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Effects of Elastic Band Training on Physical Performance in Team Sports: A Systematic Review and Meta-Analysis

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INTRODUCTION

Review question / Objective The primary objective of this systematic review and meta-analysis is to evaluate the effects of elastic band training on key physical performance indicators in team sport athletes. Specifically, this study aims to determine the extent to which elastic resistance training influences strength, power, linear sprint performance, COD and jump height in team sports contexts.

Rationale Physical performance is a cornerstone of success in team sports, as athletes are constantly required to execute high-intensity actions such as sprinting, jumping, rapid changes of direction (COD), and forceful strength-based movements. These physical attributes not only determine competitive outcomes but also play a pivotal role in reducing injury risk and sustaining long-term athletic development. Strength training, therefore, has become an integral component of conditioning programs, with traditional modalities such as free weights and machine-based resistance widely acknowledged for their effectiveness. However, the dynamic demands of modern sport and the need for accessible, adaptable, and versatile training tools have encouraged exploration of alternative methods—among which elastic band training has gained increasing popularity.

Elastic bands provide variable resistance throughout the range of motion, challenging athletes differently compared to traditional resistance training. Unlike free weights, which rely primarily on gravity, elastic bands impose progressive tension as they stretch, thereby mimicking sport-specific force applications more closely. This unique resistance profile enables targeted neuromuscular adaptations that can be effectively transferred to the explosive and multidirectional actions characteristic of team sports. Furthermore, elastic bands are portable, cost-effective, and adaptable to a wide variety of

settings, making them especially appealing in environments where access to conventional gym equipment is limited.

Previous studies have demonstrated that elastic resistance training can stimulate improvements in muscular strength, power, and endurance, often yielding adaptations comparable to those obtained through traditional resistance training. These findings suggest that elastic bands may serve as a viable alternative or complementary method for enhancing athletic performance. Yet, despite their growing use, evidence regarding their impact on sport-specific outcomes in team athletes remains inconsistent. Some research has reported notable improvements in sprint performance, COD, and jump height following elastic band training interventions, while other studies have observed only modest or negligible benefits.

This inconsistency can be attributed to several factors. Variability in study design, including differences in training duration, intensity, and frequency, makes direct comparisons difficult. Athlete characteristics—such as age, sex, baseline fitness level, and sport discipline—further contribute to the heterogeneity of outcomes. Additionally, discrepancies in how performance indicators are measured (e.g., different sprint distances, jump tests, or COD protocols) complicate the interpretation of results. Given these methodological differences, it is challenging for coaches and practitioners to draw definitive conclusions about the utility of elastic band training in team sport contexts.

A systematic review and meta-analysis are therefore essential to address these gaps. By synthesising the available evidence, this study aims to provide a clearer understanding of whether elastic band training has a meaningful impact on performance outcomes relevant to team sports. In particular, the focus on key indicators—muscular strength, linear sprint performance, COD ability, and jump height—ensures that findings will have direct applicability to the physical demands faced by athletes in competitive settings.

Beyond its scientific value, this research holds significant practical implications. If elastic band training is shown to be effective, it could offer coaches and practitioners a highly accessible method for enhancing athletic performance without requiring extensive infrastructure. This is particularly relevant for youth programs, amateur clubs, or developing regions where access to advanced facilities is limited. Moreover, the adaptability of elastic bands allows for individualized training programs tailored to specific performance goals, rehabilitation needs, or return-to-play protocols.

In summary, elastic band training presents a promising yet under-clarified method for improving sport-specific physical performance in team athletes. While individual studies have provided valuable insights, the lack of consensus underscores the need for a systematic, evidence-based evaluation. By rigorously analyzing existing research, this systematic review and meta-analysis will not only clarify the effectiveness of elastic band training but also provide practical recommendations for integrating.

Condition being studied The present systematic review and meta-analysis focus on healthy athletes participating in team sports such as football, basketball, volleyball, handball, and rugby. Unlike clinical populations with disease or injury, these individuals represent a non-pathological group whose primary concern is not treatment but performance optimization and injury prevention. Team sport athletes are required to repeatedly perform explosive and multidirectional movements—such as sprinting, jumping, and rapid changes of direction—that place high demands on lower limb strength, power, and neuromuscular control.

Suboptimal levels of these physical performance attributes, even in otherwise healthy athletes, are associated with increased fatigue, reduced match performance, and elevated risk of musculoskeletal injury. Therefore, interventions aimed at improving muscular strength, sprinting ability, change-of-direction speed, and jump height are considered essential not only for maximising competitive performance but also for safeguarding long-term athlete health and resilience.

METHODS

Search strategy The literature search strategy for this systematic review and meta-analysis was carefully designed to ensure comprehensive identification of relevant studies examining the effects of elastic band training on physical performance outcomes in team sport athletes. A structured approach was employed in accordance with PRISMA guidelines, which emphasize transparency, reproducibility, and methodological rigour in the conduct of systematic reviews.

The search strategy involved three primary components:

Defining the key concepts of interest (population, intervention, and outcomes).

Constructing search terms using synonyms, truncations, and Boolean operators.

Implementing the search across selected electronic databases and supplementary sources.

1. Population terms

The primary population of interest included team sport athletes across different competitive levels (youth, amateur, semi-professional, and elite). To capture the broadest possible sample, the following search terms were used:
“athlete”
“team sport”
Specific sports: “soccer,” “basketball,” “volleyball,” “handball,” “rugby.”
These terms were selected because they represent the most widely studied and globally popular team sports where elastic band training is commonly incorporated into conditioning programs.
2. Intervention terms
The intervention of interest was elastic band training, sometimes referred to by different terms in the literature. To avoid missing relevant studies due to variations in terminology, multiple synonyms were incorporated:
“elastic band”
“resistance band”
“rubber band”
“Thera-Band” (a brand name commonly used in research contexts)
“resistance tubing”
This range of terms ensured coverage of both generic and brand-specific descriptors of elastic resistance training.
3. Outcome terms
The outcomes focused on key indicators of physical performance in team sports. Search terms included:
“strength”
“power”
“jump performance”
“sprint speed”
“agility”
Together, these outcomes reflect the core physical attributes that underpin successful performance in multidirectional, high-speed team sports.
4. Boolean operators and search syntax
To maximize the retrieval of relevant records, the search terms were combined using Boolean operators. The overall search string took the following form:
(“elastic band” OR “resistance band” OR “rubber band” OR “Thera-Band” OR “resistance tubing”) AND (“athlete” OR “team sport” OR “soccer” OR “basketball” OR “volleyball” OR “handball” OR “rugby”) AND (“strength” OR “power” OR “jump performance” OR “sprint speed” OR “agility”)
The use of OR allowed for capturing synonyms within each concept, while the AND operator ensured that only articles addressing all three domains (population, intervention, and outcomes) were retrieved. This balance between sensitivity (capturing as many relevant articles as possible) and specificity (excluding irrelevant material) was critical to maintaining the integrity of the review.
Electronic Databases
Two major multidisciplinary and biomedical databases were searched to provide comprehensive coverage of the literature:
PubMed (U.S. National Library of Medicine)
PubMed was chosen due to its extensive coverage of biomedical, health, rehabilitation, and sport science literature.
It indexes journals from MEDLINE, as well as additional relevant publications in the areas of sports medicine, kinesiology, and physical rehabilitation.
PubMed’s advanced search functions allowed the precise use of Boolean operators, truncations, and filters to refine the search.
Web of Science (Clarivate Analytics)
Web of Science was selected for its broad interdisciplinary scope, indexing high-quality journals across sports sciences, physiology, biomechanics, and coaching science.
It includes conference proceedings and cross-disciplinary research relevant to both sports performance and applied training methodologies.
Web of Science provides robust citation tracking, enabling the identification of influential studies and emerging trends.
Together, these databases ensured that both biomedical and sport-performance research were comprehensively covered. To supplement the database search, manual searching was conducted:
Reference lists of all included studies were screened to identify additional eligible studies that were not captured by the electronic search.
This snowball technique is particularly valuable in sports science, where relevant studies may sometimes appear in less widely indexed journals.
In cases where results were presented graphically, the WebPlotDigitizer software was employed to extract numerical data, ensuring complete data inclusion for the meta-analysis.

Participant or population This systematic review and meta-analysis addresses healthy male and female athletes of varying competitive levels in team sports (football, basketball, volleyball, handball, rugby, etc.), focusing on their sport-specific performance outcomes (strength, sprint, COD, jump height, and explosive power).

Intervention The intervention of interest in this systematic review and meta-analysis is elastic band training, also commonly referred to as resistance band training, rubber band training, Thera-Band training, or resistance tubing exercises.

These interventions are characterized by the use of elastic bands as the primary resistance modality during strength and conditioning programs. Unlike traditional resistance training methods such as free weights or machines, elastic bands provide variable resistance throughout the range of motion, making them portable, adaptable, and practical for diverse training environments.
Within the studies included in this systematic review and meta-analysis, elastic band training interventions were designed to improve key physical performance outcomes in team sport athletes. These outcomes typically include:

Muscular strength (particularly of the lower limbs);
Explosive power;
Linear sprint performance;
Change of direction (COD) ability;
Jump height.

The interventions may vary in training duration, frequency, intensity, and exercise selection, but the common feature across all is the systematic application of elastic resistance exercises aimed at enhancing sport-specific physical performance.
Thus, the review evaluates elastic band training as a standalone or complementary resistance modality compared to traditional resistance training, no training, or alternative strength and conditioning programs.

Comparator In this systematic review and meta-analysis, the comparator interventions are those against which elastic band training is evaluated in the included studies. According to the provided text, these comparators fall into three main categories:
1. Traditional resistance training – interventions involving free weights, machines, or other conventional strength training methods.
2. No training – control groups where participants did not undergo any structured training program during the study period.
3. Alternative strength and conditioning programs – other structured training regimens designed to improve physical performance, but not primarily based on elastic band resistance.

Thus, this review and meta-analysis compares the effects of elastic band training with both active comparators (traditional resistance and other strength programs) and passive controls (no training). This enables the analysis to determine whether elastic band interventions provide comparable, superior, or inferior benefits relative to established or baseline practices in team sport athletes.

Study designs to be included This systematic review and meta-analysis will include randomized controlled trials (RCTs), quasi-experimental studies, and cohort studies published in peer-reviewed journals. These designs were selected to ensure methodological rigor while capturing a broad range of evidence on the effects of elastic band training on physical performance in team sport athletes. Systematic reviews, meta-analyses, case studies, and non-English publications will be excluded.

Eligibility criteria
Additional Inclusion Criteria
1. Publication type and language (only peer-reviewed journal articles were included to ensure scientific rigor and methodological quality. Studies had to be published in English; non-English language articles were excluded).
2. Study design specifics (eligible designs included randomized controlled trials (RCTs), quasi-experimental studies, and cohort studies. Studies had to provide sufficient methodological detail for replication, e.g., a clear description of interventions, participants, and outcomes).
3. Population characteristics (participants needed to be healthy male or female athletes actively competing in team sports at various competitive levels, e.g., recreational, semi-professional, professional. Studies explicitly examining youth or adult athletes were considered if they reported sport-specific training interventions).
4. Intervention clarity (elastic bands had to be used as a primary resistance modality in training protocols aimed at improving sport-specific physical performance. Interventions needed to be structured and reported with sufficient detail, e.g., training duration, frequency, intensity, and exercise types).
5. Outcome reporting (studies must have reported quantitative measures of at least one primary physical performance outcome, e.g., strength, sprint, jump, or COD).

Additional Exclusion Criteria
1. Non-athlete or clinical populations (studies focusing on rehabilitation, injured athletes, or clinical populations, e.g., patients with musculoskeletal or neurological conditions) were excluded).
2. Non-team sports or non-specific populations (Studies involving individual sport athletes, e.g., track and field, swimming, gymnastics) were excluded unless the participants were explicitly competing in a team-sport context).
3. Study design limitations (excluded: case reports, case series, editorials, narrative reviews, commentaries, theses/dissertations, and

conference abstracts without full peer-reviewed publications. Studies with insufficient methodological detail, or where elastic band training was only a supplementary/auxiliary component of a broader intervention without clear outcome attribution).
4. Data reporting issues (studies that did not provide quantitative outcome data, e.g., means, standard deviations, effect sizes, or figures extractable using WebPlotDigitizer, were excluded).
5. Duplication or overlap (if multiple studies reported findings from the same dataset, only the most complete or recent publication was included).

Information sources This this review and meta-analysis draws information from two major electronic databases (PubMed and Web of Science), supplemented by manual reference list searches to capture additional studies. Article management and bias reduction were ensured through Rayyan software with blinded screening. Where necessary, WebPlotDigitizer software was employed to extract quantitative data from graphical figures. Together, these sources and tools provide a structured, transparent, and comprehensive approach to identifying and extracting data on elastic band training interventions in team sport athletes.

Main outcome(s) The primary outcomes of this systematic review and meta-analysis focus on key physical performance indicators in healthy team sport athletes following elastic band training. Specifically, the outcomes include:
1. Muscular Strength – measured through standardized testing protocols such as maximum voluntary contraction, 1-repetition maximum (1RM), or other validated strength assessment methods. This outcome evaluates the extent to which elastic resistance training enhances force production capacity of the lower and upper limbs.
2. Explosive Power and Jump Performance – assessed using vertical and horizontal jump tests (e.g., countermovement jump, squat jump). These measures reflect lower-limb explosive strength and power adaptations, with standardized mean differences (SMD) and 95% confidence intervals (CIs) calculated to quantify effect sizes.
3. Linear Sprint Performance – evaluated through time-to-completion measures across standard sprint distances (e.g., 10 m, 20 m, or 30 m). Improvements in sprint speed are particularly relevant for multidirectional and high-intensity demands of team sports.
4. Change of Direction (COD) Ability – measured through standardized agility tests (e.g., T-test, 505 test, Illinois agility test). COD outcomes capture athletes' ability to decelerate, change movement direction efficiently, and reaccelerate, which are critical for team sport performance.
Secondary outcomes include broader indicators of neuromuscular performance and training efficiency, such as the transferability of elastic band training to sport-specific tasks. Timing of outcome assessment varies across included studies but is typically evaluated pre- and post-intervention, with intervention durations ranging from several weeks to months.
Effect measures are reported as standardized mean differences (SMDs) with corresponding 95% confidence intervals (CIs), enabling pooled effect size estimation. Statistical significance is determined at $p \leq 0.05$, with heterogeneity across studies assessed using the I^2 statistic.
Collectively, these outcomes will provide a robust synthesis of the effectiveness of elastic band training compared with traditional resistance training or no intervention in enhancing athletic performance.

Quality assessment / Risk of bias analysis The methodological quality of the primary studies included in this systematic review and meta-analysis was evaluated using the revised Cochrane Risk of Bias tool for randomized trials (RoB 2) [12]. This tool is widely recognized as the gold standard for appraising risk of bias in intervention studies, as it systematically addresses potential threats to validity across multiple domains.
RoB 2 considers five key domains:
1. Bias arising from the randomization process – assesses whether the random allocation sequence was adequately generated and concealed, and whether baseline imbalances suggest a potential problem.
2. Bias due to deviations from intended interventions – evaluates adherence to the intervention protocols, including blinding of participants and personnel, and whether deviations could have influenced the outcomes.
3. Bias due to missing outcome data – examines the extent of incomplete data, reasons for missingness, and whether this could bias the estimated effects of the intervention.
4. Bias in measurement of the outcome – considers the objectivity and consistency of outcome measurements, blinding of outcome assessors, and appropriateness of the tools used.
5. Bias in selection of the reported results – evaluates whether outcomes were selectively reported based on their results, or if outcome reporting followed pre-specified protocols.

For each included study, these domains were rated individually, and then an overall risk of bias judgment (low risk, some concerns, or high risk)

was assigned. This systematic approach ensured transparency and consistency in quality appraisal.
The bias assessment was initially conducted by a primary reviewer. In cases where judgments were uncertain or complex, consultation with a second reviewer was sought to reach a consensus. This collaborative approach minimized subjectivity and ensured reliability of the evaluations.
Notably, all studies demonstrated low risk of bias in the third domain (missing outcome data), indicating strong methodological consistency in maintaining complete datasets. Variations in other domains, such as randomization procedures or reporting practices, were carefully considered in the interpretation of pooled findings.
By applying the RoB 2 tool, this review ensured that the conclusions were based on evidence with clearly documented methodological strengths and limitations. The structured bias analysis also allowed for sensitivity assessments, highlighting areas where future research could improve study design and reporting.

Strategy of data synthesis The data collected from eligible studies will be analyzed through both qualitative synthesis and quantitative meta-analysis to provide a comprehensive assessment of the effects of elastic band training on physical performance in team sport athletes. The approach has been carefully structured to ensure methodological rigor, transparency, and reproducibility.

1. Statistical Software and Analytical Framework
The meta-analysis will be conducted using MedCalc statistical software version 19.6 (MedCalc Software Ltd, Ostend, Belgium). This program enables advanced statistical modeling and visualization of pooled effect sizes. Continuous outcome variables, such as muscular strength, jump height, sprint speed, and change of direction (COD) performance, will be synthesized using standardized mean differences (SMDs). This choice ensures comparability across studies that may have used different measurement scales or protocols to evaluate similar performance indicators.

2. Effect Size Calculation
Effect size will be determined by calculating the SMD for each performance outcome, along with 95% confidence intervals (CIs). The use of SMD allows standardization of effect magnitudes across diverse outcome measures. Significance will be determined using a p-value threshold of 0.05. Effect sizes will be interpreted following Cohen's conventional thresholds:

Small effect: SMD = 0.2
Medium effect: SMD = 0.5
Large effect: SMD = 0.8

This categorization will facilitate clear communication of the practical significance of elastic band interventions.

3. Model of Meta-Analysis
Given the expected heterogeneity in populations, sports contexts, and intervention protocols, a random-effects model will be applied. This approach assumes that the true intervention effect may vary across studies, making it more suitable than a fixed-effects model for the synthesis of evidence in sport science and applied physiology research.

4. Assessment of Heterogeneity
Heterogeneity across studies will be quantified using the I^2 statistic. The thresholds for interpreting heterogeneity are as follows:

Low: $I^2 < 25\%$
Moderate: $I^2 = 25–50\%$
High: $I^2 > 50\%$

Where high heterogeneity is observed, potential sources will be explored, including differences in study design, participant characteristics (e.g., sex, age, competitive level), intervention duration, and performance measures.

Subgroup analysis Subgroup analyses may be performed where data permits, for example, by stratifying participants according to sex, sport type, or competitive level, or by comparing short- vs. long-term training interventions.

Sensitivity analysis Sensitivity analyses will be conducted to test the robustness of pooled results by excluding studies with high risk of bias or small sample sizes.

Language restriction Language limits will be imposed, as only studies written in English will be included. Studies in other languages will be excluded from the analysis.

Country(ies) involved This study is being carried out in Serbia and the Czech Republic, reflecting a collaborative, multinational research effort across both countries.

Keywords Resistance Training; Resistance Band; Strength.

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