Original Article

ACUTE EFFECT OF SMALL-SIDED GAMES ON TACTICAL-TECHNICAL PERFORMANCE OF YOUTH FOOTBALL PLAYERS DURING A TRAINING SESSION

EFEITO AGUDO DE PEQUENOS JOGOS NA PERFORMANCE TÉCNICO-TÁTICA DE JOVENS JOGADORES DE FUTEBOL EM UMA SESSÃO DE TREINO

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RESUMO

O objetivo do presente estudo foi investigar o desempenho técnico-tático ofensivo de jovens jogadores de futebol durante cinco pequenos jogos em uma única sessão de treinamento. Vinte e quatro atletas sub-14 de dois clubes profissionais de futebol participaram do estudo. Os jogadores realizaram cinco jogos de 4 minutos em um formato GK + 4 vs. 4 + GK com um minuto de descanso passivo entre as séries. O desempenho técnico-tático ofensivo foi avaliado utilizando o Game Performance Evaluation Tool (GPET). Recorreu-se ao teste de Friedman para a comparação do desempenho entre as séries. Os resultados não indicaram mudanças significativas na tomada de decisão (p = 0.909; tamanho do efeito = pequeno) e execução do passe (p = 0.638; tamanho do efeito = pequeno), bem como na tomada de decisão para o suporte (p = 0.180; tamanho do efeito = pequeno). Entretanto, uma diferença significativa foi observada na execução do suporte (p = 0.044; tamanho do efeito = pequeno), com um declínio no desempenho na quarta série em comparação à terceira série. Esses resultados sugerem que cinco séries de pequenos jogos em uma única sessão de treinamento não foram suficientes para provocar mudanças no desempenho técnico-tático ofensivo de jovens jogadores. Sugere-se que esses achados sejam consequência de demandas físicas e cognitivas entre as séries, juntamente com uma melhora na performance defensiva, que podem ter impedido de observar melhoras na performance entre jogos. Nós sugerimos que treinadores utilizem esse formato de pequeno jogo como uma estratégia para manter a performance em uma sessão e evitar sobrecarga dos jogadores. Estudos futuros devem investigar a performance nesses pequenos jogos ao longo do tempo, bem como investigar os efeitos da manipulação de pequenos jogos em uma sessão de treino.
Palavras-chave: Futebol. Pequenos jogos. Treinamento tático. Análise de desempenho. Pedagogia do esporte.

ABSTRACT

The present study aimed to investigate the offensive technical-tactical performance of youth football players during five bouts of small-sided games within a single training session. Twenty-four U-14 athletes from two professional football clubs participated in the study. Players engaged in five 4-minute bouts of small-sided games in a GK + 4 vs. 4 + GK format with one minute of passive rest between bouts. Offensive technical-tactical performance was assessed using the Game Performance Evaluation Tool (GPET). The non-parametric Friedman test was used to compare the five consecutive SSG bouts. The results indicated no significant changes in decision-making (p = 0.909; effect size = small) or execution (p = 0.638; effect size = small) of passing actions, nor in the decision-making for support actions (p = 0.180; effect size = small). However, a significant difference was observed in the execution of support actions (p = 0.044; effect size = small), with a decline in performance in bout 4 compared to bout 3. These results suggest that five series of small-sided games in a single training session were not sufficient to produce changes in the offensive technical-tactical performance of young players. We suggest that the finding is a consequence of physical and cognitive demands over the bouts, along with better defensive performance, which could have prevented finding improvements between games. We recommend that coaches use this format of SSG as a way to maintain performance in one session in order to avoid players' overload. Future studies should investigate the performance on this game format over time, as well as the effect of the manipulation of SSG in one session.
Keywords: Football. Small-sided games. Tactical training. Performance analysis. Sport pedagogy.

Introduction

The analysis of technical-tactical performance in football constitutes a key tool for understanding how athletes adapt to the dynamics of the game[1]. Beyond competitive contexts, such analysis is particularly relevant in training settings, as it provides insights into adaptations induced by training sessions. These insights can be used to implement pedagogical modifications in small-sided games (SSGs), such as the introduction of constraints like limiting

ball touches (e.g., two touches per possession), a strategy shown to stimulate ball circulation across the pitch[2,3].

In the football literature, SSGs have been widely used as a means of technical-tactical training because they promote motor actions and decision-making within contexts that resemble formal game situations[4]. Research has shown that SSGs lead to chronic improvements in tactical variables[5,6] as well as behavioural changes within a single training session[7,8]. These adaptations are driven by an enhanced perception-action coupling, where players learn to recognize patterns and use environmental cues to guide both "*what* to do" (decision-making) and "*how* to do it" (technical execution)[9]. Consequently, even acute performance within SSGs reflects this inherent interdependence between technical and tactical domains, positioning short-term adaptations as the building blocks for long-term development[8].

Although there is growing interest in the acute effects of SSGs on tactical and technical performance, most studies have examined these dimensions in isolation: evaluating the core tactical principles using the FUT-SAT instrument[8] and notational analysis to assess discrete technical metrics (e.g., percentage of successful passes, individual number of ball losses and individual total number of ball possessions)[7,10]. Evaluating these components separately leads to reductionist interpretations that hinder a comprehensive understanding of how players behave in response to game situations, both in terms of "what to do" and "how to do it". Therefore, a significant gap persists in understanding the integrated technical-tactical profile that defines acute player adaptation within the dynamic context of a single training session.

Regarding technical performance across multiple SSG bouts in a session, previous studies have reported reductions in frequency and quality of execution in 4v4 games, assessed via notational analysis[7,10]. These declines were attributed to decreased intensity in players' actions due to accumulated fatigue. From a tactical perspective, a study[8] using the FUT-SAT instrument observed improvements in defensive performance across four bouts of 3v3 games, but no significant changes in offensive actions. The authors suggested that the limited number of bouts may have restricted offensive adaptations, which are typically prioritised in the teaching-learning process. This methodological variability underscores a clear gap in the literature: a lack of a comparative understanding of how technical-tactical performance evolves during acute exposure to multiple bouts, particularly in offensive actions. To address this, the present study aims to advance current knowledge by implementing a protocol with an increased number of bouts, specifically designed to mitigate cumulative fatigue, thereby creating better conditions to observe adaptive responses across a session.

Given the divergence in study protocols and the isolated evaluation of technical and tactical aspects, it remains difficult to understand the full impact of SSGs on integrated technical-tactical performance in football, thus highlighting a gap in the literature. To address this gap, it is essential to employ tools that allow for a comprehensive assessment of players' performance. The Game Performance Evaluation Tool (GPET) has emerged as a promising instrument for this purpose, as it simultaneously considers both decision-making and technical execution within the tactical demands of the game[11]. Whereas established instruments like FUT-SAT provide a robust framework for categorizing actions based on core tactical principles in a standardized test setting[12], they operate primarily at a behavioral level, quantifying if a principle was executed without explicitly evaluating the contextual appropriateness of the decision. Conversely, notational analysis often relies on discrete, study-specific metrics that are descriptive and can be subject to interpretive variability, failing to assess the underlying tactical rationale ('the why') behind an action. In contrast, the GPET's core construct of 'context adaptation performance' directly assesses whether a player's decision ('what to do') and its technical execution ('how to do it') were adequate solutions to the emergent tactical problem. This provides a deeper, more ecologically valid understanding of the technical-tactical

interplay, which is the central focus of this investigation. Furthermore, the GPET has demonstrated concurrent validity and high intra- and inter-observer reliability (>0.79)[11], as well as proven sensitivity in capturing the acute effects of SSGs on technical-tactical performance[13,14].

The present study aimed to compare the offensive technical-tactical performance of youth football players across five consecutive 4v4 SSG bouts conducted within a single session, with one-minute rest intervals between bouts. It was hypothesised that these recovery intervals would be sufficient to facilitate phosphagen system resynthesis and lactate clearance, thereby mitigating fatigue accumulation[15] and, consequently, supporting a progressive improvement in offensive technical-tactical performance throughout the session. The findings of this study are expected to provide novel evidence on the acute effects of SSGs, contributing to the refinement of teaching-learning-training strategies in football.

Methods

Sample

The sample consisted of 24 U-14 male football players (M = 13.9 ± 0.9 years; M = 166.5 ± 9.7 cm; M = 57.8 ± 9.1 kg) from two Brazilian football clubs selected by convenience. The participants were classified as tier 3, representing athletes at the national level[16]. All players had previous experience with small-sided games (SSGs) in training and were in suitable physical condition to participate in a conventional training session. The study was approved by the local research ethics committee (CAAE: 69494223.6.0000.5149). An a priori sample size calculation was performed using GPower software (version 3.1.9.7) to determine the minimum number of participants required for a within-subjects design. The parameters considered were: statistical power (1 - β) of 0.80, significance level (α) of 0.05, and an effect size derived from a pilot study ($\eta^2 p = 0.400$). For input in GPower, the partial eta squared value was converted to Cohen's f using the formula $f = \sqrt{(\eta^2 p/(1 - \eta^2 p))}$, resulting in f = 0.816. Based on these parameters, a minimum of 19 participants was estimated. With a final sample of 24 athletes, the study exceeded the required sample size to account for potential dropout.

Procedures

This study adopted a quasi-experimental within-subjects design with a single repeated-measures condition. All data collection was conducted in a single day at each club. Initially, the players were allocated into teams based on their positional roles and classified according to their tactical performance, as assessed by the head coach. For example, Team A consisted of the best defender, the best and the fourth-best midfielder, and the second-best forward. Team B, in turn, included the second-best defender, the second- and third-best midfielders, and the best forward. The participants performed a standardized 5-minute warm-up, including changes of direction, low-intensity runs, and sprints. Subsequently, players completed five 4-minute bouts of SSGs with 1-minute passive rest intervals for hydration. The games were played in a 4 vs. 4 format with goalkeepers on a 40×30 m field, following standard football rules, including the offside rule. Although goalkeepers participated in the activity, their data were excluded from analysis due to the specificity of the position.

The 4 vs. 4 format was selected based on evidence suggesting that the number of technical actions per player tends to decrease as team size increases[2,17]. However, smaller numerical relations may lead to less positional regularity[18]. To avoid performance bias, coaches and researchers were instructed not to provide any feedback during the bouts[19].
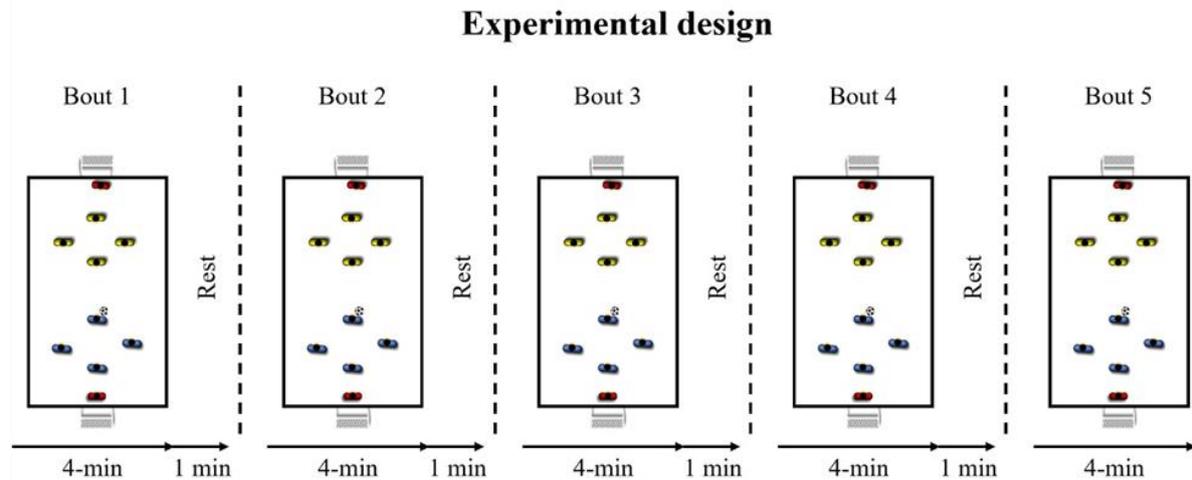
Experimental design

Figure 1. Representation of the experimental design
Source: The authors

Game Performance Evaluation Tool (GPET)

The present study used the Game Performance Evaluation Tool (GPET) to assess players' performance from a tactical perspective by analysing decision-making and motor execution in each technical action[11]. This tool has recently been applied in football SSG research[13,20]. The GPET evaluates five technical-tactical actions: passing, dribbling, shooting, ball control, and support. However, only passing and support actions were analysed in the present study due to the low frequency of the other actions—particularly shooting—in this SSG format. All game bouts were recorded using a DJI Fly MINI SE drone (DJI Technology Co., Ltd., Shenzhen, China) and analysed by trained researchers.

Each action was scored as either successful (1) or unsuccessful (0) for both decision-making and motor execution. Charts 1 and 2 present the criteria used to classify passing and support actions, respectively.

Dimension	Successful Action (1)	Unsuccessful action (0)
Decision-Making	Pass to an unmarked teammate.	Pass to a closely marked teammate; pass into a space occupied by an opponent; pass to an empty area without a teammate.
Motor Execution	Pass directed to the teammate's body if stationary; to the running path if moving; with appropriate weight and direction.	Pass intercepted by an opponent; excessively strong pass impairing control; out of bounds; significantly behind or ahead of the teammate.

Chart 1. Description of the criteria for decision-making and motor execution of passing actions
Source: García-López et al. [11]

Dimension	Successful Action (1)	Unsuccessful action (0)
Decision-Making	Moves into or maintains an unmarked position with an appropriate angle and distance for a pass; performs feints to create passing options.	Stays close to a defender; occupies the same space a teammate is moving into; stands still without offering a passing option; commits a foul; positions without a clear passing lane.
Motor Execution	Moves away from a marker; occupies an unmarked space with a real chance of receiving a pass.	Fails to break away from a marker; remains stationary without creating space when a passing opportunity arises.

Chart 2. Description of the criteria for decision-making and motor execution of support actions
Source: García-López et al. [11]

At the end of the analysis, the success percentage for each variable (decision-making and motor execution for passing and support) was calculated based on the ratio of successful actions to total actions. Two evaluators were trained to correctly apply the criteria for each variable. To ensure data reliability, intra- and inter-rater reproducibility protocols were implemented. Two games (approximately 16.6% of the sample) were analysed by both evaluators and re-analysed by the same evaluator after a 21-day interval. Cohen's Kappa coefficient was used to assess reliability[21], showing high inter-rater (Kappa = 0.82, p < .001) and intra-rater reliability (Kappa = 0.91, p < .001).

Statistical analysis

Initially, the assumptions of normality (Shapiro–Wilk test) and sphericity (Mauchly's test) were tested. The analysis revealed significant deviations from normality. Therefore, comparisons across the five consecutive SSG bouts were conducted using the non-parametric Friedman test for each variable. When significant differences were found, post-hoc pairwise comparisons were performed using Dunn's test. Effect sizes were calculated using Kendall's W and classified as small (> 0.10), moderate (> 0.30), or large (≥ 0.50). For data visualization, boxplots with overlaid individual values were generated. The significance level was set at p < 0.05 for all analyses. Statistical analyses were conducted using SPSS (Statistical Package for the Social Sciences) for Windows, version 2019, and visualizations were produced in RStudio for Windows, version 2023.09.0.

Results

The results are presented separately for passing and support actions. Regarding passing, no significant differences were found across the bouts for decision-making [χ^2 (4) = 1.01; p = 0.909; Kendall's W = 0.010, small effect] or execution [χ^2 (4) = 2.54; p = 0.638; Kendall's W = 0.026, small effect]. These results are illustrated in Table 1.

Table 1. Decision-making and motor execution of passing actions

	Bout 1	Bout 2	Bout 3	Bout 4	Bout 5
Decision-making	0.74±031	0.82±0.24	0.79±0.21	0.76±0.29	0.82±0.23
Motor Execution	0.79±0.25	0.81±0.25	0.85±0.23	0.75±0,33	0.87±0.15

Source: The authors.

For support, no significant difference was observed in decision-making [χ^2 (4) = 6.26; p = 0.180; Kendall's W = 0.065, small effect]. However, a significant difference was found in execution performance [χ^2 (4) = 9.82; p = 0.044; Kendall's W = 0.102, small effect]. Specifically, a significant decrease was observed between the third and fourth bouts (p = 0.047), with the fourth bout showing lower values than the third. No other pairwise comparisons reached statistical significance (p > 0.05). These results are presented in Table 2.

Table 2. Decision-making and motor execution of support actions

	Bout 1	Bout 2	Bout 3	Bout 4	Bout 5
Decision-making	0.66±0.13	0.64±0.13	0.65±0.16	0.59±0.12	0.67±0.11
Motor Execution	0.51±0.17	0.54±0.13	0.55±0.16	0.47±0.10*	0.55±0.08

Note (*): p < 0.05, indicating a significant difference compared to the third bout.

Source: The authors

Discussion

There is a gap in the literature regarding technical-tactical performance across consecutive small-sided game (SSG) bouts within a single training session. Aiming to contribute to the understanding of the acute effects of this training method, the present study compared the offensive technical-tactical performance of youth football players across five bouts of SSGs. To the best of our knowledge, this is the first study to use an integrated technical-tactical instrument to evaluate performance during the same small-sided games session. Therefore, the results brought here can contribute to a better understanding of players' behavior during consecutive bouts of SSG. The results indicated a significant decline only in support execution between the third and fourth bouts, while the remaining variables remained stable. This suggests that, overall, technical-tactical performance does not undergo significant variation across consecutive SSG bouts within a single session.

Initially, it was expected that passing and support actions would improve throughout the session. However, performance remained consistent, which refutes our initial hypothesis. This finding also diverges from those observed in other studies, which verified a decrease in technical performance between the first and last bouts[15,22]. One possible explanation lies in the impact of physical and cognitive demands on technical execution, possibly due to cumulative fatigue. Game formats, like 4vs4 from the present study, can promote high metabolic demands to the players, evidenced by higher distance covered by acceleration and decelerations on this format[23]. The high physical demand, combined with the interval rest between bouts (one

minute), could have caused high levels of accumulated blood lactate[23.] This phenomenon affects the central nervous system, leading to neurophysiological alterations that impair motor control and, consequently, the accuracy of technical skills[24]. In the cognitive domain, mental effort is associated with tactical performance[25]. Thus, increasing the task duration can increase the mental effort[26], which can impair performance during games. Considering the total duration of the task (20 minutes) and the total rest duration (4 minutes), it is possible that the prolonged duration of the session could have prevented any improvement from being observed. Lastly, different rest durations were used between our study and previous literature. While in the present study the 1-minute rest was adopted between bouts, in other studies the rest duration was longer than 2 minutes[15,22], which could have caused divergence between outcomes. In that way, considering the short rest intervals between bouts in the present study, it is plausible that accumulated fatigue limited performance improvements. Although there could be some influence of physical and cognitive demands on the results, the current study did not measure any of these variables to verify this assumption. In that way, future studies should address this issue, incorporating physical and cognitive variables to investigate possible influences on a player's technical-tactical performance during one session of small-sided games.

Another factor that may explain the lack of progression in offensive performance is the potential improvement in defensive behavior. Previous studies have demonstrated increased defensive effectiveness across SSG bouts. For example, Silva and colleagues[27], in a study on 3v3 SSGs, found that winning teams performed more off-the-ball defensive actions, suggesting that effective space occupation is key to success. Similarly, Praça and colleagues[8] reported improved defensive performance in the fourth bout of 3v3 SSGs. Although the current study used the GPET instrument, which only evaluates offensive variables, it is possible that players became better at recognizing offensive patterns over the bouts, thus neutralizing the success of passing and support actions. As we didn't measure the defensive performance in the present study, we encourage future research to measure players' defensive behavior in order to better understand the dynamics behind the technical-tactical outcomes in small-sided games.

Moreover, the limited duration of a single training session may be insufficient to induce noticeable offensive adaptations. Studies using the same instrument (GPET) have reported improvements in passing performance only after 12[6] or 14 training sessions[14]. Therefore, the use of five SSG bouts within a single session, as proposed in this study, appears insufficient to promote meaningful gains in offensive performance. Future studies should investigate the minimum number of bouts or sessions required to observe such improvements.

The stability in performance across bouts suggests that coaches should be aware of the intended objectives for each session of SSG. The results in the present study support that the use of 4vs4 with 4min duration and 1min rest can lead to a homogeneous behavior by players with similar characteristics, as seen in the actual sample. In this way, this format of game can be used before or after demanding physical and tactical seasons of the team in order to maintain performance. On the other hand, this result shows that coaches also should adjust the structure of SSGs to promote different technical-tactical behaviors during a session. Taking the Constraint-Led Approach as example [28], coaches could manipulate different aspects of the task (modifying the number of players, using different types of balls) to promote instabilities in players' performance, which can lead to different acute outcomes[28]. For instance, SSGs with numerical superiority (e.g., 5v4) may reduce defensive pressure, giving players more time for decision-making and increasing the likelihood of successful offensive actions[29]. Similarly, the inclusion of neutral players may create more opportunities for off-the-ball movement and support to the ball carrier[30], thereby enhancing passing and support behaviors. Future research could explore how rule modifications in SSGs affect technical-tactical performance during a single session.

This study has limitations, and its findings should be interpreted with caution. One limitation is the absence of direct measurement of physical fatigue among the players. Given the short one-minute recovery intervals, it is likely that players did not fully recover between bouts, leading to progressive fatigue accumulation. This may have hindered performance improvements, partially explaining the discrepancy between the results and the original hypothesis. Future research should incorporate objective (e.g., jump tests, heart rate variability) or subjective (e.g., perceived exertion scales) measures to monitor fatigue and better understand its influence on technical-tactical performance during SSGs. A second limitation is related to the skill level of the participants. As the players are already familiarized with small-sided games and have a high level of competition with their clubs (national level), the SSG format could not have provoked sufficient instabilities to verify different acute performances in the present study. It is possible that, with a less experienced sample, we could have observed different results. Therefore, we encourage researchers study the effect of these protocols with less experienced players to identify their behavior during this SSG format.

Conclusion

The tactical-technical performance remains stable across five 4v4 small-sided game bouts played by U-14 football athletes, given that a decline in the support action was verified only between the third and fourth bouts. Therefore, technical-tactical improvements resulting from training under the specific game configurations and population of this study are likely to emerge only over longer periods of practice. We encourage future studies to investigate the effect of this game format during a season, aiming to verify if there are any effects over time. Coaches are thus encouraged to implement this SSG format to maintain performance and prevent player overload.

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