Physical Education Theory and Methodology
Теорія та методика фізичного виховання

ISSN 1993-7989 (print)
ISSN 1993-7997 (online)
ISSN-L 1993-7989

Review Article

Systematic Review of Exercise Interventions in Archery: Injury Management and Performance Outcomes

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Authors' Contribution: A – Study design; B – Data collection; C – Statistical analysis; D – Manuscript Preparation; E – Funds Collection

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Accepted for Publication: December 30, 2025
Published: January 30, 2026

DOI: 10.17309/tmfv.2026.1.06

Abstract

Background. Exercise-based interventions are increasingly incorporated into archery training to enhance performance and reduce injury risk. However, the extent to which these interventions directly contribute to injury management and performance improvement remains unclear.

Objectives. This systematic review aimed to examine the effects of exercise interventions on injury management and performance improvement in archers. The review synthesizes 10 years of evidence (January 2015–April 2025) to provide recommendations for developing targeted exercise programs that address both performance optimization and injury prevention.

Materials and Methods. A comprehensive search was conducted across PubMed, Scopus, Web of Science, and SPORTDiscus, yielding 767 articles. Studies were screened according to predefined inclusion criteria, resulting in 15 eligible studies. Extracted outcomes included shooting accuracy, postural control, muscle strength, and indicators relevant to injury management. Methodological quality was assessed using the SQAC, with all included studies scoring ≥50%, indicating acceptable-to-high methodological rigor. Due to heterogeneity in study designs, interventions, and outcome measures, a meta-analysis was not performed.

Results. Most studies focused primarily on performance enhancement rather than direct injury management. Nonetheless, several exercise interventions demonstrated indirect benefits relevant to injury management and prevention, including improvements in postural stability, neuromuscular control, and muscular endurance. Core stability training, Pilates-based balance training, circuit training, and strength conditioning consistently produced significant improvements in postural stability (moderate-to-large effect sizes), muscle strength, and shooting accuracy. Targeted exercises such as lower trapezius strengthening, compound weight training, and archery-specific drills further enhanced accuracy, endurance, and neuromuscular coordination.

Conclusions. Exercise interventions meaningfully improve key performance outcomes in archers and may provide indirect benefits for injury prevention through improvements in strength, balance, postural control, and neuromuscular stability. Future research should incorporate standardized exercise protocols and prioritize larger randomized controlled trials explicitly examining injury-related outcomes to strengthen evidence-based practice in archery.

Keywords: archery, injury prevention, performance, strength training, systematic review.

Introduction

Archery is a competitive sport that requires a high level of physical strength and endurance to maintain technical consistency during performance (Falaahudin et al., 2024; Lau et al., 2020; Mohd Saleh et al., 2022). In addition, optimal archery performance depends on postural stability, balance, accuracy, and well-developed fine motor skills (Patil & Koley, 2019; Putra, 2022; Sarro et al., 2021). The specific nature of archery involves prolonged and repetitive upper-limb movements, which place considerable mechanical demands on the musculoskeletal system (Yachsie et al., 2023; Niestroj et al., 2018). When combined with sustained static postures, these demands substantially increase the risk of musculoskeletal injuries among archers (Alberola-Zorrilla et al., 2022; Subramaniam et al., 2025).

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Although archery is generally regarded as safe sport, injury rates can reach as high as 4.4 per 10,000 participants (Agranovich et al., 2024). A recent study of Malaysian elite archers reported that over 80% had experienced at least one injury, predominantly affecting the shoulder (bow arm 56.4%, drawing arm 54.5%), upper back (38.8%), lower back (38.2%), and neck (37.6%) (Subramaniam et al., 2025). Contributing factors such as improper technique, high training volume, insufficient strength and poor balance have been identified as significantly increase injury risk (B. R. Prine et al., 2023; Subramaniam et al., 2025). These factors not only heighten susceptibility to injury but may also compromise performance consistency and athlete longevity. Accordingly, implementing effective injury management strategies comprising well designed exercise programs with appropriate volume and intensity, along with training and movement corrections could mitigate injury risks and sustain athlete's performance.

Optimal archery performance requires precise physical control and stability throughout the shooting process that require a good core strength and lumbopelvic stability along the kinetic chain system (Sarro et al., 2021; Spratford & Campbell, 2017). Core stability, involving the trunk muscles supporting spinal alignment and abdominal organs, plays a central role in maintaining postural control and enabling efficient limb movement (Akuthota et al., 2008; Sarro et al., 2021). Research indicates that exercises targeting core strengthening exercises can improve dynamic balance abilities and reduce injury risks among archers (Park et al., 2016; Suppiah et al., 2017). Furthermore, balance training plays a vital role in synchronizing body movements with bow sway, a factor that significantly influences shooting accuracy (Sarro et al., 2021). Balance performance itself correlates strongly with archery success (Mohd Saleh et al., 2022) and tests such as static balance and star excursion have been linked to athlete's anthropometric characteristics (Patil & Koley, 2019).

In addition to core and balance factors, both upper and lower limb strength are essential for performance and stability. Upper limb strength, particularly in the arms, enables effective bow drawing and holding, directly impacting shooting accuracy and endurance (Liao et al., 2022; Susanto et al., 2021; Yachsie, Pranata, et al., 2023). Concurrently, lower limb strength especially in the hip extensors, abductors and knee flexors has been shown to significantly enhance balance control, which is vital for maintaining a stable shooting posture (Inoue et al., 2013; Wilson et al., 2018). Despite the recognition of limb strength's importance in archery, most of the training still emphasize on upper limb strength, with comparatively less focus on concurrent lower limb or trunk strengthening (Agranovich et al., 2024; Jogi et al., 2024; Subramaniam et al., 2025). It is essential to emphasize the integration of the upper limbs, trunk, and lower limbs, as the kinetic chain concept illustrates that effective movement in archery depends on the coordinated interaction of the shoulder–elbow–wrist force chain, trunk stabilization, and lower limb support (Liu, 2025) together with both static and dynamic postural stability (Fan et al., 2025; Kesilmiş et al., 2024). Previous systematic reviews in archery have explored biomechanical and performance related factors (Jogi et al., 2024; Lau et al., 2020), but they have placed less emphasis on exercise interventions that concurrently address injury management and performance enhancement. Consequently, a need exists for an integrated review synthesizing evidence on exercise interventions designed to improve both injury outcomes and performance in archers.

This systematic review aims to address these gaps by critically evaluating exercise interventions that support both injury management and injury prevention, while also enhancing performance in archery. By synthesizing current research, the review provides evidence-based recommendations for designing targeted exercise programs that can optimize performance and reduce the risk of injury among the archers.

Materials and Methods

Study Design and Protocol

This review adhered to the PRISMA-P (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines (Moher et al., 2009) and registered in PROSPERO (The International Prospective Register of Systematic Reviews) with identification number - CRD42023445770. The evaluation process was conducted according to the following: (1) preliminary, (2) identification, (3) screening, (4) eligibility, and (5) analysis. The review adhered to the pre-specified protocol without deviations; no amendments were made following registration.

Study Process

Preliminary Phase

In the initial phase, the research questions were formulated using the PICO framework (Population, Intervention, Comparison, and Outcome measures), as outlined in Table 1 (Aromataris & Riitano, 2014). Utilizing this framework, a preliminary search was conducted by

Table 1. PICO concept table

Research question: What exercise interventions are most effective for managing injuries and enhancing performance in archery athletes?	
PICO FRAMEWORK	
Population	The participants consisted of healthy female and male archers of all ages and competitive levels, with no restrictions.
Intervention	Any form of exercise intervention without constraints on training length, such as strength training, stretching exercises, circuit training, etc.
Comparison	Comparing against pre- or post-intervention data or a control group
Outcomes	Injury prevention, injury management, and skill performance Treatment effects or pre- and post-test values on injury prevention, management, or performance skills should be reported in the research, and at least one effect of the exercise intervention should be included. Actions involving a particular task or objective and requiring the synchronization of many motor skills in a given context and time period were deemed as technical skill outcomes.

combining the following terms: archer (population), exercise (intervention), and injury prevention, injury management, and skill performance (outcome measures). Keywords derived from the titles and abstracts of the selected articles were further refined utilizing a thesaurus and arranged into an organized grid table (Table 2).

Table 2. Logic grid with identified keywords

Logic grid with identified keywords		
Population	**Intervention**	**Outcomes**
Archer*	Exercise	Injury prevention
Archer* athlete	Training	Injury management
Shooting sport	Physiotherapy	Athlet* performance
Shooting game	Rehab*	Technical skill
	Resistance	Technique

Identification phase

The current study primarily employed the databases PubMed, Web of Science (WOS), SPORTDiscus, and Scopus, covering publications from January 2015 to April 2025. The keywords in the titles, abstracts, or topics of papers were matched in advance searches using a key search strategy that used Boolean operators, phrases, truncations, and wildcards (Table 3).

767 records were found overall as a result of the search, including 95 articles from PubMed, 223 from WOS, 72 from SportDiscus, and 377 from Scopus. In addition to database searches, we included a grey literature search using Google Scholar, ProQuest Dissertations, and relevant sport science repositories to identify unpublished theses and conference proceedings. Handsearching of reference lists from included articles and relevant reviews was also performed to ensure completeness.

Screening phase

The articles from all the databases were exported to Mendeley software to remove duplicates. Only 607 were screened in the third phase after eliminating duplication. During the initial part of this phase, all articles were evaluated based on (1) document type, (2) publication year, (3) language, and (4) topic area. (Table 4). The researchers restricted their selection to journal publications with empirical data, omitting master's theses, book chapters, conference proceedings, prefaces, and articles of opinion. In addition, only papers pertaining to archery or shooting disciplines, published in English between 2015 and 2025, were considered, yielding a total of 111 articles.

A second evaluation of the articles was conducted in accordance with their abstracts and titles during the second stage of the screening procedure. Articles were removed if they: (1) centered on psychological, mental, attention, arousal, concentration, or medication aspects, (2) were unrelated to exercise interventions or performance enhancement, (3) involved technology, or (4) pertained to Paralympic athletes. As a result, 18 articles were selected in this phase. Two researchers (AS and FFZ) independently evaluated the titles and abstracts of the discovered documents, subsequently conducting a full-text review. All experimental and quasi-experimental research were considered. All differences were addressed through discussions with the third author (MR).

Table 3. Databases and key search strings

Database	Strings	Results
PubMed	("Archer*"[Title/Abstract] OR "Archer* athlete*"[Title/Abstract] OR "Shooting sport"[Title/Abstract] OR "Shooting game"[Title/Abstract]) AND ("Exercise"[Title/Abstract] OR "Training"[Title/Abstract] OR "Physiotherapy"[Title/Abstract] OR "Rehab*"[Title/Abstract] OR "Resistance"[Title/Abstract] OR "Strength"[Title/Abstract] OR "Physical activity"[Title/Abstract]) AND ("Injury prevention"[Title/Abstract] OR "Injury management"[Title/Abstract] OR "Athlet* performance"[Title/Abstract] OR "Technical skill*"[Title/Abstract] OR "Technique"[Title/Abstract] OR "Performance"[Title/Abstract] OR "Injur*"[Title/Abstract] OR "skill*"[Title/Abstract])	95
Web of Science	TS = ("Archer*" OR "Archer* athlete*" OR "Shooting sport" OR "Shooting game") AND ("Exercise" OR "Training" OR "Physiotherapy" OR "Rehab*" OR "Resistance" OR "Strength" OR "Physical activity") AND ("Injury prevention" OR "Injury management" OR "Athlet* performance" OR "Technical skill*" OR "Technique" OR "Performance" OR "Injur*" OR "skill*")	223
SPORTDicus	AB (("Archer*" OR "Archer* athlete*" OR "Shooting sport" OR "Shooting game")) AND AB (("Exercise" OR "Training" OR "Physiotherapy" OR "Rehab*" OR "Resistance" OR "Strength" OR "Physical activity")) AND AB (("Injury prevention" OR "Injury management" OR "Athlet* performance" OR "Technical skill*" OR "Technique" OR "Performance" OR "Injur*" OR "skill*"))	72
SCOPUS	TITLE-ABS-KEY ("Archer*" OR "Archer* athlete*" OR "Shooting sport" OR "Shooting game") AND ("Exercise" OR "Training" OR "Physiotherapy" OR "Rehab*" OR "Resistance" OR "Strength" OR "Physical activity") AND ("Injury prevention" OR "Injury management" OR "Athlet* performance" OR "Technical skill*" OR "Technique" OR "Performance" OR "Injur*" OR "skill*")	377
TOTAL		767

Eligibility phase

A full-text screening of all 18 articles was conducted. Three articles were excluded because they were case studies or focused on validity and reliability. Figure 1 presents a

Table 4. Inclusion and exclusion criteria

Inclusion criteria	Exclusion criteria
Investigated exercise interventions targeting performance improvement and/or injury prevention or management in archers	Non-exercise-based interventions – Articles focusing on psychological, nutritional, pharmacological, or surgical interventions without an exercise component.
Involved competitive or recreational archers of any age	Low methodological quality – Articles with major flaws in study design, insufficient reporting, or no control/comparison group (for experimental designs).
Used experimental or quasi-experimental	Master's theses, book chapters, conference proceedings, prefaces, and articles of opinion
Year published; between January 2015 to April 2025	Paralympic athlete populations.
Studies published in English	
Reported outcome measures related to physical performance, postural control, or injury profiles in archery	

summary of the four stages of the systematic review. Ultimately, 15 articles remained for analysis.

There are several rationales for considering 15 publications sufficient for the present systematic literature review (SLR), which collectively demonstrate that this number is consistent with both methodological norms and existing evidence in the field. First, drawing on the concept of study maturity articulated by Kraus et al., 2020, it is recognized that immature research fields often yield a relatively small number of articles, largely due to the scarcity of studies addressing exercise interventions for archers in the context of injury management and performance improvement.

There are several rationales for considering 15 publications sufficient for the present systematic literature review (SLR), which collectively demonstrate that this number is consistent with both methodological norms and existing evidence in the field. First, drawing on the concept of study maturity articulated by Kraus et al. (2020), it is recognized that immature research fields often yield a relatively small number of articles, largely due to the scarcity of studies addressing exercise interventions for archers in the context of injury management and performance improvement. Second, Robinson and Lowe (2015) observed that SLRs commonly examine fewer than 50 articles, and in many cases fewer than 10, thereby supporting the adequacy of a smaller dataset. Third, precedents in the literature reinforce this point: published SLRs focusing on exercise and physical training among archers, such as those by Jogi et al. (2024) and Lau et al. (2020) each reviewed only 10 studies. Collectively, these considerations justify the selection of 15 studies as a sufficient and methodologically sound basis for the present review.

Quality Appraisal

The methodological quality of the included studies (n=15) was assessed using the Standard Quality Assessment Criteria (SQAC), which evaluates key domains such as sample selection, intervention design, outcome measurement, and reporting clarity. The SQAC was selected as it allows consistent methodological evaluation across both randomized and non-randomized designs, which were prevalent in this review. This approach enabled comparability across heterogenous intervention studies without excluding relevant quasi-experimental evidence. However, it is acknowledged that SQAC does not provide the same level of bias domain specificity as randomized control trial focused tools such as RoB 2 or Robins-I. Therefore, while SQAC was appropriate for this mixed design reviews, its use represents a methodological limitation that may reduce sensitivity in detecting certain area of bias.

Two independent reviewers assessed each study's quality. Any discrepancies were resolved through discussion with a third reviewer. Each study was evaluated based on the checklist, with scores assigned as follows: Y = fully met the criteria (score 2), P = partially met the criteria (score 1), and N = did not meet the criteria (score 0). If a criterion was inapplicable to a specific research, it was designated as 'n/a.' A cumulative quality score was calculated for every article and changed to a percentage following the grading process.

A quality threshold of ≥50% was used to denote acceptable methodological rigor, consistent with earlier reviews employing SQAC (Kmet, 2004). Although this threshold is inherently arbitrary, this cutoff provides a practical compromise by eliminating studies with inadequate methodology while keeping those with adequate internal validity (Kmet, 2004). All 15 articles scored above 50% and were therefore included in this phase (Table 5).

Results

Study Selection, Screening and Eligibility

The systematic review process for study selection is illustrated in Figure 1. A total of 767 articles were initially obtained from numerous databases. Following the elimination of duplicates, 607 articles were retained and evaluated according to the established inclusion and exclusion criteria, as well as the criteria pertaining to exercise interventions. This screening process resulted in 18 relevant articles. Upon further review of the full-text articles, 3 were excluded because they were either case studies or studies focused on validity and reliability. Ultimately, 15 articles met the final eligibility criteria, each scoring over 80% in the quality assessment and were considered in the current review. A meta-analysis was not performed due to the diversity in the training protocols utilized for injury management and performance development in archers. Table 6 presents the primary findings.

Study Characteristics

All 15 publications considered in the present analysis are published in English and were published between 2015 and 2025.Two studies were conducted in India (Chatla et al., 2023; Khan et al., 2024), five studies in Indonesia (Nasrulloh et al., 2022; Prasetyo et al., 2023; Subekti et al., 2023; Yachsie et al., 2024; Yachsie, Pranata, et al., 2023)3-4 sets, 15-25 repetitions, and 1-2 minutes of rest between sets. The

study population was Yogyakarta State University archery athletes selected via purposive sampling. The instrument used to measure muscle strength is the hand grip strength test. Meanwhile, to measure the upper, lower, and middle body for the endurance of muscular test, four kinds of test items were used namely bench jump, bent leg curl-ups, abdominal crunches, modified dips (man and one each in Japan (Shinohara et al., 2023)side bridges are performed in a posture similar to archery shooting for training the muscles around the shoulder joint and the shoulder girdle of the pusher. Aim The purpose of this study was to determine whether a low-tremor side-bridge exercise for 4 weeks improves bow tremor during archery movements. Methods Participants were 20 male college students. First, we measured the tremor during side bridges performed with trunk inclinations of 25°, 40°, 55°, and 70° using an accelerometer attached to the elbow joint and identified low-tremor side bridges. The participants were then randomly divided into intervention and non-intervention groups, and the low-tremor side bridges were performed for 4 weeks. Results The effect of the intervention was determined by measuring the total tremor value using an accelerometer attached to the bow and changes in the median power frequency (MdPF, Korea (Park et al., 2016), Turkey (Beyaz et al., 2024), Thailand (Hemara et al., 2021), China (Geng et al., 2023), Ukraine (Sergiy et al., 2017), Malaysia (Suppiah et al., 2017) and Taiwan (Liao et al., 2022).

Three studies focused on international and national levels (Chatla et al., 2023; Hemara et al., 2021; Khan et al., 2024), two studies addressed beginner levels (Beyaz et al., 2024; Shinohara et al., 2023)these interlimb asymmetries have been shown to associate with spatial patterns of hand selection behavior. Importantly, these interlimb asymmetries can be modified systematically by occlusion of visual feedback, or a long-term sports training. In this study, we asked about the effects of a short-term training on interlimb asymmetries. Eighteen healthy young participants underwent a 12-week novice traditional archery training (TAT, while high school level was examined in two studies (Park et al., 2016; Suppiah et al., 2017) and university level in two studies (Liao et al., 2022; Nasrulloh et al., 2022). One study investigated both national level and basic training archers (Sergiy et al., 2017) and five studies did not specify the level of the archers (Geng et al., 2023; Prasetyo et al., 2023; Subekti et al., 2023; Yachsie et al., 2024; Yachsie, Pranata, et al., 2023)this paper also explores the relationship between attention and performance in competitions. Methods: By random sampling method, 24 archery athletes were investigated. They were divided into three groups: A, B, and C. Group A represented excellent scores (8).

Outcome Measures

In the analysis of outcome variables of each study, shooting accuracy were the most assessed variables (Chatla et al., 2023; Geng et al., 2023; Khan et al., 2024; Liao et al., 2022; Prasetyo et al., 2023; Sergiy et al., 2017; Suppiah et al., 2017; Yachsie et al., 2024; Yachsie, Pranata, et al., 2023), followed by posture (Hemara et al., 2021; Sergiy et al., 2017; Suppiah et al., 2017), balance and stability (Hemara et al., 2021; Park et al., 2016; Prasetyo et al., 2023), arm muscle strength (Nasrulloh et al., 2022; Sergiy et al., 2017; Yachsie, Pranata, et al., 2023), arm muscle endurance (Nasrulloh et al., 2022; Subekti et al., 2023)to increase arm muscle endurance of archery athletes. This type of research is an experiment with a "Two Groups Pretest-Posttest Design" design. The population is archery athletes, totaling 20 males sex with ages 12-15 years. The exercise was carried out for six weeks. The instrument uses the Holding Bow Digitec Test. The data analysis technique was a t-test. The results showed: 1 and one study on each of the following variables; lumbopelvic stability (Khan et al., 2024), tremor (Shinohara et al., 2023) side bridges are performed in a posture similar to archery shooting for training the muscles around the shoulder joint and the shoulder girdle of the pusher. Aim The purpose of this study was to determine whether a low-tremor side-bridge exercise for 4 weeks improves bow tremor during archery movements. Methods Participants were 20 male college students. First, we measured the tremor during side bridges performed with trunk inclinations of 25°, 40°, 55°, and 70° using an accelerometer attached to the elbow joint and identified low-tremor side bridges. The participants were then randomly divided into intervention and non-intervention groups, and the low-tremor side bridges were performed for 4 weeks. Results The effect of the intervention was determined by measuring the total tremor value using an accelerometer attached to the bow and changes in the median power frequency (MdPF, muscle activities of upper trapezius, lower trapezius and serratus anterior (Shinohara et al., 2023)side bridges are performed in a posture similar to archery shooting for training the muscles around the shoulder joint and the shoulder girdle of the pusher. Aim The purpose of this study was to determine whether a low-tremor side-bridge exercise for 4 weeks improves bow tremor during archery movements. Methods Participants were 20 male college students. First, we measured the tremor during side bridges performed with trunk inclinations of 25°, 40°, 55°, and 70° using an accelerometer attached to the elbow joint and identified low-tremor side bridges. The participants were then randomly divided into intervention and non-intervention groups, and the low-tremor side bridges were performed for 4 weeks. Results The effect of the intervention was determined by measuring the total tremor value using an accelerometer attached to the bow and changes in the median power frequency (MdPF, arm reaching movement performance (Beyaz et al., 2024), precision (Hemara et al., 2021), attention (Geng et al., 2023), core strength and endurance (Suppiah et al., 2017), lower trapezius strength and shoulder kinematics (Liao et al., 2022) (Table 6).

Duration of the Study

The highest duration of intervention among the studies was six weeks (Khan et al., 2024; Prasetyo et al., 2023; Sergiy et al., 2017; Subekti et al., 2023; Yachsie et al., 2024; Yachsie, Pranata, et al., 2023)ip 2 = 0.159, p = 0.03, twelve weeks (Chatla et al., 2023; Liao et al., 2022; Park et al., 2016), eight weeks (Nasrulloh et al., 2022; Suppiah et al., 2017), four weeks (Shinohara et al., 2023)side bridges are performed in a posture similar to archery shooting for training the muscles around the shoulder joint and the shoulder girdle of the pusher. Aim The purpose of this study was to determine whether a low-tremor side-bridge exercise for 4 weeks improves bow tremor during archery movements.

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Types of Exercise Intervention

Balance, Pilates and Core Training

A growing body of evidence highlights the effectiveness of balance, Pilates and core training, with four studies exploring various approaches (Khan et al., 2024; Park et al., 2016; Prasetyo et al., 2023; Suppiah et al., 2017). Specifically, these included Pilates and balance exercise (Khan et al., 2024), circuit training using a Bosu ball (Prasetyo et al., 2023), Pilates core stability (Park et al., 2016) and a core stability program using bodyweight exercises (Suppiah et al., 2017). All studies reported significant improvements ($p<0.05$) in performance outcomes, particularly in shooting accuracy (Khan et al., 2024; Prasetyo et al., 2023), balance (Park et al., 2016; Prasetyo et al., 2023) and reduction in postural sway (Suppiah et al., 2017).

Strength Training

Five studies have focused on strength training to improve the performance among the archers (Chatla et al., 2023; Liao et al., 2022; Nasrulloh et al., 2022; Subekti et al., 2023; Yachsie, Pranata, et al., 2023). Three studies have focused on arm muscle strength (Nasrulloh et al., 2022; Subekti et al., 2023; Yachsie, Pranata, et al., 2023), two studies on shooting accuracy (Chatla et al., 2023; Yachsie, Pranata, et al., 2023), one study on overall endurance of upper, lower, and middle muscle groups (Nasrulloh et al., 2022), and one study on lower trapezius muscle strength (Liao et al., 2022). Significant improvements were noted in all the outcome measures of the studies intervention ($p<0.05$).

Posture and Coordination

Three studies have investigated posture and coordination in archery (Beyaz et al., 2024; Hemara et al., 2021; Sergiy et al., 2017). The first study adopted traditional archery technique training to examine improvements in arm reaching movement performance (Beyaz et al., 2024). The second study utilized the archery skill analysis assessment form (ASAAF) to enhance posture, focus and muscle control among archers (Hemara et al., 2021). The third study implemented a specialized training program me targeting coordination, technical skills readiness as well as improvement in completion of complex tasks (Sergiy et al., 2017). All three studies reported significant improvement ($p<0.05$) in their post intervention scores.

Other Exercise Interventions

Yachsie et al. (2024) have examined the effects between fixed and changing drilling exercises on the archer's shooting accuracy with 18 sessions of training. The study has reported that both the fixed and changing drilling exercises have shown significant improvements in shooting accuracy ($p<0.05$). Shinohara et al. (2023) investigated how side bridge exercises with a 40-degree trunk inclination could reduce bow tremor during the archery sighting phase. The study revealed that following four weeks of interventions, significant improvements were seen in the tremor reduction and median power frequency of the middle deltoid. However, the serratus anterior, upper, and lower trapezius muscles did not show any significant improvements. Geng et al. (2023) investigated the impact of targeted archery training on attention stability and performance among 24 Chinese athletes. Over a controlled period, standardized practices focusing on posture and mechanical energy training were implemented, resulting in significant improvements in attentional stability for the highest-performing group. The study identified a strong correlation between focused attention and competitive outcomes. These findings underscore the role of mental focus in enhancing archery performance, providing valuable insights for optimizing athletic preparation.

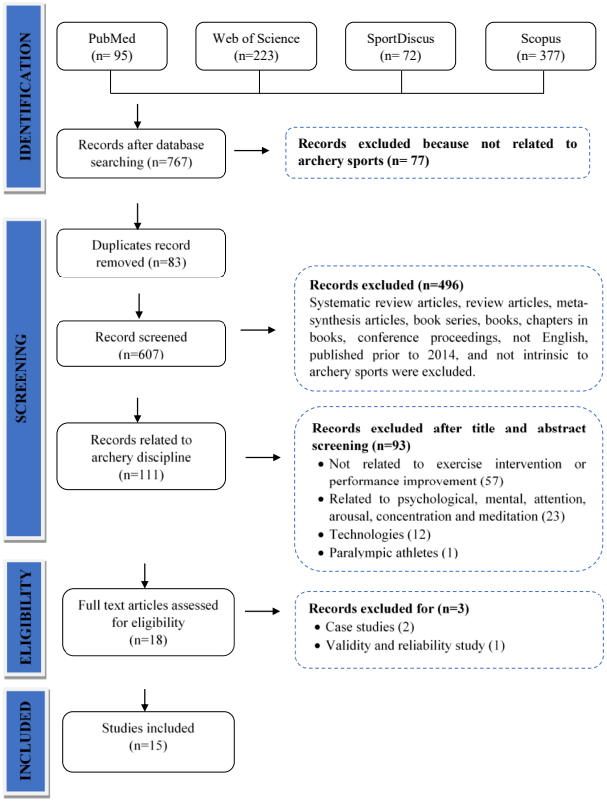

Fig. 1. PRISMA flowchat

Discussion

This systematic review consolidates the latest evidence on exercise interventions designed to enhance performance and manage injuries in archery athletes. Recent studies suggest that archers experience substantial musculoskeletal

Table 5. Quality assessment scores for the selected studies using the Standard Quality Assessment Criteria (SQAC)

Author(s)	Quality Assessment Criteria														Total Score	Quality Score
	1	2	3	4	5	6	7	8	9	10	11	12	13	14		
Khan et al., 2024 (Khan et al., 2024)	Y	Y	Y	Y	Y	P	N	Y	P	Y	Y	P	Y	Y	23/28	82.1%
Prasetyo et al., 2023	Y	Y	P	Y	n/a	n/a	n/a	Y	P	Y	Y	N	Y	Y	18/22	81.8%
Yachsie et al., 2024	Y	Y	Y	Y	Y	n/a	n/a	Y	P	Y	Y	Y	Y	Y	24	95.8%
Shinohara et al., 2023	Y	Y	Y	Y	Y	N	n/a	Y	P	Y	Y	Y	Y	Y	23	88.5%
Park et al., 2016	Y	Y	Y	Y	n/a	n/a	n/a	Y	P	Y	Y	Y	Y	Y	21	95.5%
Beyaz et al., 2024	Y	Y	Y	Y	Y	n/a	n/a	Y	P	Y	Y	Y	Y	Y	23	95.8%
Hemara et al., 2021	Y	Y	P	Y	n/a	n/a	n/a	Y	Y	Y	Y	P	Y	Y	20	90.9%
Subekti et al., 2023	Y	Y	Y	Y	P	n/a	n/a	Y	P	Y	Y	P	Y	Y	21	87.5%
Yachsie, Pranata, et al., 2023	Y	Y	P	Y	n/a	n/a	n/a	Y	P	Y	Y	P	Y	Y	19	86.4%
Geng et al., 2023 (Geng et al., 2023)	Y	Y	Y	P	n/a	n/a	n/a	Y	P	Y	Y	P	Y	Y	19	86.4%
Sergiy et al., 2017	Y	Y	Y	P	n/a	n/a	n/a	Y	P	Y	Y	P	Y	Y	19	86.4%
Chatla et al., 2023	Y	Y	Y	Y	n/a	n/a	n/a	Y	P	Y	Y	P	Y	Y	20	90.9%
Nasrulloh et al., 2022	Y	Y	Y	Y	n/a	n/a	n/a	Y	P	Y	Y	P	Y	Y	20	90.9%
Suppiah et al., 2017	Y	Y	Y	Y	Y	n/a	n/a	Y	P	Y	Y	P	Y	Y	22	91.7%
Liao et al., 2022	Y	Y	Y	Y	P	n/a	n/a	Y	P	P	Y	P	Y	Y	20	83.3%

Note. 1) Question/objective sufficiently described? 2) Study design evident and appropriate? 3) Method of subject/comparison group selection or source of information/input variables described as appropriate? 4) Subject (and comparison group, if applicable) characteristics sufficiently described? 5) If interventional and random allocation was possible, was it described? 6) If interventional and blinding of investigators was possible, was it reported? 7) If interventional and blinding of subjects was possible, was it reported? 8) Outcome and (if applicable) exposure measure(s) well defined and robust to measurement/misclassification bias? means of assessment reported? 9) Sample size appropriate? 10) Analytical methods described/justified and appropriate? 11) Some estimate of variance is reported for the main results? 12) Controlled for confounding? 13) Results reported in sufficient detail? 14) Conclusions support the by results? Y = fully met the criteria, P = partially met the criteria, and N = did not meet the criteria.

stress, particularly in regions such as the shoulder complex, spinal column and neck (B. Prine et al., 2016; Singh & Lhee, 2016; Subramaniam et al., 2025). The cumulative effects of high training volumes, technical errors, and insufficient physical preparedness can lead to tissue overload and a heightened susceptibility to both acute and chronic overuse injuries (Agranovich et al., 2024; Niestroj et al., 2018). While injury prevalence remains a pressing concern, the findings of this review indicate that exercise intervention have largely been employed with a primary focus on performance enhancement, rather than explicitly targeting injury management. Nonetheless, many of these interventions discussed in the current review indirectly reduce injury risk by correction biomechanical inefficiencies, improving neuromuscular control and enhancing tissue resilience.

The current review synthesizes results from 15 high quality studies involving various training approaches and provides valuables insight into the components of effective exercise programs for archers. The findings emphasize the multifaceted nature of effective archery training, revealing the significant contributions of intervention duration, strength conditioning, Pilates-based core engagement, balance training, and comprehensive core stability development. These elements work synergistically to improve shooting accuracy, minimize postural sway, and optimize musculoskeletal function, ultimately supporting superior performance and injury resilience in archers.

The duration of exercise interventions across the included studies ranged from a single-day protocol to programs lasting up to 12 weeks. Notably, most effective interventions spanned six to twelve weeks, delivered at a frequency of two to three sessions per week. Studies with shorter durations (e.g., 4-week side-bridge training) reported limited improvements in muscle activation patterns and neuromuscular stability (Shinohara et al., 2023). Conversely, interventions exceeding six weeks, such as the 12-week Pilates and strength training programs (Chatla et al., 2023; Khan et al., 2024), demonstrated significant improvements in lumbopelvic stability and shooting accuracy. Studies consistently show that 6-12-week interventions outperform shorter durations in developing neuromuscular adaptations and motor skills (Liao et al., 2022; Steib et al., 2017). This aligns with broader research on strength training, which indicates that untrained individuals benefit most from 3 sessions per week, while trained athletes see maximal gains with 2 weekly sessions (Rhea et al., 2003). Longer interventions allow for progressive loading and periodization, crucial for continued and maximized adaptation in strength as well as injury prevention (Severo-Silveira et al., 2021). Overall, evidence supports designing archery training programs with realistic

Table 6. Details of the included studies

Author (s)	Study design	Population	Intervention group	Control group	Protocol	Outcome measures	Result
Khan et al., 2024	RCT	30 national level athletes; male; 17-27 years.	Pilates exercises (PB) Balance training (B)	Did not receive any type of training	Pilates - 50 minutes with 10 minutes warm-up and 10 minutes cool down for 6 weeks (3 times per week). Balance - 20 minutes for 3 times per week (6 weeks)	Lumbopelvic stability - Knee Lift Abdominal Test (KLAT) and Bent Knee Fall-Out Test (BKFOT) Shooting accuracy	Significant difference in shooting accuracy ($F = 5.11$, $\eta_p^2 = 0.159$, $p = 0.03$), KLAT (Right) ($F = 8.51$, $\eta_p^2 = 0.240$, $p = 0.00$) KLAT (Left) ($F = 6.62$, $\eta_p^2 = 0.187$, $p = 0.01$) and BKFOT (Left) ($F = 6.31$, $\eta_p^2 = 0.195$, $p = 0.01$). No significant difference in BKFOT (Right) ($F = 0.99$, $\eta_p^2 = 0.035$, $p = 0.33$) among B, PB, and Control group pre and post intervention. Significant difference in shooting accuracy ($p = 0.03$) for PB group compared to the control and B training group. Significant changes in KLAT (Left and Right) between B group and control groups ($p = 0.03$ and 0.02). PB showed significant difference from control ($p = 0.05$). For BKFOT (Left), only the PB group demonstrated any significant difference ($p = 0.02$) compared to the other two groups.
Prasetyo et al., 2023	One group (pre-post test design)	12 archers; level and gender not specified; 14-17 years.	Circuit training sessions using a Bosu ball.	No control group	18 session of circuit training – Dosage and frequencies not mentioned	Shooting accuracy Balance tests	The pretest balancing score was 44.12 seconds, while the archery accuracy score was 216.50. After 18 bosu ball circuit training sessions, posttest balance score averaged 51.44 seconds and archery accuracy averaged 282.83. Significant increase in balance and accuracy was observed, with a p-value of 0.000.
Yachsie et al., 2024	One group (pre-post test design)	20 archers; level not specified; male; 15-20 years.	Drilling distance still Drilling distance changed	No control group	Still drilling: 30m, 65% intensity, 12 sessions, 6 children arrows, 45-minute recovery. Changed drilling distance: 10, 20, and 30m; 65% intensity; 12 sessions; 6 children arrow each session; 45-minute recovery.	Shooting accuracy	Fixed drilling training distance significantly improves archery accuracy in athletes (p-value < 0.05). Changing drilling training distance significantly impacts archery athletes' accuracy (p-value < 0.05). A significant difference in archery athletes' accuracy was found between constant and shifting drilling training distances (p-value < 0.05).
Shinohara et al., 2023	RCT	20 inexperienced archers; male; 20-22 years.	Side bridge exercises involving trunk inclination of 40° angle.	Did not receive any type of training	5 days/week for 4 weeks (20 days)	Tremor levels in the arm and bow during the sighting phase. Muscle activity changes in middle deltoid, upper trapezius, lower trapezius, and serratus anterior muscles.	Measurements obtained during shooting movements at baseline and after 4 weeks in the intervention group were compared, and significant differences were observed in the intensity of tremors and the MdPF of the middle deltoid. However, no significant intervention related differences were observed in the MdPF of the upper trapezius, lower trapezius, and serratus anterior muscles. In addition, none of the items in the non-intervention group showed significant differences in the findings obtained at the two evaluation points.

Table 6 (continued)

Author (s)	Study design	Population	Intervention group	Control group	Protocol	Outcome measures	Result
Park et al., 2016	Non-RCT	20 high school archers with experience of 5 years; gender not specified; 15-19 years.	Pilates core stability (PCS) exercises	Regular archery training	60 min work out (warm-up exercise for 10 min, main exercise for 40 min, warm down exercise for 10 min). 3 times/week (12 weeks). Intensity progressively increased over 12 weeks.	Static balance ability test Dynamic balance ability test	In static balance ability, there were no significant differences between pre- and post-values in the exercise group after completing the PCS program. Similarly, these results were also represented in the control group. In the aspect of comparisons between post values in both groups, there were significant improvements in only the exercise group. As for the dynamic balance ability, there were significant differences between pre- and post-values in the exercise group, except for up-right and left postures, whereas, there were no changes or decreases between pre- and post-values in the control group after completing the PCS program. Meanwhile, in the aspect of comparisons between post values in both groups, there were significant improvements in up, and up right, and downright part and overall dynamic scores of the exercise groups.
Beyaz et al., 2024	Non-RCT	36 inexperience archers, 7 males and 11 females in both groups; 18-23 years.	Traditional archery technique (TAT)	Regular archery training	1 training session (60 mins) every day for a total of 84 sessions (12 weeks).	Arm reaching movement performance	Movement accuracy, movement precision, and movement efficiency in the experimental group have all improved significantly as a result of TAT ($p < .05$). These improvements were comparable across both arms, thus the interlimb differences in movement performance were not affected by the short-term TAT and remained similar.
Hemara et al., 2021	Non- RCT	31 national and international competitive archers, gender not specified; 15-31 years.	Preferred Form Group: Archers who received training based on archery skill analysis assessment form (ASAAF). Training emphasized posture, focus, and muscle control across 10 standardized archery skills, such as aiming and release.	Actual Form Group: Archers' untrained, original shooting form served as a baseline, reflecting their usual skill levels prior to intervention.	Same day training and assessment based on guidance by experts and video.	Performance Scores: Average scores from both forms (Actual and Preferred) across 10 shooting trials. Skill Analysis (ASAAF): Ten core skills, with specific focus on precision, posture, and stability.	Significant improvement: Preferred form scores averaged 86%, compared to 79% in the Actual form, indicating a statistically significant improvement in archery performance post-training. Efficiency Indicators: Regression analyses showed ASAAF's R^2 values of 51% and 69% for actual and preferred forms, respectively, supporting the efficacy of posture training in enhancing archery skills.
Subekti et al., 2023	Non- RCT	20 archers; gender and level of experience not specified, 12-15 years.	Free Weight Training Group: (dumbbell presses, lateral raises, and incline bench exercises).	Gym Machine Training Group: (gym machines, with exercises such as pulley lateral raises, pec deck laterals, and shoulder presses).	6 weeks with a total of 18 training sessions.	Arm muscle endurance	Free weight training had a statistically significant effect on arm muscle endurance in archery athletes ($p < .001$). Gym machine–based weight training had a statistically significant effect on arm muscle endurance in archery athletes ($p = .002$). A statistically significant difference in arm muscle endurance was observed between free weight training and gym machine–based training ($p = .019$).

Table 6 (continued)

Author (s)	Study design	Population	Intervention group	Control group	Protocol	Outcome measures	Result
Yachsie, Pranata, et al., 2023	One group (pre-post test design)	12 archers; male; level of experience not specified, 16-18 years.	Circuit Plank Training	No control group	Exercise dose: 1 RM, 60-70% with 30 seconds recovery, 3-5 reps, 1-3 sets, and 3-minute breaks between sets. 3 times/week with 18 sessions (6 weeks).	Arm muscle strength Shooting accuracy	The analysis of the arm muscle strength data resulted in a t-count value of (41,894) > t-table (1.80) and a p-value of (0.000) < 0.05. Meanwhile, the archery accuracy analysis obtained a t-count value of (55,001) > t-table (1.80), and a p-value of (0.000) < 0.05. There was an increase in the strength and accuracy of archery athletes after having circuit plank training and increased endurance component of the arm muscles.
Geng et al., 2023	Non-RCT	24 archers; gender, age and level of experience not specified.	Physical fitness training Standardized archery movement Posture training Mechanical energy stretching exercises Static and dynamic exercises Arm position awareness and correction	Routine training	The protocol of each exercise not mentioned clearly in the methodology.	Archer's attention using EEG assessment Archer's performance and accuracy	Athletes in group A had the greatest increase in attention after training, showing statistical significance (P<0.01). The comparison between groups B and C also showed statistical significance (P<0.01). Significant differences were found in the stability of attention between the experimental and control groups. *Athletes were categorized based on the performance level; Group A achieved excellent results (n=8), group B had good results (n=8), and group C had average results (n=8).
Sergiy et al., 2017	Non-RCT	70 archers, gender and age not specified; 25 national level and 45 basic training archers.	Specialized training programme (Coordination skills, technical precision, reduced maximum strength training)	Usual training	The training protocol- 80% of training on coordination and technical skill enhancement.	Arm strength Muscle sensitivity Shooting accuracy Angles of body positioning before and after the shot.	Improved Coordination The experimental group showed significant enhancements in coordination tasks, such as the "Laser hold in target field," with results improving by 50.55–72.18% (p < 0.01). Muscle sensitivity deviations decreased by 29.42–146.59% (p < 0.01). Enhanced Technical Skills Skills like "stretching to the chin" and "traction phase" improved significantly in the experimental group. Shot execution time reduced, and elbow angle, hand positioning, and shoulder movement speed increased by 5.05–39.94% (p < 0.01). Physical and Technical Readiness Experimental group outperformed in exercises like "Shooting 18x18" and challenging conditions (e.g., platform or closed eyes), with gains of 1.41–24.49% (p < 0.01). The focus on coordination and stability in experimental training led to better precision performance compared to traditional methods. Training Program Comparison The experimental program delivered more significant improvements in complex tasks requiring fine motor control and stability, crucial for elite archery.

Table 6 (continued)

Author (s)	Study design	Population	Intervention group	Control group	Protocol	Outcome measures	Result
Chatla et al., 2023	Non-RCT	60 national level archers, both male and female; aged between 16 to 25 years.	Specific strength training (SSTG) General strength training (STG) Combined Training (CTG)	Usual training	SSTG – received strength training on alternate days. STG – followed a general strength training regimen on alternate days. CTG – received a combination of specific and general strength training on alternate days. *12 weeks training protocol with specific strength training protocol	Shooting accuracy	Training methods significantly improved the scoring performance index in archer groups (SSTG < 0.05, STG < 0.05, CTG < 0.05). The CTG achieved the highest performance index after strength and specific strength training. The control group showed no significant improvement in scoring performance index.
Nasrulloh et al., 2022	One group (pre-post test design)	15 university archers, gender not specified; age between 17 – 22 years.	Compound set training protocol (weight training sessions)	No control group	60-80% of the one-repetition maximum (1 RM), 3-4 sets with 15-25 repetitions, with 1-2 minutes of rest between sets.	Arm muscle strength Endurance across upper, middle, and lower body muscle groups	The t-test results showed a t-value of 14.532 with a significance of 0.000 ($p < 0.05$), indicating that compound set weight training significantly improves arm muscle strength in archery athletes. For muscle endurance, the t-test showed a t-value of 13.396 with a significance of $p < 0.05$. These results confirm that compound set weight training significantly enhances muscle endurance in archery athletes.
Suppiah et al., 2017	RCT	12 adolescent archers, 6 males and 6 females; aged between 13 to 18 years; level of experience not specified.	Core stability program (bodyweight exercises)	Usual training	45 minutes including warm up (8 weeks)	Postural sway Core strength and endurance Shooting accuracy	Mixed factorial ANOVA revealed significant time-based interactions in push-up performance, plank, archery performance, and postural sway. Postural sway differed significantly between experimental and control groups on both planes at T2 (CoP range x: $F(1,10) = 7.952$, $p < .05$, $d = 1.302$; CoP range y: $F(1,10) = 7.887$, $p < .05$). Similar results were observed at T3(CoP range x: $F(1,10) = 7.952$, $p < .05$; CoP range y: $F(1,10) = 11.105$, $p < .05$).
Liao et al., 2022	Non-RCT	14 university level archers, 5 males and 9 females; average age of 19 years.	Lower trapezius centered exercise	Usual training	12 weeks training	Lower trapezius muscle strength Shoulder kinematics Upper /lower trapezius muscle activity Shooting accuracy	The exercise group improved their simulated game score from 628 to 639 ($p = 0.045$), while the control group showed no changes. Lower trapezius strength increased from 8 to 9 kg-force in the exercise group ($p = 0.045$). Horizontal abductor strength improved from 81% to 93% of body weight ($p = 0.048$). The UT/LT ratio decreased from 2.2 to 1.1, indicating better shoulder stability during archery shots.

RCT- Randomized trial control; UT/LT- Upper trapezius/lower trapezius

timeframes of 6-12 weeks for meaningful performance improvements (Je, 2016).

Strength training has consistently proven effective in enhancing archery performance, particularly when both upper and lower limb muscle groups are targeted (Chatla et al., 2023; Liao et al., 2022; Nasrulloh et al., 2022; Sergiy et al., 2017; Subekti et al., 2023; Yachsie, Pranata, et al., 2023). Such interventions have led to marked improvements in arm endurance, postural stability, and shooting precision. Notably, compound set training protocols (Nasrulloh et al., 2022) and integrated general-specific strength programs (Chatla et al., 2023) have outperformed isolated routines, offering superior performance gains. These findings align with biomechanical principles, as archery demands coordinated, multi-joint control and stability (Vendrame et al., 2022). Evidence also shows that free weight exercises offer a slight edge over machine-based training, particularly in improving muscle endurance (Subekti et al., 2023). This advantage likely stems from the greater neuromuscular activation required by free weights due to their stabilization demands (Schwanbeck et al., 2020), an effect consistent with recent meta-analyses showing superior strength gains with free-weight training (Haugen et al., 2023; Heidel et al., 2021). Because archery involves complex three-dimensional movement and precise control, training methods that replicate these demands, such as free weights, are more effective than machines, which limit movement patterns and stabilization.

Archery is a full-body discipline that relies on a coordinated kinetic chain beginning from the lower limbs and progressing through the trunk to the upper body. While the upper extremities perform the final action of drawing and releasing the bow, the generation and transfer of force originate from the ground up, beginning with the legs and pelvis and progressing through the trunk to the shooting arm (Ertan et al., 2003). This kinetic chain mechanism is essential for optimizing shooting performance and stability in archery. The lower limbs play a crucial role in establishing postural stability and initiating movement, which then transmits through the pelvis and trunk before reaching the bow arm (Azhar et al., 2021; Serrien et al., 2018). Enhancing lower limb strength contributes to greater neuromuscular control and stability, thereby minimizing energy dissipation along the kinetic chain and improving overall performance efficiency (Simsek et al., 2014; Vendrame et al., 2022). Research shows that elite archers who emphasize core and lower extremity conditioning experience more consistent shot accuracy and postural control (Kim et al., 2019; Liao et al., 2022). From a practical standpoint, the inclusion of comprehensive training program inclusive of posture correction, correcting the muscles imbalance, core activation and stabilization, balance training, and also development of strength program should prioritize multi-joint exercises that involve dynamic stability, apply progressive overload across different movement planes, and combine general strength with archery-specific patterns. Future protocols should adopt a more comprehensive approach, addressing both upper and lower body muscular demands to prevent compensatory strategies that lead to overuse injuries.

Core stability interventions delivered through Pilates-based, circuit plank training or bodyweight-focused led to measurable improvements in balance, postural control, trunk endurance, and shooting accuracy among archers (Khan et al., 2024; Park et al., 2016; Suppiah et al., 2017). While each study emphasized different outcome measures, the findings support the conclusion that enhancing core function translates into better shooting performance and potentially reduced injury risk. These findings align with the kinetic chain theory, which posits that force generation initiates from the lower limbs and is transmitted through a stable core to the upper extremities (Kibler et al., 2006). A well-conditioned core not only provides a stable base for efficient force transfer but also minimizes compensatory movements that can contribute to common overuse injuries in the shoulder and lumbar regions (Akuthota et al., 2008). Furthermore, enhanced core stability improves energy efficiency, delaying fatigue during prolonged shooting sessions, a critical factor in competitive archery where sustained precision is required (Spratford & Campbell, 2017).

A key limitation of the current evidence base is that injury-related outcomes were rarely measured directly across the included studies. Most interventions did not report injury incidence, injury severity, or time-loss data. Consequently, conclusions regarding injury management and injury prevention are primarily derived from indirect indicators such as improvements in balance, postural control, neuromuscular stability, core endurance, and muscular strength. While these parameters are well established contributors to injury risk reduction, their interpretation as injury-related outcomes should be viewed as inferential rather than definitive.

Conclusions

This systematic review demonstrates that exercise-based interventions consistently improve crucial performance determinants in archers, including shooting accuracy, postural stability, neuromuscular coordination, core strength and upper-limb endurance; however, implications for injury prevention and injury management should be interpreted as indirect and inferential, as most studies did not directly assess injury related outcomes. Although most interventions were primarily designed for performance enhancement, the observed improvements in trunk stability, balance control, and muscular endurance suggest meaningful secondary benefits that may help reduce injury risk through better kinetic-chain efficiency and movement control. These findings support the integration of structured, multi-week exercise programs as an effective strategy for enhancing overall performance capacities among archery athletes.

Despite these demonstrated benefits, there remains a clear lack of a systematic, integrated training module that concurrently incorporates strength development (both upper and lower body), core stability, balance and proprioception, postural re-education, and archery-specific neuromuscular training. Moreover, most studies did not explicitly measure injury outcomes, underscoring the need for future research employing longitudinal designs, injury surveillance, and functional movement assessments to better capture injury risk and recurrence. Moving forward, future studies should adopt standardized intervention protocols, larger sample sizes, and multidimensional outcome measures, including explicit injury metrics to strengthen the evidence base and inform more comprehensive training guidelines for coaches, therapists, and sport scientists working with archers.

Ethics Approval

Ethical approval was not required for this study, as it is a systematic review based exclusively on previously published and publicly available data.

Informed Consent

Not applicable.

Data Availability Statement

All data analyzed in this study are derived from published sources cited in the reference list. No new datasets were generated.

AI Transparency Statement

The authors did not use artificial intelligence–assisted tools in the preparation of this manuscript.

Funding

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Conflict of Interest

The authors declare no conflicts of interest.

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Систематичний огляд фізичних вправ у стрільбі з лука: профілактика та лікування травм і вплив на показники результативності

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Авторський вклад: A – дизайн дослідження; B – збір даних; C – статаналіз; D – підготовка рукопису; E – збір коштів

Реферат. Стаття: 16 с., 6 табл., 1 рис., 55 джерел.

Обґрунтування. Тренувальні інтервенції на основі фізичних вправ дедалі частіше інтегруються у підготовку стрільців з лука з метою підвищення результативності та зниження ризику травм. Однак ступінь, до якого ці інтервенції безпосередньо сприяють управлінню травмами та покращенню спортивних показників, залишається недостатньо з'ясованим.

Мета. Цей систематичний огляд мав на меті проаналізувати вплив фізичних тренувальних інтервенцій на управління травмами та підвищення результативності у стрільців з лука. Огляд узагальнює 10 років наукових доказів (січень 2015 – квітень 2025) з метою надання рекомендацій щодо розроблення цільових програм вправ, спрямованих одночасно на оптимізацію результативності та профілактику травм.

Матеріали і методи. Комплексний пошук було проведено в базах даних PubMed, Scopus, Web of Science та SPORTDiscus, у результаті чого було виявлено 767 публікацій. Дослідження відбиралися відповідно до заздалегідь визначених критеріїв включення, що зрештою дало 15 прийнятних досліджень. До аналізованих показників належали точність стрільби, постуральний контроль, м'язова сила та індикатори, релевантні для управління травмами. Методологічну якість оцінювали за шкалою SQAC; усі включені дослідження набрали ≥50 %, що свідчить про прийнятний або високий рівень методологічної строгості. Через гетерогенність дизайнів досліджень, інтервенцій та показників результативності метааналіз не проводився.

Результати. Більшість досліджень були зосереджені переважно на підвищенні спортивної результативності, а не на безпосередньому управлінні травмами. Водночас низка тренувальних інтервенцій продемонструвала опосередковані ефекти, релевантні для управління та профілактики травм, зокрема покращення постуральної стабільності, нейром'язового контролю та м'язової витривалості. Тренування стабілізації корпусу, вправи на баланс за методикою пілатесу, кругові тренування та силова підготовка стабільно забезпечували суттєве покращення постуральної стабільності (ефекти помірного–великого розміру), м'язової сили та точності стрільби. Цільові вправи, зокрема зміцнення нижніх пучків трапецієподібного м'яза, багатосуглобові силові вправи та спеціалізовані стрілецькі вправи, додатково покращували точність, витривалість і нейром'язову координацію.

Висновки. Фізичні тренувальні інтервенції суттєво покращують ключові показники результативності у стрільців з лука та можуть забезпечувати опосередковані переваги для профілактики травм за рахунок підвищення сили, балансу, постурального контролю та нейром'язової стабільності. Подальші дослідження мають передбачати стандартизовані протоколи фізичних вправ і надавати пріоритет масштабнішим рандомізованим контрольованим дослідженням, які прямо оцінюють травматологічні результати, з метою зміцнення доказової бази у стрільбі з лука.

Ключові слова: стрільба з лука, профілактика травм, результативність, силова підготовка, систематичний огляд.

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Cite this article as: Subramaniam, A., Zainudin, F. F., & Sut Txi, M. R. (2026). Systematic Review of Exercise Interventions in Archery: Injury Management and Performance Outcomes. *Physical Education Theory and Methodology, 26*(1), 63-78. https://doi.org/10.17309/tmfv.2026.1.06

Received: 28.11.2025. Accepted: 30.12.2025. Published: 30.01.2026

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