

Modeling small-sided soccer games

A. RAHOU¹, Y. SAIDI ZERROUKI², A. MERZOUK³

1 Laboratoire Innovation et Performance Motrice, Université Hssiba Ben Bouali Chlef. a.rahou90@univ-chlef.dz

2. Laboratoire Innovation et Performance Motrice, Université Hssiba Ben Bouali Chlef. y.saidizerouki@univ-chlef.dz

3. Equipe EA3300 Adaptations Physiologiques à l'Exercice et Réadaptation à l'Effort. Université de Picardie Jules VERNE Amiens - France. abdellah.merzouk@u-picardie.fr

Received: 19/02/2024 Accepted: 08/05/2024 Published: 10/06/2024

Abstract:

This study aims to validate a specific form of reduced soccer game involving two different variations: a 3v3 + 2 fixed offensive support configuration. The modified version of the game includes two supports alternating between being inside and outside the play area, which measures 35x45 meters (1575 m²) with a density of 132 m² per player. The game consists of 2 minutes and 30 seconds of active play followed by an equal duration of recovery, repeated five times. The study concludes with a 10v10 match, including two goalkeepers covering the entire field. The primary goal is to establish physical dominance in each model of the reduced game and quantify the external training load associated with each game.

KEY WORDS : REDUCED GAMES, SOCCER, MODELING

الملخص : تهدف هذه الدراسة إلى التحقق من صحة نمط محدد من الألعاب المصغرة في كرة القدم والذي يتضمن شكلين مختلفين. الشكل الأول 3 ضد 3 + دعم هجومي ثابت بلاعبين 2 ثابتين على الأطراف. والشكل الثاني 3 ضد 3 + دعم هجومي ثابت بلاعبين 2 على الأطراف يتناوبان بين التواجد داخل وخارج منطقة اللعب، تبلغ مساحة اللعب 35 × 45 مترًا 1575 مترًا مربعًا بكثافة 132 مترًا مربعًا لكل لاعب. حدد زمن اللعبة بدقيقتين و 30 ثانية من اللعب النشط تليها مدة استرجاع مماثلة لزمن اللعب، تتكرر خمس مرات. يتم إنهاء العمل بمباراة 10 ضد 10 ، مع حارس مرمى لكل فريق يغطيان الملعب

* Corresponding author.

Modeling small-sided soccer games.

RAHOU ABDELKARIM, SAIDI ZERROUKI YOUSSEF,
MERZOUK ABDELLAH

بأكمله. الهدف الأساسي هو تحديد الصفات البدنية الغالبة في كل شكل من الألعاب المصغرة وقياس حمل التدريب الخارجي المرتبط بكل لعبة.

1-Introduction:

Soccer stands out as one of the most globally beloved sports, attracting millions of enthusiasts across various levels, from informal street matches to professional competitions. Achieving proficiency in soccer necessitates cultivating a diverse skill set encompassing technical, tactical, and physical prowess.

In contemporary soccer, the significance of physical preparation has surged, evident in the discernible differences in performance levels observed at each World Cup. This influence extends to physiological aspects, impacting attributes like speed, explosiveness, endurance, and fatigue reduction.

Over the past four decades, soccer's competitive landscape has transformed. Notable shifts include increased frequency of high-intensity efforts, reducing from every 1'17" in the 70s to every 55" since the 2000s. Additionally, there has been a marginal evolution in the distances covered, averaging 11,000 meters for all positions, excluding goalkeepers.

These changes prompted specialists to reassess training methodologies, emphasizing more precise approaches to meet evolving requirements. Contextualized work, mainly through reduced games, has gained prominence, aiming to replicate competition intensities rather than relying solely on analytical exercises.

Integrating reduced games into training has become indispensable to align with contextualized work and achieve intensities akin to competitive scenarios. These games offer numerous advantages across all skill levels, including:

- **Increased Ball Interaction:** With a smaller field and fewer players, each participant gets more touches on the ball, enhancing their adequate playing time and interaction. This fosters the rapid development of dribbling, passing, shooting, and ball control skills.
- **Technical Skill Enhancement:** Small-sided games provide a platform for players to concentrate on specific technical skills within

Modeling small-sided soccer games.

**RAHOU ABDELKARIM, SAIDI ZERROUKI YOUSOUF,
MERZOUK ABDELLAH**

dynamic gameplay. This improves vision, decision-making, passing accuracy, and operating in confined spaces.

· **Tactical Understanding:** The reduced dimensions of the pitch in small-sided games compel players to adapt swiftly, fostering a deeper understanding of tactical nuances. This includes concepts like positioning, movement without the ball, triangular play, and team coordination.

· **Fitness Improvement:** Intensity is a hallmark of small-sided soccer games, demanding constant movement, dribbling, passing, shooting, and defending within confined spaces. This contributes significantly to overall fitness enhancement, particularly in stamina and speed.

Soccer training's evolution incorporates advanced technologies to maximize players' potential, and one such innovation is the utilization of Global Positioning System (GPS) devices to quantify training load. This article explores how GPS can optimize player performance by assessing distance covered, speed, acceleration, deceleration, heart rate, and other physiological indicators during training sessions and matches.

2- General objective of the study:

This study involved the active participation of young AC Amiens U16 soccer players and was conducted over two days during the second competitive period in March 2023. The experiment included 12 players, comprising ten outfield players and two goalkeepers.

Two forms of reduced play were implemented: a 3vs3 reduced play with two fixed supports and a 3vs3 with two incoming/outgoing supports. The field dimensions were determined based on the NICK BROAD, resulting in a field size of 35 x 45 meters, totaling 1575 square meters (132 square meters per player).

Modeling small-sided soccer games.

**RAHOU ABDELKARIM, SAIDI ZERROUKI YOUSOUF,
MERZOUK ABDELLAH**

The two variations of reduced play were introduced following a 48-hour post-competition period. The training sessions consisted of practical work lasting five sets of two and 30 seconds, with a recovery period of 2 minutes and 30 seconds between each sequence. Prior to and 24 hours after the completion of the reduced play sessions, a countermovement jump (CMJ) test was conducted.

Fieldwiz V2-type GPS devices were provided to the players to gather data on player performance. These devices enabled the calculation of three key parameters: volume, frequency, and intensity for both forms of reduced play. The My Jump 2 application was also employed to conduct the CMJ test, evaluating players' jumping abilities.

This comprehensive approach utilizing GPS tracking and CMJ testing provides valuable insights into the impact of different forms of reduced play on the physical performance of young soccer players, contributing to a deeper understanding of their training effects.

3- Procedural definition of the concepts mentioned in the research:

small-sided games: A small-sided game in soccer refers to a version of the sport that is played with fewer players on a smaller playing field compared to a regular 11-a-side match. The purpose of small-sided games is to maximize player involvement, increase touches on the ball, and enhance specific skills and aspects of the game in a more controlled environment. These games are commonly used in training sessions and youth development programs.

Soccer: soccer is one of the most popular and widely played sports globally, with a massive following and numerous professional leagues and competitions. It is known for its simplicity, requiring minimal equipment, and the emphasis on skill, teamwork, and strategy. The

Modeling small-sided soccer games.

**RAHOU ABDELKARIM, SAIDI ZERROUKI YOUSOUF,
MERZOUK ABDELLAH**

sport is governed by the rules established by the Fédération International de Football Association (FIFA), the international governing body for soccer.

Modeling: Modeling small-sided soccer games involves creating a simplified representation of the game for various purposes, such as coaching, tactical analysis, or research. Here are the key steps in modeling small-sided soccer games: define objective, select game format, field dimensions, rules and modifications, time duration, players formations and positions, scoring system, feedback, analysis, variability, simulation tools, adaptability.

4- The methodological procedures used in the study:

4-1 Method and tools: to conduct this study, we used the GPS tool from ASI Fieldwis, certified by FIFA in 2018 as a reliable instrument for football-related activities. It is authorized for use during official matches.

We used the My Jump 2 application to conduct Countermovement Jump (CMJ) tests.

4-2 Presentation and Analysis of Results:

Table 1 presents the amplitude of various parameters, including intensity, volume, and frequency.

External Load Parameters:

Modeling small-sided soccer games.
RAHOU ABDELKARIM, SAIDI ZERROUKI YOUSOUF,
MERZOUK ABDELLAH

Charge externe							
Parametres	DT	DHI	DTHI	NB Sprint	NB Accelerations	NB Deccelerations	VMA
Appuies fixe	1702	218	29	1,4	69,4	61,4	23,37
	± 175	± 64,42	± 22	± 1,17	± 17,5	± 13,64	± 2
Appuies ent/ sort	1796	230	73	7,8	82,2	77,1	21,80
	± 93	± 52	± 43	± 4,28	± 16,56	± 15,31	± 1,8

	3C3 + 2 appuies fixe			3c3 + 2 appuies entrant/sortant		
DT	1702	±175,61	**IA= 0,70	1796	±92,22	
DHI	218	±64,42	*IA= 0,20	230	±51,42	
DTHI	29	±21,83	***IA= 1,35	73	±42,95	
NB Sprint	1,4	±1,17	****IA= 2,15	7,8	±4,28	
NB Acc	69,4	±17,49	**IA= 0,75	82,2	±16,56	
NB Decc	61,4	±13,64	**IA= 1,08	77,1	±15,31	
VAM	23,37	±1,97	#IA= -0,82	21,80.	±1,83	
CMJ	22,97	±0,78	#IA= 1,56	26,51.	±3,74	
CMJ+24H	22,39	±0,98	#IA= 0,51	23,33	±2,70	

Note: () substantial change, (**) significant change, (***) medium change, (****) small change, (#) deterioration.*

Figure (1) comparison of volume parameter results for the two reduced sets (intensity, volume, frequency)

Graph N°(1) shows the results of the volume parameters for the two forms of reduced play, with an average evolution for the total distances covered with an amplitude index of 0.70, a slight evolution for the total distances covered at high intensity, where the amplitude

Modeling small-sided soccer games.
RAHOU ABDELKARIM, SAIDI ZERROUKI YOUSSEF,
MERZOUK ABDELLAH

index is equivalent to 0.2, and a significant evolution for the total distances covered at very high intensity, with an amplitude index of 1.35.

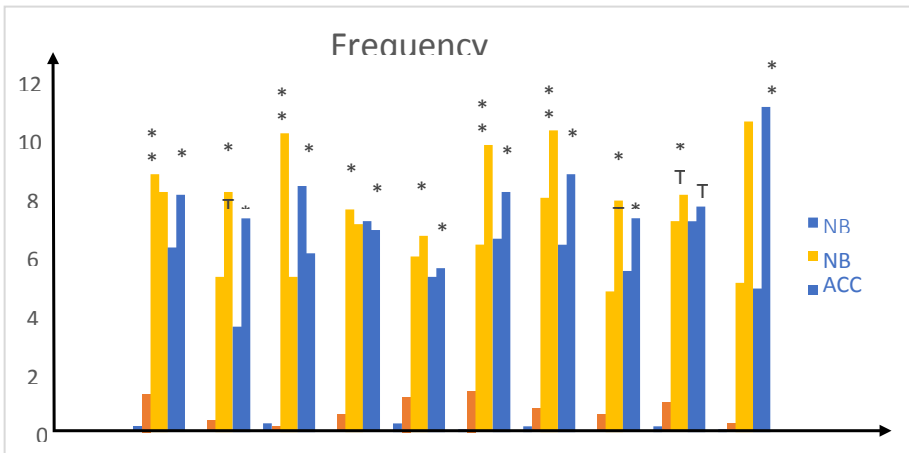


Figure (2) Comparison of frequency parameter results for the two reduced sets (NB Sprint, NB Acc, NB Decc).

Graph N() shows the results of the frequency parameters for the two forms of reduced play, where the amplitude index was equal to 2.25 for the number of sprints, which justifies a very high evolution for this parameter, as well as the amplitude index for the number of accelerations was equal to 0.75, where an average evolution can be seen. An average evolution can also be seen for the number of decelerations, with an amplitude index of 1.08.

Modeling small-sided soccer games.

**RAHOU ABDELKARIM, SAIDI ZERROUKI YOUSSEF,
MERZOUK ABDELLAH**

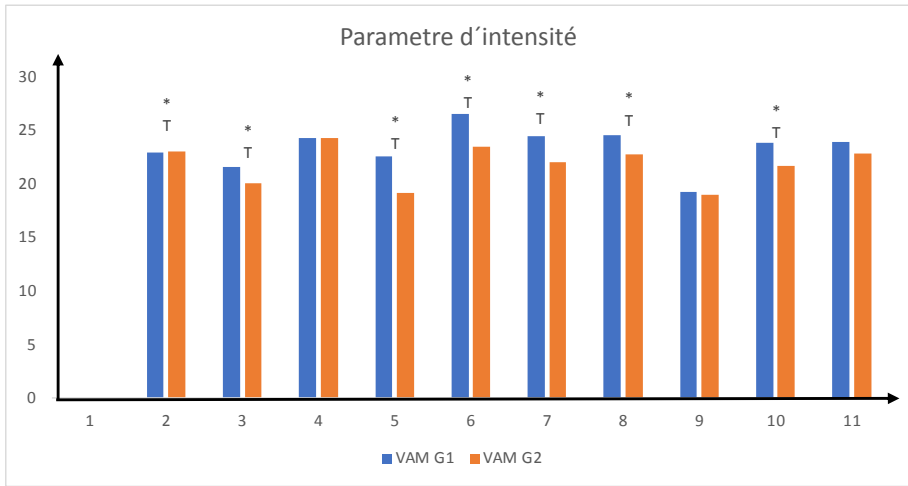


Figure (3) Comparison of the intensity parameters of the two reduced sets (VAM)

Graph N(3) shows the results of the intensity parameter for the two forms of reduced play and then calculates the amplitude index, which equals 0.70. This shows an average evolution in group performance, with the amplitude index ranging from 0.6 to 1.2.

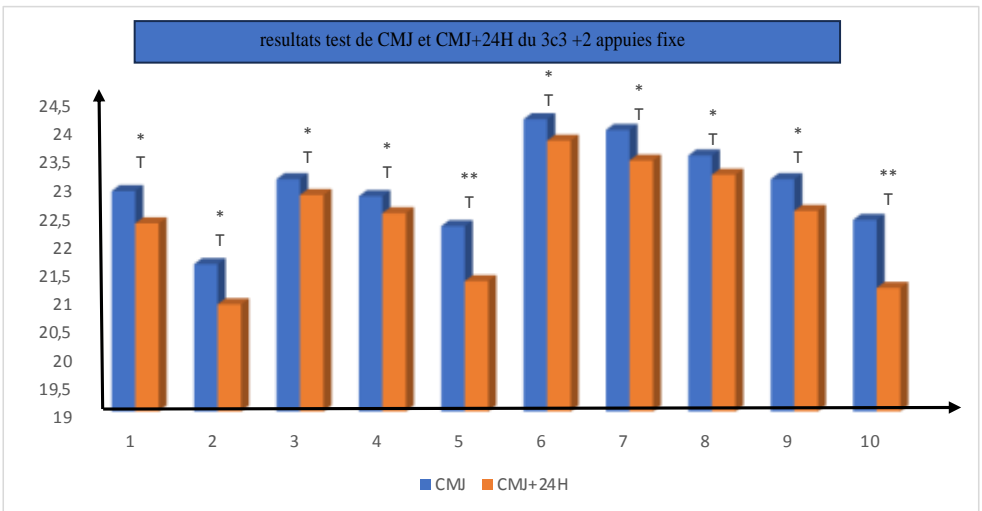


Figure (4) CMJ and CMJ+24H test results for 3c3 +2 fixed supports

Modeling small-sided soccer games.

**RAHOU ABDELKARIM, SAIDI ZERROUKI YOUSSEF,
MERZOUK ABDELLAH**

Graph N(4) presents the CMJ and CMJ+24H test results for the reduced 3c3+2 fixed-presses game. After calculating the amplitude index, which equals -0.65, we note an average degradation of performance after 24H and that the amplitude index is between -0.6 and -1.2, which is confirmed by the results of the T-test, where we found that the experimental T is higher than the theoretical T so the results are significant.

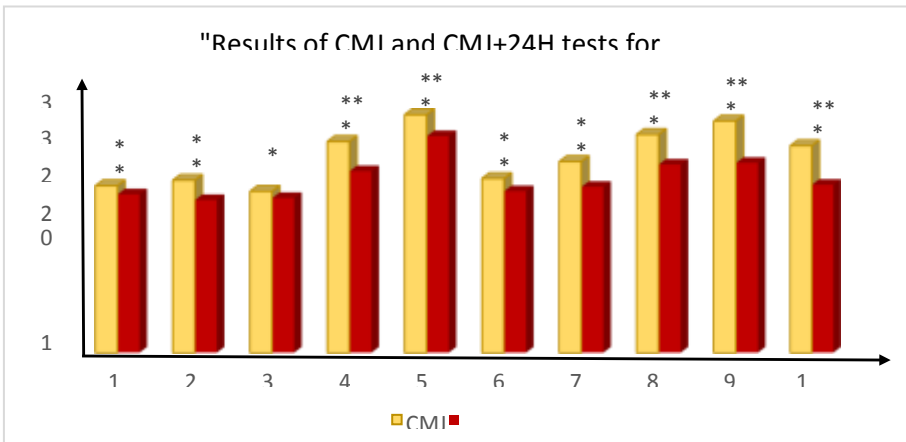


Figure (5) CMJ and CMJ+24H test results for 3c3 +2 incoming/outgoing presses

Graph N(5) presents the results of the CMJ and CMJ+24H tests for the reduced 3c3+2 presses incoming-outgoing game. After calculating the amplitude index, which equals -0.98, a significant performance degradation is observed after 24 hours. The amplitude index falls between -0.6 and -1.2, as confirmed by the results of the T-test. The

Modeling small-sided soccer games.

**RAHOU ABDELKARIM, SAIDI ZERROUKI YOUSSEF,
MERZOUK ABDELLAH**

experimental T is higher than the theoretical T, indicating significant results.

Conclusion and Practical Application:

Practical Application for the Coach:

1. Depending on the total workload determined by the trainer, the delayed muscular fatigue may be more significant after reduced play.
2. Quantifying EC using the RPE method does not allow differentiation of the cost of effort at different intensity levels.
3. The coach needs to manage exercise intensity contextually during the session, allowing players sufficient time for muscular recovery and controlling the potential risk of fatigue or injury.

Conclusion:

After verifying and parameterizing each type of contextualized exercise, our work aimed to optimize situations with the ball. Twelve Haut de France regional league players, participated in randomized entry-exit evaluation tests and a training protocol. They performed a CMJ before and 24 hours after the protocol.

In the first session, a 3c3 fixed supports game was proposed on a 35x45m (1575m²) space, with 2'30 min of work and 2'30 min of recovery over five repetitions. The second session had the same contextualized game but with incoming and outgoing support. Instructions included touching the ball freely, reducing passing angles, preserving and protecting the ball, and making oneself available for

Modeling small-sided soccer games.

**RAHOU ABDELKARIM, SAIDI ZERROUKI YOUSSEF,
MERZOUK ABDELLAH**

ball recovery. This game was set up 48 hours after a championship match.

CMJ test results show a significant difference between pre- and post-protocol. The performance index indicates a moderate deterioration for the first game and a significant deterioration for the second. Dominant strength, equivalent to a field density of 1575m² per player (Nick BROAD model), confirms the effect of our type of game on the neuromuscular level.

In conclusion, training with a contextualized 3c3 game with goalkeepers and pass-and-go instruction on a 1,575m² pitch with a density of 132m² could be an exciting alternative to analytical work dominated by strength.

Bibliography:

- A, Dellal, (2011). Comparison of physical and technical performance in European professional soccer match-play: the FA Premier League and La LIGA. *Our J Sport SciAA(2)*: 51-59
- A, Dellal, (2008). From training to performance in soccer. De Boeck.
- A. Dellal, (2016). A season of physical preparation in soccer. De Boeck supérieur, 1-15
- Analysis of the footballer's physical activity and its consequences for training orientation, specific application to intermittent high-intensity running exercises and reduced games, ALEXANDRE DELLAL, December 2008, University of Strasbourg.

Modeling small-sided soccer games.

**RAHOU ABDELKARIM, SAIDI ZERROUKI YOUSOUF,
MERZOUK ABDELLAH**

- Bangsbo J. (1994). The physiology of soccer: with particular reference to intense intermittent exercise. *Acta Physiologica Scandinavia*, 15, 619, 1-15.
- Bangsbo J., Norregaard L., Thorsoe F. (1991). Activité profile of compétition soccer. *Canadian Journal of Sports Sciences*, 16, 2, 110-116.
- Cometti G. (2012). Plyometrics a method of restoring energy to improve sports performance. Dijon : Editions Chiron. The effect of intermittent supra-max training on VAM and Muscle Power development in footballers.
- Comment évaluer et développer votre capacité aérobie, G.CAZORLA, LEGER Luc, Association Recherche et Evaluation en Activité Physique et en Sport.
 - Demanding top-level soccer, Michel Bitscharo, FIFA instruction, Switzerland 2014.
- Ebook les 5 piliers de la préparation physique, JC.HOURCADE, ACPASPORT, Bordeaux 2019.
- Study of the effects of different sequences of intermittent work, document directed by G.COMMETTI.
 - MANUEL FARHI, Algerian Football Federation, 2014.
 - Manuel de condition physique du footballeur, DRS, Raymond verheijeu 2008.
- Les bases de l'entrainement, L.P.MATVEEV, Vigot Paris, 1984, L'entrainement Sportif théorie et Méthodologie.

Modeling small-sided soccer games.

**RAHOU ABDELKARIM, SAIDI ZERROUKI YOUSSEF,
MERZOUK ABDELLAH**

- Les bases de l'entrainement, L.P.MATVEEV, Vigot Paris, 1984, L'entrainement Sportif théorie et Méthodologie.
- Préparation et entrainement du footballeur, TOME 2, TURPIN Bernard 2011.
- V.N.PLATONO, E.D revue EPS Paris 1988, les bases de l'entrainement sportif.
- S.VAUCELLE, les qualités physiques du sportif faculté des sciences du sport et du Mouvement Humain Toulouse.
- Stolen, T (2005). Physiology of soccer: an update. Sports Med 35.
- Mujika I, Santisteban J, Impellizzeri FM, Castagna C. Fitness determinants of success in men's and women's soccer. J Sports Sci. 2009; 27(2):107-114.
- Rico-González, M.; Los Arcos, A.; Rojas-Valverde, D.; Clemente, F.M.; Pino-Ortega, J. A Survey to Assess the Quality of the Data Obtained by Radio-Frequency Technologies and Microelectromechanical Systems to Measure External Workload and Collective Behavior Variables in Team Sports. Sensors 2020, 20, 2271.
- Castellano, J.; Casamichana, D. What Are the Differences between First and Second Divisions of Spanish Football Teams? Int. J.Perform. Anal. Sport 2015, 15, 135-146.
- Fernández-Navarro, J.; Fradua, L.; Zubillaga, A.; Ford, P.R.; McRobert, A.P. Attacking and Defensive Styles of Play in Soccer: Analysis of Spanish and English Elite Teams. J. Sports Sci. 2016, 34, 2195-2204.