

Small-Sided Games in Soccer (Concept, Practical Principles, and Technical and Physiological Characteristics)

الألعاب المصغرة في كرة القدم (المفهوم، المبادئ التطبيقية والخصائص الفنية والفيسيولوجية)

Mohamed seghir DAHBAZI¹

¹ Mohamed Boudiaf University, M'sila / Algeria / mohamedseghir.dahbazi@univ-msila.dz

Received: 27-02-2025

Accepted: 23-05-2025

Published: 31-07-2025

Abstract:

Small-sided games are among the modern applications in soccer training and have gained significant attention from academic researchers. This study aims to shed light on small-sided games as a new approach in the physical preparation of soccer players by relying on both direct and indirect reviews of previous studies, examining their concepts, practical principles, and technical and physiological characteristics. The study concludes with defining the concept of small-sided games and outlining the conditions for their use, which must be considered by the physical trainer in the preparation process. These include the relationship between playing area and number of players, work and rest durations, playing conditions, coach encouragement, and the availability of balls within the playing area. Additionally, the study provides tables that assist the physical trainer in regulating training load when using small-sided games.

Keywords: Soccer, small-sided games

ملخص:

تعتبر الألعاب المصغرة من بين الاستخدامات الحديثة في تدريب كرة القدم، حيث لاقى اهتماما كبيرا من قبل الباحثين الأكاديميين ولقد جاءت هذه الدراسة لتسلط الضوء على الألعاب المصغرة كتوجه جديد في عملية التحضير البدني للاعب كرة القدم وذلك بالاعتماد على مراجعة مباشرة وغير مباشرة للدراسات السابقة وما جاءت به من مفاهيم ومبادئ تطبيقية والخصائص الفنية والفيسيولوجية للألعاب المصغرة ولقد خلصت الدراسة إلى مفهوم الألعاب المصغرة وكذلك شروط استخدامها التي يجب أن يراعيها المحضر البدني في عملية التحضير البدني كالعلاقة بين مساحة اللعب وعدد اللاعبين بالإضافة إلى مدة العمل والراحة وشروط اللعب وتشجيع المدرب وتوفير الكرات في محيط اللعب، بالإضافة إلى جداول تساعد المحضر البدني على تقنين حمولة التدريب عند اعتماده على الألعاب المصغرة.

الكلمات الدالة: كرة القدم، الألعاب المصغرة

Introduction

Soccer is the most popular sport world wide due to its excitement and competitive nature. It is played between two teams of 11 players over 90 minutes and is accompanied by extensive media coverage and passionate fan engagement. This has increased the pressure on coaching staff, requiring them to optimize player preparation for both competitions in general and specific matches in particular, ensuring that players perform at their peak potential.

The evolution of soccer training methods and team preparation programs has led to a shift from isolated training components to a more integrated approach. Previously, physical, technical, and psychological aspects were trained separately, but modern methods now incorporate all elements simultaneously. This shift has resulted in more intense and competitive matches, where success is determined by fine details rather than just physical or psychological dominance. Consequently, selecting the right training exercises within sessions plays a crucial role in match performance.

The advancement of training techniques and the refinement of drills are not coincidental; they stem from continuous research into sports performance. Soccer, in particular, has greatly benefited from scientific studies that utilize technology to analyze the physiological demands of the game. These studies have provided key insights into players' responses, including heart rate fluctuations, maximal oxygen consumption, and lactic acid buildup during matches. Since the most effective training replicates real match conditions, these findings help coaches and fitness trainers design efficient and purposeful training exercises that maximize both time and effort.

The necessity of preparing soccer players according to the physiological demands of matches has led to experimentation and the adoption of training methods best suited for enhancing player capabilities. Functional abilities, in particular, serve as the foundation for improving both aerobic and anaerobic capacities essential to the game.

Didier Deschamps emphasizes this by stating, "The most important aspect of physical preparation is knowing how to combine physical effort with drills that integrate the ball. The physiological impact of ball-integrated training must be carefully assessed. This integration enhances all technical, tactical, and physical aspects of a player's performance" (**Dellal, 2008. P01**).

In light of this, training methodologies have evolved, shifting towards a more specialized selection of exercises based on scientific principles. Small-sided games (mini-matches) have become a central component of modern training, widely adopted by coaches across different preparation phases. Their diverse formats and increased training volume help achieve complex objectives more efficiently. By using small-sided games as both a training tool and a performance goal, coaches can enhance player efficiency, improve overall performance, and develop the physical and tactical attributes required for high-level competition (**Abu Al-Majd & Ismail, 1997, p. 57**).

From the above, it is evident that small-sided games are among the modern applications in the field of soccer. They can be utilized by the fitness coach at all stages of training due to their efficiency in incorporating all performance requirements. Therefore, this study aims to answer the following questions:

- 1- What is the concept of small-sided games (definition, types, importance, function, characteristics, and components)?
- 2- What are the principles and rules that a coach should consider when planning to use small-sided games?
- 3- What are the physical and physiological characteristics of small-sided games?
- 4- What are the technical characteristics of small-sided games?

1. Concept of Small-Sided Games :

1.1. Definition of Small-Sided Games :

Hanafi Mahmoud Mokhtar (1992, p 135) defines them as "exercises that are enjoyable for players, conducted in small spaces with a specific number of players, which may be equal or unequal depending on the set objectives."

Boudineau (2007) describes small-sided games as a recreational activity governed by rules and agreements, including the concepts of winners and losers, incorporating both physical and intellectual aspects.

According to **Gheneam et al. (2016, p 31)**, small-sided games involve a confrontation between two teams, which may or may not have equal numbers of players. The rules of the game are modified, including field dimensions, goal size, and the presence or absence of a goalkeeper.

Sylvain Alain (2011, p. 53) defines small-sided games as exercises involving the ball, played in a reduced playing area with fewer players than a standard (**11-a-side match**)

Cheriet Adel (2018, p. 70) states, "Small-sided games have various and diverse characteristics that change depending on the size of the playing area, the number of players, and the duration of the exercise. Through these variables, we can control the intensity of small-sided games."

Ahmed Majrali (2023, p. 115) defines them as "games not bound by strict laws and conditions, played in small areas with specific dimensions and a reduced number of players."

The researcher defines small-sided games as exercises performed in designated areas of the field using the ball, simulating real match situations. These games incorporate all the performance requirements of soccer under specific rules set by the coach according to training objectives. They represent a modern training method and a new approach to the physical preparation of players.

1.2. Forms of Small-Sided Games :

Small-sided games are defined as a confrontation between two teams, which may have equal or different numbers of players depending on the game's objective. For example, it could be (3 vs. 3) with an additional neutral player, or it may include goalkeepers for both teams or just one team. Another variation could be (3 vs. 3) with two additional players (one as a supporter and the other as an assistant).

In general, small-sided games involve fewer players than a standard competitive soccer match. They range from (1 vs. 1) up to (10 vs. 10). **Alain** (2011, p. 53) classifies them as follows: "Duel games : (1 vs. 1) and (2 vs. 2) , small-sided games : (3 vs. 3), (4 vs. 4), (5 vs. 5), (6 vs. 6) , match-based games : (7 vs. 7), (8 vs. 8), (9 vs. 9), (10 vs. 10)" ,**(Sylvain Alain, 2011, p. 53).**

1.3. Importance of Small-Sided Games :

- The importance of using small-sided games lies in placing the player in situations similar to those that occur in real matches, as their contact with the ball increases, and the opponent (the rival) is very close to them, leading to more one-on-one duels for the ball and increasing the pressure on (the ball carrier), which forces them to make a decision quickly, while the rest (must provide the necessary solutions) to improve collective thinking. **(Ghenem et al.)** add, "that through the repetition of these situations, the player will gain experience and will be able to distinguish between stimuli that carry important information, allowing them to make decisions quickly" **(Ghenem et al., 2016, p. 31).**

- Small-sided games are essential for developing players' physical, physiological, and psychological abilities while fostering teamwork. This aligns with the concept of integrated sports training. **(Jones et al. (2007))** explain that small-sided games incorporate physical preparation, technical skills, tactical strategies, and cognitive aspects through short, intense movements, quick direction changes, and frequent one-on-one encounters **(Hadjab Issam et al., 2017, p. 13).**

- Training through small-sided games or competition-based methods is one of the most effective ways to stimulate player engagement and increase motivation for performance **(Kashk & El-Basaty, 2000, p. 166).**

The importance of small-sided games can be summarized in the following points:

1. Comprehensive Training – Small-sided games encompass all performance requirements (physical, technical, tactical, and psychological), making them a new approach in physical preparation due to their efficiency in effort management.
2. Enjoyment and Engagement – The use of the ball and, in some cases, goals adds an element of fun, making players more enthusiastic about training.
3. Essential for Development – Small-sided games incorporate all key elements of soccer performance, including technical skills, tactical awareness, and physical fitness, making them crucial for player development.

4. Skill Acquisition and Creativity – Implementing small-sided games in training programs helps players acquire soccer-specific skills and fosters creativity, especially when coaches allow freedom of play.

1.4. Components of Small-Sided Games :

1.4.1. Number of Players :

Regulating the number of players in small-sided games is the primary condition for structuring a training session using this method. The number of players essentially defines the game, as it helps predict the session's objectives. The number of players in a given playing space significantly impacts one of the most critical physiological indicators— heart rate , which serves as a measure of training intensity. Additionally, a lower number of players influences the frequency of technical movements and the nature of tactical sequences.

This is supported by **Gille (2010)**, who states: "The choice of player numbers greatly affects tactical sequences, technical execution, and cardiovascular responses."

Furthermore, **Hourcade (2019)** emphasizes that reducing the number of players on the field leads to: -Increased ball contact - More frequent dribbling - Greater physical duels - A rise in heart rate frequency (**Hourcade, 2019, p. 35**).

The impact of varying player numbers on different physiological and physical performance factors has been extensively studied. For instance, research by **Jons and Durst (2007)** found no statistically significant differences in heart rate between 4v4 and 8v8 games:

- The recorded heart rate was (175 ± 10 bpm) for (4v4) and (168 ± 6 bpm) for (8v8) .
- The total distance covered was (778 ± 160 m) in (4v4) and (693 ± 103 m) in (8v8) , showing no significant difference.
- There was also no notable variation in walking, jogging, or sprinting distances between the two formats.

However, the study did find significant differences in specific movement patterns :

- Backward and lateral running distances were significantly greater in (4v4) (140 ± 68 m) compared to (8v8) (107 ± 51 m). Ball contact frequency increased as the number of players decreased: (8v8): (13 ± 7) ball touches per player. (4v4): (36 ± 12) ball touches per player

It is important to note that the playing area was not identical in both formats:

- (4v4) was played on a (30×25 m²). (8v8) was played on a (60×40 m²) field

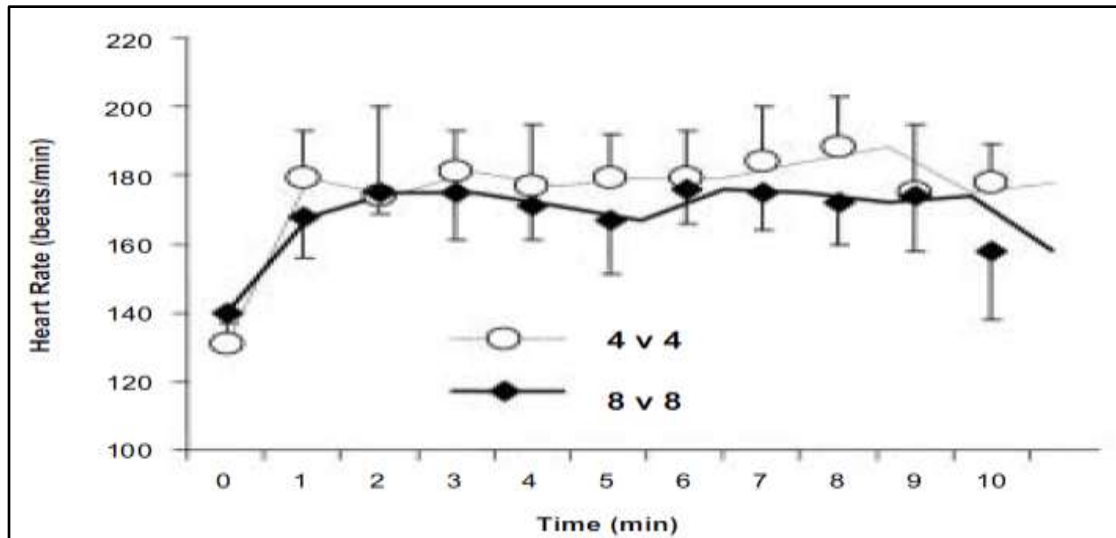


Figure 1: Comparison of Heart Rate (beats) Between Two Games (4 vs. 4) and (8 vs. 8)

Source: Jonse et Durst, 2007, p. 152.

The researcher believes that in order to obtain more accurate results regarding the number of players, it is essential to control the variables more precisely. This means adjusting the number of players while keeping other variables in small-sided games, particularly the playing area, constant. This approach was adopted by (Owen et al. 2004) in their experiments on small-sided games, where they tested five different game formats: (1 vs. 1), (2 vs. 2), (3 vs. 3), (4 vs. 4), and (5 vs. 5), each played in three different field sizes : small, medium, and large as shown in the following table:

Table 1: Dimensions of the Used by (Owen et al. 2004)

Playing Field (m)	(1 vs . 1)	(2 vs.2)	(3 vs . 3)	(4 vs. 4)	(5 vs. 5)
Small	10 × 5	15 × 10	20 × 15	25 × 20	30 × 25
Medium	15 × 10	20 × 15	25 × 20	30 × 25	35 × 30
Large	20 × 15	25 × 20	30 × 25	35 × 30	40 × 35

Source: Owen et al. 2004, p. 51

The results obtained by (Owen et al. 2004) can be summarized as follows:

- A reduction in the number of players in the playing area led to an increase in the total number of motor skills performed per player, including heading, passing, receiving, turning with direction changes, and dribbling. The most frequently used skill by players was passing. The study also found that a lower number of players led to a higher frequency of involvement of supporting players (targets) positioned along the shorter sides of the playing area. In all game scenarios, there were two supporting players moving along the short sides, and teams inside the area attempted to involve them through one-touch passing.

- An increase in the number of players in the playing area generally resulted in a decrease in heart rate levels (cardiac response during exercise). It was observed that the (3 vs. 3) game produced an average heart rate similar to that in a real (11 vs. 11) match. However, in the (1 vs. 1) and (2 vs. 2) games, heart rates were significantly higher than in a real match.

Small-Sided Games in Soccer (Concept, Practical Principles, and Technical and Physiological Characteristics)

On the other hand, in the (4 vs. 4) and (5 vs. 5) games, heart rates were generally lower than those recorded in an (11 vs. 11) match .

- The findings of **Aroso et al. (2004)** and **Sampaio et al. (2007)** were similar, reinforcing that a lower number of players in the same playing area leads to an increase in certain physiological indicators . Both studies found significant differences in cardiac excitation (**HRmax%**), blood lactate levels, and the rate of perceived exertion (RPE) , which was not specifically analyzed by **Sampaio et al.** in the (2 vs. 2) vs. (3 vs. 3) comparison. These findings confirm that the intensity of effort in small-sided games increases as the space occupied by each player increases .

Table 2: Summary of the Results from the Studies by (Aroso et al. 2004) and (Sampaio et al. 2007)

Study	Game	Work duration /Rest duration	Field dimensions	m ² /player	(%HRmax)	Lactate (mmol/l)	RPE (6-20 u.a)
J et Aroso al, 2004	1 vs 1	3 × 1.5 min / 90 sec	30 × 20	150	2.7±84.0	2.7±8.1	1.1±16.2
	2 vs 2	3 × 4 min / 90 sec	30 × 20	100	2.0±87.0	2.0±4.9	1.7±14.2
	3 vs 3	3 × 6 min / 90 sec	30 × 20	75	9.0±70.0	1.7±2.6	0.9±13.3
Sampaioa J et al, 2007	2 vs 2	2 × 1.5 min / 90 sec	30 × 20	150	1.4±83.7	-	0.6±15.5
	3 vs 3	2 × 3 min / 90 sec	30 × 20	100	1.7±80.8	-	0.2±15.8

Source: Houar et al. 2020. 13, translated by the researcher.

1.4.2. Field Dimensions (Playing Area):

The topic of field dimensions must be considered in conjunction with the number of players. However, this overlap can be eliminated by calculating the space occupied by each player individually. This is done by dividing the playing area (length × width) by the number of players in the game. As **(Alain)** affirms:

"Defining the playing space allows us to distinguish between games based on field size and surface. Taking into account the relationship between the number of players and the playing area enables us to determine the game's intensity, which is a crucial element in selecting a game within the framework of set objectives. In reality, it can be observed that the more intense the game, the greater the number of one-on-one duels and physical contacts between opposing players. The stronger and denser these confrontations, the greater the pressure on the opponent, requiring special management of time and space to maintain an appropriate game intensity. These factors are closely linked to physiological characteristics and significantly influence the players' heart response." (**Sylvain Alain, 2011, 55**)

The researcher believes that the playing area is a key factor in achieving the intended game objective, whether skill-based or physical. Studies have consistently shown differences in the number of skill movements and physiological indicators, even if some differences were not statistically significant. However, most studies indicate an increase in heart rate, lactic

acid concentration, and effort index as the playing area increases. For instance, the study by (Williams et al., 2007) recorded an increase in heart rate (HR_{max}%) with an increase in playing area, with the following results: (164±12), (166±6), and (171±11), respectively.

Table 3: Summary of the Study Results by (Williams K et al, 2007) and (Sampaioa et al. 2007)

Study	Game	Work Duration /Rest Duration	Field Dimensions	m ² /player	(%HR _{max})	Lactate (mmol/l)	RPE (6-20 u.a)
Williams K et al, 2007	3 vs 3	-	20 × 15	50	12±164	-	-
		-	25 × 20	83	6±166	-	-
		-	30 × 25	125	11±171	-	-
Rampinini E et al, 2007	3 vs 3	3 × 4 min / 3 min	20 × 12	40	2.9±89.5	1.8±6.0	0.6±8.1
		-	25 × 15	63	2.3±90.5	1.8±6.0	0.6±8.1
		-	30 × 18	90	2±90.0	1.5±6.3	0.4±8.4
	4 vs 4	-	24 × 16	48	3.6±88.7	1.5±6.5	0.4±8.5
		-	30 × 20	75	3.1±89.4	1.9±5.3	0.5±7.6
		-	36 × 24	108	2.3±89.7	1.8±5.5	0.5±7.9
	5 vs 5	-	28 × 20	56	3.6±87.8	1.6±6.0	0.5±8.1
		-	35 × 25	88	3.1±88.8	1.4±5.2	0.9±7.2
		-	42 × 30	126	2.3±88.8	1.7±5.0	0.6±7.6
	6 vs 6	-	32 × 24	64	2.0±86.4	1.6±5.8	0.6±6.8
		-	40 × 30	100	2.4±87.0	1.5±4.5	0.6±6.8
		-	48 × 36	144	2.4±86.9	1.6±5.0	0.7±7.3

Source: Houar et al. 2020. 12, Researcher's Translation

The study by (Owen et al. 2004) also examined various forms of small-sided games (1 vs. 1), (2 vs. 2), (3 vs. 3), (4 vs. 4), (5 vs. 5). The researchers did not record any differences in skill-related demands (heading, turning and changing direction, passing, receiving, and dribbling), attributing this to the fact that the percentage increase was not sufficient to create a significant difference in skill requirements. In contrast, there were noticeable differences in physiological indicators (heart rate during small-sided matches), with results showing an increase in heart rate, as illustrated in Figure 2 . The data indicate a rise in heart rate across all game formats, with this increase being more significant in larger playing areas , except in the (4 vs. 4) game , where the medium-sized area recorded the highest heart rate.

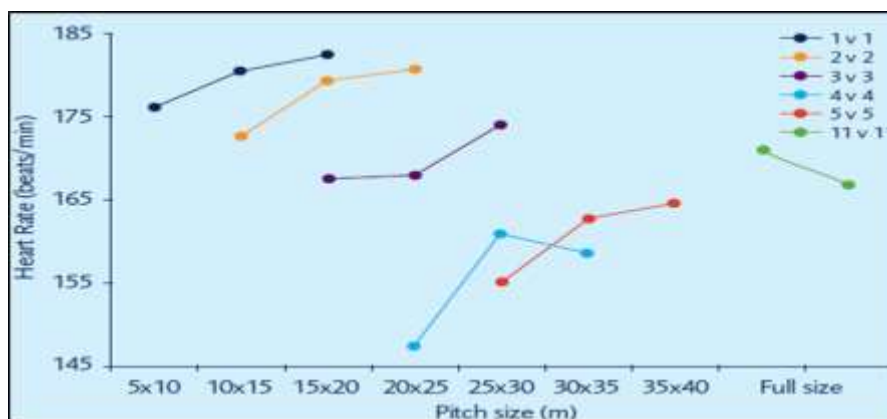


Figure 2: Average Heart Rate During Small-Sided Games

Source: Owen et al, 2007

1.4.3. Duration of Sequences and Rest Periods:

The duration of activity and the ratio and nature of rest periods are among the crucial aspects of planning a training session using small-sided games. Both elements help determine the predominant energy system involved. The work-to-rest ratio depends on the purpose of rest:

- Complete rest: In this case, the heart rate drops below 120 bpm, reaching around 100 bpm, and the work duration can extend to twice or more of the rest duration.
- Incomplete rest: Here, the heart rate does not drop below 130 bpm, and the rest duration is equal to or less than half of the work duration.

Coaches may use two types of rest as active rest, where players engage in light activities such as jogging, stretching, or ball bouncing to promote relaxation and a gradual reduction in heart rate. And passive rest, where players stop all physical activity, which coaches can utilize for explanations, performance corrections, or hydration breaks.

Understanding the impact of the work-to-rest ratio on physiological variables in small-sided games requires precise control of other variables, such as maintaining the same number of players, playing area, and total game duration while varying only the rest duration and its nature. This principle was demonstrated by (Gille 2010), citing (Lechaue and Lacroix 2009), who tested the same (2v2) game format under two conditions: 1 minute of play followed by 1 minute of passive rest. Whereas 1 minute of play followed by 30 seconds of passive rest.

The results showed no significant differences in heart rate response, with values averaging approximately 88% of maximum heart rate. However, based on the **Sarjent** Test for muscle recovery, recovery in the second protocol (30-second rest) was slower compared to the first protocol (60-second rest), where recovery was more effective (unpublished data).

1.4.4. Game Rules and Conditions:

During training sessions using small-sided games, coaches apply various rules and conditions that increase the physical demands on players within the playing area. These include limiting the number of touches, requiring players to involve a support player, aiming to score the highest number of goals, or other conditions such as ball retention or reaching the opponent's zone. The researcher believes that all these conditions contribute to an increase in maximum heart rate percentage, blood lactate concentration, and the Rating of Perceived Exertion (RPE).

According to (Hourcade 2019, p. 36), citing (Nago et al.), the type of marking—whether individual, zone-based, or without a specific zone—plays a decisive role in player engagement and game intensity. For instance, in a (3v3) game with individual marking compared to the same game with free movement, heart rate remained at a significantly higher level. Reported findings showed an increase in reserve heart rate percentage in the (3v3)

game with individual marking ($80.5 \pm 5.8\%$) compared to the same setup with free movement ($75.7 \pm 4.7\%$). Additionally, the RPE score was higher in the individual marking setup (7.1 ± 0.7) versus the free movement setup (6.0 ± 0.9).

Game rules and conditions are often linked to technical constraints (such as limiting touches, restricting dribbling, enforcing quick directional changes, and requiring shots on small or large goals with a goalkeeper) or tactical principles (such as numerical superiority, marking and escaping from marking, and defensive or offensive transitions). These conditions inevitably impact the number of technical actions performed, while also increasing the intensity of effort and triggering physiological adaptations.

1.4.5. Coach Activation (Role of the Coach):

A coach's encouragement of players on the field directly motivates them to exert more effort and achieve their goals. Numerous studies have demonstrated the clear and direct impact of verbal encouragement during small-sided games on heart rate (**HR**) and blood lactate concentration, which are both linked to the intensity of effort exerted (**RPE – Rating of Perceived Exertion**).

1.4.6. Ball Availability:

The researcher believes that the biggest challenge coaches face when conducting training sessions using small-sided games is the excessive downtime, commonly referred to as negative time, which occurs when the ball leaves the playing area. It is evident that having balls readily available throughout the field significantly increases effective playing time, leading to more player-ball interactions and, consequently, higher game intensity.

2. Practical Principles for Using Small-Sided Games

2.1. Rules for Using Small-Sided Games:

Based on the previously mentioned elements, we can establish some key rules for conducting a successful training session using small-sided games as follows:

1. Clearly define the objective of the game: Is the training session targeting the physical aspect, the technical aspect, or the tactical aspect?
2. Adjust the number of players in the playing area, as this affects the game's flow and the achievement of its objective.
3. Define the playing area precisely according to the number of players, ensuring that the space is carefully measured to control the game's intensity.
4. Set the work-to-rest ratio accurately according to the training goal. (**Gille 2010**) recommends using passive rest to maintain good performance when repeating the game.

Small-Sided Games in Soccer (Concept, Practical Principles, and Technical and Physiological Characteristics)

5. Ensure a sufficient number of balls around the playing area. It is preferable to have a ball feeder outside the playing area to avoid unnecessary stoppages.
6. The coach should provide continuous encouragement to the players during the small-sided game to ensure they perform at their maximum capacity.
7. The presence of both small and large goals, along with a goalkeeper, is an important factor in increasing player responsiveness and motivation to perform at the required level.
8. **(Gille 2010)** recommends using small-sided game training sessions in a(6v6) format at most, with short and intense periods ranging from (7 to 30 minutes).
9. It is advisable to use simple and non-complex game rules when implementing small-sided games with players of lower skill levels.

2.2. Organizing and Using Small-Sided Games:

Small-sided games are widely used as they encompass all performance requirements (physical, technical, tactical, and even psychological). The same game can be adapted primarily for physical development when the objective is to enhance physical fitness. It can also be oriented toward improving technical or tactical skills, in which case the intensity of effort is lower, allowing for game stoppages for correction and guidance. Additionally, small-sided games can be used for recreational purposes, where they are played without strict rules, monitoring, or motivation, providing a space for creativity, especially for younger age groups.

The same small-sided game can be organized with different objectives, depending on the aspect to be developed in the training session (**Dominant**). For instance, if the goal is physical development, the focus might be on aerobic capacity, whereas if the objective is tactical improvement, the emphasis could be on ball possession. This specific focus should guide the coach's approach during the training session.

Table 4 : The table illustrates the key elements of a training session using small-sided games.

Thème : Selected title	4v4 Game with Two Small Goals	
Dominante: Aspect to be developed	Tactical: Ball Possession	Physical: Aerobic Capacity (2 min work / 2 min rest)
Support : Supporting System	Physical: Aerobic	Tactical: Ball Possession

Source :FIFA. Foot balle des jeunes

2.3. Physical and Physiological Characteristics of Small-Sided Games :

The training load is clearly defined in individual exercises, making it easier to control and analyze. However, it is more challenging to assess in small-sided games. To properly structure the training load in small-sided games, it is essential to understand some physiological characteristics associated with their use.

3. Physical and physiological characteristics of Small-Sided Games

3.1. Small-Sided Games and Endurance:

Endurance is a fundamental trait for soccer players. The physical trainer aims to develop and maintain it throughout the season, progressing from aerobic capacity (functional endurance) to aerobic power (soccer-specific endurance). The integration of the ball in endurance-based exercises is essential for soccer players, and small-sided games provide this naturally, as they encompass all performance requirements and offer various forms of play. They are also an effective tool in engaging players in training and pushing them to exert maximum effort.

As previously mentioned, small-sided games elicit cardiac responses similar to those in real soccer matches. A study by (Owen et al. 2004) recorded a cardiac stimulation in a (3v3) game comparable to that in an (11v11) match. In contrast, (1v1) and (2v2) games showed significantly higher heart rates than those in an actual match, while (4v4) and (5v5) games generally had lower heart rates compared to an (11v11) match.

These maximum levels of physical effort, as indicated by cardiac stimulation when using small-sided games, are sufficient to bring about developments in endurance. Therefore, we see that small-sided games are an important means for developing both general and specific endurance. This is confirmed by Hourcade, who states:

"Small-sided games aim to develop and/or maintain players' physical and physiological capacities with the same effectiveness as classical (traditional) physical exercises. Their main advantage is that they are more enjoyable for players. This category of exercises is often found in different and variable formats (from 1v1 to 8v8) and aims to develop endurance in its various forms: aerobic endurance, maximal aerobic power, as well as the strength component, but to a lesser extent." (Hourcade, 2019, p. 34).

Small-sided games contribute to endurance development throughout the season and during the competition phase. They are a valuable choice because they incorporate all physical, technical, and tactical requirements. The impact of small-sided games on the heart and aerobic system is equivalent to that of intermittent physical exertion (Dellal et al., 2008).

For example, a study comparing two groups of soccer players over a training period (four weeks before competition and eight weeks during the competition phase) found that small-sided games (3v3, 4v4, 5v5) produced similar physiological responses to interval training (4 × 4 minutes at 90–95% of maximum heart rate with three minutes of rest). The results showed that small-sided games led to:

1. Comparable cardiac stimulation.
2. A similar increase in peak oxygen consumption (VO₂ max).
3. A similar rise in lactate threshold levels.
4. Comparable improvements in running economy. (Dellal et al., 2013, pp. 15–16).

3.2. Small-Sided Games and Energy Production Systems:

It is well known that energy production systems are determined by the duration of the exercise (physical effort) and its relationship to the intensity exerted. There are three distinct

systems: the **alactic anaerobic system** (lasting no more than 15 seconds), which in soccer manifests in sprinting, jumping, explosive movements, dribbling, and shooting; **the lactic anaerobic system** (up to 2 minutes), which involves repeated fast and explosive movements with or without the ball, contributing to overall performance endurance; and **the aerobic system** (exceeding 2 minutes), which represents the effort sustained throughout a soccer match. Therefore, soccer activity primarily stimulates the aerobic system while also incorporating both anaerobic systems (**alactic and lactic**).

When using small-sided games, the relationship between exercise duration (time), total effort (distance covered), and the number of players (density) must be considered. As stated: "The use of lactic or alactic anaerobic processes depends on recovery duration. For the same total duration of aerobic activity, it has been observed that the shorter and more frequent the work phases, the greater the stimulation of lactic and alactic anaerobic processes. Therefore, the different types of small-sided games used in the training session should align with a total distance covered between 3600 and 4200 meters. It is preferable to select intensity periods ranging from 45 seconds to 6 minutes." (Chiha Fouad, 2023, p. 100).

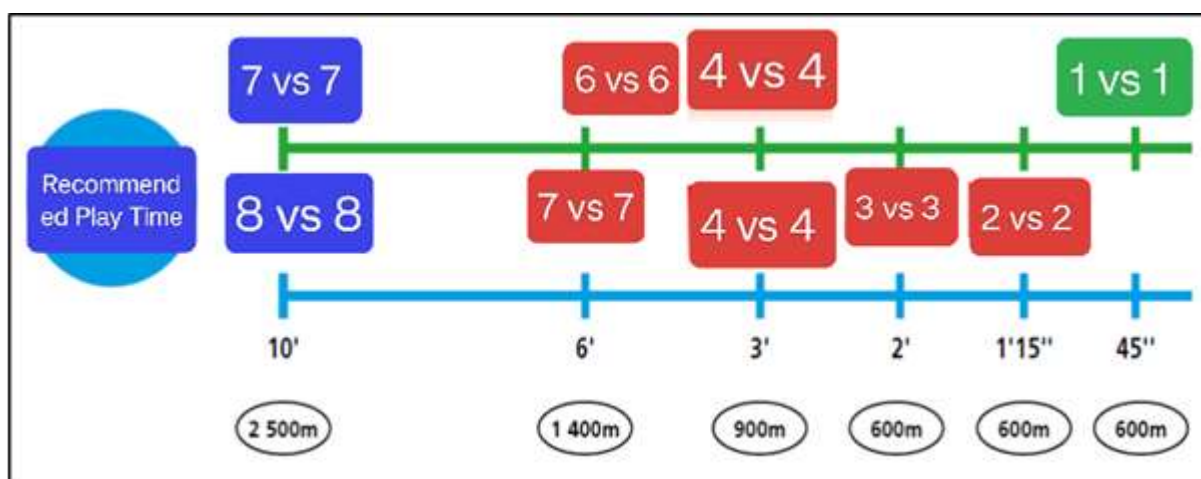


Figure No. 3: Small-Sided Games and Quantitative Measurement According to Time

Source: FIFA. Small-Sided Games and Physical Preparation. 53

The coach can determine the targeted energy system by controlling the number of players, where small-sided games can be classified as follows :

- Games from (8 vs. 8) to (5 vs. 5) contribute to developing aerobic capacity .
- Games of (4 vs. 4) or (3 vs. 3) develop aerobic power .
- Games of (2 vs. 2) or (1 vs. 1) develop anaerobic capacity, both lactic and alactic (speed, explosive movements)

The coach can rely on the following table to structure training loads using small-sided games

Table No. 5: Represents Training Load Models in Small-Sided Games.

Training Type	Exercise Examples							Reference
	HR (%)	Lactic Acid	Volume	Exercise Duration	Repetitions	Rest	Exercise	
Aerobic Capacity	90 - 80	6 - 3	60 - 30	6 – 25 min	8 - 1	< 1 min	5 vs 5	Castagna 2004
							6 vs 6	Rampinini 2007
							7 vs 7	Castagna 2004
							8 vs 8	Saasi 2004
Aerobic Power (85-90% of VMA)	95 - 90	12 - 6	35 - 12	6 - 3	8 - 4	Exercise duration = Rest duration	3 vs 3	Balsom 1999
							4 vs 4	Holf 2004
Anaerobic Power	> 85	> 10	16 - 4	20 sec – 3 min	4 – 2	4 - 1	2 vs 2	Aros 2004
							3 vs 3	Little 2006

Source: Chiha Fouad, 2023, p. 100. Researcher's translation.

The following figure also illustrates the relationship between the targeted energy system and the playing area. The numerical density of players within the playing space influences the intensity of the effort exerted. The larger the area covered by the player, the greater the exertion, leading to increased distances covered at higher intensity and speed. This, in turn, stimulates the anaerobic alactic energy system, **fostering speed and explosive movements (fewer players – larger space).**

Conversely, when there are(**fewer players in a smaller space**), the focus shifts towards developing **strength** through an increased number of one-on-one duels. On the other hand, when (**a large number of players occupy a small space**), the intensity of effort exerted by each player is moderate, which **promotes aerobic endurance development** (i.e., stimulating the aerobic system = aerobic capacity). However, when(**a large number of players are spread across a large space**), the intensity of effort increases due to covering long distances repeatedly under the pressure of opposing players. This stimulates the anaerobic lactic energy system, enhancing specific endurance (performance endurance = resistance).

Small-Sided Games in Soccer (Concept, Practical Principles, and Technical and Physiological Characteristics)



Figure 4: Playing Area According to Training Type and Targeted Energy System

Source: Sadouki Bilal, 2021, p. 121.

Table 6: Characteristics of Different Small-Sided Games and Their Main Effects on Physical, Technical, and Tactical Aspects.

	Playing Duration	Repetitions	Rest Between Repetitions	Field Dimensions	Physiological & Physical Effects	Technical/Physical Components
1vs1	30 sec – 1.30 min	4 - 2	30 sec – 3.30 min	5 m ² – 25 m ²	Lower limb muscle strengthening	One-on-one duels, ball protection, dribbling
2 vs 2	45 sec – 2 min	5 - 2	45 sec – 3.30 min	12 m ² – 30 m ²	Anaerobic + lower limb muscle strengthening	One-on-one duels, ball protection, dribbling, Running without the ball etc.
3 vs 3	2 – 4 min	5 - 2	1 – 3.30 min	100 m ² – 225 m ²	Anaerobic + aerobic + endurance	One-on-one duels, ball protection, dribbling, Running without the ball, combination play among three players
4 vs 4	2.30 – 6 min	6 – 2	4 – 1	300 – 1200 m ²	Mixed anaerobic/aerobic work + maximal aerobic power + endurance	One-on-one duels, dribbling, Running without the ball, restricting ball carrier's movement, combination play among three players, intercepting passes, etc.

5 vs 5	7 – 4	6 – 2	4 – 1	600 – 1400 m ²	Mixed anaerobic/aerobic work + maximal aerobic power + endurance	One-on-one duels, dribbling, protecting the ball, restricting ball carrier's movement, combination play among three players, intercepting passes, etc.
6 vs 6	8 - 5	4 - 1	4 – 1	900 – 2000 m ²	Mixed anaerobic/aerobic work + maximal aerobic power + endurance	One-on-one duels, protecting the ball, restricting ball carrier's movement, combination play among three players, intercepting passes, short and medium passes, etc.
7 vs 7	At least 8 min	3 – 1	4 – 1	1600 – 2500 m ²	Predominantly aerobic – anaerobic	One-on-one duels, protecting the ball, restricting ball carrier's movement, teamwork, intercepting passes, short and medium passes, synchronization of attack and defense, etc.
8 vs 8	At least 10 min	3 - 1	4 – 1	More than 1600 m ²	Predominantly aerobic – anaerobic	

Source: Chiha Fouad, 2023, p. 101

3.3. Small-Sided Games and Heart Rate:

Heart rate (pulse) refers to the number of heart beats per minute, typically ranging between 60 and 70 beats per minute (bpm). Among athletes, a phenomenon known as bradycardia (slow heart rate) is often observed, where resting heart rate can drop below 60 bpm (Kamach & Saad, 2006, p. 151).

Heart rate is considered an indicator of cardiovascular and respiratory fitness, as a physically fit individual returns to their resting heart rate more quickly (Billat, 2012, p. 30). Additionally, heart rate is used as a measure of exertion and is recommended as a tool for monitoring training rather than as a training objective itself (Carré, 2013, p. 08).

Table 7: The Effect of Different Game Formats on Maximum Heart Rate

Exercise	Work & Rest Duration	Field Dimensions	% of Maximum Heart Rate	Standard Deviation
2 vs 2	4 × 2 min (2 min)	27 × 18	90.8	1.7
3 vs 3	4 × 3 min (1 min 30 sec)	36 × 27	90.6	1.3
4 vs 4	3 × 3 min 30 sec (2 min)	45 × 27	90.2	2.1
5 vs 5	3 × 5 min (1 min 30 sec)	50 × 27	89.3	2.5
6 vs 6	3 × 6 min (1 min 30 sec)	55 × 27	87.5	2
8 vs 8	3 × 10 min (2 min)	64 × 27	87.6	1.2
5vs 5 (½ field)	5 × 2 min (2 min)	55 × 32	86.9	1.4
6 vs 6 (½field)	5 × 2 min (2 min)	59 × 27	90.5	0.9

Source: Sylvain, 2011, p. 54. Researcher's translation

The heart rate in small-sided games and continuous work without the ball was found to be similar. Additionally, when comparing small-sided games with interval training while maintaining the same work-to-rest ratio, the results showed a match between intermittent training and training through a small-sided game (5 vs. 5). However, heart rate results in small-sided games can vary depending on the game rules (number of touches, playing duration, presence of a goalkeeper, etc.) (Delall, 2008, pp. 53–54).

4. Small-Sided Games and Technical (Skill) Characteristics:

Several studies and statistics highlight the benefits of small-sided games compared to standard (11-a-side) soccer. These studies indicate that in a (4 vs. 4) game, a player touches the ball five times more frequently and 50% more frequently in a (7 vs. 7) game than in an (11-a-side) match. Moreover, in a (1 vs. 1) game, a player touches the ball three times more than in a (4 vs. 4) game and twice as much as in a (7 vs. 7) match.

On average, a goal is scored every two minutes in a (4 vs. 4) game and every four minutes in a (7 vs. 7) game. The goalkeeper's involvement is two to four times higher in a (7 vs. 7) match compared to an (11-a-side) soccer match. The ball is out of play for 8% of the time in a (4 vs. 4) game, 14% in a (7 vs. 7) game, and 34% in an (11 vs. 11) match (Yvon Avry et al., GRASSROOTS, FIFA, p. 62).

Conclusion:

Through the review of previous studies on small-sided games, it has been shown that they can be an important alternative to many training methods in physical preparation. This is due to their resemblance to real match situations and their various formats, such as (1v1), (2v2), (3v3), (4v4), etc. Studies have also demonstrated that the impact of small-sided games is comparable to that of other training methods and is particularly suitable for developing specific endurance in soccer players. However, their use requires adherence to several conditions that physical trainers must consider to control and direct the training load according to certain physiological principles. These principles are related to the number of players, the playing area, the duration of work and rest periods, the rules of play, the availability of balls to avoid wasted time, as well as the coach's encouragement.

References and Sources:

1. Ahmed Mijrali , "The Effect of Small-Sided Games on Developing Some Basic Skills in U15 Soccer Players," Al-Tahadi Journal , Vol. 15, Issue 1, 2023, pp. 112-125.
2. Alexandre Dellal. De L' Entrainement A La Performance. Edition De Boeck Université. 2008
3. Alexandre DELLEL, Analyse de l'activité physique du soccereur et de ses conséquences dans l'orientation de l'entraînement : Application spécifique aux exercice intermittent cours a haut intensité et aux jeux réduits, thèse doctorat, université de Strasbourg, 2008.
4. Alexandre DELLEL: une saison de préparation physique en soccer, Edition de boeck université, bruxelles, 2013.
5. Amr Abu Al-Majd & Jamal Ismail Al-Namki , Planning Training and Education Programs for Juniors , Vol. 1, 1st Edition, Markaz Al-Kitab for Publishing, 1997.
6. Billat. Véronique, Physiologie et méthodologie de l'entrainement , Ed 03^{eme}, De boeck, Bruxelles, 2012
7. Chiha Fouad, Le guide de préparateur physique 2, dar alhouda, Algérie, 2023
8. Francois CARE, cardiologie du sport, de boeck, 2013
9. Frédéric BODINEAU: soccer-jeu et jeu réduits, éditions Amphora, 2007.
10. Gheneam Nourddine, Abbd Abdelhak, Etude Comparative De L'influence Des Exercices Intermittents Course A Haute Intensite Et De Jeux Reduits Sur L'amelioration De L'endurance Chez Les Soccereurs (17-19 Ans), Revue- Le Défi. Volume 8, Numéro 2, 2016, Pages 11- 48
11. Gilles Cometti, L'utilisation Des Jeux Réduits Dans La Preparation Physique Du Soccereur, CEP, Newsletter N3, 2010
12. Hanafi Mahmoud Mukhtar , Soccer for Juniors , Dar Al-Fikr Al-Arabi, Amman, 1992.
13. Hijab Issam & Kamal Bin Misbah , "The Effect of Using Small-Sided Games in Training Programs to Develop Physical Attributes in Soccer Players (Ages 17-19)," Journal of Sciences and Practices of Physical, Sports, and Artistic Activities , Vol. 7, Issue 2, 2018, pp. 129-143.
14. Houar abdelatif, bengoua ali, kacem abdelhadi. Les paramètres du calibrage de l'intensité du travail physique dans les jeux réduits en football , International Scientifique Communication la formation dans les institué des sciences des activité physique et sportive, université de m'sil, 29 et 30 décembre 2020
15. Jean-Christophe Hourcade, les 5 piliers de la performance physique soccer, ed 1, 2019
16. Mohamed Keshk & Amrullah Al-Basati , Fundamentals of Skill and Tactical Preparation in Soccer , University of Alexandria, Egypt, 2000.
17. Owen Adem , Craig Twist, Paul R. Ford. (2004). Small-sided games: the physio-logical and technical effect of altering pitch size and playernumbers. Insight FACA J, 7 (2): 50-3.
18. Sharit Adel , "The Contribution of Small-Sided Games in Improving Dribbling Technique and Developing Agility in U13 Soccer Players," Al-Tahadi Journal , Vol. 10, Issue 2, 2018, pp. 66-79.
19. Soccer des jeunes : les jeux d'entrainement, Ressources. FIFA. Com youth – soccer – training-manual 2866317 – 2866319 .
20. Steven JONES et barry DURST, physiological and technical demends of 4v4 and 8v8 games in elite youth soccer players, Kinesiology 39 , 2007, 2 : 150-156
21. Sylvain Alain MONKAM TCHOKONTE, evolution du soccer et consequence l'entrainement et la préparation physique ; Aplication a l' etude des incidence des jeux – réduit sur les adaptations des joueur, thèse doctorat, université de Strasbourg, 2011
22. Youssef Lazem Kamash & Saleh Bashir Saad , Physiological Foundations of Training in Soccer , Dar Al-Wafa, Alexandria, 2006.
23. Yvon Avry, Marco Bernet, Alvin Corneal, Belhassen, GRASSROOTS, FIFA Education and Technical Development Department.