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Endurance Training in Futsal: A Systematic Review of The Last Two Decades

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Abstract

Futsal is a sport characterized by a high level of technical and tactical complexity. It requires exceptional endurance to maintain technical and tactical execution and quality throughout the match. To this day, coaches continue to seek out and develop effective endurance training methods for futsal. This study aims to synthesize the latest scientific literature from the past two decades regarding endurance training methods or types in futsal. This review follows the PRISMA guidelines. Research data from the Scopus database were included if the study involved endurance training methods or types in futsal, was a peer-reviewed article in English, was a final research publication, and was published between 2005 and 2025. The search yielded 124 studies; after removing duplicates and screening abstracts and full texts, 16 studies were included in this analysis. A qualitative narrative synthesis using a thematic analysis approach was used to integrate and analyze the findings from the included studies. The results identified several methods and types of training used to improve endurance capacity in futsal. These include skill-based training, coordination training, combination training, small-sided games, and generic training. Of these five methods or types of training, it was found that the most commonly used method to improve futsal players' endurance is small-sided games. These methods and types of training have been proven to significantly improve the endurance of futsal players. However, recent research has focused on the principle of specificity in futsal training. Sports practitioners in the field, whether coaches or sports scientists, can prioritize training types specific to futsal.

Keywords: aerobic, anaerobic, endurance, futsal, training method, training program

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Introduction

Futsal is a highly complex team sport. It requires players to execute skillful moves flawlessly under pressure from opponents, thus demanding a high level of physical fitness (González-Fernández et al., 2024; Reinhardt et al., 2020). Skillful actions executed under pressure are performed repeatedly, with quality that must be maintained at the highest level. This creates intermittent high-intensity conditions, demanding very high levels of both anaerobic and aerobic endurance (Barbero-Alvarez et al., 2008). More specifically, physical aspects—one of which is endurance—are considered crucial and are even referred to as a fundamental prerequisite in futsal (Reinhardt et al., 2020). Physical factors are also identified as key determinants of futsal performance (González-Fernández et al., 2024).

During a match, an average of 83% of playing time is spent at at least 85% of maximum heart rate (170 to 190 beats per minute), as a result of high-intensity anaerobic activity (Chiu et al., 2024). To support this, professional futsal players require a VO2max of over 60 ml/kg/min to meet the demands of the game (Bekris et al., 2022). These high physiological demands are also reflected in the players' activity profiles during the match. Time-motion analysis in futsal matches shows that players cover a total distance of 4,000 to 5,000 meters per half, with a much higher proportion of high-intensity activity compared to full-field soccer (Barbero-Alvarez et al., 2008). Furthermore, the narrow field and fast pace of the game cause players to change activity intensity hundreds of times in a single match, making the aerobic energy system's ability to support recovery between sprints crucial (Castagna et al., 2009).

The high demands on endurance in futsal also have a direct impact on the overall quality of play. Research shows that a decline in endurance capacity during a match correlates with a decline in players' technical performance, such as passing accuracy, decision-making speed, and the quality of shots on goal (Fortes et al., 2020). This means that endurance not only plays a role in maintaining players' physical abilities but also supports technical and tactical performance right up until the final minutes of the match. This reinforces the argument that endurance is an integral component of a player's overall readiness.

Taking all these demands into account, it can be asserted that endurance is the primary foundation underpinning a futsal player's success in coping with physical and physiological stress during a match. Good endurance capacity allows players to maintain game intensity, minimize the effects of fatigue, and continue to contribute optimally to the team until the end of the futsal match (Bekris et al., 2022; González-Fernández et al., 2024; Reinhardt et al., 2020). Therefore, a deep understanding of endurance profiles and requirements in futsal is an essential prerequisite for any sports practitioner seeking to develop player performance in a scientific and measurable manner.

In developing futsal players' performance, coaches continue to search for and experiment with effective training models and methods, particularly those aimed at improving players' endurance in futsal (Amani-Shalamzari et al., 2019; Agus et al., 2025). The more effective the training models or methods used, the more they will help coaches develop endurance and, consequently, improve futsal players' performance. However, to date, there has been no recent literature review that comprehensively and in-depth examines the methods, models, and forms of endurance training specifically tailored for futsal. Over the past few decades, there have been only a few literature reviews focused on the sport of futsal that specifically analyzed game conditioning factors, training load, physical, physiological, and mechanical capacities, technical and tactical aspects, and injuries in futsal (Sanmiguel-Rodríguez & Arufe Giráldez, 2021; Gene-Morales et al., 2021). However, studies on endurance training models and methods are crucial as references for coaches looking to develop futsal players. Consequently, there is currently no robust and comprehensive framework or reference available to coaches and practitioners in the futsal community for developing players' endurance.

Given the importance of developing endurance in futsal, it is necessary to conduct a comprehensive study on endurance training methods in futsal within a scientific research framework. This study will examine the endurance training methods used in futsal based on published research findings. It will also explore the characteristics of the endurance training methods used in futsal as reported in the scientific literature.

Methods

Research Design

This study is a systematic review focusing on endurance training methods in futsal over the past 20 years. In line with the study's objectives, a systematic review was employed to comprehensively examine the latest and most reliable research findings regarding endurance training methods in futsal. This review follows the guidelines established by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) (Moher et al., 2009). The search for

research articles was conducted using data from Scopus, and no existing or ongoing reviews addressing this topic were found.

The search was conducted in January 2026, and records were identified through a combination of terms found in the titles, abstracts, and keywords within each database. The search strategy was formulated using the terms "futsal," "endurance," and their synonyms. Specifically, the following terms were used: "futsal" AND "endurance" OR "aerobic" OR "anaerobic," following a procedure similar to that described in the study (Barreira et al., 2025). Boolean operators were applied to optimize the search process. TITLE-ABS-KEY (futsal AND endurance OR aerobic OR anaerobic) AND (LIMIT-TO (DOCTYPE , "ar")) AND (LIMIT-TO (LANGUAGE , "English")) AND (LIMIT-TO (PUBSTAGE , "final")) AND PUBYEAR > 2004 AND PUBYEAR < 2025.

This review follows the PRISMA guidelines. The articles reviewed are those related to exercises designed to improve endurance in the sport of futsal. The review is limited to research articles published in English, with a final scientific publication status, and restricted to studies published between 2005 and 2025. The search yielded 124 articles; after removing duplicates and screening abstracts and full texts, 16 studies were included in this review.

Data Sources

All research articles used in this study were obtained from the Scopus database (Elsevier). This source was selected to ensure the quality of the research data used, as Scopus implements strict quality control and indexing mechanisms. Journal articles are required to meet high standards of publication ethics, citation metrics, and editorial policies. This ensures the quality of published articles, thereby providing the best research data for a comprehensive analysis in this study.

Procedure

The process of screening article sources in this study was conducted systematically to ensure that the data used in this literature review were relevant based on predetermined criteria, in accordance with the objectives of the study. The screening process began with an initial identification of articles relevant to the research topic. Subsequently, the screening process involved evaluating the relevance of the articles based on their abstracts and relevant keywords. Articles that did not meet the inclusion criteria were excluded from further analysis. After this stage, a final selection was made by reviewing the entire content of the articles to ensure alignment with the research focus, particularly those directly related to endurance training methods in the sport of futsal. All these processes were carried out to ensure the accuracy of the data for a comprehensive analysis in this study.

Data Analysis

All research article data collected were compiled into an online Excel spreadsheet for filtering. This spreadsheet was first used to detect duplicates. The dataset was then filtered based on titles and abstracts according to predetermined inclusion and exclusion criteria. The filtered research articles were subsequently selected in detail based on their full text, tailored to the analytical needs and objectives of the study. A common finding was that many studies on endurance in futsal did not detail the training methods used. Consequently, these could not be used in this study, as they did not align with the research objective of comprehensively reviewing endurance training methods in modern-day futsal.

Research articles will be included if they meet the following criteria:

1. Involve endurance training methods in the sport of futsal
2. Published in English
3. Published in an international journal indexed in Scopus in its final form
4. Published between 2005 and 2025

Research articles will not be included if they meet the following criteria:

1. The research was conducted across multiple sports simultaneously
2. The training methods failed to improve either aerobic or anaerobic endurance

A qualitative narrative synthesis using a thematic analysis approach was used to integrate and analyze the findings from the included studies. The extracted data were systematically coded and categorized into distinct themes based on the endurance training methods used in futsal and their respective physiological outcomes. This thematic framework allowed for a comprehensive evaluation of trends, similarities, and differences across the literature.

Quality Assessment

The methodological quality of the included articles was independently evaluated by two reviewers using the PEDro scale, which provides a total score ranging from 0 to 10 (Maher et al., 2003). This scale is a well-validated instrument for assessing physical exercise interventions in sports science, and any discrepancies between the reviewers were resolved through consensus. Following the criteria established by Maher et al. (2003), the quality of the studies was classified into three levels: high (scores 6–10), fair (scores 4–5), and poor (scores <4). To maintain the validity of the review findings, articles were deemed eligible for final inclusion only if they met a minimum threshold score of 4

(fair to high quality), thereby excluding all poor-quality studies.

Results

The results of the search and study selection process are illustrated in the PRISMA flow diagram in **Figure 1**. Of the 124 studies identified in the Scopus database, 16 final research articles were selected for analysis in this study. An initial search of the Scopus database yielded 124 articles based on the keywords used. Six articles were eliminated due to duplication. This left 118 research articles, which were screened based on their titles and abstracts using inclusion and exclusion criteria determined according to the study's objectives. Of these, 52 research articles did not meet the criteria, leaving only 66 research articles eligible for the full-text review process. During the process of obtaining the full-text research articles, 12 articles could not be found or access to their full text was unavailable. Consequently, they had to be excluded from the data to be analyzed. A full-text review was conducted on 54 research articles, and it was found that 33 research articles did not include a complete endurance training program, and 5 research articles had unclear training methods. Consequently, these 38 articles could not be used as data for analysis in this study, as they did not align with the specific objectives of the research. Ultimately, only 16 articles met the criteria and were analyzed in this study.

Table 1 shows the details of the 16 research articles used in this study. Of the 16 studies, the most recent was conducted by Gomes et al. in 2025, while the oldest study used in this research was conducted by Duarte et al. in 2009. From these 16 articles, five training methods or models were identified that are used to improve futsal players' endurance. These include skill-based training (two articles), coordination training (one article), combination training (four articles), small-sided games (eight articles), and generic endurance training (one article).

Discussion

Skill-based Training

Over the past twenty years, two studies have been published that utilized skill-based training in endurance training for futsal. Skill-based training involves using futsal skills as the foundation of the training activities. In the study conducted by Karahan (2012), futsal skills such as dribbling and shooting were used in training to improve endurance. Meanwhile, in the study by Barbieri et al. (2016), more specific futsal skills were used to improve players' endurance. These specific skills relate to player positions, which are divided into goalkeeper, defender, wingers, and forwards/pivots.

In Karahan's (2012) study, the training experiment was divided into four stations. The first station focused on slalom dribbling and sprinting skills; the second and third stations featured two variations of agility drills and goal shooting. The fourth station involved a small-sided game played on a 15×25-meter field with 6 vs. 6 players. At stations one through three, each repetition lasted 20 to 25 seconds. Participants performed 4 to 7 sets progressively over 8 weeks. The rest period between repetitions was 30 seconds. The rest period between sets was 4 minutes in weeks one through four and 5 minutes in weeks six through eight. For the fourth station, the exercise lasted 10 minutes per set. The total exercise duration ranges from 33 to 37 minutes, increasing gradually from the first week to the eighth week. This experiment was conducted over 8 weeks, with 4 training sessions per week. The results of this study found that skill-based maximal intensity interval training has a significant impact on improving aerobic and anaerobic endurance in female futsal athletes.

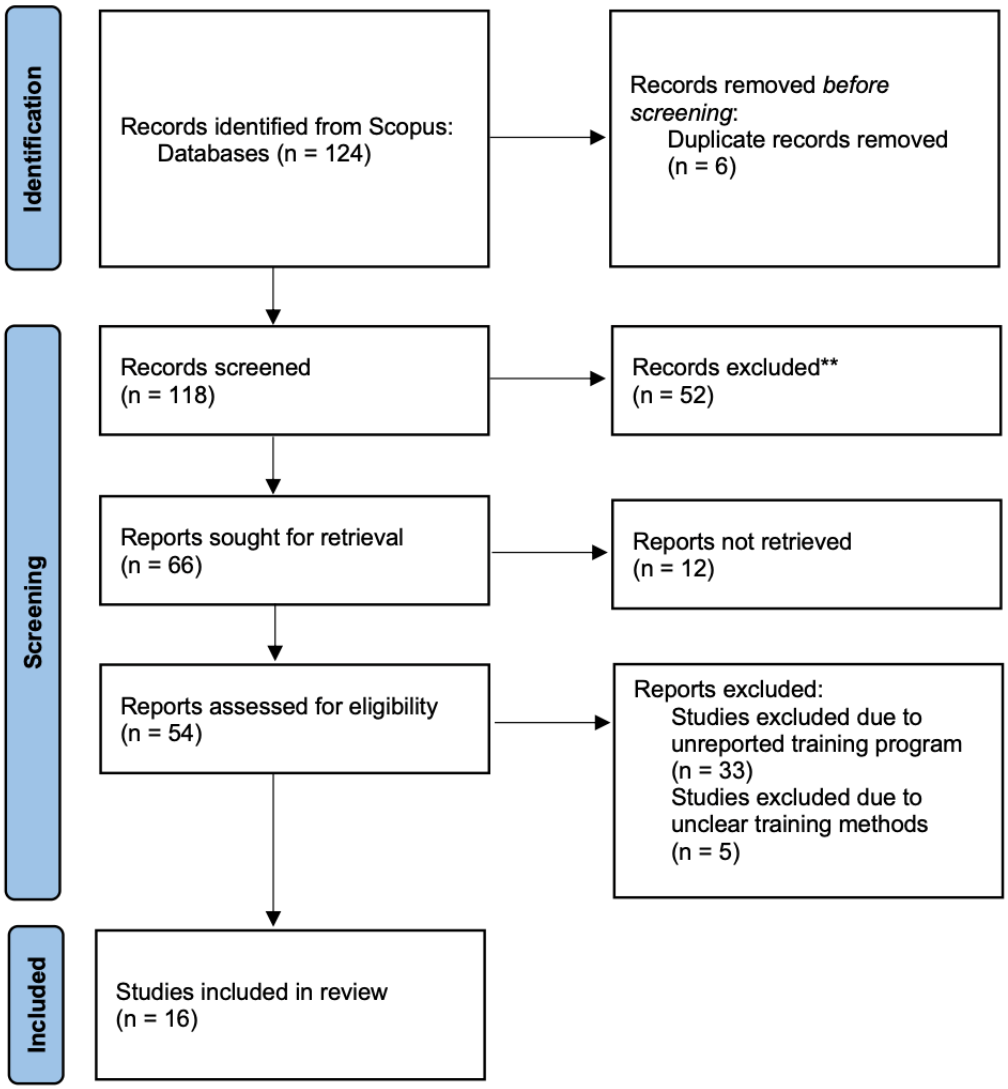
Meanwhile, in the study by Barbieri et al. (2016), training activities used specific exercises in the form of jumps, changes in direction, and specific defense movements for Goalkeepers. Then, activities such as small changes of direction to simulate man-marking for Defenders. Executed intense displacements followed by shooting drills for finishing were used for Wingers' training. And finally, for forwards/pivots, exercises were performed to train ball protection, dribbling, and shooting drills for finishing. These specific futsal actions were used in training using continuous training and interval training methods at an intensity of 7 to 9 (RPE). The training program was given for 12 weeks, and concluded that specific training for futsal can significantly improve the aerobic and anaerobic capacity of semi-professional futsal players.

In this skills-based training method, futsal-specific skill actions are used to improve physical capacity, particularly endurance. Unlike traditional endurance training, which generally uses simple activities like running or cycling, skills-based training utilizes futsal actions such as passing, dribbling, shooting, and special game situations like man-to-man marking for defenders, and ball protection and finishing for forwards/pivots. The use of futsal-specific actions is closely linked to the training principle of specificity.

Several methodological limitations warrant caution. Because Karahan's (2012) isolated study focused exclusively on female athletes, the generalizability of these findings to male, youth, or elite cohorts remains unverified. Furthermore, the

Figure 1

Flow chart of the study inclution process.



rigid repetition-duration-rest structure lacks individualization based on real-time physiological markers, such as heart rate variability (HRV) or Session RPE.

Coordination Training

In this study, one research study was identified that used coordination training methods to improve the aerobic endurance of futsal players. This study was conducted by Miftachurochmah et al. (2023), who compared coordination training with small-sided games in terms of their effects on improving aerobic endurance. The coordination training program was designed with five types of exercises: Agility Ladder Single Step with Passing and Control, Agility Ladder Steps Run Integration with Dribbling, Agility Ladder Lateral In and Out Run Integration with 1vs1, Two-Foot Hops with Shooting, and Combination Training Using a Circuit System. Training was conducted over six weeks with five sessions per week. The training was divided into four intensity levels: low-intensity aerobic training, moderate-intensity aerobic training, high-intensity aerobic training, and anaerobic training.

For low-intensity aerobic training, the Agility Ladder Single Step with Passing and Control exercise was used, lasting >15 minutes, with 2 to 3 repetitions and a 2-minute rest between repetitions, on a 20 x 20-meter field. For moderate-intensity aerobic training, the Agility Ladder Steps Run Integration with Dribbling exercise was used, with a duration of 6 to 10 minutes, 2 to 4 repetitions, 2 to 3 minutes of rest between repetitions, on a 30

Table 1

Summary of Studies

No	Authors	Participant	Method	Training Program	Result
1	Karahan, 2012	12 elite female futsal players and 12 physically active female sports-school students	Skill-based training	Four stations, with stations 1-3 holding 20 to 25 seconds per repetition, four to seven sets. Station four held 10 minutes per set, for a total duration of 33 to 37 minutes. The experiment was conducted over eight weeks, with four training sessions per week.	Skill-based maximal intensity interval training had significant effects on both aerobic and anaerobic performance variables of female futsal players.
2	Barbieri et al., 2016	Thirteen male semi-professional futsal players (age 22 ± 2 years, body mass 74 ± 11 kg and height 175 ± 6 cm) comprising three goalkeepers, two defenders, six wing midfielders, and two forwards/pivots were recruited	Skill-based training	12 weeks of training using continuous training and interval training methods with an intensity of 7 to 9 (RPE). Specific physical activities: jumps, changes in direction and specific defenses movements (goalkeeper) small changes of direction to simulate the man marking (defender) executed intense displacements followed shooting drills for finishing (wingers) performed exercises to train ball protection, dribbling and shooting drills for finishing (forwards/pivots).	12-week program of specific training for futsal can significantly improve aerobic and anaerobic capacity of semi-professional futsal players
3	Miftachurochmah et al., 2023	18 male futsal athletes players in Yogyakarta City, aged 18 ± 0.9 years old, height 168.7 ± 3.4 cm and weight 63 ± 3.4 kg	Coordination training	Six weeks, with 5 training sessions per week. Durasi 30 detik sampai 15 menit, 2 sampai 10 repetisi. The training was divided into four intensity levels: low-intensity aerobic training, moderate-intensity aerobic training, high-intensity aerobic training, and anaerobic training.	Coordination training has a significant impact on the aerobic endurance of futsal players
4	Sidik & Rosdiana, 2022	The sample was 17 futsal players who joined the Pro Futsal League in 2020.	Combination training	Combined interval training (a method commonly used in endurance training) with the use of a weighted vest. Training was conducted three times a week.	The interval training method using a weighted jacket has a significant effect on increasing aerobic capacity in futsal players.
5	Gómez et al., 2023	18 years of age and belonging to El Pilar Sports Society (Valencia, Spain)	Combination training	High-intensity interval training (HIIT) program supplemented with the Nordic Curl Exercise Program. Durasi 25 menit (8 post/exercises, 3 set). The Nordic curl (NC)	No difference between HIIT + NC and the HIIT program alone in terms of intermittent work performance, and both had a

No	Authors	Participant	Method	Training Program	Result
				exercise takes a total of 10 minutes.	significant impact on endurance (intermittent work performance) in futsal players.
6	Digham & Khuzaie, 2019	Sixteen male players from Al-Nasiriyah City Club (21 and 23 years old).	Combination training	A specialized resistance training program performed on sand was developed. The experiment was conducted over two months (8 weeks).	The results of the study showed the positive effects of composite sand-resistance exercises on the development of physical abilities.
7	Mondher & Khalaf, 2023	Players of Al-Zawraa Club, who are 14 players.	Combination training	The training took place over two months (8 weeks), with 3 training sessions per week (24 sessions). Each session lasted 40 minutes and consisted of compound exercises performed using the HIIT method.	The study show that compound exercises combined with the use of a training mask effectively improve endurance, particularly speed endurance, in futsal players.
8	Karahan, 2012	12 elite female futsal players from university league division I and 12 physically active female sports-school students.	Small-sided games	6 vs. 6 on a 15x25-meter field. The drill lasts 10 minutes, at maximum effort.	Skill-based maximal-intensity interval training (including SSG) had significant effects on both aerobic and anaerobic performance
9	Duarte et al., 2009	Eight semi-professional players from a Portuguese First Division team	Small-sided games	4 vs. 4, 3 vs. 3, and 2 vs. 2 on a 20x20-meter field. The drill lasts 10 minutes.	The decrease in the number of players and exercise duration resulted in intensity increases and more frequent individual tactical actions.
10	Gomes et al., 2024	Forty-two male U17 players (age = 15.62 ± 0.58 years) from three futsal teams participated in the study	Small-sided games	2-on-2 and 3-on-3 with a goalkeeper, on 20x20, 30x20, and 40x20-meter fields. Drill duration: 2 minutes, 4 repetitions. High intensity with full-court pressing at all times.	Increasing the relative area by reducing the number of players involved in the tasks in the form of small-sided games
11	Gomes et al., 2025	Fifty-six male futsal players from U15, U17, U19, and adult age categories participated	Small-sided games	2-on-2 and 3-on-3 with a goalkeeper, on a 20x20 and 40x20-meter field. Drill duration: 2 minutes, 4 repetitions. High intensity with a man-to-man defensive strategy.	Greater variability in high-intensity accelerations and high-intensity decelerations.

No	Authors	Participant	Method	Training Program	Result
12	Amani-Shalamzari et al., 2019	Twenty male young futsal players with experience in first youth division of province league (aged: 18.6 ± 0.5 years old; experience: 5.4 ± 1.6 years) voluntary participated in study	Small-sided games	6 vs. 6, 4 vs. 4, 3 vs. 3, 2 vs. 2, and 1 vs. 1 on fields measuring 20 x 30, 20 x 20, and 10 x 15 meters. Duration: 30 seconds to 15 minutes; 2 to 10 sets. With 3 training intensities: Moderate, High, and Extreme.	SSG-based program provided a similar heart rate stimulus on players comparing to generic fitness training program and both programs meaningfully improved the fitness parameters of the young futsal players
13	Himawan et al., 2024	This study involved 16 male amateur futsal players who participated in a regional amateur competition in East Java, Indonesia.	Small-sided games	4-on-4 with a goalkeeper, on a 20x30-meter playing field. The drill lasts 5 minutes, with 3 to 9 repetitions. The intensity ranges from 80 to 95%.	Situational game training with an additional 5-minute exercise load is effective in improving VO2max and agility in futsal players
14	Pizarro et al., 2021	Thirty male futsal players from the under-19 (U19) category (age, M = 17.714 and SD = 0.713) of four different Spanish clubs	Small-sided games	3-on-3, 2-on-2, using a combination of goalkeepers and floater players. Playing areas: 30x15 and 20x10 meters. Drill duration: 2 to 3 minutes, 3 repetitions.	Manipulating the number of players and the floater's position affects the skill actions performed by players, which in turn influences the physical demands placed on players during the exercise.
15	Miftachurochmah et al., 2023	18 male futsal athletes players in Yogyakarta City, aged 18 ± 0.9 years old, height 168.7 ± 3.4 cm and weight 63 ± 3.4 kg	Small-sided games	4 vs. 5, 3 vs. 3, and 2 vs. 2 on 30x20, 20x20, and 20x15-meter fields. Drill duration ranges from 30 seconds to 2 minutes, with 2 to 10 repetitions, at 4 intensity levels: low intensity, moderate intensity, high intensity, and anaerobic intensity.	Small-sided game method is proven to be more effective and efficient at improving aerobic endurance than coordination training.
16	Amani-Shalamzari et al., 2019	Twenty male young futsal players with experience in first youth division of province league (aged: 18.6 ± 0.5 years old; experience: 5.4 ± 1.6 years) voluntary participated in study	Generic training	6 weeks, with 26 physical training sessions. Duration: 30 seconds to 15 minutes, 2 to 10 sets. With 3 exercise intensities: moderate, high, and extreme.	SSG-based program provided a similar heart rate stimulus on players comparing to generic fitness training program and both programs meaningfully improved the fitness parameters of the young futsal players

x 20-meter field. For high-intensity aerobic training, the Agility Ladder Lateral In and Out Run Integration with 1vs1 exercise was used, with a duration of 2 to 4 minutes, 5 to 10 repetitions, a rest period of 1 to 2 minutes between repetitions, and a field size of 20 x 20 meters. Meanwhile, for anaerobic training, the exercises used were Two-Foot Hops with Shooting and Combination Training Using a Circuit System, with a duration of 30 to 90 seconds, 4 to 8 repetitions, a rest period of 30 to 90 seconds between repetitions, and a field size of 20 x 15 meters.

This research experiment was conducted over six weeks, with 5 training sessions per week. The study found that coordination training has a significant impact on the aerobic endurance of futsal players. However, when compared to small-sided games, coordination training does not have a greater impact on aerobic endurance than small-sided games.

Physiologically, coordination training improves aerobic capacity via the neuromuscular-metabolic link; complex agility ladder drills combined with technical actions (passing, dribbling, 1v1) increase motor unit recruitment and elevate metabolic costs, maintaining heart rates within aerobic zones when organized into a progressive circuit. However, the finding that small-sided games (SSGs) are superior or equally effective underlines the core principle of metabolic specificity in futsal conditioning. Unlike structured coordination circuits with predictable movement patterns that can inadvertently lower cardiovascular strain, SSGs inherently induce chaotic, unpredictable movements, constant speed fluctuations, and higher psychological stress. This directional fluidity yields significantly higher mean heart rates and blood lactate concentrations.

Methodologically, the reliance on a single study underscores a persistent gap in the literature, as Miftachurochmah et al. (2023) did not thoroughly detail the exact physiological metrics (such as %HRmax) used to categorize their four intensity levels, exposing a clear need for more rigorous quantification. Consequently, future research should explore hybrid training models that combine the neuromuscular and technical benefits of coordination training with the superior cardiovascular stress of SSGs to optimize player development.

Combination Training

Over the past twenty years, four studies have been identified that combine training methods or forms, or the use of specific equipment in a workout, with the aim of improving futsal players' endurance. The first involves endurance training using interval training methods with the addition of a weighted vest. This study, conducted by Sidik & Rosdiana (2022), combined interval training—a method commonly used in endurance training—with the use of a weighted vest. The purpose of using the weighted vest in interval training was to add resistance, particularly external resistance to the player's body. The weighted jacket was also used due to its flexibility in interval training (Yusup et al., 2021). Thus, it does not restrict the activities performed during interval training. This is because the added load adheres perfectly to the athlete's upper body. Training was conducted three times a week. This study found that the interval training method using a weighted jacket has a significant effect on increasing aerobic capacity in futsal players.

The next study combined high-intensity interval training (HIIT) with the Nordic Curl Exercise Program. Gómez et al. (2023) compared the effects of a HIIT program supplemented with the Nordic Curl Exercise Program to a program using HIIT alone. The HIIT program was designed as a circuit consisting of 8 exercises, completed in 25 minutes. Each exercise was performed for 40 seconds, with a 15-second rest between exercises. All 8 exercises were performed in three sets. Meanwhile, the Nordic Curl Exercise Program utilized eccentric movements of the hamstring muscles. This exercise was performed in 10 repetitions per set, with 3 sets, accompanied by a 1-minute rest between sets. The Nordic curl exercise takes a total of 10 minutes. The study found no difference between HIIT + NC and the HIIT program alone in terms of intermittent work performance, and both had a significant impact on endurance (intermittent work performance) in futsal players.

The findings of the third exercise combination are titled "Special Exercises on the Sand." This study was conducted by Digham & Khuzaie (2019), who developed a specialized resistance training program performed on sand. The results of the study showed the positive effects of composite sand-resistance exercises on the development of physical abilities. The study explained that this occurs due to increased resistance during exercise (in terms of training load), and psychologically, the variation in exercises can increase players' interest and even delay the onset of fatigue during training.

The fourth study on combination training focused on compound exercises (which incorporate both physical activity and skill-based movements) combined with the use of a training mask (Phantom) (Mondher & Khalaf, 2023). Compound exercises involve various combinations of activities such as running, throwing, passing a ball, zigzag running, etc. All exercises were performed while wearing the mask. In this study, the training mask was used to train the inhalation and exhalation processes during exercise. Theoretically, this mask can facilitate better air

intake, enhance respiratory muscle capacity, and increase the surface area and elasticity of the alveoli (Mondher & Khalaf, 2023). The mechanism of this mask works by reducing the percentage of air entering the lungs and, consequently, reducing the percentage of oxygen entering the body through a valve in the mask. Continuous training with this mask can improve air intake capacity by allowing for deeper and more efficient breathing. This results in positive improvements in respiratory and cardiac function. The training was conducted over two months (8 weeks), with 3 training sessions per week (24 sessions). The program was implemented with repetitions, intensity, rest between repetitions, sets, and rest between sets that were strictly regulated. The results of the study show that compound exercises combined with the use of a training mask effectively improve endurance, particularly speed endurance, in futsal players.

Combining endurance protocols with external loading, alternative surfaces, or respiratory aids modifies futsal conditioning by significantly elevating biomechanical and metabolic demands. Integrating weighted vests increases total body mass without restricting fluidity (Yusup et al., 2021; Sidik & Rosdiana, 2022), thereby raising the metabolic cost of locomotion and forcing higher motor unit recruitment and cardiopulmonary output. Similarly, executing exercises on a compliant sand surface drastically shifts conditioning dynamics (Digham & Khuzaie, 2019). Sand absorbs kinetic energy during the foot-strike phase, decreasing elastic energy return from the Achilles tendon and forcing the lower-limb musculature to perform greater concentric work. This biomechanical shift amplifies oxygen consumption and heart rate responses, enabling players to reach high-intensity training thresholds without subjecting joints to the high peak impact forces typical of hard courts surfaces.

Respiratory and neuromuscular conditioning offer alternative tactical synergies. Wearing elevation training masks during compound, skill-based drills act as resistance training for the diaphragm and intercostals (Mondher & Khalaf, 2023). By restricting airflow, these masks induce transient hypoxia and hypercapnia, forcing deeper inhalation cycles that enhance respiratory muscle strength, alveolar gas exchange efficiency, and cardiac output over time. Conversely, combining High-Intensity Interval Training (HIIT) with the Nordic Curl program yields no supplementary aerobic benefits (Gómez et al.,2023). Because the Nordic Curl targets eccentric hamstring strength for injury prevention rather than metabolic conditioning, this lack of additive endurance adaptation is logical. However, this finding critically proves that strength-based injury prevention protocols can be integrated alongside high-intensity conditioning circuits without causing negative interference or compromising endurance gains.

Despite these innovative pathways, implementing combination methods requires careful methodological critique. Restricting airflow with training masks may induce premature central fatigue, inadvertently compromising technical precision—such as passing accuracy or sharp dribbling mechanics—during skill-based drills (Mondher & Khalaf, 2023). Furthermore, the lack of rigorous, long-term internal load tracking (e.g., blood lactate or continuous heart rate monitoring) across these studies makes it difficult to ensure athletes are not pushed into overtraining zones.

Small-sided Games

In this study, small-sided games were the most widely used method in endurance training for futsal players. This is because small-sided games have been shown to improve athletes' endurance through the game of futsal itself. This means that they are closely related to the skills and tactics developed in futsal. Additionally, several studies have found that small-sided games present more engaging and challenging psychological factors for players during endurance training (Amani-Shalamzari et al., 2019; Fajarullah et al., 2025).

Eight studies on small-sided games related to endurance in futsal were identified. The first study, conducted by Karahan (2012), examined the effects of high-intensity interval training based on small-sided games on anaerobic and aerobic endurance capacity. In this study, Karahan divided the training into 4 stations: 3 skill-drill-based stations and one station in the form of small-sided games. The small-sided games were conducted for 10 minutes on a 15 x 25-meter playing area, with 6 players versus 6 players, including goalkeepers. The published article explains that the intensity of the training was 100% or maximal effort. The results of the study indicate that high-intensity interval training based on skills (which includes small-sided games) has a significant impact on anaerobic and aerobic endurance capacity.

A second study conducted by Duarte et al. (2009) examined the effects of game duration and the number of players on heart rate responses and technical skills in small-sided futsal games. The small-sided games were played on a half futsal court (20 m × 20 m) using official game rules. Unless the ball went out over the goal line (clearance), play would immediately restart with the goalkeeper. Four balls were placed at each goal to encourage play to resume immediately if a ball went out, thereby minimizing time lost due to the ball going out of play.

Small-sided games are played in four formats or variations: 4 vs. 4, 3 vs. 3, and 2 vs. 2, each lasting

4 minutes. The fourth variation is 4 vs. 4, lasting 10 minutes. An active rest period of 4 minutes is provided between each repetition in the form of continuous running (low intensity). This study found that reducing the number of players and shortening the game duration increases training intensity (as evidenced by players' heart rates) and also increases the number of individual tactical actions performed by players during training sessions. More specifically, the lowest average heart rate among the four training variations was found in the 4v4 session compared to 3v3 or 2v2.

The third study, conducted by Gomes et al. (2024), examined the playing area and the number of players and their relationship to external and internal load in young futsal players. Seven training schemes were tested: the first was GK + 2 × 2 + GK in a 20 × 20 m playing area. The second was GK + 2 × 2 + GK in a 30 × 20 m playing area. The third was GK + 2 × 2 + GK in a 40 × 20 m playing area. The fourth was GK + 3 × 3 + GK in a 20 × 20 m playing area. The fifth was GK + 3 × 3 + GK in a 30 × 20 m playing area. The sixth is GK + 3 × 3 + GK in a 40 × 20 m area, and the seventh is GK + 4 × 4 + GK played in a 40 × 20 m area. Played according to official futsal rules.

The coach instructed the team to implement a defensive strategy involving individual pressure across the entire playing field. Each drill was conducted over the course of one week, with one trial of a specific drill performed once per week. This was because the team needed to prepare other drills for upcoming competitions. Each drill lasted 2 minutes and consisted of 4 repetitions, with a 3-minute rest period between repetitions. This study found that fewer players in a larger playing area will increase the physical and physiological effects. Conversely, the more players there are in a smaller playing area, the less the physical and physiological effects will be. This is because with fewer players and a larger playing area, athletes are required to be more involved in the game and perform more actions during training.

The fourth study was also conducted by Gomes et al. (2025) the following year. This study continued the investigation into the effects of playing area and the number of players in small-sided games on external and internal load in futsal players across different age groups. The age groups studied were 15, 17, 19, and adults. The study was conducted over 7 weeks. This study examined 6 different small-sided drills. The first was GK + 2 × 2 + GK in a 20 × 20 m playing area. The second was GK + 2 × 2 + GK in a 40 × 20 m area. The third was GK + 3 × 3 + GK in a 20 × 20 m area. The fourth was GK + 3 × 3 + GK in a 40 × 20 m playing area. The fifth was GK + 4 × 4 + GK in a 20 × 20 m area. And the sixth was GK + 4 × 4 + GK in a 40 × 20 m playing area.

Tactical and technical actions in attack: the number of touches in attack is unlimited (free touches) for each player. Meanwhile, tactical and technical actions in defense employ man-to-man marking, applying specific defensive principles to the player in possession of the ball (attacker). Each drill is conducted over 1 week, and during that week, one trial of each type of training drill is performed. The drill is conducted for 2 minutes with 4 repetitions. The rest period between repetitions is 2 minutes. The results of the study indicate that as age increases, there is a tendency toward greater physical exertion during the game, except in the senior age group. However, overall, it was found that a larger playing area and fewer players result in greater physical demands during the exercise.

The fifth study compared small-sided games and generic training on aerobic capacity, anaerobic power, and agility. The study conducted by Amani-Shalamzari et al. (2019) spanned 6 weeks and included 26 training sessions. Ten sessions consisted of moderate-intensity aerobic training, nine sessions consisted of high-intensity aerobic training, and seven sessions consisted of anaerobic training. Moderate-intensity small-sided games (SSGs) were designed as 4-on-4 to 6-on-6 matches on a playing field ranging from 20x20 meters to 20x30 meters, lasting 6 to 10 minutes, with 2 to 6 repetitions. High-intensity SSGs were designed as 3-on-3 and 4-on-4 drills on a playing area of 20x20 meters to 20x30 meters, lasting 2 to 4 minutes, with 5 to 8 repetitions. Extreme SSGs are designed in 1-on-1 and 2-on-2 formats on a playing area ranging from 10x15 meters to 20x20 meters, with a duration of 30 to 90 seconds, performed 4 to 8 times. The results of the study indicate that SSGs can have a positive effect on aerobic and anaerobic fitness similar to that of generic training.

The sixth study was conducted by Himawan et al. (2024), who examined the effects of 5 minutes of situational game training on the VO_2max and agility of futsal players. The training program was conducted over 6 weeks, with 3 training sessions per week. The game situation was set up with 5-on-5 players (including goalkeepers) on a 20x30-meter playing field. Training in the first and second weeks began with an intensity of 80–95%, a duration of 5 minutes, performed in 3 repetitions, with a rest-to-work ratio of 1:1. In the third and fourth weeks, the intensity remained at 80–95%, with a training duration of 5 minutes, performed 6 times, and a rest-to-work ratio of 1:1. In the fifth and sixth weeks, the training load remained at an intensity of 80–95%, with a work duration of 5 minutes, the number of repetitions was increased to 9, and a rest-to-work ratio of 1:1.

The game employs a man-to-man marking strategy with high pressure. If play is stopped

because the ball goes out of bounds or a goal is scored, play resumes as soon as possible at the spot where the ball went out or where play was stopped. Each player must move continuously to create space and opportunities to receive passes during offensive plays, while defensive players maintain close-range pressure wherever the attacking players go. Research findings indicate that 5 minutes of game-situation drills are effective for improving VO2max.

The seventh study was conducted by Pizarro et al. (2021), who examined futsal small-sided games in relation to the number of players and floaters' positioning. Three game scenarios were tested in the formats GK + 3vs3 + GK and GK + 2vs2 + GK. The first scenario involved no additional floaters. In the second condition, one floater was added to each team at the end line. In the third condition, one floater was added to each team at the sideline. Tactically, the second scenario (with an additional floater on the end line) is closely related to the 3-1 attacking system. Meanwhile, the third scenario (with an additional floater on the sideline) is closely related to the 4-0 attacking system. Floaters will only be involved in the game during attacks, with a limited number of touches (maximum 2 touches), and may only be in the line area (side line or end line), and may not score goals. Meanwhile, players other than floaters may not enter the floater's area.

A small-sided game with the format GK + 3v3 + GK is conducted in a 30 x 15-meter playing area. The drill lasts 3 minutes, with 3 repetitions and a 1-minute rest between repetitions. Meanwhile, a small-sided game with the format GK + 2v2 + GK is conducted in a 20 x 10-meter playing area. The duration of the exercise is 2 minutes, performed in 3 repetitions, with a 1-minute rest between repetitions. Several balls are placed around the field to allow the game to restart quickly if the ball goes out of play. This study found that manipulating the number of players and the floater's position affects the skill actions performed by players, which in turn influences the physical demands placed on players during the exercise.

The eighth study was conducted by Miftachurochmah et al. (2023), which compared the effects of small-sided games and coordination drills on aerobic endurance in futsal athletes. This training method experiment was conducted over 6 weeks, with 5 training sessions per week. The small-sided game training was designed in four formats. The first was a 4-vs-5 format on a 20x20-meter field, lasting 2 minutes with 2 to 3 repetitions, with a 2-minute interval between repetitions, constituting low-intensity aerobic training. The second format was 4 vs. 5 on a 30x20-meter field, lasting 2 to 3 minutes with 2 to 4 repetitions, with a 2- to 3-minute interval between repetitions, constituting moderate-intensity aerobic training. The third session uses a 3 vs. 3 format on a 20x20-meter field, lasting 1 to 2 minutes with 5 to 10 repetitions, with 1 to 2-minute intervals between repetitions, constituting high-intensity aerobic training. The fourth format is 2 vs 2 on a 20x15-meter field, lasting 30 to 90 seconds with 4 to 8 repetitions, with a 30- to 90-second interval between sets, constituting anaerobic training. This study found that training using small-sided games has a positive and significant impact on aerobic endurance in futsal athletes. Furthermore, the findings also revealed that the small-sided game method is proven to be more effective and efficient at improving aerobic endurance than coordination training.

The collective evidence demonstrates that manipulating pitch dimensions, player numbers, and tactical constraints serves as the primary mechanism for regulating internal and external loads during futsal small-sided games (SSGs). In terms of structural design, an inverse relationship exists between player density and physiological strain (Duarte et al., 2009; Gomes et al., 2024, 2025). Reducing player counts (e.g., 4v4 to 2v2) while enlarging the playing area maximizes relative individual space, forcing athletes to cover greater distances with increased high-intensity accelerations, decelerations, and limited passive rest. This elevated external workload drives higher mean heart rates and escalates metabolic fatigue, successfully replicating the intense cardiovascular demands of traditional high-intensity interval training (HIIT).

Crucially, SSGs offer a distinct advantage over generic interval training by seamlessly integrating these physical demands with technical execution and tactical pressure. Enforcing strict tactical constraints—such as full-court, high-pressure man-to-man marking—significantly elevates internal load metrics, including VO_2max and high-percentage heart rate zones (Gomes et al., 2024; Himawan et al., 2024). Furthermore, strategic adjustments, such as manipulating the positioning of floaters on the endline or sideline, allow coaches to mimic specific attacking systems (3-1 or 4-0) and intentionally target precise metabolic pathways by altering the length and speed of support runs (Pizarro et al., 2021).

To sustain this high level of metabolic and cardiovascular stress, minimizing "dead time" through continuous play is highly vital (Duarte et al., 2009; Himawan et al., 2024; Pizarro et al., 2021). Implementing logistical controls, such as placing multiple spare balls around the court perimeter and enforcing rapid goalkeeper restarts, prevents the drop in heart rate that naturally occurs during out-of-bound interruptions. This operational

fluidity ensures a continuous or structured intermittent stimulus rather than a fragmented workload, directly optimizing adaptations in aerobic capacity and intermittent work performance.

Despite these robust benefits, establishing a standardized SSG protocol remains difficult due to major methodological discrepancies across the literature. Reviewed interventions featured vastly inconsistent work-to-rest configurations, with bout durations ranging from ultra-short anaerobic sequences of 30–90 seconds (Amani-Shalamzari et al., 2019; Miftachurochmah et al., 2023) to extended continuous blocks of 10 minutes (Duarte et al., 2009; Karahan, 2012). Moreover, while physical exertion scales progressively with age in youth cohorts (Gomes et al., 2025), there is a critical shortage of longitudinal data on elite adult professionals. This demographic gap, combined with a widespread reliance on simple heart rate averages rather than advanced physiological tracking, such as blood lactate or GPS-derived metabolic power.

Generic Training

From the full-text analysis conducted, one study was identified that utilized generic training. This study compared generic training with small-sided games training in terms of aerobic capacity, anaerobic power, and agility (Amani-Shalamzari et al., 2019). In this study, generic training involved jogging and running as the training activities. The study was conducted over 6 weeks, with 26 physical training sessions, which were divided into low-intensity aerobic training, moderate-intensity aerobic training, high-intensity aerobic training, and anaerobic training. Low-intensity aerobic training involved low-intensity jogging for recovery, lasting 15 minutes, with 2 to 3 sets. Moderate-intensity aerobic training involved running at a speed of 3 to 3.5 m/s, lasting 6 to 10 minutes, with 2 to 4 sets. High-intensity aerobic training is performed by running interspersed with rest, following the 15:15 principle: 15 seconds of high-intensity running followed by 15 seconds of low-intensity running (3.9 to 4.4 m/s), with a total duration of 2 to 4 minutes, for 5 to 10 sets. Anaerobic training is performed by running at maximum speed, greater than 5 m/s, for 30 to 90 seconds, in 4 to 8 sets. The results of the study indicate that generic training can have a positive effect on aerobic and anaerobic fitness similar to that of small-sided games.

Interestingly, however, in that study, Amani-Shalamzari et al. (2019) found that although generic training programs offer significant effects on endurance (similar to small-sided games), training using the generic training method does not provide players with the same level of motivation and enjoyment during the training process as small-sided games do. And indeed, generic training has advantages in terms of ease of management, organization, and monitoring of training, but it has limitations regarding the level of training specificity in the sport of futsal (Amani-Shalamzari et al., 2019).

Physiologically, the comparable adaptations between generic running and small-sided games (SSGs) prove that both modalities effectively stress the cardiopulmonary system to trigger metabolic adaptations, with protocols like the 15:15 interval efficiently stimulating oxygen kinetics and stroke volume. Methodologically, generic training offers undeniable advantages in operational logistics, allowing practitioners to precisely control, organize, and monitor external load parameters—such as running speeds (m/s), work durations, and rest intervals—individualized to a player's maximal aerobic speed while eliminating the unpredictable load variances inherent in tactical games.

However, generic running possesses severe limitations regarding neuromuscular specificity and sports psychology. Futsal is an inherently chaotic sport demanding multidirectional agility, rapid accelerations, sharp decelerations, and constant technical execution under pressure. Linear running completely omits these physical mechanics, failing to condition the specific muscle groups and joint complexes required for eccentric braking and agility. Furthermore, as demonstrated by Amani-Shalamzari et al. (2019), monotonous linear running elicits significantly lower levels of motivation and situational enjoyment compared to SSGs. Prolonged reliance on such protocols can induce mental fatigue, lower training compliance, and reduce a player's perceived readiness to perform. While the reliance on a single study underscores a major gap in the past two decades of futsal literature, practitioners should not view generic and skill-based methods as mutually exclusive. Instead, coaches can consider a hybridized periodization strategy where generic conditioning is utilized during the early off-season or pre-season to systematically build a foundational cardiovascular base and safely manage volume. Subsequently, as the competitive season approaches, training should transition to SSGs and skill-based circuits to sharpen tactical awareness and technical proficiency under match-like metabolic fatigue.

Limitations

When analyzing and interpreting the findings of this systematic review, several limitations must be considered. First, only the Scopus database was used to analyze the article sources. There are many other sources of scientific articles that could be

reviewed and analyzed that are relevant to the objectives of this study. The study's data was collected from the Scopus database to ensure the quality of the articles used as sources. Scopus has strict quality control and indexing mechanisms. Second, there are differences in the dosage and training load provided by each method. When understanding and analyzing the training methods and models, differences in activity and training formats were found, which were identified as having an effect on the development of aerobic and anaerobic endurance. It is important to note that each treatment provided differs in the training load. These differences include the amount of training (volume), effort exerted during training (intensity), rest intervals between exercises, the number of treatments given per week (density), and the total number of treatments given during the study. Third, there are differences in the characteristics of the participants used in the study sample. These differences include the level of competition they are involved in, the participants' age category, gender, and initial endurance capacity. This will undoubtedly have varying impacts on resilience, even on the methods chosen as research variables. The limitations of this study are important to consider in future research, emphasizing the need for more comprehensive, methodologically consistent studies that will produce relevant and valid results in line with research objectives and field realities.

Conclusions

A systematic review conducted in this study identified several methods and types of training used to improve endurance in futsal. These include skill-based training, coordination training, combination training, small-sided games, and generic training. Of these five methods or types of training, it was found that the most commonly used method to improve futsal players' endurance is small-sided games.

In terms of timeline, recent studies have pointed toward endurance training methods and types that are increasingly specific to the game of futsal itself. Since 2009, the development of endurance training based on small-sided games has been published and continues to be developed to this day. Recently, several studies have examined the forms and types of small-sided games (field size, number of players, specific player tasks) in relation to the physiological responses occurring in the players' bodies. Meanwhile, during those years, several other methods (skill-based training, coordination training, generic training) were also studied, and their research results were compared with those of the small-sided games method. Additionally, several training combinations have been studied, involving specific endurance training (such as HIIT) with sand-based exercises, training using additional equipment like weighted vests, and special masks.

The training methods and types described above have been proven to significantly improve futsal players' endurance. However, recent research has focused on the principle of specificity in futsal training. Research evidence highlights the effects of player motivation and engagement during training sessions, which point toward training methods specific to the game of futsal. These create activities, challenges, and the goal-scoring objective inherent in futsal, even though the primary goal of training is to improve endurance.

Practitioners in the field of sports, including both coaches and sports scientists, are recommended, based on existing studies, to prioritize training methods that are specific to futsal. In particular, training methods related to small-sided games and skill-based training are encouraged, as these have been proven to enhance endurance while maintaining player engagement and motivation. In practice, the methods and forms of training should be adapted to the developmental stage and specific needs of futsal players, both individually and as a group. A combination of futsal-specific training methods and general training methods may be highly relevant. The dominance or percentage of each method used should be determined according to the players' needs and developmental stages, as well as the current training phase.

For future research, it is expected that greater attention will be given to the limitations of this study, particularly regarding the sources of articles reviewed, differences in training dosage for each method, and variations in participant characteristics. Addressing these issues will help to obtain more comprehensive and thorough conclusions through a broader range of data sources, as well as stronger conclusions regarding the most effective and efficient methods, by utilizing more homogeneous training doses and participant characteristics.

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