

FACTORS INFLUENCING THE PERFORMANCE OF VOLLEYBALL ATHLETES: A REVIEW OF THE LITERATURE

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ABSTRACT

Purpose of the study: This systematic literature review aims to identify and analyze the factors that influence volleyball athlete performance through a comprehensive examination of scientific literature published between 2004-2025.

Materials and methods: A systematic literature review was conducted using SPORTDiscus and PubMed databases. Studies were selected based on predefined inclusion criteria focusing on volleyball performance factors, training interventions, and game-related statistics. Data extraction was performed using a standardized protocol, and findings were synthesized qualitatively.

Results: Analysis of 55 studies revealed that volleyball performance is influenced by multiple interconnected factors including technical skills (attack success, serve effectiveness, blocking proficiency), physical attributes (agility, explosive power, VO2max endurance), psychological factors (athlete well-being, coaching quality), and tactical elements (game-related statistics). Performance determinants varied by gender, with women's teams showing stronger correlation with attack attempts and team errors, while men's teams demonstrated greater dependence on serve points and blocking effectiveness.

Conclusions: Volleyball athlete performance is multifactorial, requiring integrated training approaches addressing technical, physical, psychological, and tactical components. Evidence supports that comprehensive monitoring systems combining internal load (sRPE), external load metrics, and readiness indicators are essential for optimizing performance.

Keywords: volleyball performance; athlete factors; systematic review; training interventions; game analysis; sports performance.

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INTRODUCTION

Volleyball has grown into one of the most popular and widely played sports worldwide, practiced in both recreational and elite contexts. Since its inception over a century ago, the game has undergone substantial transformation, particularly in terms of speed, intensity, and tactical complexity. Modern volleyball requires athletes to execute high-intensity efforts in repeated sequences, combining explosive jumping, rapid changes of direction, and precise technical execution under conditions of fatigue. As the game has evolved, so too have the physical, technical, psychological, and tactical demands placed on players, making performance optimization a multidimensional challenge for athletes, coaches, and sport scientists.

Research in volleyball performance has shifted significantly in recent decades. Earlier studies largely adopted descriptive approaches, focusing on isolated aspects of gameplay or athlete characteristics. More recent work, however, has advanced toward predictive modeling and multifactorial analyses, integrating variables such as training load, physiological readiness, and psychological states with technical and tactical performance metrics. The introduction of wearable technologies and microsenors since 2017 has further enriched this field, enabling continuous monitoring of external load (e.g., jump counts, accelerations) and internal load (e.g., session rating of

perceived exertion, heart-rate variability). These innovations provide researchers and practitioners with unprecedented opportunities to link training inputs with competitive outcomes.

Despite these advances, several unresolved issues remain. There is no universal consensus on the most effective monitoring strategies across competitive levels, nor on the optimal way to integrate contextual factors such as player position, match phases, or gender-specific demands into performance models. Furthermore, while certain determinants such as attack efficiency and serve reception are well-established predictors of success, the degree to which psychological elements (e.g., motivation, perceived coaching quality) interact with technical or physical variables remains underexplored. Similarly, methodological heterogeneity across studies—including varying operational definitions, outcome measures, and study designs—creates challenges for synthesizing evidence and translating findings into practice.

A systematic review of volleyball performance factors is therefore crucial for both scientific and practical reasons. Scientifically, it provides a foundation for consolidating disparate lines of research, clarifying conceptual frameworks, and identifying methodological strengths and weaknesses. Practically, such synthesis supports evidence-based decision-making in training and competition, enabling coaches to prioritize the most impactful determinants of success while tailoring interventions to specific athlete populations. The urgency of this synthesis is heightened by the rapid pace of technological development, which risks fragmenting knowledge unless integrated into coherent monitoring and intervention strategies.

Accordingly, the present review seeks to (1) identify and categorize the factors influencing volleyball performance across technical, physical, psychological, and tactical domains; (2) evaluate the methodological approaches used in performance analysis; (3) synthesize evidence on effective training and monitoring strategies; and (4) propose future directions for research and applied practice. By doing so, this study aims to bridge the gap between scientific research and coaching application, offering a structured roadmap for optimizing athlete development and team performance in volleyball.

MATERIALS FOR ANALYSIS

Literature Review

The foundation of this systematic review rests on a rigorous and comprehensive literature search designed to ensure coverage of all relevant studies on volleyball performance. Two primary databases were selected for the analysis: SPORTDiscus with Full Text and PubMed Central. SPORTDiscus was chosen due to its reputation as the leading database in sports sciences and sports medicine, offering extensive coverage of peer-reviewed journals and a strong subject indexing system specifically tailored to athletic performance and training. PubMed Central was included to complement this scope, particularly given its emphasis on biomedical and physiological aspects of sport performance that are essential in understanding the multifactorial demands of volleyball. Together, these databases provided a robust foundation to capture a wide spectrum of technical, physical, psychological, and tactical studies relevant to volleyball athletes.

The search protocol was carefully structured to maximize retrieval of relevant articles. Searches were executed on August 31, 2025, applying a combination of keywords and Boolean operators to capture the diverse dimensions of volleyball research. Keywords included “volleyball athlete performance,” “factors influencing volleyball performance,” “volleyball training interventions,” “volleyball game analysis,” “volleyball performance monitoring,” and “systematic review volleyball.” This multi-faceted approach ensured that both empirical intervention studies and analytical reviews were captured, while also accommodating the breadth of methodologies applied in volleyball research.

Inclusion and Exclusion Criteria

To guarantee methodological rigor, specific inclusion and exclusion criteria were established. Studies were included if they were peer-reviewed, published between 2004–2025, written in English, and explicitly examined performance factors, training interventions, or match analysis in volleyball. The inclusion also required that participants were human athletes, ensuring the results were applicable to real-world sporting contexts. Excluded were non-peer-reviewed publications, studies not explicitly related to volleyball, those lacking performance outcome measures, case studies with insufficient sample sizes that threatened generalizability, and duplicate publications. This strict filtering ensured that only methodologically sound and contextually relevant research contributed to the synthesis.

Organization of the Study

The search initially yielded 1,774 records, reflecting the wide research activity in the field of volleyball. After the title and abstract screening, only 78 studies qualified for full-text assessment, and ultimately 55 studies met all inclusion criteria to be systematically reviewed. To manage and standardize the review process, a structured data extraction form was developed. This template enabled consistent recording of key details, including

authorship, year of publication, sample size, demographic characteristics of participants, research design, intervention type and duration, outcome measures, and principal findings. Such systematic organization minimized the risk of bias and facilitated cross-study comparison.

Variables Examined

The extracted variables were categorized into five major domains. Technical factors included attack success rate, serve effectiveness, blocking proficiency, and reception quality—elements critical to performance consistency during matches. Physical attributes encompassed measures such as VO₂max, agility, explosive power, muscular strength, and endurance, which underpin the physiological demands of high-level volleyball. Psychological factors focused on athlete well-being, motivation, and perceptions of coaching quality, all of which are increasingly recognized as performance mediators. Tactical elements were analyzed through game-related statistics, positional play, and match phase analyses to highlight situational determinants of success. Finally, training factors included load monitoring, intervention effectiveness, and recovery status, acknowledging the importance of training science in shaping performance outcomes

Methods of Analysis

The data processing stage combined quantitative and qualitative approaches to synthesize findings. Quantitative variables were summarized using descriptive statistics to provide an overview of measured performance outcomes, while qualitative insights were analyzed thematically to identify recurring patterns, emerging themes, and areas of inconsistency across studies. The review process was conducted in strict accordance with the PRISMA 2020 guidelines, ensuring transparency, replicability, and adherence to international standards for systematic reviews.

Given the heterogeneity in study designs, populations, and outcome measures, a narrative synthesis was adopted in place of a meta-analysis. This approach allowed for the integration of diverse methodologies and highlighted both converging evidence and contradictions across studies. Results were then categorized by factor type—technical, physical, psychological, tactical, and training—to provide a structured framework. This categorization not only enhanced the clarity of presentation but also facilitated the identification of evidence gaps, contradictions, and future research opportunities.

RESULTS

Study Characteristics

A total of 55 studies were included in this systematic review, spanning research conducted between 2004–2025. The studies encompassed various research designs including comparative analyses, predictive modeling, intervention studies, and systematic reviews.

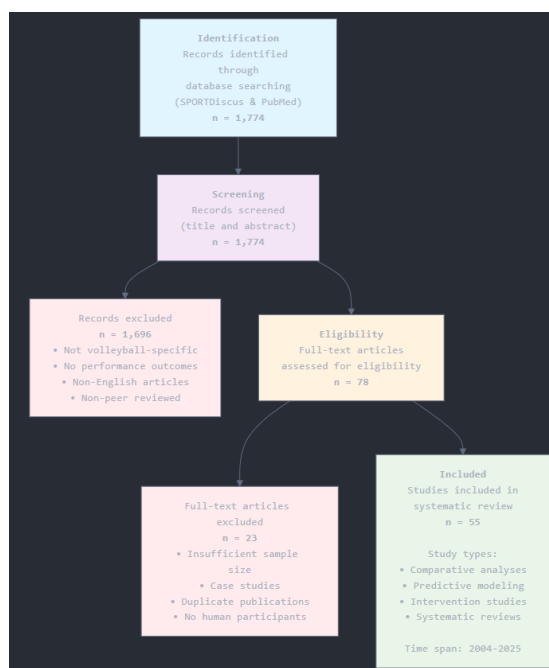


Figure 1. PRISMA flow diagram based on the study selection process described in your systematic review

Based on Elite International Competitions (2004-2016) Research

Game-Related Statistics

Table 1. Game-Related Statistics

Category	Factor	Women's Teams	Men's Teams	Performance Impact
Attack Performance	Attack Attempts (AA)	Negative correlation (fewer = better)	-	Quality over quantity approach
	Successful Attacks (AP)	Strong positive correlation	Third ranking determinant	Critical for match success
Defensive Performance	Blocking Points (BP)	Significant predictor	Second most important	Essential for both genders
	Serve Points (SP)	-	Most significant determinant	Men's volleyball priority
Error Management	Team Errors (TE)	Strong negative correlation	-	Critical for women's success

Skill Effectiveness

Table 2. Skill Effectiveness

Element	Description	Impact Level
Complex II Elements	Counterattack situations	Crucial for top-level teams
Serve Reception	Enables effective attack initiation	Foundation for success
Skill Level Parity	Similar individual/team skills at elite level	Outcomes depend on minimal details

Physical Performance Factors

Endurance Capabilities (VO2max Analysis)

Table 3. Endurance Capabilities (VO2max Analysis)

Performance Category	Club A Distribution	Club B Distribution	Performance Gap
Poor Category	57.5%	-	Major deficiency
Good Category	10%	40%	4x performance difference
Excellent Category	-	6.7%	Elite performance gap

Agility and Explosive Power

Table 4. Agility and Explosive Power

Component	Training Approach	Key Factors
Agility	Specific training programs	Training surface influences results
Explosive Power	Integrated strength + power training	Combined methodological approach

Training Load and Monitoring Systems

Table 5. Training Load and Monitoring Systems

Monitoring Type	Primary Method	Time Period	Benefits	Target Population
Internal Load	session Rating of Perceived Exertion (sRPE)	2010-2022 "Golden Standard"	Cost-effective, reliable	Developmental teams
External Load	Quantified jump analysis	Current standard	Objective measurement	All levels
Readiness Assessment	Multi-method approach	Ongoing	Comprehensive monitoring	Developmental teams

Readiness Monitoring Components

Table 6. Readiness Monitoring Components

Assessment Tool	Purpose	Implementation Cost
Total Quality Recovery (TQR) Scale	Recovery status evaluation	💰 Low cost
Wellness Questionnaires	Overall athlete condition	💰 Low cost
Countermovement Jump (CMJ) Testing	Physical readiness indicator	💰 💰 Moderate cost

Gender-Specific Performance Priorities

Table 7. Gender-Specific Performance Priorities

Women's Volleyball Focus	Men's Volleyball Focus
Attack efficiency optimization	Serve point maximization
Error reduction emphasis	Blocking effectiveness
Quality over quantity attacks	Serve-block combination
Counterattack mastery	Physical dominance factors

The landscape of volleyball performance analysis has undergone significant technological transformation over the past decade. The introduction of microsensors in 2017 marked a pivotal moment in sports monitoring capabilities, enabling real-time data collection and more precise athlete assessment. However, despite these technological advances, traditional video analysis methods continue to remain prevalent in current research practice, suggesting that established methodologies still hold valuable analytical merit. Perhaps most significantly, the field has experienced a fundamental paradigm shift from purely descriptive research approaches toward sophisticated predictive modeling systems, allowing coaches and researchers to anticipate performance outcomes rather than simply documenting past events.

Contemporary volleyball training philosophy has evolved to emphasize integrated approaches that address multiple performance components simultaneously, moving away from traditional isolated skill development methods. This holistic perspective recognizes that volleyball performance emerges from the complex interaction of technical, physical, psychological, and tactical elements. The research strongly supports the implementation of comprehensive monitoring systems that combine various assessment methods to provide a complete picture of athlete status and development. However, successful implementation requires careful balance between cutting-edge technological solutions and practical considerations such as cost, accessibility, and ease of use, particularly for developmental teams with limited resources.

The multifactorial nature of volleyball performance necessitates integrated coaching and training approaches that acknowledge the complex interplay between various performance components. One of the most striking findings from this systematic review is the identification of significant gender differences in success factors, with women's volleyball prioritizing attack efficiency and error reduction, while men's volleyball emphasizes serve effectiveness and blocking performance. This evolution toward increasingly sophisticated analysis methodologies reflects the sport's maturation as a field of scientific inquiry, moving from intuition-based coaching decisions toward evidence-based practice that can optimize athlete development and competitive success through data-driven insights.

DISCUSSION

Multifactorial Nature and Gender-Specific Performance Determinants

The findings of this systematic review underscore the complex, multifactorial nature of volleyball performance, revealing that success in this dynamic sport cannot be attributed to any single factor but rather emerges from the intricate interplay of technical, physical, psychological, and tactical elements (Silva et al., 2016; Zaccagni et al., 2024). The identification of gender-specific performance determinants represents a particularly significant finding, with women's volleyball success being most strongly correlated with attack efficiency and error minimization, while men's performance depends primarily on serve effectiveness and blocking proficiency (Volkov & Statsenko, 2024). These findings align with previous research demonstrating that "men's volleyball games were better associated with terminal actions (errors of service) and women's volleyball games were characterized by continuous actions (in defense and attack)" (Kountouris et al., 2015). Training methods that replicate the male game without adapting to women's volleyball pose risks (Kountouris et al., 2015), suggesting that the traditional "one-size-fits-all" approach to volleyball training is suboptimal. The divergence in performance determinants is further supported by evidence showing that gender differences in motor properties and saccadic dynamics differentiate between reactive agility of female and male players, with explosive strength and complex reaction time being significant predictors for males, while females show greater dependence on sensory sensitivity and selective attention (Trajković et al., 2024).

Training Load Monitoring and Technological Evolution

The emergence of session Rating of Perceived Exertion (sRPE) as the "golden standard" for internal load monitoring, combined with quantified jump analysis for external load assessment, provides practitioners with evidence-based, cost-effective tools for comprehensive performance monitoring (Pisa et al., 2022). Recent systematic reviews have emphasized that volleyball's unique calendar structure, with brief off-season and pre-season phases juxtaposed against extensive in-season phases characterized by high match density, necessitates careful management of training loads and recovery periods (Rebello et al., 2024). The effectiveness of load

management has emerged as a critical factor influencing overall team performance and success, with vertical jumping being central to key actions such as serving, blocking, and attacking, making it not just a frequent movement but a critical skill that significantly influences team performance (Rebelo et al., 2024). Despite technological advances, including the introduction of microsensors in 2017, traditional video analysis remains prevalent in current research practice, indicating a need for better integration of emerging technologies with established monitoring methods.

Physical Performance Factors and Training Interventions

Comprehensive analysis of physical performance factors reveals significant variations in endurance capabilities among female volleyball athletes, with VO₂max levels showing substantial disparities between clubs (Yolanda et al., 2025). Training intervention studies demonstrate that agility can be improved through specific training programs, with significant improvements found in decision-action time, agility T-test performance, and 10-meter sprint times for shuttle-run and agility ladder training groups (Keoliya et al., 2024). The effectiveness of different training modalities varies by gender, with male players showing higher values in strength and power production-related physical tests, while females demonstrated better performance in flexibility tests (Albaladejo-Saura et al., 2022). Research indicates that plyometric training's superior effectiveness in explosive power development primarily benefits movements requiring rapid force production, making it particularly valuable for volleyball's repeated jumps, sprints, and rapid directional changes (Keoliya et al., 2024). However, short-term interventions such as week-long intensive training camps can produce significant changes in anthropometric characteristics but limited improvements in motor abilities, suggesting that longer-term, systematic approaches are necessary for meaningful performance enhancements.

Coaching Quality and Psychological Factors

The strong correlation between perceived coaching quality and athlete performance emphasizes the critical role of coach-athlete relationships in optimizing outcomes (Trajković et al., 2024). Analysis of training program effectiveness reveals strong positive correlations between coaching styles and athlete achievements, with customized training programs based on specific coaching philosophies demonstrating enhanced effectiveness in promoting athlete success (Jolo, 2024). Recent research exploring constraint-led approaches in high-level female volleyball has highlighted the importance of match analysis intervention programs, with athletes demonstrating improved performance when tactical information is effectively integrated into training design (Fernández-Echeverría et al., 2021). The psychological dimension extends beyond coaching quality to encompass factors including diet, training intensity, and overall health, all of which significantly affect athletic performance outcomes and must be considered within a holistic performance framework.

Methodological Evolution and Practical Implications

The evolution from descriptive to predictive modeling approaches in volleyball research represents a paradigm shift that enables coaches to make data-driven decisions rather than relying solely on intuition or tradition (Silva et al., 2016). Modern sensing technologies and data analysis methods usher in a new era for sports training and practice, with advanced monitoring systems allowing for real-time feedback and performance optimization (Salim et al., 2024). The integration of comprehensive monitoring systems combining sRPE, external load metrics, and readiness indicators using Total Quality Recovery (TQR) scales and wellness questionnaires provides optimal performance oversight while maintaining cost-effectiveness for teams across competitive levels. Position-specific analyses have revealed that setting efficacy in formative categories varies by gender, with reception efficacy, setting technique, and tempo being consistent predictors across both sexes, while jump serve effectiveness differs between male and female categories (Fernández-Echeverría et al., 2016).

Limitations and Future Directions

Several methodological limitations emerged from this analysis that require attention in future research endeavors. Despite advancements in volleyball performance research, there remains a gap in systematic synthesis of literature, particularly in integrating diverse findings to inform monitoring strategies (Rebelo et al., 2024). The heterogeneity in study designs across the reviewed literature prevented meta-analytical synthesis, while variations in operational definitions limit direct comparisons between studies. Sample limitations include gender bias toward specific populations in some research areas, concentration on elite-level athletes that may limit applicability to developmental populations, and geographic clustering that restricts cultural and training system diversity. Future research should focus on developing standardized assessment criteria for cross-training tests and their potential usefulness for volleyball training, while addressing the challenge of evaluating psychomotor abilities (Sterkowicz-Przybycień et al., 2025). The rapid pace of technological advancement necessitates continuous evaluation of monitoring methods, with particular emphasis on ensuring accessibility and standardization across different technological platforms. Future investigations should prioritize longitudinal studies examining performance development trajectories, increased focus on developmental athletes, and integration of positional and match phase contexts to provide more comprehensive understanding of volleyball performance optimization strategies...

CONCLUSION

This systematic literature review demonstrates that volleyball athlete performance is influenced by complex, interconnected factors spanning technical skills, physical attributes, psychological elements, and tactical understanding. The evidence strongly supports integrated training approaches rather than isolated skill development, with performance optimization requiring comprehensive monitoring systems that balance technological advancement with practical implementation considerations.

Key findings indicate significant gender differences in performance determinants, with women's volleyball success correlating most strongly with attack efficiency and error reduction, while men's performance depends primarily on serve and block effectiveness. The evolution from descriptive to predictive research approaches provides coaches with evidence-based tools for strategic decision-making and performance enhancement.

Practical applications include implementing sRPE-based internal load monitoring, quantified jump analysis for external load assessment, and TQR/wellness questionnaires for readiness evaluation. These methods provide cost-effective solutions suitable for teams across competitive levels while maintaining scientific rigor.

Future research should address identified gaps through comprehensive operational definitions, increased focus on developmental athletes, integration of positional and match phase contexts, and longitudinal studies examining performance trajectory development. Additionally, research should explore optimal integration of emerging technologies with traditional monitoring methods to enhance accessibility and effectiveness across diverse competitive environments.

The evidence presented reinforces the importance of evidence-based coaching practices and highlights volleyball's evolution toward increasingly sophisticated performance analysis methodologies. Continued research integration with practical application will further advance athlete development and competitive success in this dynamic sport.

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Conflict of interests

The authors declare no conflicts of interest in the preparation and publication of this systematic literature review. No financial support or institutional relationships that could potentially influence the research outcomes or interpretations were present during the conduct of this review.

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