

Health Benefits of Petanque Participation Across the Lifespan: A Systematic Review of Physical, Cognitive, and Psychosocial Outcomes

Gede Wirabuana Putra ^{1*}, Putu Erma Pradnyani², Made Rania Deviyanti³, I Gede Candra Adi Parwata⁴, Ni Wayan Nita Diah Tamayanti⁵

¹Sniper Petanque Club

¹Politeknik Kesehatan Kartini Bali

²Universitas Pembangunan Nasional Veteran Jakarta

^{3,4}Universitas Udayana

⁵Universitas Mercu Buana Yogyakarta

Corresponding Author: Gede Wirabuana Putra buanawira09@gmail.com

ARTICLE INFO

Keywords: health benefits; pétanque; physical; cognitive; psychosocial; PRISMA; systematic review

Received : 20, April

Revised : 26, May

Accepted: 28, June

©2026 Putra, Pradnyani, Deviyanti, Parwata, Tamayanti: This is an open-access article distributed under the terms of the [Creative Commons Atribusi 4.0 Internasional](https://creativecommons.org/licenses/by/4.0/).



ABSTRACT

Background: Physical inactivity represents one of the most pressing global public health challenges. Petanque, a precision-based boules sport of growing popularity across Southeast Asia, offers a unique physical activity profile: low-impact, neuromotor-intensive, and inherently social. This study aimed to synthesize evidence on physical, cognitive, and psychosocial health outcomes associated with petanque participation. Methods: A systematic review was conducted following PRISMA 2020 guidelines across eight electronic databases (PubMed/MEDLINE, Scopus, Web of Science, SPORTDiscus, Cochrane Library, CINAHL, PsycINFO, Google Scholar) and Indonesian national databases (GARUDA, SINTA), covering studies published 2000–2026. Risk of bias was assessed using the Newcastle-Ottawa Scale (NOS), ROBINS-I, and CASP checklist. Results: A total of 25 studies met the eligibility criteria from 340 identified records. Physical outcomes documented include upper extremity muscular strength, hand-eye coordination, static and dynamic balance, and wrist flexibility. Cognitive outcomes include concentration, kinesthetic perception, and mental imagery proficiency. Psychological outcomes include competitive anxiety (high prevalence: 56.7% of athletes), mental toughness ($r=-0.692$, $p=0.001$), and efficacy of structured psychological interventions. Conclusions: Petanque participation is associated with meaningful multidomain health benefits. Its sport profile positions it as a strategic candidate for community-based health promotion, particularly for older adults and sedentary populations. Rigorous RCTs and longitudinal studies in community populations are urgently needed

INTRODUCTION

Physical inactivity is recognized as a global pandemic, affecting an estimated 1.4 billion adults worldwide and contributing directly to the rising burden of non-communicable diseases (NCD) including cardiovascular disease, type 2 diabetes mellitus, and mental health disorders (1). The World Health Organization (WHO) projects the cost of physical inactivity to global healthcare systems at approximately US\$300 billion between 2020 and 2030 if current trends persist (1). These figures underscore the urgent need to identify accessible, inclusive, and sustainable physical activities suitable for integration into diverse community contexts.

Petanque (pétanque) is a precision boules sport that originated in Provence, France, in 1910, originally designed to accommodate a player with severe rheumatism who could no longer run before throwing (2). The sport requires throwing hollow metal balls (boules) as close as possible to a small wooden target ball (cochonnet) while both feet remain stationary within a circle. Petanque can be played by one to three players per team in any outdoor flat space at minimal cost, with no restriction on age or physical fitness level characteristics that make it uniquely inclusive.

Globally, the Fédération Internationale de Pétanque et Jeu Provençal (FIPJP) reports approximately 800,000 licensed players, with the sport recognized by the International Olympic Committee and featured at the World Games, Asian Games, and Southeast Asian (SEA) Games (3). In Indonesia, the Federasi Olahraga Petanque Indonesia (FOPI) has expanded to all provinces since the sport's introduction at the 2011 SEA Games (4), with petanque now included in the National Multi-Sport Week (Pekan Olahraga Nasional / PON).

Despite this growth, petanque remains substantially understudied from a health sciences perspective. Recent bibliometric analyses have consistently identified a predominance of research focused on technical performance, biomechanics, and coaching methodology, with minimal attention to health outcomes (5,6). No systematic review has comprehensively synthesized the multidimensional health benefits of petanque participation across the lifespan a critical evidence gap addressed by this study.

From an exercise physiology standpoint (AIFO-P), petanque involves coordinated upper extremity kinetic chain activation, precision postural control demands, and intermittent low-to-moderate intensity activity (estimated 2.5–4.0 METs during active play) placing it within the WHO moderate physical activity range (1). From a cognitive neuroscience perspective, the sport imposes high demands on selective attention, spatial perception, and kinesthetic feedback. From a public health standpoint, its inherently social team-based structure addresses multiple social determinants of health.

This systematic review aimed to: 1. synthesize evidence on physical health outcomes (muscular strength, balance, flexibility, hand-eye coordination, cardiorespiratory fitness) from petanque participation; 2. examine cognitive and psychological outcomes (concentration, kinesthetic perception, competitive anxiety, mental toughness, mental imagery); and 3. identify critical research gaps and evidence-based recommendations for public health policy.

LITERATURE REVIEW

Petanque as a Precision Sport: Historical and Epidemiological Context

Petanque occupies a distinctive position within the taxonomy of precision sports, a category characterized by low cardiovascular demand but high requirements for fine motor control, postural stability, and perceptual-cognitive precision. The sport was formally codified in 1910 in La Ciotat, Provence, as an adaptation of the older *jeu provençal* game for a player with severe rheumatism who could no longer run before throwing, a historical origin that foreshadows its contemporary relevance for populations with reduced physical capacity. Petanque can be played by one to three players per team in any outdoor flat space at minimal cost, with no restriction on age or physical fitness level, placing it within the light-to-moderate intensity activity range (2.5–4.0 METs) described by WHO physical activity guidelines.

Despite institutional recognition by the International Olympic Committee and inclusion in multi-sport events such as the World Games, Asian Games, and Southeast Asian (SEA) Games, the scientific literature on petanque remains markedly disproportionate to its participation base of approximately 800,000 licensed players worldwide. Two independent bibliometric analyses converge on this observation: Pelana et al. (2025), mapping two decades of petanque research (2002–2023), and Hafidz et al. (2024), mapping Scopus-indexed literature from 2011–2024, both identify a literature dominated by technical performance and biomechanical determinants, with health outcomes occupying a peripheral position in the overall research landscape. This asymmetry constitutes the central evidentiary gap that the present systematic review addresses. The methodological apparatus used to characterize this gap keyword co-occurrence network analysis is itself grounded in established bibliometric visualization methods.

Physiological and Biomechanical Evidence

The physiological demands of petanque are concentrated in the upper extremity kinetic chain, postural control system, and fine manual dexterity rather than in cardiorespiratory capacity. Within petanque-specific literature, the largest body of evidence addresses the determinants of pointing and shooting accuracy. Hanief and Purnomo (2019) and the subsequent meta-analysis by Hanief (2022) identify eye–hand coordination, arm muscle strength, wrist flexibility, and static/dynamic balance as the four physical components with the most consistent empirical support, a finding independently corroborated by the literature synthesis of Haq et al. (2024). This convergence is further reinforced by correlational and experimental work from multiple independent research groups, including Maliki et al. (2022), Pelana, Irfansyah, and Setiakarnawijaya (2019), Kurniawan, Junaidi, and Hidayah (2022), Irawan et al. (2019), Zulfahri et al. (2024), Nurfatoni and Hanief (2020), Syahwira et al. (2022), Sani and Hulfian (2022), and Badaru et al. (2021).

Notably, the near-universal excellence in wrist flexibility documented by Ariyanto et al. (2026) suggests a sport-specific neuromuscular adaptation distinct from general fitness profiles, while the path-analytic findings of Pelana et al. (2021) demonstrate that arm length, arm endurance, and self-confidence jointly predict shooting performance. At the more extreme end of adaptation, the case

series of task-specific focal dystonia reported by Laguëny et al. (2002) provides rare neurological evidence of the depth of cortical motor reorganization induced by sustained, repetitive petanque practice a phenomenon with documented parallels in other fine-motor disciplines reliant on highly specific, repetitive movement patterns.

Cognitive Mechanisms

A second, smaller but methodologically important stream of literature examines the cognitive substrates of petanque performance. Concentration, kinesthetic perception, and mental imagery emerge as the three most frequently studied cognitive constructs across the included literature. The path-analytic study by Purnomo and Yendrizar (2020) provides the most direct quantitative evidence for the primacy of cognitive over purely physical determinants, demonstrating that concentration exerts a larger direct effect on shooting accuracy (23.32%) than hand-eye coordination itself (10.49%). This finding converges with the principal component analysis of Maliki et al. (2022), in which eye-hand coordination, concentration, and kinesthetic perception together loaded onto a single dominant component accounting for 42.9% of variance in pointing success, and with the correlational findings of Kristanto and Nurkholis (2020), who identified kinesthetic perception and concentration as the strongest cognitive predictors of pointing performance.

Mental imagery constitutes a further area of convergent evidence. The systematic literature review by Abdurrahman et al. (2024) and the experimental work of Mulya (2020) both report measurable improvements in shooting performance following structured imagery interventions. The pioneering psychological skills training program documented by Hernandez and De Los Fayos Ruiz (2009) among the earliest petanque-specific psychological interventions in the literature, predating the more recent imagery studies by over a decade likewise incorporated imagery alongside relaxation, self-talk, and goal-setting techniques to improve team concentration and pressure management, anticipating the broader convergence of evidence on imagery's role in petanque performance.

Psychological and Psychosocial Dimensions

The psychological literature on petanque, though the smallest of the three domains synthesized in this review, reveals a coherent and clinically relevant pattern centered on competitive anxiety and its modifiability. Vauziah et al. (2026) document a high prevalence of competitive anxiety (56.7% of athletes in the high category) with a strong inverse correlation to mental toughness ($r=-0.692$, $p=0.001$), establishing the clinical significance of this construct within the sport. Subsequent intervention studies provide encouraging, if methodologically preliminary, evidence for remediation: Isyani, Salabi, and Jamaluddin (2022) demonstrate the efficacy of problem-focused coping strategy training in reducing pre-competition anxiety, while the quasi-experimental mindfulness intervention reported by Baharuddin, Firdaus, and Fakhri (2025) yields a modest but statistically significant reduction in competitive anxiety (N-Gain = 22%, $p=0.043$).

These sport-specific psychological findings align with the broader literature on the social and mental health benefits of structured sport

participation. The systematic review by Eather, Wade, Pankowiak, and Eime (2023) and the earlier foundational synthesis by Eime, Young, Harvey, Charity, and Payne (2013) both demonstrate that team-based community sport participation is consistently associated with superior psychosocial health outcomes compared to individual physical activity a mechanism directly applicable to petanque's inherently social, team-based structure of one to three players per side.

Synthesis and Identification of the Research Gap

Three convergent observations emerge from this literature review. First, the petanque-specific evidence base, while methodologically heterogeneous, demonstrates internally consistent findings regarding the physical determinants of performance, with eye-hand coordination, wrist flexibility, and balance recurring across independent studies and research groups. Second, the cognitive and psychological dimensions of petanque, although substantially less studied, reveal theoretically coherent and internally consistent mechanisms particularly the mediating role of concentration and the demonstrated modifiability of competitive anxiety through structured intervention. Third, and most critically, no prior work has integrated these three domains (physical, cognitive, psychosocial) within a single systematic, PRISMA-compliant synthesis; existing bibliometric reviews describe the structural composition of the literature but do not evaluate the substantive health evidence it contains, while individual primary studies remain confined to single-domain investigations.

This synthesis gap is compounded by a near-total absence of evidence concerning non-athlete, community-dwelling, or older adult populations: as documented in the Discussion of this review, the existing literature is drawn almost exclusively from competitive athlete samples in Indonesia, leaving the considerable public health potential of petanque as a low-barrier, socially embedded physical activity for sedentary or aging populations largely untested. The broader sport-participation literature on team-based psychosocial benefits suggests this potential is substantial, but petanque-specific confirmation is absent. The present systematic review is therefore positioned to address this gap by providing the first multidomain, PRISMA 2020-guided synthesis of physical, cognitive, and psychosocial health evidence associated with petanque participation, while explicitly identifying the population and design limitations that must guide future research priorities.

METHODOLOGY

This systematic review was conducted and reported in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 statement. A review protocol was developed prior to data collection.

Study design

Systematic literature review following PRISMA 2020 guidelines. No primary data collection was conducted; ethical approval was therefore not required.

Ethical statement

Not applicable. This systematic review synthesized existing published studies. No human subjects research was conducted by the authors.

Eligibility Criteria (PICOS)

Studies were eligible if they involved: (P) individuals of any age actively participating in petanque or boules sports; (I) active petanque participation as the primary activity or intervention; (C) non-participants, alternative activities, or pre-intervention baselines (not mandatory); (O) any quantified physical, cognitive, or psychosocial health outcome; (S) any observational or interventional design, including RCTs, quasi-experimental, cross-sectional, cohort, case series, or review studies. Studies were excluded if: they focused exclusively on technical/biomechanical performance without any health-related outcome; used non-human subjects; were conference abstracts without accessible full text; or reported duplicate data from an already-included population.

Information Sources and Search Strategy

A comprehensive search was conducted across eight electronic databases: PubMed/MEDLINE, Scopus, Web of Science (Core Collection), SPORTDiscus, Cochrane Library, CINAHL, PsycINFO, and Google Scholar. Supplementary searches were conducted in Indonesian national databases (GARUDA, SINTA). The search was last updated March 2026. The PubMed search string was: (*petanque*[tiab] OR *pétanque*[tiab] OR *boules*[tiab] OR "*jeu provençal*"[tiab]) AND (*health*[tiab] OR "*physical fitness*"[tiab] OR "*cognitive function*"[tiab] OR "*mental health*"[tiab] OR "*quality of life*"[tiab] OR "*motor skill*"[tiab] OR *wellbeing*[tiab] OR *balance*[tiab] OR *coordination*[tiab] OR *concentration*[tiab] OR *anxiety*[tiab]). An equivalent Bahasa Indonesia string was applied for national databases.

Statistical Analysis

Due to high heterogeneity in study designs, populations, and outcome measures, a narrative synthesis approach was adopted following EPPI-Centre guidance (8). Studies were grouped by primary outcome domain (physical, cognitive/psychological). Quantitative meta-analytic pooling was not performed. Risk of bias was assessed using the Newcastle-Ottawa Scale (NOS, 0–9 stars) for observational studies (9), ROBINS-I for quasi-experimental designs, and the CASP checklist for review studies. Two independent reviewers screened all records (Cohen's $\kappa = 0.81$); discrepancies were resolved by consensus.

RESEARCH RESULT

The systematic database search identified 340 total records (298 from electronic databases; 42 from additional sources). After removing 73 duplicates, 267 unique records were screened. Following title/abstract screening, 69 full texts were retrieved for eligibility assessment. A total of 25 studies met all PICOS eligibility criteria and were included in the final synthesis.

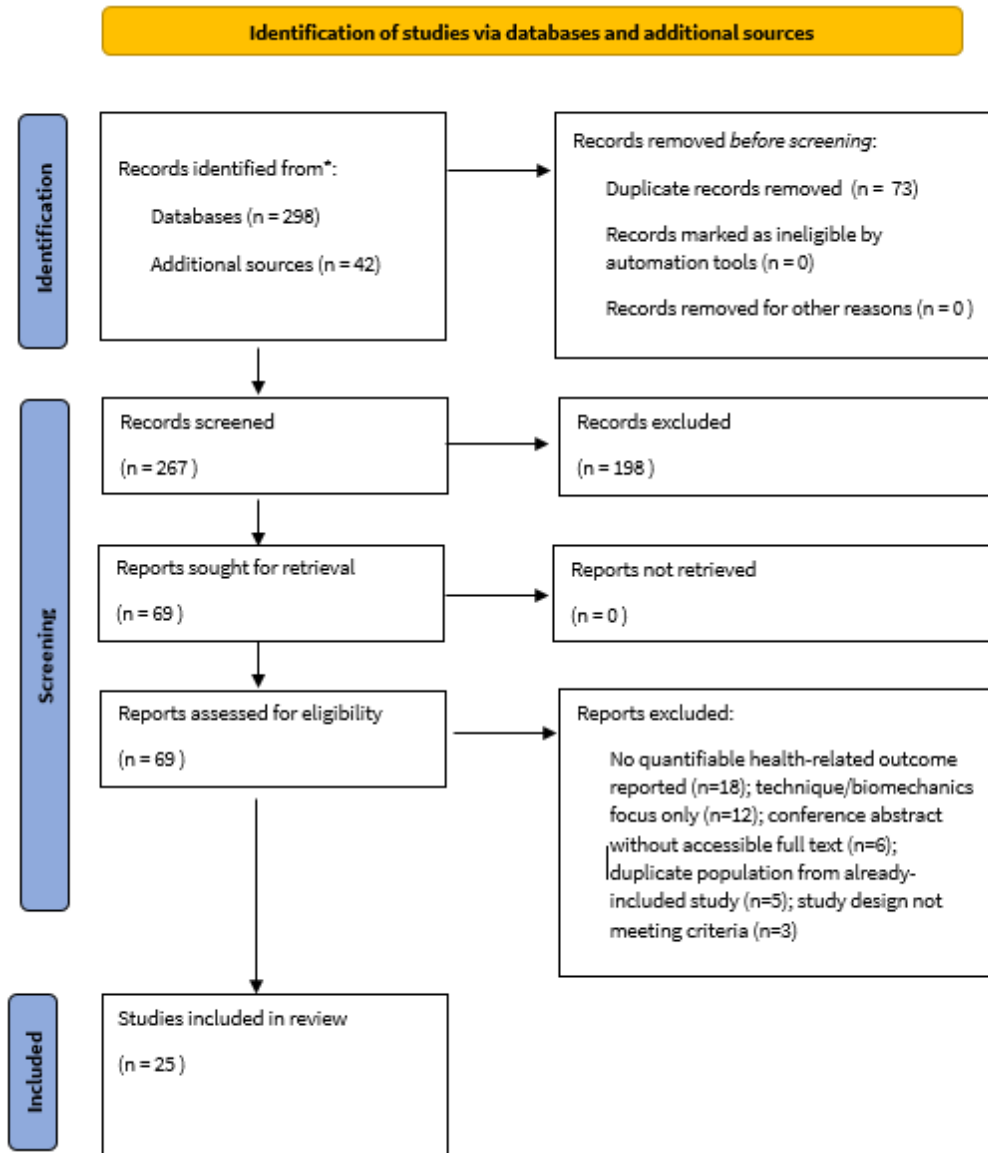


Figure 1. Databases: PubMed/MEDLINE, Scopus, Web of Science, SPORTDiscus, Cochrane Library, CINAHL, PsycINFO, Google Scholar, GARUDA, SINTA ** = Excluded at title/abstract screening: tidak relevan topik petanque/boules (n=89); tidak ada luaran kesehatan (n=67); bahasa tidak sesuai (n=22); subjek non-manusia (n=20).

Characteristics of Included Studies

The 25 included studies were published between 2002 and 2026, predominantly from Indonesia (n=20), with contributions from France (n=2), Spain (n=1), and international contexts (n=2). Study designs included cross-sectional/correlational (n=14), quasi-experimental (n=7), bibliometric review (n=2), case series (n=1), and descriptive quantitative (n=1). Sample sizes ranged from 10 to pooled multi-study analyses. The complete characteristics and key findings of all included studies are presented in Table 1 (physical outcomes) and Table 2 (cognitive/psychological outcomes).

Table 1. Characteristics and key results of included studies Physical health outcomes (n=16).

No .	Author(s), Year	Design	N	Variables	Instruments	Key Results
1	Ariyanto et al. (2026) (12)	Descriptive	N=24	Endurance, balance, strength, flexibility	Step Test; Stork Test; Handgrip; Flexibility Test	Flexibility 100% excellent; balance 71% good-excellent; strength/endurance deficits.
2	Pelana et al. (2019) (13)	Correlation al	N=31	Arm power, shoulder ROM	Arm power test; goniometry	r=0.462 (power); r=0.553 (ROM); R=0.652 combined (p<0.05).
3	Kurniawan et al. (2022) (14)	Quasi-exp.	N=30	Trunk flexibility, balance, eye-hand coordination	Flexibility test; Stork Test; throw-catch	r=0.697 combined variables; all p<0.05.
4	Irawan et al. (2019) (15)	Cross-sect.	N=16	Hand-eye coordination, shooting accuracy	Coordination test; FIPJP test	Significant correlation concentration & coordination with accuracy (p=0.003).
5	Maliki et al. (2022) (5)	Cross-sect. (PCA)	N=38	Coordination, strength, flexibility, balance, kinesthetics	Battery test; PCA	Component 1 (coord. +conc.+kinesth.) =42.9%; Component 2 (strength+flex. +balance) =19.4%.
6	Zulbahri et al. (2024) (16)	Correlation al	N=24	Hand-eye coordination, arm length	Throw-catch; anthropometry	r=0.72 (p<0.001); concentration strongest predictor.
7	Hanief & Purnomo (2019) (17)	Descriptive	N=15	Height, arm length, strength, wrist flex., balance, power, grip, coordination	9-item battery	6/9 variables significant: height, arm length, strength, wrist flex., balance, coordination.
8	Purnomo & Yendrizar (2020) (18)	Path analysis	N=40	Hand-eye coordination, accuracy	Throw-catch; path analysis	Concentration direct effect 23.32%; coordination 10.49%; confidence 19.53%.
9	Nurfatoni & Hanief (2020) (19)	Correlation al	NR	Eye-hand coord., wrist flex., trunk flex., balance	Multi-test battery	All 4 variables significant; balance + coordination

						largest contributors.
10	Syahrira et al. (2022) (20)	Quasi-exp.	N=18	Wrist flexibility, arm power	Flex. test; arm power test	Significant effects of combined wrist flex. + arm power exercises on shooting (p<0.05).
11	Sani & Hulfian (2022) (21)	Correlation al	NR	Arm strength, eye-hand coord.	Push-up test; throw-catch	Both variables significantly related to shooting accuracy (p<0.05).
12	Badaru et al. (2021) (22)	Pre-post exp.	N=16	Arm muscle strength	Push-up training; shooting test	Strength group: +19.147 points. Strength > accuracy training.
13	Pelana et al. (2021) (4)	Path analysis	N=45	Arm length, arm endurance, self-confidence	Anthropometry; endurance test	Endurance quartile ≥ median: +23% accuracy; path coefficients significant (p<0.05).
14	Lagueny et al. (2002) (2)	Case series	N=12	Shoulder neuromotor function, focal dystonia	EMG; clinical neuro exam	12 cases task-specific focal dystonia: evidence of cortical motor reorganization.
15	Haq et al. (2024) (23)	Literature study	Multi - study	Physical condition factor analysis	Frequency analysis of variables	4 dominant factors: arm strength, wrist flexibility, balance, eye-hand coordination.
16	Hanief (2022) (24)	Meta-analysis	Multi - study	Multi-component physical contribution	Meta-analytic pooling	Eye-hand coordination = largest contributor; strength and balance significant across all studies.

Table 2. Characteristics and key results of included studies Cognitive and psychological health outcomes (n=7).

No .	Author(s), Year	Design	N	Variables	Instruments	Key Results
17	Vauziah et al. (2026) (25)	Descriptive corr.	~67	Mental toughness, competitive anxiety	SMTQ; CSAI-2	Anxiety high: 56.7%. Mental toughness moderate: 43.8%. r=-0.692 (p=0.001).
18	Isyani et al. (2022) (26)	Quasi-exp.	NR	Pre-competition anxiety, coping strategy	CSAI; pre-post design	Problem-focused coping training significantly reduced pre-

						competition anxiety (p<0.05).
19	Baharuddin et al. (2025) (27)	Quasi-exp.	N=16	Competitive anxiety, mindfulness	CSAI-2; N-Gain analysis	Mindfulness N-Gain=22%; significant between-group difference (p=0.043).
20	Mulya (2020) (28)	2×2 Factorial	NR	Mental imagery, coordination, shooting skill	Imagery protocol; factorial ANOVA	Imagery + high coordination: greatest improvement (p<0.05).
21	Abdurrahman et al. (2024) (29)	Literature review	Multi - study	Mental imagery, concentration, petanque performance	PRISMA-guided narrative review	Visual/kinesthetic imagery consistently improved concentration and mental stability.
22	Kristanto & Nurkholis (2020) (30)	Correlational	NR	Concentration, kinesthetic perception, pointing	Multi-test; multiple regression	Kinesthetic perception + concentration: strongest cognitive predictors (p<0.05).
23	Hernandez & De Los Fayos (2009) (31)	Case study	Elite team	Psychological skills: imagery, relax., self-talk, goal-setting	PST protocol; performance observation	Comprehensive PST improved team cohesion, concentration, and pressure management.

Table 3. Bibliometric and systematic reviews of petanque research (n=2).

No.	Author(s), Year	Design	Scope	Key Findings
24	Pelana et al. (2025) (32)	Bibliometric	268 Google Scholar + 11 Scopus articles (2002–2023)	3 dominant clusters: (1) hand-eye coordination; (2) kinesthetic perception; (3) wrist flexibility. Exponential growth in petanque research since 2015.
25	Hafidz et al. (2024) (6)	Bibliometric	15 Scopus articles (2011–2024)	Dominant keywords: performance, athlete, psychological training plan. Most cited: Pelana et al. (2021), 26 citations. Literature expanding but still limited.

a. Keyword Co-occurrence Network Analysis

Keyword co-occurrence analysis of the 25 included studies using VOSviewer (version 1.6.20) identified 29 keywords meeting the minimum occurrence threshold (≥ 2), forming 166 co-occurrence links (Figure 2)(33–35). The

network revealed five distinct thematic clusters reflecting the multidimensional scope of petanque research.

The Physical-Motor cluster (Cluster 2, green) constituted the largest and most interconnected domain, with *eye-hand coordination* (11 occurrences, total link strength [TLS] = 47) and *shooting accuracy* (12 occurrences, TLS = 52) as the dominant nodes, consistent with meta-analytic evidence identifying eye-hand coordination as the primary contributor to petanque performance (24).

The Cognitive cluster (Cluster 3, blue) occupied a structurally mediating position between the Physical-Motor and Psychological clusters, with *concentration* (6 occurrences) and *kinesthetic perception* as anchor nodes. This structural positioning reflects the empirical finding that concentration exerted a larger direct effect on shooting accuracy (23.32%) than physical hand-eye coordination (10.49%) in path analysis (18).

The Psychological cluster (Cluster 4, yellow) anchored by *sport psychology* (7 occurrences) and *competitive anxiety* (3 occurrences) represents an emerging research frontier. Although smaller than the Physical-Motor cluster, its growth trajectory reflects increasing scholarly attention to psychological demands in petanque, including the high prevalence of competitive anxiety (56.7%) documented by Vauziah et al. (2026) (25).

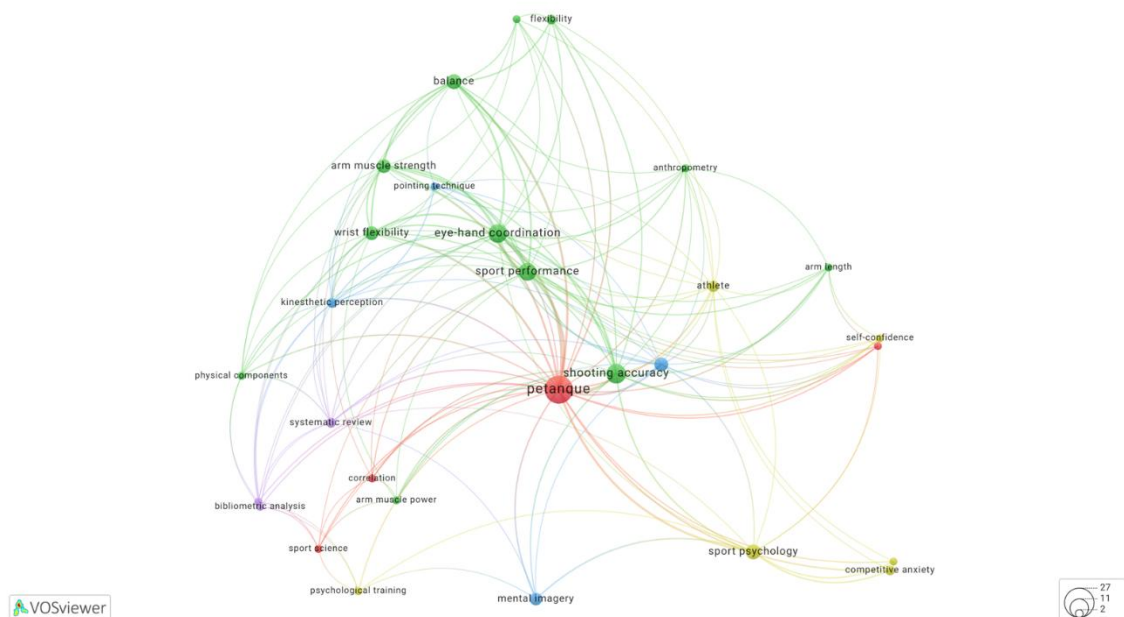


Figure 2. Keyword co-occurrence network of 25 studies included in the systematic review, generated using VOSviewer (version 1.6.20). Node size is proportional to keyword occurrence frequency; line thickness indicates co-occurrence strength. Five thematic clusters were identified: Cluster 1 (red) = general/petanque hub; Cluster 2 (green) = Physical-Motor domain; Cluster 3 (blue) = Cognitive domain; Cluster 4 (yellow) = Psychological domain; Cluster 5 (purple) = Review/Bibliometric domain. Minimum keyword occurrence threshold = 2. Total network: 29 nodes, 166 co-occurrence links

Physical Health Outcomes

Arm muscle strength represents the most frequently studied physical variable (11 of 16 studies). The meta-analysis by Hanief (2022) (24) confirmed eye-hand coordination as the largest contributor to petanque performance across pooled studies. Pelana et al. (2021) found that athletes with arm endurance in the highest quartile demonstrated 23% higher shooting accuracy than the lowest quartile (N=45) (4). Badaru et al. (2021) established that arm strength training produced greater performance gains (+19.147 points) than accuracy training alone (22).

Wrist flexibility was identified by two independent bibliometric analyses as one of three dominant physical components of petanque (5,32). Ariyanto et al. (2026) reported 100% of petanque athletes in the excellent flexibility category the only fitness dimension with universal excellence suggesting a training-specific adaptation (12).

Static and dynamic balance were documented in 9 of 16 physical studies as critical for performance. The throwing stance, which requires both feet stationary within a 35–50 cm circle, demands precise postural control. Kurniawan et al. (2022) demonstrated that combined balance and coordination training produced greater outcomes than either variable alone ($r=0.697$) (14). Ariyanto et al. (2026) found 71% of athletes in good-to-excellent balance categories, consistent with long-term sport adaptation(12).

The neurological case series by Lagueny et al. (2002) documented 12 cases of task-specific focal dystonia in experienced petanque players (ages 42–64 years), providing indirect evidence for deep cortical motor reorganization from sustained, repetitive petanque practice a finding unique to this sport in the neurological literature (2).

Cognitive and Psychological Health Outcomes

Concentration emerged as the most consistently documented cognitive predictor of petanque performance. Purnomo and Yendrizar (2020) demonstrated that concentration exerted the largest direct effect on shooting accuracy (23.32%), exceeding hand-eye coordination (10.49%) in a path analysis model (18). Maliki et al. (2022) identified Component 1 (eye-hand coordination + concentration + kinesthetic perception) as accounting for 42.9% of pointing success variance (5).

Competitive anxiety was documented as a significant psychological challenge. Vauziah et al. (2026) found that 56.7% of competitive petanque athletes reported highly competitive anxiety, with a strong negative correlation to mental toughness ($r=-0.692$, $p=0.001$) (25). Structured interventions demonstrated efficacy: Isyani et al. (2022) found problem-focused coping training significantly reduced pre-competition anxiety ($p<0.05$) (26), while a mindfulness training study reported N-Gain of 22% with significant between-group difference ($p=0.043$) (27). The first sport-psychology intervention specifically designed for petanque by Hernandez and De Los Fayos Ruiz (2009) demonstrated improvements in team cohesion, concentration, and competitive pressure management in an elite team (31).

DISCUSSION

This systematic review identified 25 eligible studies from 340 records and represents the first PRISMA 2020-guided synthesis of health outcomes associated with petanque participation across the lifespan. The evidence converges consistently: petanque produces specific, documentable adaptations across physical, cognitive, and psychological health domains.

The keyword co-occurrence network (Figure 2) structurally validates the thematic architecture of this review. The dominance of the Physical-Motor cluster (Cluster 2) with *eye-hand coordination* and *shooting accuracy* as the two highest-frequency nodes after *petanque* itself reflects the historical research trajectory in Indonesian petanque science, where performance-oriented physical variables have constituted the primary focus since systematic investigation began (12,32).

Importantly, the mediating structural position of the Cognitive cluster (Cluster 3, blue) between the Physical-Motor and Psychological clusters is not incidental: it reflects a genuine neurocognitive pathway through which petanque practice generates psychological and health benefits. The co-occurrence of *mental imagery* with *concentration* (TLS = 3) aligns with the established internal imagery-attention-performance loop in sport psychology theory (28,29,31).

The relative smallness of the Review/Bibliometric cluster (Cluster 5, purple) confirms that rigorous evidence synthesis of petanque research is a recent development (5,12,32). The present systematic review therefore fills a critical gap not only substantively but also methodologically, as the first PRISMA 2020-guided multidomain health outcome synthesis in this sport.

The physical evidence profile positions petanque within the class of low-impact precision sports alongside archery, shooting sports, and bocce but distinguishes it through superior social infrastructure and broader demographic accessibility. Unlike comparator sports, petanque requires no specialized facility, expensive equipment, or prerequisite fitness level, characteristics that reduce structural barriers to participation (1,2). The distinctive physical fitness profile identified by Ariyanto et al. (2026) near-universal flexibility excellence contrasted with cardiorespiratory and strength deficits suggests that petanque training produces specific neuromuscular adaptations relevant to precision and postural control, but that supplementary cardiorespiratory conditioning may be beneficial for comprehensive health outcomes (12).

From a cognitive health perspective, the dominance of concentration and kinesthetic perception as performance predictors is consistent with the dual-task cognitive architecture of precision sports, where simultaneous execution of a precise motor skill and strategic environmental processing creates a rich training environment for executive function and attentional capacity (5,18). This theoretical mechanism is further supported by the documented occurrence of task-specific focal dystonia in experienced players (17), which provides neurophysiological evidence for the depth of cortical reorganization induced by intensive petanque practice.

The high prevalence of competitive anxiety (56.7% of athletes: high category) (25) and its demonstrated amenability to intervention has direct implications for athlete welfare and coaching practice within FOPI and allied

organizations(26,27). Integration of sport psychology services into petanque development programs including mental imagery training, mindfulness-based interventions, and coping strategy protocols is supported by the evidence and should be prioritized.

From a public health standpoint, several of the evidence patterns in this review align with recommendations from the broader sport participation and active aging literature. The systematic review by Eather et al. (2023) and the foundational work of Eime et al. (2013) demonstrate that team-based community sport participation is consistently associated with superior psychosocial health outcomes compared to individual physical activities, a mechanism directly applicable to petanque's inherent team structure (36,37).

The current evidence base has important limitations. First, 80% of included studies originated from Indonesia and exclusively recruited competitive athletes, limiting generalizability to recreational participants and community populations. Second, no study specifically examined petanque as a community health intervention or measured outcomes in older adult or clinical populations despite the sport's theoretical potential in these contexts. Third, the predominance of cross-sectional designs (56%) precludes causal inference. Fourth, high instrument heterogeneity prevented quantitative meta-analysis.

CONCLUSIONS AND RECOMMENDATIONS

This systematic review, comprising 25 eligible studies identified through PRISMA 2020-compliant selection from 340 records, demonstrates that petanque participation is associated with meaningful health benefits across physical, cognitive, and psychological domains. In the physical domain, the sport produces specific neuromuscular adaptations particularly superior hand-eye coordination, wrist flexibility, and postural balance consistent with its precision-based demands. In the cognitive domain, concentration and kinesthetic perception emerge as strong, consistent predictors of performance, indicative of a rich attentional training environment. In the psychological domain, competitive anxiety is prevalent but responsive to structured intervention, affirming the value of sport psychology integration in petanque development.

Petanque's combination of low-impact physical demands, high cognitive engagement, team-based social structure, and minimal participation barriers positions it as a strategically valuable candidate for community-based health promotion across the lifespan particularly for older adults, sedentary populations, and contexts where costly sports infrastructure is unavailable. Future research priorities include randomized controlled trials in community-dwelling populations, longitudinal cohort studies with standardized multi-domain outcome assessment, neuroimaging studies of experienced petanque athletes, and clinical trials examining petanque as a therapeutic activity for populations with Parkinson's disease, mild cognitive impairment, or treatment-resistant depression.

REFERENCES

- Abdurrahman E, Nasuka, Sulaiman, Raharjo HP, Setyawati H. Analysing mental imagery training to improve petanque shooting: A literature review. *Phys Educ Theory Methodol*. 2024;24(3):474–9. doi:10.17309/tmfv.2024.3.17
- Ariyanto AF, Yuliasitrid D, Wahyudi H, Susanto IH. Analysis of physical condition components of petanque athletes. *Sriwijaya J Sport*. 2026;5(2):453–62. doi:10.55379/sjs.v5i2.193
- Badaru B, Kasmad MR, Juhanis J, Anwar NI. Effect of accuracy and muscle strength training on the result of shooting throws in petanque. *Jurnal Maenpo*. 2021;11(1):56–67. doi:10.35194/jm.v11i1.1213
- Baharuddin AAP, Firdaus F, Fakhri N. Efektivitas Pelatihan Mindfulness untuk Mengurangi Kecemasan Bertanding pada Atlet Petanque. *JIP Jurnal Intervensi Psikologi*. 2025;17(1):55–68. doi:10.20885/intervensipsikologi.vol17.iss1.art5
- Cohen J. A coefficient of agreement for nominal scales. *Educ Psychol Meas*. 1960;20(1):37–46. doi:10.1177/001316446002000104
- Donthu N, Kumar S, Mukherjee D, Pandey N, Lim WM. How to conduct a bibliometric analysis: An overview and guidelines. *J Bus Res*. 2021;133:285–96. doi:10.1016/j.jbusres.2021.04.070
- Eather N, Wade L, Pankowiak A, Eime R. The impact of sports participation on mental health and social outcomes in adults: A systematic review and the ‘Mental Health through Sport’ conceptual model. *Syst Rev*. 2023;12(1):102. doi:10.1186/s13643-023-02264-8
- Eime RM, Young JA, Harvey JT, Charity MJ, Payne WR. A systematic review of the psychological and social benefits of participation in sport for adults. *Int J Behav Nutr Phys Act*. 2013;10:135. doi:10.1186/1479-5868-10-135
- Fédération Internationale de Pétanque et Jeu Provençal (FIPJP). About FIPJP. 2024. [Internet]. 2024 [cited 2026 Mar 18]. Available from: <https://fipjp.org/index.php/en/f-i-p-j-p/who-are-we>
- Hafidz A, Wiriawan O, Nurhasan, Nurkholis, Nugraha AD, Purnomo M, et al. Mapping of petanque sports research trends for the period 2011-2024: A bibliometric analysis in the Scopus database. *Phys Educ Theory Methodol*. 2024;24(5):808–18. doi:10.17309/tmfv.2024.5.17
- Hanief YN, Purnomo AMI. Petanque: What are the physical factors that determine performance? *Jurnal Keolahragaan*. 2019;7(2):116–25. doi:10.21831/jk.v7i2.26619
- Hanief YN. Contribution of physical components to petanque sports performance: A meta-analysis study. *Dharmas J Sport*. 2022;2(1):8–17. doi:10.56667/djs.v2i1.626

- Haq A, Jariono G, Subekti N, Nurhidayat N. Literature study: Factor analysis of dominant physical conditions in petanque sports. *Jorpres*. 2024;20(1):25–30. doi:10.21831/jorpres.v20i1.70804
- Hernandez JG, De Los Fayos Ruiz EJG. Psychological training plan for the sport of petanque: In search of optimum group performance. *Cuad Psicol Dep*. 2009;9(2):7–22.
- Irawan FA, Permana DFW, Akromawati HR, Yang-Tian H. Biomechanical analysis of concentration and coordination on the accuracy in petanque shooting. *J Phys Educ Sport Health Recreation*. 2019;8(2):96–100. doi:10.15294/active.v8i2.30467
- Isyani I, Salabi M, Jamaluddin J. Effectiveness of problem-focused coping strategy training in reducing pre-competition anxiety in petanque athletes. *Gelora IKIP Mataram*. 2022;9(2):75–81. doi:10.33394/gjpok.v9i2.6580
- Kristanto AA, Nurkholis. Contribution of concentration, height, arm length, and kinesthetic perception to pointing results in East Java petanque athletes. *JPO J Prestasi Olahraga*. 2020;3(1):1–5.
- Kurniawan R, Junaidi S, Hidayah T. The effect of flexibility exercises, static balance, eye-hand coordination on petanque shooting results. *JUARA J Olahraga*. 2022;7(2):442–54. doi:10.33222/juara.v7i2.2015
- Lagueny A, Burbaud P, Dubos JL, Le Masson G, Guelh D, Macia F, et al. Freezing of shoulder flexion impeding boule throwing: A form of task-specific focal dystonia in petanque players. *Mov Disord*. 2002;17(5):1092–5. doi:10.1002/mds.10228
- Maliki O, Suherman WS, Prasetyo Y, Pradipta GD, Hartono AR. Analysis of pointing success factors in petanque athlete. *Jurnal SPORTIF*. 2022;8(4):460–74. doi:10.29407/js_unpgri.v8i4.18752
- Mulya G. Effect of imagery and coordination training on shooting skills in petanque. *Training J SPORT*. 2020;4(2).
- Nurfatoni A, Hanief YN. Petanque: Can hand-eye coordination, wrist flexibility, trunk flexibility and balance contribute to shooting accuracy? *J Phys Activity*. 2020;1(1):10–20.
- Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. *BMJ*. 2021;372:n71. doi:10.1136/bmj.n71
- Pelana R, Irfansyah AR, Setiakarnawijaya Y. Study of correlation between power of the arm muscle and ROM of shoulder with the results of 9 meters distance shooting in petanque athlete. *Eur J Phys Educ Sport Sci*. 2019. doi:10.46827/EJPE.V0I0.2443

- Pelana R, Setiakarnawijaya Y, Dwiyana F, Sari LP, Abdurrahman, Antoni R, et al. The effect of arm length, arm endurance and self-confidence on petanque shooting. *J Phys Educ Sport*. 2021;21(4):2381–8.
- Pelana R, Wenly AP, Ratiyono, Sukiri. Two decades of petanque research: A bibliometric analysis of dominant physical components (2002-2023). *J Sport Area*. 2025;10(1):156–65. doi:10.25299/sportarea.2025.vol10(1).12237
- Popay J, Roberts H, Sowden A, Petticrew M, Arai L, Rodgers M, et al. Guidance on the conduct of narrative synthesis in systematic reviews: A product from the ESRC Methods Programme [Internet]. Lancaster: Economic and Social Research Council (ESRC) Methods Programme; 2006. Report. Available from: <https://www.lancaster.ac.uk/media/lancaster-university/content-assets/documents/fhm/dhr/chir/NSsynthesisguidanceVersion1-April2006.pdf>
- Purnomo A, Yendrizar. Effect of hand-eye coordination, concentration and believe in the accuracy of shooting in petanque. In: *Proceedings of the 1st International Conference of Physical Education (ICPE 2019)*. Atlantis Press; 2020. p. 90–6. doi:10.2991/assehr.k.200805.027
- Radhakrishnan S, Erbis S, Isaacs JA, Kamarthi S. Novel keyword co-occurrence network-based methods to foster systematic reviews of scientific literature. *PLoS One*. 2017;12(3):e0172778. doi:10.1371/journal.pone.0172778
- Sani A, Hulfian L. Relationship between arm muscle strength and eye-hand coordination with shooting accuracy in petanque at MBC. *Gelanggang Olahraga*. 2022;6(1):118–28. doi:10.31539/jpjo.v6i1.3827
- Sterne JAC, Hernán MA, Reeves BC, Savović J, Berkman ND, Viswanathan M, et al. ROBINS-I: a tool for assessing risk of bias in non-randomised studies of interventions. *BMJ*. 2016;355:i4919. doi:10.1136/bmj.i4919
- Syahwira I, Junaidi S, Hidayah T, Sumartiningsih S, Rahayu S. Exercises for wrist flexibility, arm power, concentration and shooting results on petanque. *JUARA J Olahraga* [Internet]. 2022. Available from: <http://jurnal.umkuningan.ac.id/index.php/juara/article/view/2410>
- van Eck NJ, Waltman L. Visualizing bibliometric networks. *Measuring Scholarly Impact: Methods and Practice*. 2014;285–320. doi:10.1007/978-3-319-10377-8_13
- Vauziah V, Permadi AA, Kurniawati A. Diagnostic study: Mental toughness and competitive anxiety profile of petanque athletes at Bk Porprov Garut 2025. *Jurnal Porkes*. 2026;9(1):530–43. doi:10.29408/porkes.v9i1.33635
- Wells GA, Shea B, O'Connell D, Peterson J, Welch V, Losos M, et al. The Newcastle-Ottawa Scale (NOS) for assessing the quality of

nonrandomised studies in meta-analyses. Ottawa Hospital Research Institute [Internet]. 2000. Available from: https://www.ohri.ca/programs/clinical_epidemiology/oxford.asp

World Health Organization. WHO guidelines on physical activity and sedentary behaviour. [Internet]. Geneva; 2020 [cited 2026 Mar 18]. Report. Available from: <https://www.who.int/publications/i/item/9789240015128>.

Zulbahri, Effendi R, Ihsan N, Okilanda A, Putra AN, Syafrianto D. Petanque athletes' shooting skills: Hand eye coordination, concentration and arm length. *J Phys Educ Sport*. 2024;24(8):2049–56. doi:10.7752/jpes.2024.08227