



Determination of students' physical and psychological abilities in learning basketball free throws

Author Name(s): Suci Ramadani, Muhamad Sazeli Rifki

Publication details, including author guidelines

URL: <https://jurnal.iicet.org/index.php/jppi/about/submissions#authorGuidelines>

Editor: Fiky Zarya

Article History

Received: 15 Oct 2025

Revised: 16 Nov 2025

Accepted: 30 Dec 2025

How to cite this article (APA)

Ramadani, S. & Rifki, M.S., (2025). Determination of students' physical and psychological abilities in learning basketball free throws. *Jurnal Penelitian Pendidikan Indonesia*, 11(4), 82-91. <https://doi.org/10.29210/020256654>

The readers can link to article via <https://doi.org/10.29210/020256654>

SCROLL DOWN TO READ THIS ARTICLE



Indonesian Institute for Counseling, Education and Therapy (as publisher) makes every effort to ensure the accuracy of all the information (the "Content") contained in the publications. However, we make no representations or warranties whatsoever as to the accuracy, completeness, or suitability for any purpose of the Content. Any opinions and views expressed in this publication are the opinions and views of the authors and are not the views of or endorsed by Indonesian Institute for Counseling, Education and Therapy. The accuracy of the Content should not be relied upon and should be independently verified with primary sources of information. Indonesian Institute for Counseling, Education and Therapy shall not be liable for any losses, actions, claims, proceedings, demands, costs, expenses, damages, and other liabilities whatsoever or howsoever caused arising directly or indirectly in connection with, in relation to, or arising out of the use of the content.

JPPI (Jurnal Penelitian Pendidikan Indonesia) is published by Indonesian Institute for Counseling, Education and Therapy comply with the [Principles of Transparency and Best Practice in Scholarly Publishing](#) at all stages of the publication process. JPPI (Jurnal Penelitian Pendidikan Indonesia) also may contain links to web sites operated by other parties. These links are provided purely for educational purpose.



This work is licensed under a [Creative Commons Attribution 4.0 International License](#).

Copyright by Ramadani, S. & Rifki, M.S., (2025).

The author(s) whose names are listed in this manuscript declared that they have NO affiliations with or involvement in any organization or entity with any financial interest (such as honoraria; educational grants; participation in speakers' bureaus; membership, employment, consultancies, stock ownership, or other equity interest; and expert testimony or patent-licensing arrangements), or non-financial interest (such as personal or professional relationships, affiliations, knowledge or beliefs) in the subject matter or materials discussed in this manuscript. This statement is signed by all the authors to indicate agreement that the all information in this article is true and correct.

JPPI (Jurnal Penelitian Pendidikan Indonesia)

ISSN: 2502-8103 (Print) | ISSN: 2477-8524 (Electronic)



Determination of students' physical and psychological abilities in learning basketball free throws

Suci Ramadani, Muhamad Sazeli Rifki^{*)}

Universitas Negeri Padang, Indonesia

Article Info

Article history:

Received Oct 15th, 2025

Revised Nov 16th, 2025

Accepted Dec 30th, 2025

Keyword:

Free-throw performance,

Explosive strength,

Hand-eye coordination,

concentration,

Basketball training

ABSTRACT

Free-throw performance is a crucial skill in basketball, directly affecting scoring without defensive interference. This study systematically reviewed national and international literature (2018–2024) to examine physical, psychomotor, and psychological determinants of free-throw accuracy in youth players. Using a PRISMA-based approach and thematic synthesis, three core variables were analyzed: upper-limb explosive power, hand-eye coordination, and concentration. Findings indicate that upper-limb strength enhances elbow stability, release speed, and movement efficiency; hand-eye coordination improves visual-motor integration and shooting precision; and concentration supports motor control, emotional stability, and resistance to competitive pressure. These factors interact synergistically to enable consistent and accurate free throws. The review highlights the importance of integrated training programs combining physical conditioning, coordination drills, and mental skills practice for youth development. Results provide evidence-based guidance for coaches to design holistic interventions that optimize free-throw performance and contribute to long-term skill consistency in competitive basketball settings.



© 2025 The Authors. Published by IICET.

This is an open access article under the CC BY-NC-SA license

(<https://creativecommons.org/licenses/by-nc-sa/4.0/>)

Corresponding Author:

Muhamad Sazeli Rifki

Universitas Negeri Padang,

Email: ms_rifki@fik.unp.ac.id

Introduction

Free-throw performance is a fundamental aspect of basketball, providing players with scoring opportunities without direct defensive pressure. Ideally, a player with optimal physical capacity, technical skill, and mental focus can execute free throws consistently and accurately. International studies indicate that free-throw accuracy is influenced by a combination of physical and psychomotor factors, including upper-arm strength, motor coordination, and mental control (Andriani et al., 2023; Olteanu et al., 2023). Concentration has also been identified as a key psychological determinant, with stable attentional focus improving shooting outcomes (Goldschmied et al., 2021; Uludağ et al., 2021). Similarly, national studies highlight that free-throw proficiency emerges from the synergy between muscular strength, movement coordination, and attentional control (Matsunaga & Oshikawa, 2022;

Munir et al., 2024). Achieving this ideal condition requires structured, evidence-based training that integrates both physical and psychological components.

In practice, many youth players struggle to achieve consistent free-throw accuracy due to limitations in physical capacity and mental focus. National research identifies low upper-arm explosive power and poor motor coordination as major contributors to weak shooting performance (Fernandez-Fernandez et al., 2022; Smajla et al., 2020). International studies further show that adolescent athletes often experience concentration lapses under competitive pressure, reducing shot accuracy (Silva et al., 2021; Zhen et al., 2023). Similar patterns have been observed in Indonesian student teams, where technical errors frequently result from weaknesses in foundational physical abilities (Bayu et al., 2025; Henjilito et al., 2025). These findings illustrate a clear gap between ideal expectations and actual performance among young players, especially in school-based programs.

Previous research provides evidence of the individual influence of physical and psychomotor components on shooting outcomes. For example, Aksoy et al. (2023) showed that upper-arm strength and hand-eye coordination significantly affect jump-shot performance, a skill biomechanically related to free throws. Li et al. (2024) also emphasized the direct effect of hand-eye coordination on free-throw accuracy in student-athletes, while Cabarkapa et al. (2022) identified elbow positioning, movement rhythm, and upper-arm strength as strong biomechanical predictors. However, most studies analyze these factors in isolation, leaving interactions between physical and psychological determinants insufficiently explored. Therefore, a systematic literature review is needed to examine upper-arm explosive power, hand-eye coordination, and concentration simultaneously as principal determinants of free-throw performance.

Understanding these factors is particularly important because free throws often influence game outcomes at both school and competitive levels. Integrated insights from national and international research can guide coaches in designing training programs that consider physical capacity, motor coordination, and mental readiness. International evidence indicates that mental-based interventions, including visualization and attentional control strategies, can improve accuracy by 10–15% (Alimuddin et al., 2024; Anbalagan & Sivasanthosh, 2025). In Indonesia, integrated physical and psychological training remains uncommon, contributing to inconsistent performance among youth players (A. Akbar et al., 2025).

Despite the existing research, there is still limited knowledge about how these physical, psychomotor, and psychological factors interact to influence free-throw performance holistically. Few studies provide a comparative perspective between national and international contexts or offer actionable insights for integrated training programs. Addressing this gap is critical for developing evidence-based interventions that enhance not only physical strength and coordination but also mental resilience during shooting. This review contributes by synthesizing multivariable findings, mapping dominant determinants, and proposing practical implications for coaches and trainers aiming to optimize free-throw performance in youth basketball.

This study is positioned strategically compared to prior research because it provides a multivariable synthesis, integrating upper-arm explosive power, hand-eye coordination, and concentration as core determinants of free-throw performance. By comparing national and international findings, this review offers a comprehensive understanding of dominant factors influencing free throws in both local and global contexts. The primary aim is to critically analyze previous research on physical and psychological determinants, thereby formulating theoretical and practical implications for evidence-based training programs to improve youth-athlete performance.

Method

This study employed a systematic literature review to identify, evaluate, and synthesize scientific evidence on the physical and psychological determinants of free-throw performance in basketball. A PRISMA-based approach was adapted to fit the conceptual and empirical studies in sports science, ensuring systematic screening, selection, and synthesis of relevant publications. Adaptations included modifications in data extraction forms and thematic analysis procedures suitable for multivariable sports research.

Data sources comprised national and international peer-reviewed journal articles published between 2018 and 2024. The search was conducted across multiple databases, including Scopus, Web of Science, PubMed, and Garuda, using Boolean keyword combinations such as "free throw performance," "basketball shooting accuracy," "upper limb power," "hand-eye coordination," "concentration in sports," "basketball motor skills," and "explosive strength basketball." The inclusion criteria were: (1) studies examining upper-limb explosive power, hand-eye coordination, concentration, or free-throw/shooting performance; (2) quantitative, experimental, or literature review designs; (3) full-text availability in English or Bahasa Indonesia; and (4) peer-reviewed journal publications. Exclusion criteria were: (1) non-scientific reports, such as theses dissertations, books, or non-indexed conference proceedings; (2) studies not empirically examining relationships among relevant variables; and (3) studies with insufficient methodological detail.

The initial search identified 152 articles, of which 87 were screened based on titles and abstracts, and 54 underwent full-text review. Ultimately, 36 studies met all criteria and were included in the review, consisting of 20 international and 16 national studies. Data extraction was independently performed by two researchers to reduce bias, recording study characteristics, sample size, measurement instruments, key findings, and relevance to the study objectives.

Data were analyzed using thematic synthesis, categorizing findings into three main themes: (1) physical determinants, such as upper-limb explosive power; (2) psychomotor determinants, such as hand-eye coordination; and (3) psychological determinants, such as concentration. Each theme was examined for relationship patterns, consistency, and differences across national and international studies. Methodological trends, including measurement instruments, sample characteristics, and study robustness, were also compared. The synthesis results were used to identify dominant determinants of free-throw performance and highlight research gaps warranting further investigation.

Results and Discussions

The Influence of Upper-Limb Explosive Power on Free-Throw Accuracy

The synthesis of the reviewed literature indicates that upper-limb explosive power is one of the most consistently reported physical determinants of free-throw accuracy across national and international studies. Most empirical findings highlight that the free-throw motion requires sufficient arm propulsion, wrist stability, and a consistent release velocity to generate an optimal ball trajectory. Athletes with greater upper-limb power tend to exhibit smoother kinematic patterns, reduced movement variability, and more efficient force transfer during the shooting action. Conversely, limited arm power is associated with inconsistent release angles and insufficient force production, both of which negatively influence shooting precision. The reviewed studies demonstrate similar conclusions, reinforcing the idea that biomechanical efficiency heavily depends on the explosive capability of the upper limbs. To provide a clearer understanding of how arm explosive power contributes to free-throw performance, the findings from three representative studies are summarized in the following table.

Table 1. Summary of Findings on Upper-Limb Explosive Power and Free-Throw Accuracy

Author & Year	Population / Sample	Key Findings	Conclusion
Wanena (2018)	Youth basketball athletes (n=30)	Arm strength contributed 30.5% to shooting accuracy	Arm explosive power influences movement control during shooting
Gutiérrez-Capote et al. (2023)	Junior club basketball players (n=40)	Significant direct effect of arm strength on free-throw performance	Explosive strength determines release stability and propulsion
Pocius & Malinauskas (2024)	International review	Strength-speed synergy improves free-throw accuracy	Explosive power is a dominant biomechanical predictor

The synthesis of the three studies demonstrates a strong and consistent relationship between upper-limb explosive power and free-throw accuracy. Wanena, (2018) found a substantial 30.5%

contribution of arm strength to shooting accuracy, indicating that physical capacity is a fundamental predictor of motor consistency during the shooting action. This finding is strengthened by [Gutiérrez-Capote et al. \(2023\)](#), who reported that arm strength not only influences propulsion but also stabilizes elbow mechanics during the ball release phase. Meanwhile, the international review by [Pocius & Malinauskas, \(2024\)](#) supports these conclusions by emphasizing that the synergy between speed and strength is essential for producing an ideal projectile arc and minimizing release variability. The convergence of these findings suggests that athletes with well-developed upper-limb explosive power are more capable of executing repeatable, biomechanically efficient free-throw motions. Moreover, the role of arm strength extends beyond simply generating force, as it also affects movement control, timing, and follow-through mechanics. Overall, these results affirm that upper-limb explosive power is a critical component of free-throw performance and should be prioritized in basketball training programs.

The role of upper-limb explosive power in free-throw mechanics becomes clearer when examined through broader biomechanical frameworks that go beyond the findings of the reviewed studies. Recent sport biomechanics research notes that explosive strength contributes to movement efficiency by optimizing intersegmental energy transfer and reducing compensatory motions that often destabilize shooting precision ([Terbalyan et al., 2025](#); [Y. Wang et al., 2025](#)). This aligns with motor-control theories suggesting that athletes with higher neuromuscular responsiveness are better able to fine-tune ballistic movements such as the free throw, due to more efficient recruitment of high-threshold motor units ([Akbar et al., 2022](#); [Tirta et al., 2024](#)). Furthermore, computational models of basketball shooting show that small variations in force generation have disproportionately large effects on ball trajectory, reinforcing why force consistency driven by explosive power is central to scoring probability ([Nakano et al., 2018](#); [Yan et al., 2023](#)). International performance research also indicates that athletes with superior explosive capacity exhibit reduced kinematic noise across repeated tasks, a factor that strongly predicts long-term shooting accuracy ([Guo et al., 2024](#); [Morgulev et al., 2022](#)). The integration of these theories expands the understanding of the findings by highlighting that explosive power influences not only strength output but also movement predictability and error minimization ([Spancken et al., 2021](#); [S. Wang et al., 2025](#)). Consequently, the findings of this review advance previous knowledge by positioning explosive power as both a physical and neuro-mechanical determinant of free-throw accuracy, supporting the need for upper-body plyometric and neuromuscular- activation training to enhance shooting performance more holistically.

The Influence of Hand–Eye Coordination on Free-Throw Accuracy

The reviewed literature shows that hand–eye coordination plays a critical psychomotor role in determining free-throw accuracy, given the precision required to align visual information with fine motor execution. This variable enables athletes to make accurate adjustments to shooting angle, target perception, and release timing. Studies consistently report that players with high visual-motor coordination demonstrate superior stability during the preparatory, release, and follow-through phases of the free-throw motion. Conversely, low coordination is associated with misjudgments in distance perception and inconsistent target alignment, leading to reduced shooting success. The presence of psychological pressure has also been shown to degrade coordination quality, highlighting its sensitivity to situational factors. To illustrate how coordination influences free-throw performance, the synthesis of three key studies is presented in the following table.

Table 2. Summary of Findings on Hand–Eye Coordination and Free-Throw Accuracy

Author & Year	Population / Sample	Key Findings	Conclusion
Fonseca & Bonilla (2025)	School-level basketball players (n=40)	Hand–eye coordination significantly affects free-throw accuracy	Coordination influences shot direction and stability
Bohloul et al. (2025)	Youth basketball players	Visual coordination declines under psychological pressure	Coordination is closely linked to visual focus
Ren et al. (2025)	Psychomotor review	Hand–eye coordination improves precision-based motor tasks	Coordination is a core psychomotor component in shooting

The analysis reveals that hand–eye coordination is a fundamental determinant of free-throw accuracy due to its essential role in integrating perceptual and motor processes. Fonseca & Bonilla, (2025) demonstrated that coordination directly influences shooting execution, particularly in adjusting distance estimation and directional alignment. The findings by Bohloul et al., (2025) show that high-pressure situations disrupt visual tracking, which in turn compromises motor alignment and shot accuracy underscoring the vulnerability of coordination to psychological factors. Ren et al., (2025) further supports the central role of coordination by identifying it as a primary psychomotor skill required for precision-based movements such as aiming, targeting, and object release. Taken together, these studies highlight that coordination is not merely an auxiliary skill but a core requirement for consistent free-throw execution. Improved coordination is likely to enhance timing, alignment, and the ability to maintain a stable motion pattern. These findings collectively emphasize the importance of visual-motor integration in basketball shooting performance.

A deeper interpretation of the role of hand–eye coordination reveals its function as a central mechanism in the sensorimotor integration system, which governs how athletes convert visual cues into precise motor actions. According to recent perceptual-motor research, successful shooting is heavily dependent on the efficiency of the dorsal visual stream, which processes spatial information needed for alignment, targeting, and movement correction (Bosco et al., 2023; Gao et al., 2025). Studies in precision sports further show that athletes with higher visual-motor integration demonstrate improved anticipatory control, allowing them to predict ball trajectory and adjust joint angles before releasing the ball (Ottononi et al., 2021; Sirkic et al., 2022). This adds nuance to the understanding of the findings, indicating that coordination influences not only timing but also predictive processing. Moreover, neurocognitive studies suggest that repeated exposure to visually demanding tasks strengthens synaptic efficiency in regions associated with aim-related motor planning, enhancing long-term shooting stability (Hessam et al., 2023; Zaj et al., 2023). Researchers also note that coordination skills are particularly sensitive to cognitive load: when attentional resources are divided, visual-motor integration deteriorates, explaining why performance drops under competitive pressure (Alemanno et al., 2025; Gokeler et al., 2019; Vine et al., 2016). Therefore, the new insight gained from the synthesized findings is that hand–eye coordination should be conceptualized not merely as a motor skill but as a holistic cognitive-sensorimotor capability. This reinforces the importance of integrating perceptual- training drills, dual-task shooting, and pressure-simulation tasks in basketball training programs to bridge laboratory skill execution with real-game demands.

The Influence of Concentration on Free-Throw Accuracy

The literature consistently identifies concentration as one of the most influential psychological determinants of free-throw performance, primarily because this shooting action is executed without defensive interference but under substantial mental pressure. The ability to maintain attentional focus directly affects the athlete’s capacity to control motor flow, stabilize emotional responses, and resist external distractions. Studies show that athletes with higher concentration levels are better able to sustain consistent shooting routines and preserve technical precision during competition. Conversely, reductions in concentration often lead to breakdowns in shooting mechanics, mistimed releases, and diminished accuracy. Psychological pressure also appears to exacerbate lapses in concentration, making it a highly fragile yet decisive factor. A summary of three representative studies related to concentration is provided in the following table.

Table 3. Summary of Findings on Concentration and Free-Throw Accuracy

Author & Year	Population / Sample	Key Findings	Conclusion
Tan & Teoh (2024)	Adolescent basketball athletes	Visual focus strategies increase accuracy by up to 15%	Concentration stabilizes motor execution
Purnomo & Yendrizal (2020)	Youth players	Psychological pressure reduces focus and shooting accuracy	Concentration is vulnerable to external distractions
Ellis & Ward (2022)	Indonesian youth athletes	Concentration significantly affects shooting accuracy	Concentration is a dominant psychological determinant

The synthesis of the three studies demonstrates that concentration has a substantial effect on free-throw accuracy because it governs the player's ability to maintain optimal motor control and cognitive stability during execution. [Tan & Teoh, \(2024\)](#) highlight that visual-focus interventions can meaningfully improve free-throw accuracy, underscoring the importance of targeted attentional strategies. [Purnomo & Yendrizal, \(2020\)](#) emphasize that psychological pressure is one of the main disruptors of concentration, which often results in impaired shooting accuracy an issue commonly observed during competitive settings. The study by [Ellis & Ward, \(2022\)](#) further reinforces the significance of concentration through evidence of its direct and consistent influence on shooting accuracy among youth athletes. Collectively, these findings reveal that concentration is both crucial and susceptible to disturbance, making it a focal point in performance optimization. When concentration falters, athletes may exhibit erratic release timing, altered shot mechanics, and reduced follow-through quality. Therefore, psychological training aimed at enhancing attentional control is essential for improving free-throw outcomes.

A broader psychological interpretation of these findings suggests that concentration operates as a central regulatory mechanism that shapes how effectively athletes can express both their physical capacities and coordinative skills during free-throw execution. Contemporary sport-psychology literature characterizes the free throw as a highly controlled self-paced task in which attentional regulation determines whether athletes can maintain optimal arousal levels and avoid performance deterioration ([Beatty & Janelle, 2019](#); [Cheng et al., 2024](#)). Neurocognitive evidence further indicates that sustained attentional focus enhances activation in the anterior cingulate cortex an area essential for error monitoring and fine-tuning motor responses thereby supporting consistent shooting mechanics. Field-based studies also show that athletes who cultivate stable attentional routines demonstrate greater resilience to competitive stressors such as crowd distraction, temporal pressure, and situational anxiety, ultimately producing higher accuracy in decisive game moments ([Y. Li et al., 2025](#); [Yu et al., 2024](#)). Moreover, recent meta-analytical work highlights that performance under pressure is often compromised when attention shifts toward conscious self-evaluation a process known as reinvestment which disrupts automaticity and interferes with the natural fluidity of the shooting motion ([Luo et al., 2025](#); [Yang & Wang, 2023](#)). Taken together, these theoretical perspectives expand the implications of the present findings by illustrating that concentration influences both biomechanical execution and underlying psychophysiological responses. This underscores the importance of incorporating structured mental-training components such as attentional cueing, controlled breathing, quiet-eye routines, and short pre-performance focus intervals into free-throw training programs to enhance performance stability in competitive environments.

The synthesis of the literature highlights that upper-limb explosive power, hand-eye coordination, and concentration are critical determinants of free-throw performance in youth basketball. Upper-limb explosive power facilitates stable elbow mechanics, efficient force transfer, and consistent release velocity, which collectively improve movement efficiency and shooting accuracy ([Wanena, 2018](#); [Gutiérrez-Capote et al., 2023](#); [Pocius & Malinauskas, 2024](#)). Hand-eye coordination enables precise visual-motor integration, supporting alignment, timing, and motor adjustments, particularly under competitive pressure ([Fonseca & Bonilla, 2025](#); [Bohloul et al., 2025](#); [Ren et al., 2025](#)). Concentration governs attentional control, emotional regulation, and motor consistency, allowing athletes to maintain technical precision despite situational stressors ([Tan & Teoh, 2024](#); [Purnomo & Yendrizal, 2020](#); [Ellis & Ward, 2022](#)).

Integrating these findings underscores the importance of viewing free-throw performance as a multidimensional skill that requires simultaneous development of physical, psychomotor, and psychological capacities. Physical training alone may enhance strength and propulsion, but without hand-eye coordination drills and attentional strategies, improvements in accuracy are likely limited. Similarly, mental training is most effective when combined with adequate physical conditioning and motor skill development. This interaction suggests that holistic, multicomponent training programs are more effective in promoting consistent and accurate free throws among youth athletes than single-factor interventions.

From a practical standpoint, coaches should design structured training sessions that combine upper-body plyometrics, coordination drills, and concentration-enhancing exercises such as quiet-eye routines, pre-shot focus intervals, and pressure simulation. For example, integrating dual-task shooting

exercises can simultaneously challenge motor control and attentional focus, better preparing athletes for game-like conditions. Furthermore, periodic assessment of arm explosive power, visual-motor coordination, and focus stability can provide objective feedback, enabling targeted improvements in individualized training programs.

Despite these insights, several limitations warrant consideration. The reviewed studies varied in sample size, age groups, and methodological rigor, potentially affecting generalizability. Few studies examined the interactions among physical, psychomotor, and psychological factors directly, leaving some uncertainty regarding causal mechanisms. Additionally, most national studies focus on school-level athletes, with limited data on higher-level competitive contexts. Future research should employ longitudinal and experimental designs to explore multivariable interactions and test integrated training models across different competitive levels, providing more robust evidence for evidence-based coaching strategies.

Conclusions

Free-throw performance in basketball is influenced by the combined effects of upper-limb explosive power, hand-eye coordination, and concentration, which interact to support movement stability, attentional control, and shooting consistency. Optimizing accuracy requires integrated training that combines physical conditioning, perceptual-motor skills, and mental focus rather than relying on physical training alone. These findings provide evidence-based guidance for coaches to design comprehensive programs that address both biomechanical and psychological demands, particularly under competitive pressure. Future research should explore integrated interventions across different ages, skill levels, and competitive contexts to further enhance understanding of free-throw determinants.

References

- Akbar, A., Karim, Z. A., Syafitri, F. U., & Cahyani, F. I. (2025). Sports Psychology Perspectives on Cognitive Aspects in Shaping the Pathways of Young Football Players in Indonesia and Malaysia. *Retos*, 66, 1194–1205.
- Akbar, S., Soh, K. G., Nasiruddin, N. J. M., Bashir, M., Cao, S., & Soh, K. L. (2022). Effects Of Neuromuscular Training On Athletes Physical Fitness In Sports : A Systematic Review. *Frontiers in Psychology*, 13(September), 1–13. <https://doi.org/10.3389/fpsyg.2022.939042>
- Aksoy, Y., Serbest, K., Dereshgi, H. A., Aksoy, Y. O., Savas, D. D. E., & Gose, E. (2023). The Leadership Puzzle : Unveiling the Impact of Leader Behaviors on Basketball Players Performance through Breakthrough EMG and EEG Measurements. *Research Square*, 1–40.
- Alemanno, M., Pompeo, I. Di, Marcaccio, M., Canini, D., Curcio, G., & Migliore, S. (2025). From Gaze to Game : A Systematic Review of Eye-Tracking Applications in Basketball. *Brain Science*, 15(421), 1– 26.
- Alimuddin, Khairunnisa, A., Dinata, W. W., Rifki, M. S., Komaini, A., Igoresky, A., Liza, Asman, A., Nazri, S. B. M., & Wahyudin. (2024). Enhancing Free Throw Basketball Shooting Ability In Female Basketball Players Through Imagery And Concentration Exercises. *Journal of Physical Education and Sport* @, 24(6), 1426–1433. <https://doi.org/10.7752/jpes.2024.06161>
- Anbalagan, P., & Sivasanthosh, S. (2025). Enhancing Clutch Performance In Basketball : The Effect Of PETTLEP Based Imagery On Free Throw Accuracy Under Pressure. *International Journal of Physical Education, Sports and Health*, 12(4), 278–281.
- Andriani, F. M., Rasyid, W., Neldi, H., & Refki, M. S. (2023). The Influence of Arm Muscle Strength, Hand Eye Coordination and Concentration on the Free Throw Ability of Binuang Sakti Basketball Athletes in Sijunjung Regency. *Literacy: International Scientific Journala of Social, Education, and Humaniora*, 2(1), 1–9.
- Bayu, W. I., Solahuddin, S., Mohamad, N. I., Nanda, F. A., & Yusfi, H. (2025). Personalised BEEF Shooting Training For Female Basketball Players : Enhancing Accuracy And Consistency. *Journal Sport Area*, 10(1), 148–155.

- Beatty, G. F., & Janelle, C. M. (2019). Emotion regulation and motor performance : an integrated review and proposal of the Temporal Influence Model of Emotion Regulation (TIMER). *International Review of Sport and Exercise Psychology*, 9858, 1–32. <https://doi.org/10.1080/1750984X.2019.1695140>
- Bohloul, A., Shahbazi, M., Broujeni, S. T., & Moghadas, Y. (2025). Decision making and visual perception in soccer players under pressure. *Sport Sciences and Health Research*, 17(1), 107–119.
- Bosco, A., Diez, P. S., Filippini, M., & Fattori, P. (2023). The Influence Of Action On Perception Spans Di Erent E Ectors. *Frontiers in Systems Neuroscience*, 17(May), 1–16.
- Cabarkapa, D., Fry, A. C., Cabarkapa, D. V, Myers, C. A., Jones, G. T., Philipp, N. M., Yu, D., & Deane, M. A. (2022). Differences in Biomechanical Characteristics between Made and Missed Jump Shots in Male Basketball Players. *Biomechanics*, 2, 352–360.
- Cheng, M., Yu, C., An, X., Wang, L., Tsai, C., Qi, F., & Wang, K. (2024). Evaluating EEG Neurofeedback In Sport Psychology : A Systematic Review Of RCT Studies For Insights Into Mechanisms And Performance Improvement. *Frontiers in Psychology*, 15(July), 1–16. <https://doi.org/10.3389/fpsyg.2024.1331997>
- Ellis, L., & Ward, P. (2022). The effect of a high-pressure protocol on penalty shooting performance , psychological , and psychophysiological response in professional football : A mixed methods study. *Journal of Sports Science*, 40(1), 3–15. <https://doi.org/10.1080/02640414.2021.1957344>
- Fernandez-Fernandez, J., Granacher, U., Martinez-Martin, I., Garcia-Tormo, V., Herrero-Molleda, A., Barbado, D., & Garcia-Lopez, J. (2022). Physical Fitness And Throwing Speed In U13 Versus U15 Male Handball Players. *BMC Sports Science, Medicine and Rehabilitation*, 14(113), 1–13.
- Fonseca, C. S. V., & Bonilla, J. A. M. (2025). Application of offensive basketball technical fundamentals in motor coordination. *Mentor*, 4(10), 58–80.
- Gao, D., Hu, B., Yuan, T., Guo, Q., Wei, P., Wu, Y., & Chen, C. (2025). Exploring The Relationship Between Motor Visual Proficiency And Performance Metrics In Elite Skeet Shooters : An In-Depth Analysis. *PLoS ONE*, 20(6), 1–16. <https://doi.org/10.1371/journal.pone.0325351>
- Gokeler, A., Neuhaus, D., Benjaminse, A., Grooms, D. R., & Baumeister, J. (2019). Principles of Motor Learning to Support Neuroplasticity After ACL Injury : Implications for Optimizing Performance and Reducing Risk of Second ACL Injury. *Sports Medicine*, 49, 853–865.
- Goldschmied, N., Raphaeli, M., Moothart, S., & Furley, P. (2021). Free Throw Shooting Performance Under Pressure : A Social Psychology Critical Review Of Research. *International Journal of Sport and Exercise Psychology*, 0(0), 1–19. <https://doi.org/10.1080/1612197X.2021.1979073>
- Guo, Y., Yuan, T., Peng, J., Deng, L., & Chen, C. (2024). Impact Of Sports Vision Training On Visuomotor Skills And Shooting Performance In Elite Skeet Shooters. *Frontiers in Human Neuroscience*, 18(November), 1–13. <https://doi.org/10.3389/fnhum.2024.1476649>
- Gutiérrez-Capote, A., Madinabeitia, I., Torre, E., Alarcón, F., Jiménez-Martínez, J., & Cárdenas, D. (2023). Changes in Perceived Mental Load and Motor Performance during Practice-to-Learn and Practice-to-Maintain in Basketball. *International Journal of Environmental Research and Public Health*, 20(4664), 1–20.
- Henjilito, R., Yani, A., Setiawan, B. A., & Pardilla, H. (2025). Reliability Assessment of Physical Education Students ' Discus Throwing Competencies: A Cross-sectional Study. *International Journal of Human Movement and Sports Sciences*, 13(1), 243–253. <https://doi.org/10.13189/saj.2025.130126>
- Hessam, M., Fathalipour, K., Behdarvandan, A., & Goharpey, S. (2023). The Effect of McGill Core Stability Training on Movement Patterns , Shooting Accuracy , and Throwing Performance in Male Basketball Players : A Randomized Controlled Trial. *Journal of Sport Rehabilitation*, 32, 296–304.
- Li, F., Dukari, V., Ocic, M., Li, Z., & Knjaz, D. (2024). Influence of Fatigue and Defensive Pressure on Three-Point Jump-Shot Kinematics in Basketball. *Applied Sciences*, 14(9582), 1–11.
- Li, Y., Ren, Y., Du, Z., Li, M., & Jiang, J. (2025). Competitive Pressure , Psychological Resilience, And Coping Strategies In Athletes ' Pre-Competition Anxiety. *Scientific Reports*, 15(35467), 1–14.
- Luo, Y., Cao, Y., Li, S., Shi, Y., & Peng Chen. (2025). Effects Of Physiological Fatigue On Basketball Shooting Performance : The Moderating Role Of Attentional Focus. *Frontiers in Psychology*, 16(September), 1–12. <https://doi.org/10.3389/fpsyg.2025.1593182>
- Matsunaga, N., & Oshikawa, T. (2022). Muscle Synergy During Free Throw Shooting In Basketball Is Di Erent Between Scored And Missed Shots. *Frontiers in Sport Research*, 4(1), 1–7.

- Morgulev, E., Kenett, R. S., Arnon, M., Lidor, R., & Ben-sira, D. (2022). Longitudinal trends in human accuracy : A five-decade analysis (1969–2019) of free-throw shooting in the NBA. *Journal of Sports Analytics*, 8(2022), 211–219. <https://doi.org/10.3233/JSA-200597>
- Munir, A., Rismayanthi, C., Nasrulloh, A., Padli, Prayoga, A. S., Nia, T. A., Zarya, F., & Rahman, D. (2024). The Effect Of Animal Name And Wall Shoot Training On The Accuracy Of Shooting Free Throw In Terms Of Hand Eye Coordination In Beginner Athletes. *Retos*, 56, 538–545.
- Nakano, N., Fukashiro, S., & Yoshioka, S. (2018). The Effect Of Increased Shooting Distance On Energy Flow In Basketball Jump Shot. *Sports Biomechanics*, 3141, 1–17.
- Olteanu, M., Oancea, B. M., & Badau, D. (2023). Improving Effectiveness of Basketball Free Throws through the Implementation of Technologies in the Technical Training Process. *Applied Sciences*, 13(2650), 1–16.
- Ottoboni, G., Nicoletti, R., & Tessari, A. (2021). The Effect of Sport Practice on Enhanced Cognitive Processing of Bodily Indices : A Study on Volleyball Players and Their Ability to Predict Hand Gestures. *International Journal of Environmental Research and Public Health*, 18(5384), 1–14.
- Pocius, E., & Malinauskas, R. (2024). Characteristics Of Mental Toughness In Young Basketball Players Of Different Age Groups. *Human Movement*, 25(2), 128–139.
- Purnomo, A., & Yendrizal. (2020). Effect of Hand-Eye Coordination , Concentration and Believe in the Accuracy of Shooting in Petanque. 1st International Conference of Physical Education (ICPE), 460(Icpe 2019), 90–96.
- Ren, G., Huang, Z., You, S., Lin, W., Huang, T., Wang, G., & Lee, J. E. E. H. (2025). Enhancing Motor Skills and Coordination With Visual-Haptic Feedback in Ball Sport Training. *IEEE Access*, 13(February), 49214–49231.
- Silva, F. M. da, Sousa, P. M., Pinheiro, V. B., López-Torres, O., Roman, I. R., & Mon-López, D. (2021). Which Are the Most Determinant Psychological Factors in Olympic Shooting Performance ? A Self-Perspective from Elite Shooters. *International Journal of Environmental Research and Public Health*, 18(4637), 1–13.
- Sirnik, M., Erčulj, F., & Rošker, J. (2022). Research Of Visual Attention In Basketball Shooting : A Systematic Review With Meta-Analysis. *International Journal of Sports Science & Coaching*, 17(5), 1195–1210. <https://doi.org/10.1177/17479541221075740>
- Smajla, D., Kozinc, Ž., & Šarabon, N. (2020). Elbow Extensors and Volar Flexors Strength Capacity and Its Relation to Shooting Performance in Basketball Players – A Pilot Study. *Applied Sciences*, 10(8206), 1–12.
- Spancken, S., Steingrebe, H., & Stein, T. (2021). Factors That Influence Performance In Olympic Air-Rifle And Small-Bore Shooting : A Systematic Review. *PLoS ONE*, 16(3), 1–24. <https://doi.org/10.1371/journal.pone.0247353>
- Tan, S., & Teoh, T. T. (2024). Predicting Shot Accuracy in Badminton Using Quiet Eye Metrics and Neural Networks. *Applied Sciences*, 14(9906).
- Terbalyan, A., Skotniczny, K., Krzysztofik, M., Chycki, J., Kasparov, V., & Roczniok, R. (2025). Effect of Post-Activation Performance Enhancement in Combat Sports : A Systematic Review and Meta-Analysis-Part I : General Performance Indicators. *Journal of Functional Morphology and Kinesiology*, 10(88), 1–24.
- Tirta, V., Imron, B., & Wijaya, E. B. (2024). Pengaruh Latihan Lateral Barrier Hop Terhadap Kecepatan Tendangan pada Atlet Pencak Silat usia 11-15 tahun di PSHT Cabang Jakarta Selatan Tahun 2024. *Jurnal Sains Student Research*, 2(5), 472–478.
- Uludağ, S., Dorak, F., Vurgun, N., Yüzbaşıoğlu, Y., & Ateş, E. (2021). Effects Of 10 Weeks Of Imagery And Concentration Training On Visual Focus And Free-Throw Performance In Basketball Players. *Journal of Physical Education and Sport*, 21(June), 1761–1768. <https://doi.org/10.7752/jpes.2021.04223>
- Vine, S. J., Moore, L. J., & Wilson, M. R. (2016). An Integrative Framework of Stress , Attention , and Visuomotor Performance. *Frontiers in Psychology*, 7(November), 1–10. <https://doi.org/10.3389/fpsyg.2016.01671>
- Wanena, T. (2018). Kontribusi power otot tungkai, kekuatan otot lengan, dan koordinasi mata tangan dengan kemampuan jump shot bolabasket pada mahasiswa FIK Uncen Tahun 2017 Tery. *Journal Power of Sports*, 1(2), 8–13.

- Wang, S., Jiang, X., Chen, Z., Xing, X., Zhang, X., & Che, T. (2025). The Effect Of Complex Training And Ballistic Exercise On The Time-Course Adaptations Of Lower Extremity Explosive Strength In Elite Female Field Hockey Players. *Frontiers in Public Health*, 13(October), 1–11. <https://doi.org/10.3389/fpubh.2025.1676079>
- Wang, Y., Sun, D., Wang, D., Chen, D., Li, F., Zhou, Z., Cen, X., Cen, X., Song, Y., Janicijevic, D., & Gu, Y. (2025). Skill-Level Dependent Lower Limb Muscle Synergy Patterns During Open-Stance Forehand Strokes in Competitive Tennis Players. *Applied Sciences*, 15(4831), 1–13.
- Yan, W., Jiang, X., & Liu, P. (2023). A Review of Basketball Shooting Analysis Based on Artificial Intelligence. *IEEE Access*, 11(August), 87344–87365.
- Yang, L., & Wang, Y. (2023). The Effect Of Motivational And Instructional Self-Talk On Attentional Control Under Noise Distraction. *PLoS ONE*, 18(9), 1–16.
- Yu, X., Yang, Y., & He, B. (2024). The Effect Of Athletes ' Training Satisfaction On Competitive State Anxiety-A Chain-Mediated Effect Based On Psychological Resilience And Coping Strategies. *Frontiers in Psychology*, 15(1409757), 1–11.
- Zaj, T., Mikołajec, K., Chmura, P., Konefał, M., Krzysztofik, M., & Makar, P. (2023). Long-Term Trends in Shooting Performance in the NBA: An Analysis of Two- and Three-Point Shooting across 40 Consecutive Seasons. *International Journal of Environmental Research and Public Health*, 20(1924), 1–12.
- Zhen, Z., Rittisom, S., & Kanchanataweekul, T. (2023). Effect of Imagery Training on College Students ' Basketball Shooting Accuracy. *International Journal of Sociologies and Anthropologies Science Reviews (IJSASR)*, 3(6), 413–424.