

Mapping the landscape of pétanque research: a scoping review of research trends, knowledge gaps, and future directions

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Abstract

Research Problems: The growing pétanque literature remains fragmented and lacks a comprehensive synthesis, making it difficult to understand research trends, dominant themes, and knowledge gaps. **Research Objective:** This study aims to map the evolution, thematic structure, methodological characteristics, and future research directions of pétanque research through a scoping review. **Methods:** Following the Arksey and O'Malley framework and PRISMA-ScR guidelines, a scoping review was conducted using the Scopus database with the Boolean query TITLE-ABS-KEY ("petanque" OR "pétanque"). Eligible studies published between 2017 and 2026 were screened and synthesized through descriptive and thematic analyses to identify publication patterns, research themes, and future research directions. **Results:** Twenty studies were included in the review. Publication output increased after 2020 and was predominantly concentrated in Indonesia. The literature was dominated by experimental and correlational studies, with performance enhancement, training interventions, and physical determinants emerging as the most frequently investigated themes. Emerging areas included technology-assisted athlete monitoring, biomechanical analysis, socio-cultural perspectives, and sport management. Despite this diversification, psychological, organizational, and athlete well-being research remained scarce, indicating important gaps in the current evidence base. **Conclusion:** The current evidence suggests that pétanque has emerged as a developing field within sport science, characterized by a strong performance-oriented focus and growing technological innovation. Expanding research beyond traditional performance determinants toward multidisciplinary and holistic perspectives may strengthen the scientific foundation of athlete development and performance in precision sports.

Keywords: pétanque; precision sport; athlete development

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INTRODUCTION

Sport has evolved beyond its traditional role in promoting physical health and recreation to become a highly competitive domain that requires systematic training, scientific support, and evidence-based performance enhancement strategies (Warne et al., 2026; Woods, McKeown, Rothwell, et al., 2020). Within this context, precision sports have attracted increasing scholarly attention because successful performance depends on the integration of technical, physical, cognitive, and psychological capabilities. One such sport is pétanque, a target-based game originating in France in which players attempt to throw metal balls (boules)

as close as possible to a small wooden target ball (cochonnet) (Nurhasan, Al Ardha, Putra, et al., 2024; Pelana et al., 2025). As a precision sport, pétanque demands a high degree of motor control, coordination, concentration, decision-making, and movement consistency, making it a valuable context for scientific investigation.

Over the past decade, pétanque has experienced substantial growth beyond its traditional European roots and has become increasingly popular in several regions, particularly Southeast Asia. In Indonesia, the sport has expanded rapidly through educational institutions, regional competitions, and national athlete development programs. Its relatively simple equipment requirements and accessibility across different age groups and competitive levels have further contributed to its widespread adoption (Helmi et al., 2024). Parallel to this growth in participation, scholarly interest in pétanque has also increased, resulting in a growing body of literature examining athlete performance, training methods, physical conditioning, and sport development.

Existing research has primarily focused on performance-related outcomes, including shooting accuracy, pointing performance, training interventions, biomechanical characteristics, and the physical and psychological determinants of successful performance (Nurhasan, Al Ardha, Ristanto, et al., 2024; Phytanza et al., 2022; Rasyono & Yanto, 2024; Zulfahri et al., 2024). Previous studies have demonstrated the importance of factors such as hand–eye coordination, muscular endurance, anthropometric characteristics, concentration, and self-confidence in influencing technical execution and competitive success. While these studies have contributed valuable insights into the determinants of performance, the literature remains dispersed across multiple disciplines and methodological traditions. Consequently, a comprehensive understanding of how pétanque research has evolved and which areas have received the greatest scholarly attention remains limited.

From a theoretical perspective, athletic performance is increasingly recognized as a multidimensional phenomenon emerging from the interaction of physiological, biomechanical, psychological, technical, and environmental factors (Glazier, 2017; Rumini et al., 2024). Contemporary frameworks such as Sports Performance Theory and ecological dynamics emphasize that successful performance cannot be adequately explained through isolated variables alone but should instead be understood as the product of complex interactions among athletes, tasks, and environments (Glazier, 2017; Woods, McKeown, O’Sullivan, et al., 2020). From this perspective, evaluating the existing body of pétanque literature provides an

opportunity to determine whether current research reflects this multidimensional understanding of performance or remains concentrated within a limited set of performance-oriented topics.

Despite the growing body of literature on pétanque, evidence remains fragmented across performance, biomechanical, psychological, technological, and socio-cultural domains, limiting the development of a coherent understanding of athlete development and performance within this emerging precision sport. As noted by Levac et al. (2010), scoping reviews are particularly valuable for clarifying the extent, nature, and characteristics of evidence within emerging and heterogeneous fields. However, no review has systematically mapped the development of pétanque research or examined the relative prominence of these research areas. Consequently, the thematic structure, methodological characteristics, geographical distribution, and existing knowledge gaps within the field remain poorly understood. This lack of synthesis limits the ability of researchers, practitioners, and policymakers to identify underexplored topics and establish evidence-informed priorities for future investigation.

Scoping reviews are particularly valuable for addressing such challenges because they enable researchers to systematically map the breadth, characteristics, and development of evidence within emerging or fragmented research fields (Arksey & O'Malley, 2005; Levac et al., 2010). Unlike traditional systematic reviews, which typically focus on narrowly defined interventions or outcomes, scoping reviews are designed to provide a comprehensive overview of existing knowledge, identify dominant research areas, and highlight gaps requiring further scholarly attention. Given the relatively small but growing body of pétanque literature and the diversity of research topics represented within it, a scoping review offers an appropriate approach for synthesizing the current state of knowledge.

To date, no scoping review has comprehensively examined the development of pétanque research. As a result, it remains unclear how publication activity has evolved, which methodological approaches have been most frequently employed, what major research themes have emerged, and which areas remain underexplored. Addressing these questions is essential for advancing the scientific understanding of pétanque and establishing a more coherent research agenda for the field.

Therefore, this study aims to map the current state of pétanque research through a scoping review of Scopus-indexed publications published between 2017 and 2026. Specifically, the review seeks to answer three research questions: (1) How has pétanque research evolved in terms of publication characteristics, geographical distribution, and study designs? (2) What

major research themes and areas have been investigated in the pétanque literature? and (3) What knowledge gaps and future research directions can be identified within the field? By identifying publication patterns, methodological tendencies, dominant research themes, and underexplored areas, this review seeks to establish an evidence-informed research agenda and contribute to the continued development of pétanque as an emerging field within sport science.

METHOD

This scoping review follows the framework developed by Arksey & O'Malley (2005) and consist of: (i) identifying the research question/s, (ii) identifying relevant studies, (iii) study selection, (iv) charting the data, and (v) collating, summarizing, and reporting the results.

Stage 1: Identifying the research question

Following the scoping review framework proposed by Arksey & O'Malley (2005), the present review was guided by the following overarching research question: What is currently known from the existing scientific literature regarding pétanque research?. To address this overarching issue, the review was structured around three sub-research questions: (i) How has pétanque research evolved in terms of publication characteristics, geographical distribution, and study designs? (ii) What major research themes and areas have been investigated in the pétanque literature? and (iii) What gaps remain in the existing body of knowledge, and what future research directions should be prioritized?.

Stage 2: Identifying relevant studies: Data sources and search strategy

Database selection was informed by previous scoping reviews in sport science, which frequently utilized Scopus due to its broad multidisciplinary coverage and comprehensive indexing of peer-reviewed literature (Abdelrahman et al., 2021; Alanen et al., 2021; Allen et al., 2021). Scopus was selected because it provides broad multidisciplinary coverage and is widely recognized as one of the largest and most comprehensive databases for sport science research.

All records were retrieved from the Scopus database (Elsevier) in April 2026. The search strategy was designed to capture the widest possible body of literature related to pétanque. The following search query was applied: TITLE-ABS-KEY ("petanque" OR "pétanque") AND PUBYEAR > 2016 AND PUBYEAR < 2027 AND (LIMIT-TO (DOCTYPE, "ar")). The search was conducted within the title, abstract, and keyword fields. Retrieved records were exported in CSV format, including information such as authors, publication year, title, abstract, keywords, source title, affiliation, and citation data.

Studies were considered eligible if they met the following inclusion criteria: (i) focused on the sport of pétanque; (ii) indexed in Scopus; (iii) published between 2017 and 2026; and (iv) classified as original research articles. Studies were excluded if they were (i) review articles, conference papers, editorials, notes, book chapters, or other non-article document types; (ii) retracted publications; or (iii) not directly related to pétanque despite containing the search terms. Restricting the dataset to original research articles ensured the inclusion of primary empirical evidence and minimized duplication of findings derived from secondary literature.

Stage 3: Study selection

The study selection process was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses Extension for Scoping Reviews (PRISMA-ScR) proposed by Tricco et al. (2018). Following the database search, all retrieved records underwent a multi-stage screening process based on predefined inclusion and exclusion criteria. Duplicate records were identified and removed, followed by title, abstract, and full-text screening to assess eligibility. The complete selection process, including the number of records identified, screened, excluded, and included, is presented in the PRISMA 2020 flow diagram (Figure 1).

The Scopus search identified 52 records, with no duplicate records removed. After screening, 8 records were excluded due to ineligible document types, leaving 44 full-text articles for eligibility assessment. Following full-text review, 24 articles were excluded because they were not directly related to pétanque research despite containing the search terms. Finally, 20 studies met the inclusion criteria and were included in the final synthesis.

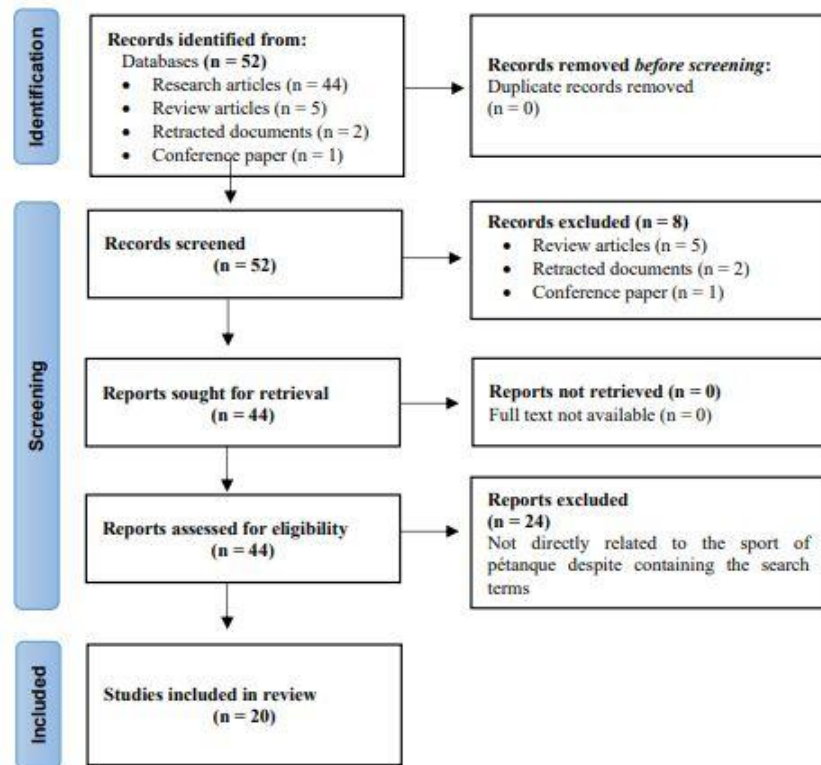


Figure 1. PRISMA 2020 flow diagram of the study selection process.

Stage 4: Charting the data

Data were systematically extracted from all included studies using a standardized charting form developed in accordance with the scoping review framework proposed by Arksey & O'Malley (2005). The extracted information included author(s), year of publication, country of affiliation, journal, study design, participant characteristics, sample size, research objectives, primary research themes, key findings, and future research recommendations.

To address the first research question, bibliometric and methodological characteristics, including publication year, geographical distribution, study design, and participant profiles, were recorded. To address the second research question, studies were coded according to their primary research themes and areas of investigation. To address the third research question, authors reported limitations and future research recommendations were extracted and synthesized to identify knowledge gaps and emerging research directions within the field of pétanque.

The extracted data were organized in Microsoft Excel and subsequently analyzed using descriptive statistics and thematic synthesis to provide a comprehensive overview of the evolution, thematic structure, and future trajectory of pétanque research.

RESULT

The study selection process of the Scopus search identified 52 records related to pétanque research. After the screening and eligibility assessment process, 20 studies fulfilled all inclusion criteria and were included in the final synthesis (Figure 1). These included studies represented the available evidence base for examining the development of pétanque research across different dimensions. The selected studies were subsequently analyzed using descriptive, bibliometric, and thematic approaches to identify publication trends, geographical distribution, methodological characteristics, major research themes, and future research directions within the field of pétanque.

How has pétanque research evolved in terms of publication characteristics, geographical distribution, and study designs?

The publication trend indicates a gradual increase in petanque research output, particularly after 2020, suggesting growing scholarly attention toward petanque as an emerging field within sport science.

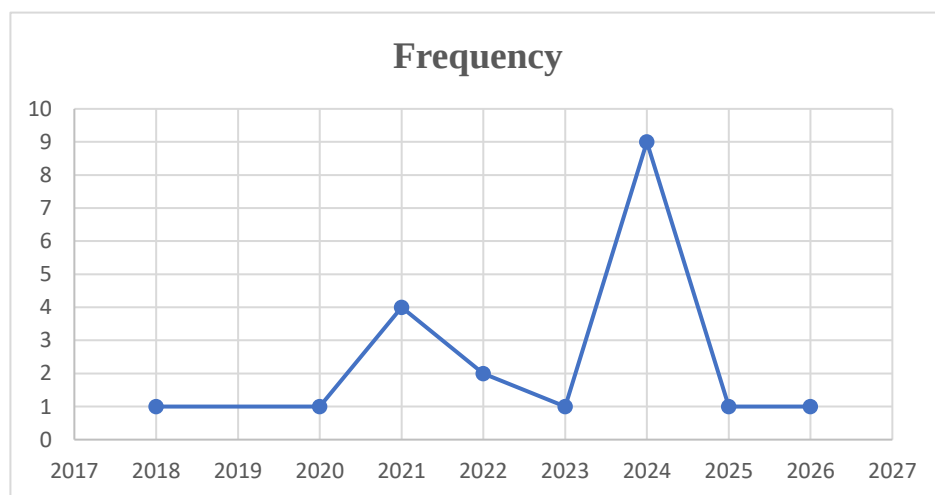


Figure 1. Annual publication trend of pétanque research (2018–2026).

The publication pattern demonstrates that research activity remained limited during the early years but increased substantially after 2020. Most studies were published within the last five years of the review period, indicating that pétanque has gained increasing recognition as a relevant topic for scientific investigation. This growth may reflect the expansion of pétanque participation, athlete development programs, and research interest in precision sports.

The geographical distribution reveals that pétanque research is predominantly concentrated in Indonesia, with limited contributions from other countries.

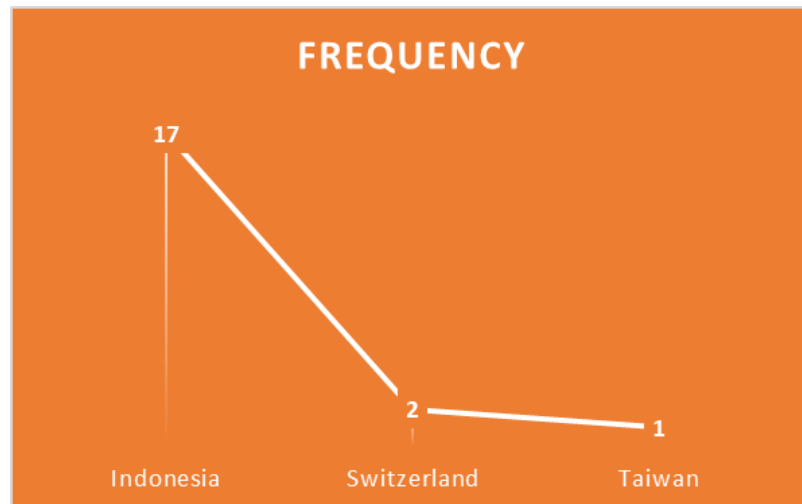


Figure 2. Geographical distribution of pétanque studies.

The dominance of Indonesian publications indicates that Southeast Asia, particularly Indonesia, has become an important contributor to contemporary pétanque research. Although pétanque originated in Europe, current scientific production appears to be driven by regions where the sport has experienced rapid development through educational institutions, competitions, and athlete development initiatives. However, the limited international distribution suggests the need for broader cross-country research collaboration.

Experimental research represents the dominant methodological approach in pétanque studies, followed by correlational designs.

Table 1. Methodological characteristics of included studies.

Study Design Category	n (%)
Experimental	8 (40.0)
Correlational	4 (20.0)
Qualitative	2 (10.0)
Observational	2 (10.0)
Descriptive	1 (5.0)
Evaluation	1 (5.0)
Mixed Methods	1 (5.0)
Development (R&D)	1 (5.0)
Total	20 (100.0)

The predominance of experimental studies indicates that current pétanque research has mainly focused on evaluating training interventions and identifying factors associated with athletic performance. Meanwhile, qualitative, organizational, social, and developmental

perspectives remain relatively underrepresented, highlighting opportunities for future multidisciplinary research.

What major research themes and areas have been investigated in the pétanque literature?

The existing literature demonstrates that pétanque research is primarily focused on performance enhancement and physical determinants, while psychological, social, and athlete well-being perspectives remain limited.

Table 2. Major research themes identified in pétanque studies.

Major Research Theme	n (%)
Performance Enhancement and Training	6 (30.0)
Physical and Anthropometric Determinants	4 (20.0)
Sports Technology and Biomechanics	3 (15.0)
Sport Management and Socio-Cultural Studies	3 (15.0)
Social Interaction and Rule-Related Studies	2 (10.0)
Psychological Factors	1 (5.0)
External Challenges and Athlete Well-being	1 (5.0)
Total	20 (100.0)

The thematic distribution confirms that performance-oriented research remains the central focus of pétanque studies. Training interventions, technical improvement, and physical characteristics represent the most frequently investigated areas. In contrast, psychological factors, athlete well-being, and broader socio-organizational perspectives receive limited attention, indicating important knowledge gaps for future research.

Performance Enhancement and Training

Six studies (30.0%) examined training interventions and strategies aimed at improving pétanque performance. The findings consistently showed positive effects of structured training programs on shooting accuracy and technical performance. Accuracy training significantly improved shooting outcomes (Phytanza et al., 2022), guided error-based learning enhanced both self-efficacy and skill achievement compared with correct-motion instruction (Chien & Chen, 2018), and a six-week core stability program significantly improved shooting accuracy, static balance, and dynamic balance (Rasyono et al., 2026).

Additional studies reported that target practice and precision-target training significantly increased shooting accuracy and technical consistency (Jupri et al., 2024; Nurhidayat et al., 2024). In contrast, (Eka Wahyudhi et al., 2025) found no significant differences among shot on the iron, half shoot, and lob shoot training methods, nor any interaction effects involving

arm muscle endurance. Taken together, these findings suggest that structured and evidence-based training interventions are generally effective for enhancing pétanque performance, making this the most extensively investigated area within the literature.

Physical and Anthropometric Determinants

Four studies (20.0%) investigated the contribution of physical, physiological, and anthropometric characteristics to pétanque performance. Significant variables identified across studies included arm length, arm muscle endurance, body height, palm length, grip strength, static balance, concentration, and hand-eye coordination (Pratama et al., 2024; Ramdan et al., 2021; Setiakarnawijaya et al., 2021; Zulbahri et al., 2024). Among these variables, hand-eye coordination emerged as the most consistent and strongest predictor of both shooting and pointing performance (Pratama et al., 2024; Zulbahri et al., 2024). Arm length and arm muscle endurance were also repeatedly associated with superior technical execution (Ramdan et al., 2021; Setiakarnawijaya et al., 2021). Overall, the evidence indicates that successful pétanque performance depends on a combination of anthropometric characteristics and motor-control capacities rather than on a single physical attribute.

Sports Technology and Biomechanics

Three studies (15.0%) focused on technological innovation and biomechanical analysis in pétanque. Hidayah et al. (2024) reported the need for an Android-based monitoring system to facilitate athlete development, training supervision, communication, and physical-condition monitoring. Nurhasan, Al Ardha, Ristanto, et al. (2024) identified significant kinematic differences between pointing and shooting techniques across several movement phases, demonstrating distinct biomechanical requirements for each skill. In addition, Putra et al. (2024) developed a pétanque match-statistics application capable of systematically recording and analyzing competition data. Collectively, these studies demonstrate an increasing interest in integrating technology and biomechanical assessment into coaching practice, athlete monitoring, and performance evaluation.

Sport Management and Socio-Cultural Studies

Three studies (15.0%) explored organizational, cultural, and contextual aspects of pétanque. Hafidz et al. (2024) applied the Context–Input–Process–Product (CIPP) evaluation model and identified both strengths and areas requiring improvement within athlete development programs. Two additional studies examined the influence of traditional and culturally grounded conditioning approaches on athlete performance (Santosa, 2022; Santosa

et al., 2024). Empirical findings showed that traditional Balinese holistic conditioning significantly improved shooting accuracy by 36.96% ($p < 0.001$) (Santosa et al., 2024), while Sidhakarya-based self-conditioning enhanced confidence, emotional control, skill mastery, and strategic implementation during competition (Santosa, 2022). These results suggest that cultural practices and local knowledge systems may provide valuable complementary approaches to athlete development and performance enhancement.

Social Interaction and Rule-Related Studies

Two studies (10.0%) examined the interactional and rule-governed dimensions of pétanque using ethnomethodological and conversation-analytic approaches. Svensson & Tekin (2021) demonstrated that rules are actively produced and enforced through player interaction, with participants collaboratively identifying and correcting violations during gameplay. A subsequent study by Svensson & Tekin (2023) identified two distinct correction trajectories: one treating violations as mistakes and another framing them as potential cheating. These findings indicate that rule enforcement in pétanque extends beyond formal regulations and is embedded within ongoing social interaction. The studies therefore contribute a unique sociological perspective by highlighting how accountability, intentionality, and shared understandings shape competitive practice.

Psychological Factors

Only one study (5.0%) specifically focused on psychological factors. Rizal et al. (2021) reported that self-talk significantly improved shooting accuracy ($t = 2.690$, $p = 0.014$) by helping athletes regulate concentration, emotions, breathing, and movement execution. Supporting evidence from Ramdan et al. (2021) further indicated that self-confidence contributes positively to shooting performance. Although represented by a limited number of studies, the available evidence suggests that psychological skills may play an important role in performance optimization, psychological research remains substantially underrepresented despite its recognized role in precision sport performance. The scarcity of research in this area highlights a notable gap within the current pétanque literature.

External Challenges and Athlete Well-being

One study (5.0%) investigated athlete well-being under external constraints. During the COVID-19 pandemic, athletes experienced increases in body weight and substantial declines in physical condition as a consequence of restricted training opportunities (Kurdi et al., 2020). Despite these adverse effects, athletes maintained relatively high levels of motivation

throughout the disruption. These findings suggest that while pétanque athletes demonstrate considerable psychological resilience, prolonged interruptions to training and competition can negatively affect physical preparedness. Consequently, athlete well-being and adaptation to external challenges remain important but underexplored areas for future research.

DISCUSSION

This review mapped the current landscape of pétanque research and identified several notable patterns in the development of the field. The evidence indicates a growing volume of publications, a predominance of performance-oriented investigations, and an emerging diversification of research themes and methodologies. Collectively, these findings provide important insights into how knowledge in pétanque has evolved, the areas that have received the greatest scholarly attention, and the critical gaps that remain. The discussion contextualizes these findings within contemporary sport science literature and outlines implications for future research.

Evolution of Pétanque Research

One of the principal findings of this review is the increasing number of pétanque publications after 2020, indicating growing scholarly interest in the sport. This trend suggests that pétanque is increasingly being recognized as a relevant area of inquiry within sport science, particularly in countries where athlete development initiatives and competitive participation have expanded (Helmi et al., 2024). Consistent with broader developments in sport science, emerging sports tend to attract greater scientific attention as participation, institutional support, and performance demands increase (Warne et al., 2026). Therefore, the growth of publications reflects the gradual establishment of pétanque as an evidence-based field of research.

Another notable finding is the strong geographical concentration of studies in Indonesia, despite pétanque originating in France. This pattern suggests that contemporary knowledge production is driven more by regions experiencing rapid growth in athlete participation and development systems than by traditional centers of sporting history, as evidenced by the increasing geographical diversification of research output in athlete development literature (Agus et al., 2025; Al Ardha et al., 2024; Huggins & Izushi, 2013). While this reflects the expanding role of Southeast Asia in the development of pétanque, the limited international representation may constrain the generalizability of existing evidence and highlights the need for broader cross-national collaboration.

The methodological profile further demonstrates that pétanque research remains predominantly performance-oriented. Experimental and correlational studies accounted for most publications, reflecting a strong focus on identifying performance determinants and evaluating training interventions. This finding aligns with traditional sport science approaches that seek to optimize athletic performance through measurable physical, technical, and biomechanical variables (Glazier, 2017). The distribution of study designs and research topics also confirms that pétanque literature spans multiple disciplinary perspectives, although performance-related investigations continue to dominate the field.

Nevertheless, the emergence of qualitative, socio-cultural, management, and interaction-focused studies indicates a gradual diversification of research interests. From the perspective of Sports Performance Theory and ecological dynamics, athletic performance emerges through interactions among physical, psychological, social, and environmental factors rather than isolated variables alone (Glazier, 2017; Woods, McKeown, O’Sullivan, et al., 2020). Overall, the evidence suggests that pétanque research is evolving from a narrowly performance-oriented field toward a more multidisciplinary domain encompassing technological, socio-cultural, organizational, and psychological perspectives. However, this transition remains incomplete, as performance-related investigations continue to dominate the literature and several dimensions of athlete development remain underexplored.

Major Research Trends and Knowledge Development

The findings indicate that knowledge development in pétanque has been predominantly driven by efforts to optimize athletic performance. The dominance of studies focusing on training interventions, shooting accuracy, and physical determinants suggests that research priorities have largely centered on improving competitive outcomes. This orientation reflects broader trends in sport science, where evidence-based training and performance enhancement constitute major areas of investigation (Warne et al., 2026). As a result, the current literature remains strongly aligned with the practical demands of athlete development and performance improvement.

The prominence of training and physical determinant studies further highlights the multidimensional nature of pétanque performance. Research consistently identified the importance of structured training, hand–eye coordination, muscular endurance, anthropometric characteristics, concentration, and self-confidence in supporting successful performance (Chien & Chen, 2018; Irawan et al., 2022; Phytanza et al., 2022; Pratama et al., 2024; Ramdan

et al., 2021; Zulfahri et al., 2024). Rather than pointing to a single determinant, these findings collectively support Sports Performance Theory, which proposes that athletic performance emerges through the integration of physical, technical, biomechanical, and psychological factors (Glazier, 2017). Consequently, successful performance in pétanque appears to depend on the interaction of multiple athlete characteristics rather than isolated variables.

Another notable trend is the growing adoption of technology and biomechanical approaches. Studies examining athlete-monitoring systems, match-analysis applications, and movement characteristics indicate an increasing reliance on objective performance assessment and data-informed coaching practices (Hidayah et al., 2024; Nurhasan, Al Ardha, Ristanto, et al., 2024; Putra et al., 2024). This development reflects the broader integration of technological innovation within sport science and suggests that pétanque research is gradually progressing toward more sophisticated methods of athlete evaluation and performance monitoring.

At the same time, the emergence of socio-cultural, organizational, and interaction-focused studies suggests a gradual expansion beyond traditional performance-oriented perspectives (Hafidz et al., 2024; Santosa, 2022; Santosa et al., 2024; Svensson & Tekin, 2021, 2023). These themes are consistent with ecological dynamics, which emphasizes that performance emerges from interactions among athletes, tasks, and environments (Woods, McKeown, O'Sullivan, et al., 2020). Nevertheless, psychological, well-being, and contextual dimensions remain relatively underrepresented. Therefore, although pétanque research is becoming increasingly diverse, the field remains largely centered on performance enhancement, indicating that a fully multidimensional understanding of performance has yet to be achieved.

Knowledge Gaps and Future Research Directions: What gaps remain in the existing body of knowledge, and what future research directions should be prioritized?

Despite the growing body of pétanque research, several important knowledge gaps remain. First, the literature is strongly dominated by studies on training interventions, technical performance, and physical determinants, whereas psychological, social, organizational, and athlete well-being dimensions receive considerably less attention. This imbalance contrasts with contemporary sport-performance frameworks, which conceptualize athletic performance as the product of interactions among physiological, biomechanical, psychological, and environmental factors rather than isolated variables (Glazier, 2017; Woods, McKeown,

O’Sullivan, et al., 2020). Future research should therefore adopt more holistic approaches that integrate multiple dimensions of athlete development and performance.

Second, the methodological landscape remains relatively narrow. Experimental and correlational studies dominate the field, while qualitative, mixed-methods, and longitudinal investigations are scarce. Although existing studies have successfully identified performance-related determinants, they provide limited understanding of how athletes develop expertise over time and how contextual factors influence performance. Given the dynamic nature of skill acquisition proposed within ecological dynamics (Woods, McKeown, Rothwell, et al., 2020), future studies should employ more diverse methodological approaches to capture the complexity of athlete development.

Third, the evidence base is geographically concentrated, with most studies originating from Indonesia. While this reflects the rapid growth of pétanque in Southeast Asia, it limits the generalizability of current findings across different cultural and sporting contexts. Expanding international collaboration and conducting cross-cultural research would contribute to a more globally representative understanding of the sport. This pattern aligns with broader bibliometric evidence in sport science and athlete development research, which indicates a tendency for knowledge production to cluster in regions experiencing rapid growth in sport participation and research capacity rather than in traditional centers of sporting history (Al Ardha et al., 2024; Huggins & Izushi, 2013). Such geographical concentration has been widely identified as a structural feature of emerging sport research fields, reinforcing the need for more internationally distributed and collaborative research designs.

Finally, several important topics remain largely unexplored, including injury prevention, talent identification, coaching effectiveness, female athlete development, youth participation, long-term athlete development, and athlete well-being. The growing use of biomechanical analysis and performance-monitoring technologies also highlights opportunities to integrate technological innovations with broader multidimensional models of performance (Rebelo et al., 2023). Collectively, these findings suggest that future pétanque research should move beyond a predominantly performance-oriented perspective toward a more comprehensive and multidisciplinary understanding of athlete development and sporting performance.

Future Research Agenda

Based on the findings of this review, several priorities can be proposed to advance the development of pétanque research. First, Future studies should examine the interaction

between biomechanical variables, psychological skills, and athlete well-being using longitudinal and mixed-methods designs. Such an approach would better reflect contemporary perspectives on sport performance, which emphasize the interaction among athletes, tasks, and contexts rather than isolated determinants (Glazier, 2017; Woods, McKeown, O’Sullivan, et al., 2020). Developing comprehensive performance models may therefore provide a more accurate understanding of the factors underpinning success in pétanque.

Second, greater methodological diversity is needed. While experimental studies have contributed important evidence regarding training effectiveness, future research should incorporate longitudinal, qualitative, and mixed-methods designs to examine athlete development, expertise acquisition, and coaching processes over time (Dunn et al., 2025; Nijenhuis et al., 2024; Thompson et al., 2022). Such approaches may generate deeper insights into how technical, psychological, and contextual factors interact throughout different stages of athletic development.

Third, technological innovation should become a central component of future investigations. The emergence of biomechanical analyses, athlete-monitoring systems, and performance-analysis applications suggests considerable potential for data-driven athlete development (Hidayah et al., 2024; Nurhasan, Al Ardha, Ristanto, et al., 2024; Putra et al., 2024). Future studies should explore the integration of biomechanical, physiological, and psychological data to support evidence-based coaching, performance monitoring, and talent development systems.

Fourth, future research should expand its focus toward underrepresented populations and contexts. Studies involving female athletes, youth athletes, recreational participants, coaches, and officials remain scarce despite their importance for the sustainable growth of the sport. Similarly, greater attention should be given to injury prevention, athlete well-being, talent identification, and long-term athlete development (Beech et al., 2024; Ramachandran et al., 2024; Sniffen et al., 2022). Expanding research into these areas would contribute to a more comprehensive understanding of participation and performance across the athlete lifespan.

Finally, international collaboration should be strengthened to enhance the global relevance of pétanque research. Given the strong concentration of studies in Indonesia, collaborative projects involving researchers from different countries and competitive environments would facilitate cross-cultural comparisons and improve the generalizability of

findings (Awais, 2025). Such efforts may also accelerate the development of a more mature and internationally connected body of knowledge within pétanque research.

Overall, future pétanque research should progress toward a multidisciplinary, technology-informed, and globally collaborative research agenda. Advancing these priorities will not only strengthen the scientific foundation of pétanque but also contribute to the broader understanding of athlete development and performance in precision sports.

The findings of this review should be interpreted in light of several limitations. As a scoping review, the primary objective was to map and synthesize the breadth of available evidence rather than to evaluate the methodological quality of individual studies or estimate the effectiveness of specific interventions. In addition, the results reflect the characteristics of the currently available literature, which remains geographically concentrated and unevenly distributed across research themes. Consequently, some aspects of pétanque development and performance may be underrepresented within the existing evidence base.

CONCLUSIONS

This scoping review demonstrates that pétanque research has expanded considerably in recent years, with the literature predominantly focused on performance enhancement, training interventions, physical determinants, and emerging applications of technology and biomechanics. The findings indicate that successful pétanque performance is shaped by the interaction of multiple physical, technical, biomechanical, and psychological factors, reflecting contemporary multidimensional perspectives in sport science. At the same time, the evidence base remains geographically concentrated and methodologically dominated by experimental and correlational approaches, while psychological, socio-cultural, organizational, and athlete well-being dimensions remain underrepresented. These findings contribute to the development of precision sport research by providing a comprehensive overview of the current state of knowledge and highlighting the evolving role of technology-informed and evidence-based athlete development. Future research should integrate previously isolated themes by examining the combined influence of physical, psychological, socio-cultural, technological, and well-being factors on performance and athlete development. Such interdisciplinary approaches

would provide a more comprehensive understanding of pétanque performance and help address existing gaps in the literature.

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