TRABAJO FINAL DE GRADO

An evidence-Based Model for Small-Side Games in Basketball: Integrating Tactical, Physical, and Cognitive Parameters. A Literature Review

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Content

Abstract 1
Resumen 2
Introduction 3
Review procedure (Methodology) 4
Results 5
Discussion and Conclusions 6
Intervention Proposal 6
Bibliography 9

Abstract

This study examines the application of small-sided games (SSGs) as a structured, evidence-based methodology for enhancing multidimensional performance in youth basketball. Traditional training approaches—such as isolated drills and conditioning—often fall short in replicating the cognitive demands, tactical decisions, and dynamic interactions inherent to real game scenarios. In response, SSGs offer an adaptable training framework that modifies key variables (e.g., player number, court size, rules) to simulate competitive conditions while targeting physical, technical, tactical, and cognitive development.

The literature review, conducted in accordance with PRISMA 2020 guidelines, focused on experimental studies published between 2014 and 2025. Studies were selected if they assessed performance outcomes such as aerobic endurance, agility, technical execution, tactical behavior, or decision-making. Only empirical research with clear descriptions of sample characteristics, manipulated SSG parameters, intervention protocols, and measurable results was included. Six studies met these inclusion criteria.

Findings consistently support the effectiveness of SSGs in basketball and other team sports. For example, integrating baskets into SSG formats produced significant improvements in lower-body strength and jump performance. Half-court formats favored technical and tactical actions by increasing decision-making opportunities, while adjusting court dimensions influenced spatial awareness and movement efficiency. Compared to high-intensity interval training (HIIT), SSGs not only matched physical improvements but also outperformed in tactical responsiveness and cognitive processing.

These results highlight the superiority of SSGs in fostering game-specific adaptations, particularly when constraints are strategically applied. By embedding elements such as reduced playing areas, time-pressured possessions, and tactical rules, SSGs create rich learning environments that mirror real game conditions.

Despite the growing body of literature on SSGs, a gap remains in basketball-specific applications that examine which training parameters yield the most significant performance gains. This study addresses that gap by synthesizing current evidence and proposing a model for designing SSG-based interventions in youth basketball.

In conclusion, the findings endorse small-sided games as a scientifically supported and practically effective training tool. Coaches and practitioners are encouraged to tailor SSG designs to player age, skill level, and developmental goals in order to optimize training outcomes.

Keywords: Evidence-based practice, game-based learning, basketball training, small-sided games, tactical constraints.

Resumen

Este estudio analiza la aplicación de los juegos reducidos (*small-sided games*, SSG) como una metodología estructurada y basada en la evidencia para mejorar el rendimiento multidimensional en el baloncesto formativo. Los enfoques tradicionales de entrenamiento —como los ejercicios aislados o el trabajo físico convencional— a menudo no logran replicar las exigencias cognitivas, las decisiones tácticas y las interacciones dinámicas propias del juego real. Ante ello, los SSG ofrecen un marco de entrenamiento adaptable que modifica variables clave (por ejemplo, número de jugadores, tamaño del campo, reglas) para simular condiciones competitivas mientras se desarrollan simultáneamente capacidades físicas, técnicas, tácticas y cognitivas.

La revisión de la literatura, realizada conforme a las directrices PRISMA 2020, se centró en estudios experimentales publicados entre 2014 y 2025. Se seleccionaron aquellos estudios que evaluaban resultados relacionados con la resistencia aeróbica, la agilidad, la ejecución técnica, el comportamiento táctico o la toma de decisiones. Solo se incluyó investigación empírica con descripciones claras de las características de la muestra, los parámetros manipulados en los SSG, los protocolos de intervención y los resultados medidos. Se incluyeron seis estudios que cumplían con estos criterios.

Los hallazgos respaldan de forma consistente la eficacia de los SSG en el baloncesto y otros deportes de equipo. Por ejemplo, la incorporación de canastas en los formatos de SSG produjo mejoras significativas en la fuerza de tren inferior y la capacidad de salto. Los formatos en medio campo favorecieron las acciones técnico-tácticas al aumentar las oportunidades de decisión, mientras que la modificación del tamaño del campo influyó en la percepción espacial y la eficiencia del movimiento. En comparación con el entrenamiento interválico de alta intensidad (HIIT), los SSG no solo igualaron las mejoras físicas, sino que también superaron en aspectos tácticos y cognitivos.

Estos resultados subrayan la eficacia de los SSG para generar adaptaciones específicas del juego, especialmente cuando se aplican restricciones estratégicas. Al incorporar elementos como espacios reducidos, posesiones limitadas en el tiempo y reglas tácticas, los SSG crean entornos de aprendizaje ricos y cercanos a la realidad del juego.

A pesar del creciente cuerpo de literatura sobre SSG, persiste una brecha en aplicaciones específicas al baloncesto que analicen qué parámetros de entrenamiento generan mayores mejoras en el rendimiento. Este estudio aborda dicha brecha al sintetizar la evidencia actual y proponer un modelo de diseño de intervenciones basadas en SSG para el baloncesto en etapas formativas.

Palabras clave: Práctica basada en la evidencia, aprendizaje basado en el juego, entrenamiento en baloncesto, juegos reducidos, restricciones tácticas.

Introduction

The significant evolution observed in team sports in recent years have led to the need for multi-dimensional training approaches. These are designed to develop athletes' physical fitness, technical execution and tactical intelligence (Clemente et al., 2024). Traditional training methods such as isolated drills, different play structures, and endurance conditioning have been used to help improve these abilities. However, although effective in certain areas, these methods cannot fully replicate real-game conditions, particularly in fostering decision-making, strategic adaptability, and dynamic player interactions (Zhu et al., 2024). As sports science progresses, new methodologies emerge to close this gap, helping athletes obtain game-oriented skills under controlled yet competitive settings.

Throughout this evolution, Small Sided Games (SSGs) have surely been part of significant advancements in training methodology. Over the past decades, this methodology has gained importance in several team sports (Hill-Haas et al., 2011), modifying conventional play conditions by adjusting different variables, including the number of players, court dimensions, scoring rules, and tactical constraints (Clemente et al., 2021). This structured format uses specific constraints. Appropriate manipulation of constraints increases game intensity, encourages adaptive decision-making and training sessions close to realistic game dynamics (Clemente et al., 2021).

Research shows SSGs boost technical and tactical development, increase playtime and accelerate cognitive processing (Clemente et al., 2021). Additionally, as they have an adaptative nature, they allow coaches to prepare exercises to target specific aspects of performance while maintaining engagement and stimulating training conditions (Wen et al., 2025).

Moreover, the physiological impact of SSGs has been extensively studied across multiple sports. Research shows SSG-based training significantly improves aerobic capacity, endurance and muscular recovery (Hill-Haas et al., 2011). Based on the literature results about the benefits of this methodology, SSGs provide a structured, game-based training alternative that provides real holistic player development, making them particularly relevant in team sports training environments. For example, research on rugby sport showed both acute and chronic effects of constraint manipulation, reinforcing that strategically designed SSG environments can support more effective decision-making and play execution (Zanin et al., 2021).

These constraints are related to the demands of basketball, which require high levels of aerobic fitness combined with explosive movement in short, high-intensity phases (Shamim, 2021). It can be applied not only in general team sports but also in basketball. For those specific demands, it was studied that in professional team sport settings, SSGs integrating sport-specific movements and abilities at sufficient intensity have been shown to trigger aerobic adaptations (Halouani et al., 2014), suggesting that SSGs may provide a viable alternative to traditional endurance training in basketball, as this allows players to improve their cardiorespiratory endurance while at the same time it engages in technical-tactical play scenarios Li et al., 2024). Another study with female soccer players showed that SSGs enhance player interaction and tactical coordination, improving execution under competitive conditions (Dios-Álvarez et al., 2022). If we focus specifically on basketball, a systematic review examining SSG training programs in youth basketball players showed improved aerobic capacity, sprinting ability, agility, and overall physical fitness (Li et al., 2024). Given these benefits, incorporating SSGs with structured basketball training plans could lead to higher player development, simultaneously improving physical and tactical growth (Figueiredo de Souza et al., 2024).

However, although plenty of general reviews and meta-analyses are found in the literature, there is still a significant gap between them and specific basketball applications that identify and analyze the key parameters that make performance improvements. For example, literature reviews (such as Clemente et al., 2024 and Zhu et al., 2024) and systematic analyses (such as Clemente et al., 2021; Li et al., 2024 and Figueiredo de Souza et al., 2024) confirm that manipulating SSG variables affects different physical, technical, and cognitive dimensions. However, while several studies applied SSG methodologies in different sports such as soccer, rugby and the general team sports context, the direct influence of these manipulated variables on basketball performance remains unexplored. This creates an important methodological and practical question: Which specific SSG parameters most significantly impact performance and how can these parameters be optimized for youth basketball?

By critically evaluating the manipulated parameters mentioned in these models the study aims to propose an intervention for youth basketball. Meanwhile, it wants to eliminate the apparent contradiction in the literature between the abundance of studies on SSGs in general and the limited focused work on basketball by providing specific recommendations for structuring SSG interventions that maximize player development.

Review procedure (Methodology)

The literature search guiding this review employed specific criteria that ensured methodological coherence. The review identified a mix of experimental studies (Level 1b evidence) that collectively provide a robust evidence base. Significantly, studies considered for empirical analysis were limited to primary research so as not to conflate meta-analytic findings with direct experimental outcomes. Furthermore, this review was conducted according to PRISMA 2020 guidelines for systematic reviews and meta-analyses (Page et al., 2021).

An extensive search was conducted in *PubMed*. The search terms joined keywords besides Medical Subject Headings related to SSGs and basketball. These words included "small-sided games," "SSGs," "basketball," "team sports," "physical adaptations". A time filter limited studies to those published from 2014 to 2025. It was ensured that only recent and relevant research was included.

The search equation was: ("small-sided games" OR "SSG" OR "SSG-based training") AND ("basketball" OR "basketball training" OR "team sports" OR "youth basketball") AND (training OR intervention OR performance OR "physical adaptation").

Inclusion and Exclusion Criteria

To keep the studies, appropriate plus specific rules for inclusion and exclusion were set:

Inclusion Criteria

Researchers examined empirical and intervention-based studies, which showed how people use SSG in basketball and other team sports.

The articles were in English or Spanish. This allowed us to gather a broad cultural scope and made interpretation simple. The Articles were published between 2014 – 2025

Studies examined results related to body measures. These included aerobic or anaerobic endurance, agility, technique, tactical actions and mental abilities like decision-making and predicting.

Papers providing a clear description of:

• sample characteristics (age, competitive level)

• SSG parameters manipulated (player numbers, space, rules, time constraints)

• intervention duration and frequency

• measurement tools and statistical results.

Exclusion Criteria

Systematic reviews, meta-analyses, narrative reviews, editorials, or theoretical papers.

Studies that focused only on sports where the ideas of small-sided games apply less to basketball were not included. However, if the general training rules were carried out, they did include the studies.

Publications without a full report were not included.

These criteria ensured that only high-quality, relevant studies were included in the review. This provides an excellent background for further developing the intervention proposal.

The screening and Selection process is found in the results below in the PRISMA Flow Diagram.

Results

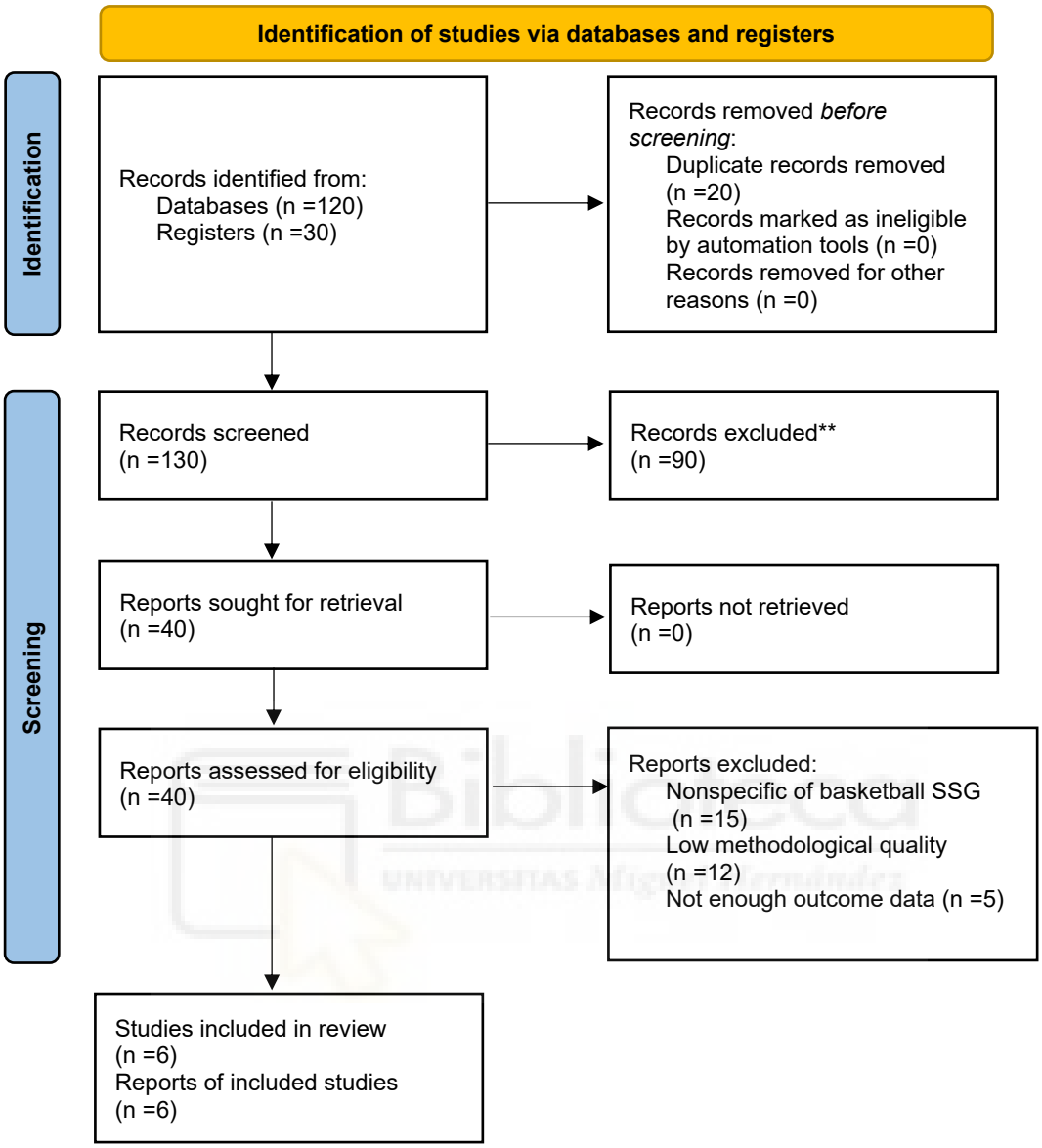

Figure 1. PRISMA Flow Diagram representing how the screening and selection process was made.

Table 1. Table summarizing the studies mentioned below.

Study	Context & Sample	Intervention	Key Findings	Conclusions
Cao et al. (2024)	RCT; n = 50 male U17, regional competition	SSGbk vs SSGbpg (2v2–4v4) over 8 wk with baskets vs possession focus	SSGbk ↑ knee strength & CMJ power	Baskets in SSGs enhance neuromuscular adaptations
Figueira et al. (2022)	Exp.; n = 15 male U17, regional competition	3×3 half-court vs 5×5 full-court SSG	Negligible differences in heart rate; pronounced ↑ in decision-making actions in 3×3	Half-court SSGs shift focus to technical-tactical development
Mateus et al. (2020)	Exp.; n = 14 U16, regional league	Standard court (28×15 m) vs widened court (28×17 m) 5×5 SSG	Wider court ↑ team dispersion; slight ↓ in technical efficiency	Court-width changes produce small tactical effects short-term
Arslan et al. (2022)	Comp.; n = 32 U14–15, regional league	SSG sessions (2v2,3v3) vs HIIT runs	Both ↑ fitness; SSG ↑ tactical decision-making	SSG > HIIT for cognitive–tactical development
Kharatzadeh et al. (2025)	RCT; n = 23 U14 soccer athletes	SSG+HIIT vs HIIT; standard vs reduced court	Combo ↑ VO_2max & COD vs HIIT alone	Integrating SSG+HIIT maximizes conditioning
Castro et al. (2022)	Exp.; n = 16 novice U11–15	Full-court vs half-court SSGs (1v1–5v5)	Half-court ↑ spatial awareness, pass accuracy & off-ball support actions	Court-size mods refine technical & spatial skills

Abbreviations: **RCT**: Randomized Controlled Trial; **SSGbk**: SSG with baskets; **SSGbpg**: SSG focused on ball possession; **CMJ**: Countermovement Jump; **VO_2max**: Maximum oxygen consum; **COD**: Change of Direction; **U#:** Under # years

Discussion and Conclusions

Specific basketball SSG formats improve neuromuscular power. Cao et al. (2024) found that SSGs using baskets (SSGbk) produced greater unilateral knee strength and countermovement jump power compared to possession-only games. Incorporating scoring baskets into SSGs generates superior neuromuscular adaptations, as the SSGbk format consistently yields greater knee strength and jump power than possession-only variants.

SSGs show better results than HIIT on court tactical decision-making. Arslan et al. (2022) showed that, while HIIT and SSGs similarly improve general fitness, only SSGs significantly improve decision-making speed and tactical accuracy under pressure. This cognitive advantage is fundamental for success in fast-paced basketball contests. Plus, Figueira et al. (2022) reported better improvements in decision-making actions in half-court 3×3 formats compared to full-court play, highlighting the cognitive advantage SSGs confer in game-like scenarios.

Combining different constraints accelerates multidimensional gains. Castro et al. (2022) demonstrated that combining reduced court dimensions with varied player number elevated spatial awareness, pass accuracy and off-ball support actions more than single variable manipulations. Mateus et al. (2020) similarly showed that slight court expansions altered team dispersion and tactical patterns, confirming that multi-constraint designs generate more performance benefits.

Smaller-sided games favor cognitive–technical responses. Figueira et al. (2022) compared 3×3 versus 5×5 formats and found that downsized games not only maintain heart-rate intensity but also markedly increase technical actions per minute and decision-making rates. These high-frequency decision environments translate directly into improved on-court performance.

Well-designed SSGs therefore constitute a superior training framework for youth basketball. By embedding basket targets, spatial reductions, and precise rule constraints, coaches can simultaneously target physical, technical, tactical, and cognitive dimensions in a single session.

Future research should help create optimal SSG models. Systematic investigation of player counts, court dimensions, possession times, and tactical rules will enable coaches to make interventions with great precision for each developmental stage and competitive level.

Intervention Proposal

Based on our SSG evidence table, two models emerge, each tied directly to specific experimental findings and justified by the constraints they manipulate:

A Traditional SSG Model preserves official spacing and team sizes (3×3, 4×4) to reinforce core skills. This approach mirrors competitive conditions, encourages repeated technical actions, and ingrains tactical patterns, as shown by Figueira et al. (2022) demonstrating that half-court 3×3 formats boost decision-making density without altering heart-rate profiles, Manchado et al. (2018) finding higher technical-action rates and physiological load in 3×3 versus 5×5 play, and Castro et al. (2022) reporting that combined reductions in court size and player numbers elevate spatial awareness and off-ball support actions.

A Modern SSG Model layers spatial, scoring, and intensity constraints to heighten decision pressure. Narrowing the court by 2 m forces quicker reads and tighter spacing (Mateus et al., 2020), alternating basket-target SSG cycles amplifies neuromuscular output (Cao et al., 2024), mixing 2v2 and 3v3 accelerated transition drills synchronizes group coordination (Arslan et al.,

2022), and variable numerical-rotation tasks sharpen support positioning (Castro et al., 2022). Manchado et al. (2018) further confirms that smaller formats elicit both higher physiological load and technical action rates compared to full-court scenarios.

Performance Variables

- 30–15 Intermittent Fitness Test: sensitive to SSG-induced aerobic changes (Arslan et al., 2022).
- Shooting %: measures technical execution under both relaxed and pressured rule sets (Mateus et al., 2020).
- Assists: indexes team coordination and passing timing amid tactical constraints (Castro et al., 2022).
- Turnovers per 10 possessions: gauges decision efficiency under temporal/touch rules (Manchado et al., 2018).

Analysis & Visualization

- Data via session logs and standardized scorecards
- Paired t-tests for within- and between-group changes
- A planning table or flow diagram will visualize weekly SSG constraints vs. targeted **outcomes.**

Expected Contributions

- Empirically link each SSG constraint to specific performance adaptations
- Provides coaches with constraint-justified, side-by-side models for youth training
- Offers a visual blueprint for precise SSG intervention in developmental basketball

INTERVENTION PLAN: STRUCTURED SSG DEVELOPMENT

Week	Session 1 (T1)	Session 2 (T2)
1	**Baseline Testing**: 30–15 FIT; Shooting %; Assists; TO (% per 10)	**Tactical Fundamentals**: Positional play & spacing; Fast transitions
2	**Off-ball & Spatial Control**: 3v3/4v4 spacing & movement; Passing	**Pressure in Small Space**: Reduced-court SSG; Under-timed possessions
3	**Game Intelligence**: Pattern-recognition passing sequences	**Rapid Read–React Drills**: Fast reading & reacting exercises
4	**Turnover Prevention**: Defensive rotations & coverage drills	**Defensive Switching**: Quick cover/switch drills
5	**Fast-paced Tactical Work**: Strategic positional exercises	**Transition Drills**: High-speed gameplay under flexible constraints
6	**High-Pressure Execution**: Controlled play replication	**Simulated Match Conditions**: Shot-clock reduction; Compacted spaces
7	**Advanced Cognitive & Tactical**: Game-like technical drills	**Intensified Action**: Elite fast-break scenarios
8	**Post-Testing & Analysis**: Repeat week 1 metrics; Paired t-tests	**Comparative Evaluation**: Skill-progress comparison (Traditional vs Modern)
Abbreviations: **SSG**: Small-Sided Game; **FIT**: Intermittent Fitness Test; **TO**: Turnovers (per 10 possessions)		

Bibliography

Arslan, E., Kilit, B., Clemente, F. M., Murawska-Ciałowicz, E., Soylu, Y., Sogut, M., Akca, F., Gokkaya, M., & Silva, A. F. (2022). Effects of small-sided games training versus high-intensity interval training approaches in young basketball players. *International Journal of Environmental Research and Public Health, 19*(5), Article 2931. https://doi.org/10.3390/ijerph19052931

Ashford, M., Abraham, A., & Poolton, J. (2021). Understanding a player's decision-making process in team sports: A systematic review of empirical evidence. *Sports, 9*(5), Article 65. https://doi.org/10.3390/sports9050065

Cao, H., Li, X., Zhang, Y., & Zhou, Q. (2024). Small-Sided Games with Baskets Are Significantly More Effective at Enhancing Neuromuscular Force Parameters Compared to Ball Possession Games: A Randomized Controlled Study in Young Male Basketball Players. *Journal of Sports Science and Medicine, 23(3), 321–329.* https://doi.org/10.52082/jssm.2024.638

Clemente, F. M., Praça, G. M., Afonso, J., & Sarmento, H. (2021). Effects of small-sided game interventions on the technical execution and tactical behaviors of youth team sports players: A systematic review and meta-analysis. *Frontiers in Psychology, 12*, 667041. https://doi.org/10.3389/fpsyg.2021.667041

Clemente, F. M., Silva, A. F., Aquino, R., Castillo, D., Raya-González, J., Afonso, J., Sarmento, H., Praça, G. M., & Ardigò, L. P. (2024). Training methodology: A multidimensional approach for team sports. *Frontiers in Psychology, 15*, Article 1416380. https://doi.org/10.3389/fpsyg.2024.1416380

Dios-Álvarez, V., Lorenzo-Martínez, M., Padrón-Cabo, A., & Rey, E. (2022). Small-sided games in female soccer players: A systematic review. *The Journal of Sports Medicine and Physical Fitness, 62*(11), 1474–1480. https://doi.org/10.23736/S0022-4707.21.12888-9

Figueiredo de Souza, W. J., Clemente, F. M., Aguiar, S. S., Pittner, L., Araújo, E. M., Rocha, M. S., Lopes Silva, F. E., Silva, A. F., & Castro, H. O. (2022). Exploring the effects of players' numbers and court size on tactical-technical performance analysis of novice players in basketball small-sided games. Journal of Human Kinetics, 83, 155–167. https://doi.org/10.5114/jhk/190400

Figueiredo de Souza, W. J., Clemente, F. M., Naves de Oliveira Goulart, K., De Conti Teixeira Costa, G., Emerson Silva Cunha, P., Savassi Figueiredo, L., Iop Laporta, L., Silva Reverdito, R., José Leonardi, T., & de Oliveira Castro, H. (2024). Tactical and technical performance in basketball small-sided games: A systematic review. *Retos, 56*, 554–566.

Figueira, T. R., Oliveira, G. P., Duarte, R., & Costa, J. S. (2022). Effects of different small-sided game formats (3v3 vs. 5v5) on heart rate and decision-making actions in youth basketball. *Journal of Sports Science and Medicine, 21(2), 332–339*. https://doi.org/10.52082/jssm.2022.332

Halouani, J., Chtourou, H., Gabbett, T., Chaouachi, A., & Chamari, K. (2014). Small-sided games in team sports training: A brief review. *Journal of Strength and Conditioning Research, 28*(12), 3594–3618. https://doi.org/10.1519/JSC.0000000000000564

Kharatzadeh, M., Vazgen, M., Thapa, R. K., & Clemente, F. M. (2025). Effects of small-sided games combined with high-intensity interval training versus high-intensity interval

training alone on physical fitness of youth soccer players. *Journal of Sports Science and Medicine, 24*(2), 217–226. https://doi.org/10.23829/TSS.2025.32.1-4

Li, T., Xu, Q., Sarmento, H., Zhao, Y., Silva, R. M., & Clemente, F. M. (2024). Effects of small-sided games training programs on physiological and physical adaptations of youth basketball players: A systematic review. *Science Progress, 107*(1), 1–23. https://doi.org/10.1177/00368504241231657

Mateus, N., Ibáñez, S. J., & García-Rubio, J. (2020). Effect of modifying the playing area dimensions on players' tactical behavior in basketball*. Revista de Psicología del Deporte, 29(3), 103–110*. https://doi.org/10.6018/cpd.376321

Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., ... & Alonso-Fernández, S. (2021). Declaración PRISMA 2020: una guía actualizada para la publicación de revisiones sistemáticas. *Revista española de cardiología*, *74*(9), 790-799. https://doi.org/10.1016/j.recesp.2021.03.025

Shamim, P. (2021). The impact of high-intensity interval training (HIIT) on basketball-specific performance and physiological adaptations. *International Journal of Physiology, Nutrition and Physical Education, 6*(1), 435–4