing evidence-based support for the use of Guggulu and Turmeric.

The study significance of promoting integrative healthcare by advancing the acceptance and understanding of traditional herbal remedies within athletic care, thereby fostering a more inclusive approach that addresses both physiological needs and cultural contexts.

The study lies in its attempt to bridge ancient wisdom and modern science, contributing to the knowledge base and highlighting the need for empirical validation of traditional practices in contemporary athletic care.

The study highlights the potential of Guggulu and Turmeric as natural alternatives that could reshape and

revolutionize inflammation management and recovery in sports medicine.

METHODOLOGY

This review was conducted in accordance with standard protocols for systematic literature reviews (PRISMA-2020), with a focus on ensuring transparency and reproducibility of the process.

ELIGIBILITY CRITERIA

The review included only peer-reviewed original research articles restricted to randomized controlled trials (RCTs), controlled clinical trials, and cohort studies. Eligible studies involved adult participants (≥18 years) who experienced sports-induced inflammation and recovery processes. Interventions of interest were limited to those that explicitly incorporated traditional preparations of Guggulu and Turmeric, administered for a sufficient duration to allow for measurable metabolic responses. Publications outside these criteria, such as editorials, commentaries, case studies, qualitative research, book chapters, and reviews, were excluded.

SEARCH STRATEGY

A structured electronic search was undertaken across PubMed, Scopus, and Google Scholar. The strategy was designed by combining relevant keywords with insights from the existing literature. Key search terms included combinations of "Guggulu and Turmeric" "Sports-Induced Inflammation," "Sports injury," and "Sports recovery," among others. Filters were applied to restrict the results to human studies published in English within the period from January 2016 to June 2025.

Table 1: literature source and extractions Source

Source	PubMed	Scopus	Google Scholar
literature	44	545	28

SCREENING AND SELECTION PROCESS

The retrieved records were consolidated, and duplicates were systematically removed. Titles, abstracts, and full texts of the remaining publications were independently screened to assess compliance with the predefined eligibility criteria. Articles that failed to meet the inclusion requirements were excluded at this stage. Only studies that satisfied all selection conditions were retained for qualitative synthesis.

DESCRIPTION AND SELECTION PROCESS OF LITERATURE:

The initial search strategy identified 617 records from electronic databases, with no additional studies retrieved from trial registers, organizational repositories, websites, or citation searches. Following the removal of 14 duplicate records and 21 entries deemed ineligible by automated

screening tools, a total of 582 records were subjected to title and abstract screening.

During this stage, 297 records were excluded based on irrelevance to the research objectives. Of the remaining records, 217 reports could not be retrieved, primarily due to access limitations or unavailability. The subsequent full-text screening of potentially eligible studies resulted in the exclusion of several articles for the following reasons: insufficient clarity of reporting (n = 6), high risk of methodological bias (n = 4), lack of reported outcomes (n = 13), incomplete methodological descriptions (n = 8), and publication as conference abstracts only (n = 16).

After applying all eligibility criteria, a total of 21 studies were deemed suitable and were included in the final review. These studies provide the evidence base for the synthesis presented in this review.

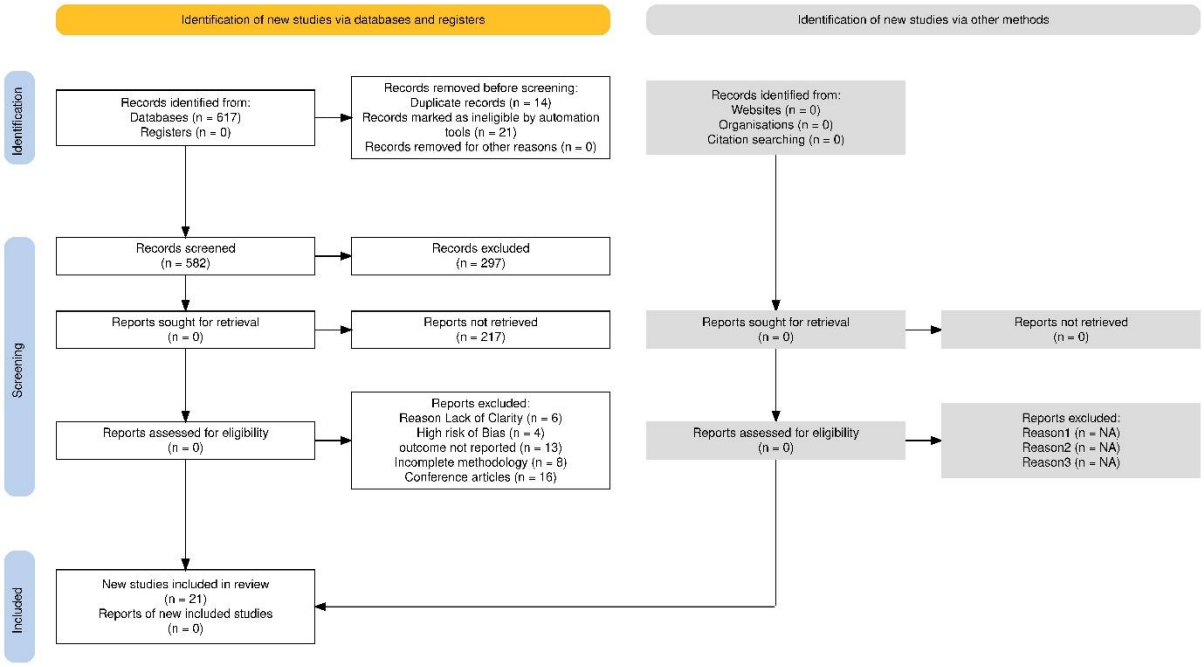

Figure 1: Prisma Flow Chart 2020 [5]

RESULTS AND DISCUSSION

Turmeric (*Curcuma longa*) and Guggulu (Commiphora mukul) have long been utilized in traditional Indian medicine and demonstrate notable potential in mitigating sports-induced inflammation through distinct yet complementary biochemical pathways. Turmeric's primary bioactive compound, curcumin, exerts robust anti-inflammatory and antioxidant effects. It suppresses transcription factors such as NF-κB and AP-1, downregulates pro-inflammatory cytokines (IL-6, TNF-α), and inhibits enzymes including COX-2, LOX-5, and iNOS **[2]**. Curcumin further enhances endogenous antioxidant defenses by

upregulating Nrf2 and enzymes such as SOD and GPx, thereby reducing oxidative stress markers like MDA **[6]**. Clinically, these mechanisms translate into attenuated delayed-onset muscle soreness (DOMS), reduced muscle damage markers (CK, LDH), improved recovery of muscle strength, and enhanced psychological well-being **[6]**. However, curcumin's low bioavailability necessitates novel formulations with adjuvants or nanocarriers to optimize efficacy **[7]**.

Guggulu, characterized by *guggulsterones* and other *terpenoid* constituents, complements curcumin's actions through inhibition of COX and LOX enzymes, modulation of NF-κB signaling, and augmentation of endogenous antioxidants **[6, 8]**. Beyond localized anti-inflammatory activity, Guggulu supports systemic recovery by improving lipid metabolism, reducing oxidative stress, and promoting metabolic balance. Traditional polyherbal formulations combining Guggulu with curcuminoids and other botanicals yield synergistic anti-inflammatory effects. Collectively, both botanicals present evidence-based adjuncts for athletes, targeting inflammatory cascades, oxidative stress, and systemic resilience to facilitate enhanced post-exercise recovery **[9]**.

Curcumin and guggulu (including *Boswellia serrata*) provide strong anti-inflammatory and recovery benefits for athletes. Curcumin reduces cytokines, muscle damage, soreness, and oxidative stress, while guggulu enhances these effects **[10]**. Combined, they offer a comprehensive approach to exercise-induced inflammation. Though promising, more research is needed on dosage and responses, but both herbs show great potential as safe, effective natural supplements.

Both turmeric (*Curcuma longa*) and guggulu (*Commiphora mukul*) are integral to Ayurvedic medicine and have gained modern scientific attention due to their bioactive constituents and recovery-enhancing potential **[8, 11]**. Turmeric's principal compound, curcumin, alongside demethoxycurcumin and bisdemethoxy-curcumin, exerts robust anti-inflammatory and antioxidant effects **[12]**.

Mechanistically, curcumin modulates cytokine expression, inhibits transcription factors such as NF-κB and AP-1, and suppresses inflammatory enzymes including COX-2, LOX-5, and iNOS **[13]**. These pathways collectively reduce pro-inflammatory mediators, muscle soreness, creatine kinase activity, and fatigue, while improving range of motion and psychological well-being. Additionally, curcumin acts as a potent free radical scavenger, enhances endogenous antioxidant defenses, and upregulates Nrf2 activity,

thereby attenuating oxidative stress and lipid peroxidation **[6]**. Beyond inflammation control, curcumin supports gut integrity, modulates microbiota, promotes muscle regeneration, and enhances glycogen storage, although its poor bioavailability necessitates formulation strategies for clinical efficacy.

Guggulu, rich in guggulsterones (E and Z isomers), also exhibits anti-inflammatory actions via NF-κB modulation and inhibition of COX and LOX enzymes **[2]**. Its antioxidant activity enhances endogenous defense enzymes and prevents lipid peroxidation, contributing to cardiovascular protection. Moreover, guggulu supports systemic recovery through lipid modulation, cardio protection, improved insulin sensitivity, and detoxifying effects. Collectively, turmeric and guggulu employ complementary biochemical mechanisms, underscoring their therapeutic promise for mitigating inflammation, oxidative stress, and metabolic imbalance in recovery contexts **[14]**.

Turmeric (curcumin) and Guggulu benefit athletes by reducing inflammation and oxidative stress. Curcumin modulates cytokines, transcription factors, and enzymes while offering antioxidant protection, aiding recovery, reducing soreness, and boosting performance **[10, 15]**. Guggulu, rich in guggulsterones and often paired with Boswellia or curcumin, complements these effects, especially for joint inflammation and maintaining oxidative balance in athletic populations **[8, 16]**.

Athlete-centered qualitative data on herbal supplementation for sports recovery primarily emphasizes Turmeric (*Curcuma longa*) and its active compound, curcumin, with limited evidence available for Guggulu (*Commiphora wightii*). Reports from athletes and physically active individuals highlight subjective improvements in post-exercise outcomes following curcumin supplementation **[4, 17]**. Most notably, athletes frequently describe reduced muscle soreness and pain, as reflected in self-reported scores such as the Visual Analogue Scale **[13, 18]**. Studies involving adolescent athletes, elite rugby players, and professional soccer players indicate perceived attenuation of delayed onset muscle soreness (DOMS) and muscle fatigue, though some trials report inconsistent effects, underscoring the variability of subjective pain perception **[6, 13]**. Beyond musculoskeletal outcomes, curcumin has also been associated with improved psychological responses, including reduced stress during training and a perceived acceleration of recovery. Importantly, curcumin is generally regarded

as safe and well-tolerated, with most studies documenting no adverse events, though isolated cases of mild gastrointestinal or dermatological discomfort have been reported. In contrast, direct qualitative evidence for Guggulu in sports contexts remains uncommon. While Guggulu has a long-standing role in Ayurveda for managing inflammation and pain, modern studies involving athletes largely focus on biochemical rather than experiential outcomes **[11]**. Thus, current evidence highlights curcumin's perceived benefits for athletes, whereas Guggulu's role in contemporary sports recovery warrants further investigation.

LIMITATIONS OF THE STUDY

This review faced several methodological and contextual limitations that may have influenced its findings. Restricting the search to English-language publications from January 2016 to June 2025 excluded potentially relevant evidence, while access issues prevented retrieval of 217 reports. Exclusion of qualitative studies and editorials limited experiential insights. Inconsistent reporting standards, lack of standardized dosing protocols, and methodological bias further weakened evidence synthesis. Research was primarily confined to adult athletes, with underrepresentation of females, younger populations, and diverse ethnic groups. Moreover, heterogeneity in outcome measures, reliance on self-reported data, limited long-term follow-up, and insufficient high-quality randomized controlled trials constrained robust conclusions.

DIRECTIONS FOR FUTURE STUDIES

1. Rigorous Clinical Trials: Conduct large-scale, multi-center randomized controlled trials with double-blind, placebo-controlled designs and standardized protocols.
2. Dosing & Delivery: Establish optimal dosing regimens, dose-response ranges, and explore advanced delivery systems to improve bioavailability.
3. Mechanistic Insights: Apply metabolomics, proteomics, pharmacogenomics, and biomarker development to clarify molecular mechanisms and monitor outcomes.
4. Population Diversity: Expand studies to include female athletes, younger and older groups, and varied ethnic populations.
5. Safety & Guidelines: Undertake long-term safety assessments, monitor herb-drug interactions, and develop evidence-based sports medicine guidelines.

6. Technology & Integration: Use digital health tools, AI-driven personalization, and mixed-methods approaches to capture athlete experiences and optimize interventions.

These future research directions aim to address current knowledge gaps and establish a robust evidence base for the integration of Guggulu and Turmeric into evidence-based sports medicine practice.

CONCLUSION

Guggulu and Turmeric, both known for their strong healing powers in traditional medicine, show real promise in helping athletes recover from sports-related inflammation and tiredness. Turmeric, with its active compound curcumin, helps reduce muscle soreness, damage, and stress by fighting inflammation and harmful free radicals. Guggulu adds further support by balancing the body's recovery process and improving overall strength and resilience.

Together, they may give athletes a natural and safe way to manage inflammation and speed up recovery. However, more detailed studies are needed to find the best doses, long-term effects, and how these herbs work for different groups of athletes.

Overall, linking ancient herbal wisdom with modern science can open new doors in sports medicine. Guggulu and Turmeric could become valuable natural options to support athletes' performance, recovery, and well-being in a safe and holistic way.

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