

Effect Of A 2v2 Small-Sided Game Exercise On Countermovement Jump Performance In Young Football Players

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Abstract:

This study aims to optimise ball-related scenarios. A total of twenty-four U18 inter-league players participated in the randomised entry-exit evaluation tests and the training protocol, forming two age-specific groups: U18 (n=12) and U17 (n=12). The results of countermovement jump (CMJ) tests showed a significant difference between pre- and post-protocol measurements. The Rate of Perceived Exertion (RPE) index indicated a slight decline in the U17 group compared to a moderate decline in the U18 group. The dominant force corresponds to an equivalent field density of $101 \pm 13 \text{ m}^2$ per player (according to the Nick BROAD model), confirming the impact of our gameplay on neuromuscular aspects. Thus, training with a contextualised 2v2 game effectively enhances CMJ performance.

Keywords: 2v2 game, CMJ, RPE, U18 football players.

1. Introduction:

The significant advancements observed in football in recent years are attributed to various factors, including improvements in sports facilities and equipment (Ben Kassad, 2005), greater emphasis on coach preparation, their scientific and practical qualifications, and the implementation of well-planned training methods grounded in scientific principles, incorporating enhanced and diverse approaches.

Player preparation in conditions closely resembling actual match situations, often referred to as real-life situations, has become imperative. This demand places a responsibility on coaches to acquire the necessary skills that align with the continuous pace of football's development (Ghoual and Bengoua, 2015, p. 14).

Integral to the training process, physical preparation encompasses a range of techniques aimed at fostering and sustaining various physical qualities (Hamek et al., 2018, p. 26). The primary objectives of physical preparation are as follows:

- Enhancing cardiovascular, respiratory, and neuromuscular systems' adaptation during exertion.
- Improving post-exertion recovery and fatigue management.
- Efficient energy expenditure for enhanced endurance.
- Developing speed, strength, and muscular power.
- Optimizing physical performance factors.
- Improving coordination, explosiveness, and specific technical gestures.

In contemporary football, physical preparation plays an increasingly significant role, driven by the growing number of football events held in close succession, resulting in substantially reduced rest and recovery periods (Dellal, 2008, p.48). Moreover, there has been a notable evolution in competition demands, characterized by heightened frequency and duration of high-intensity efforts along with increased distance covered during matches. Major tournaments such as the World Cup reveal significant performance discrepancies among players, stemming

from their prior physical readiness for the event. Football competition requirements have experienced substantial transformations in recent years (Goual and Bengoua, 2015). For instance, a noteworthy contrast can be observed in the frequencies of efforts performed at very high intensity, transitioning from one effort every 1'17" in the 1970s to one effort every 55" since the 2000s. Additionally, there has been a slight increment in the overall distance covered, averaging 11,000 metres for all positions except goalkeepers (Rampinini et al. 2007).

To meet these new demands, the integration of small-sided games, known as contextualised training, has become essential for achieving intensities similar to those in actual competitions.

Small-sided games in football involve opposition play on reduced surfaces, providing opportunities for the simultaneous development of physical and technical-tactical aspects. Numerous studies have highlighted that these aspects are addressed more comprehensively and enriched compared to traditional ball-less (analytical) physical training (Impellizzeri, 2006; Little, 2006; Reilly, 2004). Various research studies have demonstrated the positive effects of this type of training. For instance, Kharroubi et al. (2018) compared ballistic training and two forms of mini-training in young individuals, focusing on explosive power development in terms of vitality, speed, and vertical jump. Nicolas and Julien (2017) examined the physiological aspect, comparing the effects of three forms of small-sided games on heart rate response, and found increased mobilisation of the aerobic system.

Castelano et al. (2013) investigated the effect of changing the game format on physiological demands and observed that altering game objectives or internal rules positively influenced these physical demands. Monkam (2011) addressed these demands in his study, demonstrating that certain types of mini-games affect heart performance modifications and enable estimation of effort intensity for each type through maximum pulse measurement. Most of these studies relied on an experimental approach, with results predominantly confirming the positive impact of small-sided games on football players' physical abilities.

From a technical and physical standpoint, reduced games offer various advantages, including:

- Increased player motivation.
- Replication of real-life match situations during gameplay.
- Opportunities to address tactical aspects.
- Similar metabolic demands to those experienced in actual matches.

However, two significant challenges must be taken into account:

- The unpredictability of controlling training load and intensity.
- The need to establish a dominant training objective.

Therefore, it is crucial to consider factors that can influence the intensity of the proposed exercises. These factors depend on the session's objectives, the players' performance level, the type of exercise, and the size or surface of the playing field. Notably, there is a direct relationship between the intensity of the game and the number of players involved.

Likewise, the number of proposed games also impacts intensity. Prior research by Grant et al. (1999), Platt et al. (2001), and Jones et al. (2007) facilitated the classification of solicitation intensities based on the number of players in opposition and the chosen playing surface.

Various factors contribute to the intensity of reduced games, including:

- The quality of coaching animation.
- The number of players.
- The work-to-recovery ratio.
- The dimensions of the playing field.
- The type of marking.
- The rules.

The primary aim of this study was to investigate whether training with a contextualised 2v2 game on a 361 m² field with a density of 90.25 m² per player could serve as a valuable alternative to dominant strength-focused analytical training for young U18 football players.

We hypothesised that the U18 category would demonstrate better responses to the proposed training compared to the U17

category, and that the 2v2 format with the specified dimensions would primarily target strength development.

2. General Objective of the Study:

In every scientific or theoretical field study, specific objectives or multiple objectives are pursued. The primary objective of this study is to evaluate the tolerance of each age group towards the proposed training. Furthermore, we seek to determine whether U18 players demonstrate a more favourable response to the proposed training compared to U17 players, and whether the 2v2 format with the specified dimensions predominantly focuses on strength development.

3. Procedural Definition of Concepts Mentioned in the Research:

- **The first concept:** Small-sided games involve opposition play on a reduced surface, enabling the simultaneous development of physical and technical-tactical aspects. Numerous studies have emphasised that these aspects are addressed in a more comprehensive and enriched manner compared to traditional ball-less (analytical) physical training (Impellizzeri, 2006; Little, 2006; Reilly, 2004). The researcher concludes that the proposed 2v2 game represents intense training on a 361 m² field with a density of 90.25 m² per player.
- **The second concept:** CMJ stands for “The Countermovement Jump” (Owen, 2016). The researcher concludes that CMJ is an exercise measuring lower body power.

4. Methodological Procedures Used in the Study:

4.1. Method and Tools:

To conduct our research, we adopted an experimental method to address our initial questions. The study was conducted in October 2019 at the ORB Oued Fodda football club of Chlef, involving the U18 category competing in the Blida regional football championship.

Protocol:

For our study, we implemented a reduced 2v2 game 72 hours after a match, following a standardised 25-minute warm-up session. The warm-up consisted of the following components:

- 6 minutes of moderate-paced running
- 4 minutes of athletic drills
- 2 minutes of stretching
- Technical warm-up involving passing and controlling the ball
- 2 minutes of dual preparation exercises
- 3 minutes of dynamic stretching

Following the warm-up, we implemented a 2v2 reduced game with the following specifications:

- Duration: 24 minutes (2 minutes of work followed by 2 minutes of recovery, for a total of 24 cycles).
- Playing field size: 19 x 19 metres, providing a total area of 361 square metres, which corresponds to 90.25 square metres per player.
- Instructions: Players were limited to using three touches of the ball and required to reduce the angles of passes, protect the ball, and remain available for quick recovery.
- Number of accelerations / Number of decelerations

For a better evaluation of our protocol, we conducted the following physical tests:

- Countermovement Jump (CMJ) test: For this test, we used the “My Jump 2” application.

We also intended to use the lactate pro2 or lactate scout+ devices available in our laboratory to evaluate the evolution of Lactate levels after the game. However, this was not possible due to a lack of test strips in our laboratory, and thus, the test was not conducted.

The nature of this work necessitates the use of cardio-GPS to better quantify the physical load, enabling a more comprehensive analysis of the quantitative and

qualitative aspects of the game, such as the number of accelerations, decelerations, sprints, maximum speed, and total distance covered by each player.

Given the unavailability of this equipment and its usage constraints, we opted for alternative approaches and conducted

additional tests. Primarily, we performed a CMJ test before the protocol and another test 24 hours after the completion of the protocol. To better quantify the effort, we employed the Rate of Perceived Exertion (RPE) proposed by Foster in 2001, where each player was asked to subjectively rate their perceived effort and muscle work in the lower limbs (Toumi and Ghenam, 2020).

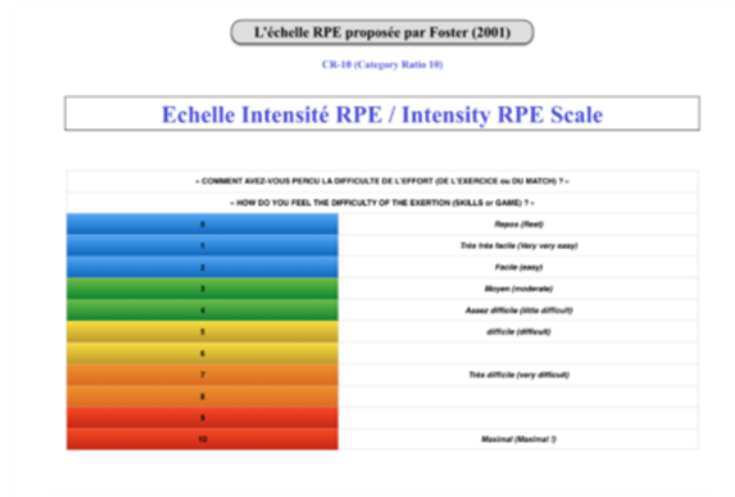


Figure No. 1: The RPE S
Source: Foster (2001)

However, it is imperative to address two significant constraints:

Control of training load and intensity (which can be unpredictable).

Establishment of a dominant objective

Therefore, it is crucial to take into account the factors that may influence the intensity of the proposed exercises. These factors depend on the session's objectives, the players' performance level, the type of exercise, and the size or surface of the playing field. In fact, there is a direct relationship between the intensity of the game and the number of players involved.

Statistical Tools:

Mean:

$$\bar{x} = \frac{1}{n} \sum_{i=1}^n x_i$$

Standard Deviation:

$$s = \sqrt{\frac{\sum (x - \bar{x})^2}{n}}$$

Independent Sample T-Test:

$$t = \frac{m_A - m_B}{\sqrt{\frac{S^2}{n_A} + \frac{S^2}{n_B}}}$$

For the statistical analysis of the data, we utilised IBM SPSS Statistics 24 software.

4.2. Presentation and Analysis of Results:

In this study, the participant population comprised 24 players, with 12 belonging to the U18 category, having an average age of 17.08 years $\pm$ 0.51 years, a height of 175.58 cm $\pm$ 7.73 cm, a weight of 64.62 kg $\pm$ 3.97 kg, and a BMI of 20.65 kg/m² $\pm$ 2.16 kg/m². The remaining 12 players were from the U17 category, with an average age of 16.33 years $\pm$ 0.49 years, a height of 173.66 cm $\pm$ 6.89 cm, a weight of 64 kg $\pm$ 3.17 kg, and a BMI of 21.38 kg/m² $\pm$ 3.13 kg/m², participating in the inter-league championship. All participants took part in the pre-test evaluations as part of our randomised study protocol.

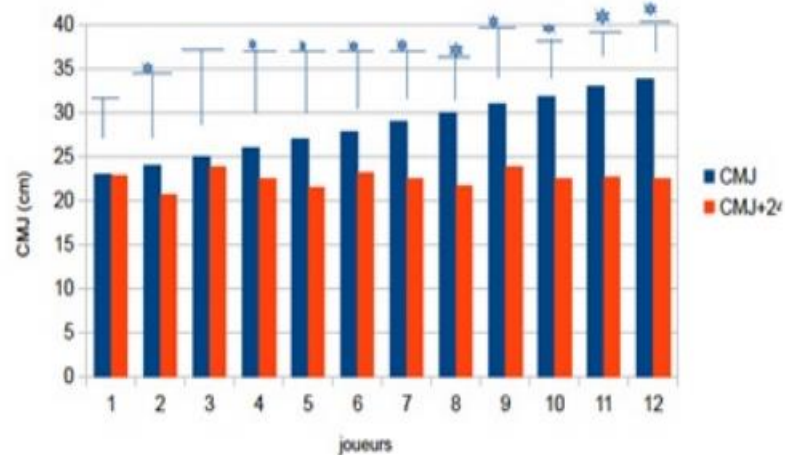
Table No. 1: CMJ Test Results for U18 Players

CMJ (cm)	Mean	Standard Deviation	Calculated T	T Tableau	Sig
Pre CMJ	22,98	0,79	2,42	1,79	Significant t
CMJ 24H	22,58	0,90			
RPE	5,41	TL	TL = 5,41 X 24 = 129,84 UA		

Source: Ouddak (2019)

In Table No. 1, the pre- and post-test results for the CMJ test of the U18 players are presented. The obtained amplitude index is -0.67, indicating a decline in the group's performance. This decline can be considered moderate, as the index should fall within the range of -0.6 to -1.2, as confirmed by the results of the T-test. It is noteworthy that the experimental T-value is higher than the theoretical T-value, implying that the difference is significant.

Figure No.2: CMJ Test for U18 Group



Source: Ouddak (2019)

Figure No. 2 depicts a notable decrease in the performance of most players after the training protocol, which can be attributed to the intensity of the training load applied to this group.

Table No. 2: CMJ Test Results for U17

CMJ (cm)	Mean	Standard Deviation	Calculated T	T Tableau	Sig
Pre CMJ	23,55	22,58	3,98	1,79	Significant
CMJ 24H	2,61	2,44			
RPE	5,25	TL	TL = 5,25X 24 = 126 UA		

Source: Rahou (2019)

In Table N°2, the results of the pre- and post-CMJ tests for U17 players are presented. The obtained amplitude index is -0.38, indicating a decline in the group's performance. This decline can be considered small or weak since the index should fall between -0.2 and -0.6, a finding supported by the results of the T-test. Notably, the experimental T-value exceeds the theoretical T-value, implying that the difference is statistically significant.

Figure N°3: CMJ Test for the U17 Group

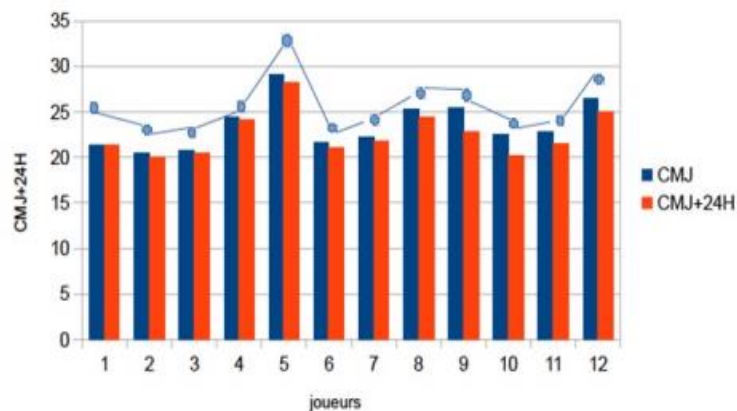


Figure N°3 illustrates a relative decline in performances, which is lower than the decrease observed in the first group after the training protocol. This can be explained by the fact that the second group, being younger, recovers more effectively.

4.3. Discussion and Interpretation of the Results:

After carefully adjusting each contextualised exercise, considering factors such as field dimension, opposition ratio, rules, work and rest time, number of sequences, and environmental conditions, we aimed to optimize the ball-inclusive situations. The study involved a total of 24 regional-level players, divided into two groups: U18 (n=12) and U17 (n=12), with average ages of 17.08 ± 0.5 years and 16.33 ± 0.49 years, respectively. The players were homogeneous in terms of height ($SD=1.92 \pm 0.48$ cm), weight ($SD=0.23 \pm 0.8$ kg), and BMI ($SD=0.73 \pm 0.97$). Before and 24 hours after the protocol, each participant underwent a Countermovement Jump (CMJ) test. The proposed small-sided game was a 2v2 format played on a 19 x 19 m pitch (361 m²), providing a density of 90.25 m² per player. The game consisted of 1 minute of work followed by 2 minutes of recovery, resulting in a total duration of 24 minutes. The players were instructed to use a maximum of three touches on the ball,

reduce angles of passes, protect the ball, and remain available for recovery.

This small-sided game was conducted 72 hours after a championship match and preceded by a standardized 25-minute warm-up. The CMJ test results demonstrated a significant difference between the pre- and post-protocol evaluations. The performance index indicated a slight decline for U17 players and a moderate decline for U18 players. Notably, the dominant force corresponds to an equivalent field density of $101 \pm 13 \text{ m}^2$ per player, according to the Nick BROAD model, thus confirming the neuromuscular impact of our specific small-sided game format.

Conclusion:

In conclusion, our study demonstrates that a training session involving a contextualised 2v2 game on a 361 m^2 pitch with a density of 90.25 m^2 per player can effectively replace a strength-focused analytical workout. This finding has practical implications for coaches, and we offer the following recommendations:

- Coaches should consider the total workload imposed on players, as delayed muscle fatigue after the small-sided game may be more pronounced.
- Quantification of Training Load (TL) using the Rating of Perceived Exertion (RPE) method may not provide precise differentiation of efforts at various intensity levels.
- As a result, coaches should carefully manage the intensity of contextualised exercises during the session, ensuring sufficient recovery time for players at the muscular level to control potential risks of fatigue or injury.

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