PHYSICAL DEMAND IN SOCCER SMALL-SIDED GAMES: INFLUENCE OF TEAM COMPOSITION

DEMANDA FÍSICA DE PEQUENOS JOGOS NO FUTEBOL: INFLUÊNCIA DO CRITÉRIO DE COMPOSIÇÃO DAS EQUIPES

DEMANDA FÍSICA EN PEQUEÑOS PARTIDOS EN EL FÚTBOL: INFLUENCIA DEL CRITERIO DE COMPOSICIÓN DE LOS EQUIPOS

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Gibson Moreira Praça[1]
(Physical Education Professional)
Marcelo Vilhena Silva[2]
(Physical Education Professional)
Raphael Brito e Sousa[1]
(Physical Education Professional)
Juan Carlos Pérez Morales[1]
(Physical Education Professional)
Pablo Juan Greco[1]
(Physical Education Professional)

1. Universidade Federal de Minas Gerais (UFMG), Escola de Educação Física, Fisioterapia e Terapia Ocupacional, Sports Department. Belo Horizonte, MG, Brazil.
2. Pontifícia Universidade Católica (PUC), Belo Horizonte, MG, Brazil.

Correspondence:
Pablo Juan Greco.
EEFFTO - Escola de Educação Física, Fisioterapia e Terapia Ocupacional.
Av. Pres. Antônio Carlos, 6627
Campus - Pampulha,
Belo Horizonte, MG, Brazil.
31270-901. grecopj@ufmg.br

ABSTRACT

Introduction: Small-sided games (SSG) are used as training tools for physical conditioning in soccer. To date, however, it is unknown whether team composition affects athletes' physical performance. Specifically, based on the differences presented by players of different positions, it is expected that the use of positional status as a criterion for team composition will affect players' physical performance. Objective: To compare the physical demands of SSG in teams composed of young soccer players in the same position or different positions. Methods: 12 U-15 soccer players participated in the study. The athletes performed 3v3 SSGs under two conditions: teams in which the athletes played in the same position (i.e. three defenders), and teams in which the players took up different positions (i.e. defender, midfielder and attacker). Data were obtained on total distance traveled, distance in speed zones, and accelerations, using GPS devices. The data were analyzed using the paired t-test, comparing the two experimental conditions. Results: There was higher physical demand among defenders and midfielders when the SSG was performed with athletes playing in the same position, in terms of distances covered in different speed zones. However, there were no differences in relation to acceleration actions. Conclusion: Team composition affects the physical performance of soccer athletes during 3v3 SSG. ***Level of evidence IV; Case series.***

Keywords: Task performance and analysis; Soccer; Physical education and training.

RESUMO

Introdução: Pequenos jogos (PJ) são utilizados como meios de treinamento físico no futebol. Até o momento, contudo, desconhece-se se compor as equipes de diferentes formas para a realização dos jogos gera impacto no desempenho físico dos atletas. Especificamente, baseando-se nas diferenças apresentadas pelos jogadores de diferentes posições, espera-se que a utilização do estatuto posicional como critério para composição das equipes modifique o desempenho físico dos jogadores. Objetivo: Desta forma, o presente estudo teve como objetivo comparar a demanda física dos pequenos jogos em equipes compostas por atletas de mesma posição ou de posições diferentes praticados por jovens atletas de futebol. Métodos: Participaram do estudo 12 atletas de futebol da categoria sub-15. Os atletas realizaram PJ na estrutura 3v3 em duas condições: com equipes compostas por atletas de mesma posição (por exemplo, três defensores) ou com equipes compostas por atletas de posições diferentes (por exemplo, um defensor, um meio-campista e um atacante por equipe). Analisaram-se os dados referentes à distância total percorrida e à distância em faixas de velocidade e acelerações obtidos através do equipamento de GPS. Os dados foram comparados entre as situações experimentais por meio do teste t pareado. Resultados: Os resultados apontaram maior demanda física entre os defensores e meio-campistas quando esses realizaram os PJ com atletas da mesma posição em relação às distâncias percorridas em diferentes faixas de velocidade, sem diferença nas ações de aceleração. Conclusão: O critério de composição das equipes altera o desempenho físico dos atletas de futebol durante o pequeno jogo 3v3. ***Nível de evidência IV; Série de casos.***

Descritores: *Análise e desempenho de tarefas; Futebol; Educação física e treinamento.*

RESUMEN

Introducción: Pequeños partidos (PP) son utilizados como medios de entrenamiento físico en el fútbol. Hasta el momento, sin embargo, se desconoce si componer a los equipos de diferentes formas para la realización de los partidos genera impacto en el desempeño físico de los atletas. Específicamente, basándose en las diferencias presentadas por los jugadores de diferentes posiciones, se espera que la utilización del estatuto posicional como criterio para la composición de los equipos modifique el desempeño físico de los jugadores. Objetivo: De esta forma, el presente estudio tuvo como objetivo comparar la demanda física de los pequeños partidos en equipos compuestos por atletas de la misma posición o de posiciones diferentes practicados por jóvenes atletas de fútbol. Métodos: Participaron en el estudio 12 atletas de fútbol de la categoría sub-15. Los atletas realizaron PP en la estructura 3 contra 3 en dos condiciones: con equipos compuestos por jugadores de la misma posición (por ejemplo, tres defensores), o con equipos compuestos por jugadores de posiciones diferentes (por ejemplo, un defensor, un mediocampista y un atacante por equipo).

Se analizaron los datos referentes a la distancia total recorrida y la distancia en rangos de velocidad y aceleraciones, obtenidos a través del equipamiento de GPS. Se compararon los datos entre las situaciones experimentales por medio del test t pareado. Resultados: Los resultados apuntaron mayor demanda física entre defensores y mediocampistas cuando esos realizaron los PP con atletas de la misma posición con relación a las distancias recorridas en diferentes rangos de velocidad, sin diferencia en las acciones de aceleración. Conclusión: El criterio de composición de los equipos altera el desempeño físico de los atletas de fútbol durante el pequeño partido de 3 contra 3. ***Nivel de evidencia IV; Serie de casos.***

Descriptores: *Análisis y desempeño de tareas; F*útbol; Educación y entrenamiento físico.

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INTRODUCTION

During the last decades, the use of small-sided games (SSG) has been suggested to develop players' physical skills. The SSG allows replicating, at least partially, the match physical, physiological, technical, and tactical demands, in a game-based context [1,2]. It is known that changes in variables such as pitch size [3] and the number of players per team lead to different training adaptations. In addition, different teams' composition criteria (i.e., criteria used to form teams), such as players' aerobic power [4,5], technical skills [4], and tactical knowledge can be adopted to balance teams. The most common strategy to form balanced teams comprises the division of players according to playing positions (e.g., defender, midfielder and forward) [6,7], although, in some cases, complementary criteria can be adopted, such as players' tactical knowledge [8].

The physical demands of SSG are often investigated using the data provided by GPS devices [9,10]. Although data obtained from GPS equipment with sampling rates lower than 5hz showed low reliability during non-linear, accelerated/decelerated movements, movements[11,12] devices with a higher sampling rate (e.g.10hz), and coupled with 100hz triaxial accelerometers provided more accurate information regarding players' accelerations [13,14]. Therefore, strength and conditioning coaches can use this data to better plan training loads during the training process.

Previous studies indicated that physical demands vary according to playing positions in soccer. [15,16]. Usually, midfielders and fullbacks present a higher physical response during official matches in comparison to other positions, such as defenders [15,16]. Considering the specific physical responses expected for each position, it is desirable that the training process, including the SSG, provide specific stimuli to players from different positions. Indeed, Praça et al. [8] confirmed that the 3v3 SSG presents specific demands for players from different positions, which indicates the potential use of SSG for training soccer-specific content.

Furthermore, the teams' composition criteria seem to influence players' responses during SSG [4,5]. Köklü et al. [4] observed that teams composed based on the players' aerobic power or based on the combination of players' aerobic power and technical skills during SSG presented a higher physical demand (i.e., distance covered at high speeds and average heart rate) compared to other criteria. This result confirms the influence of the teams' composition criteria on players' responses during SSG. Previous studies have based the teams' composition on playing positions, by choosing a defender, a midfielder, and a forward for each team [1]. However, to the best of our knowledge, no study has investigated the effect of the team's composition based on playing positions. On the one hand, the team's composition based on the homogeneous distribution of players from each playing position on the teams (e.g., the same number of defenders, midfielders and forwards on each team) allows the replication of specific stimuli in regard to the official matches. On the other hand, the adoption of a heterogeneous distribution (e.g., three defenders against three midfielders) could change the physical response, revealing an interesting possibility for coaches to adjust the training load in some training sessions. The present study aimed to compare the physical demands of small-sided games played by teams composed of players from the same position with teams composed of players of different positions.

METHODOLOGICAL PROCEDURES

Subjects

Twelve male soccer players (age 14.43 ± 0.16 years; weight 62.58 kg ± 8.72, height 172.16 ± 7.20 cm, 2.7 years ± 0.9 of time of deliberate practice), registered at the Confederação Brasileira de Futebol (CBF) participated in the study. All players belonged to the same national-level club, from the city of Curitiba. The players were selected based on their playing position, comprising three goalkeepers (not evaluated), three defenders (center-backs), three midfielders (defensive midfielders of center midfielders), and three forwards (center forwards). This study was approved by the local Ethics committee (51011915.9.0000.5149). All participants and legal guardians gave their written consent to participate in the study.

The number of participants was estimated using the software GPower 3.17, as recommended in the literature [17]. The dependent variable with a higher coefficient of variation (distance between 14,4 e 21,5km/h – CV= 0,062), collected during a pilot study, was used to calculate the sample size. This information was inserted at the field "t-tests for two matched groups" at the GPower software. The software recommended six subjects in order to reach and alfa of 0.05 and a beta of 0.80. The final design of this study comprised twelve subjects, higher than the recommended by the sample size estimation procedures.

Procedures

Firstly, three teams were composed for each experimental condition, in a repeated measures design: teams composed of athletes from different positions (one defender, one midfielder, and one forward per team) – condition 1; and teams composed of athletes from the same position (e.g. three defenders) – condition 2. In addition, a control team was composed of a defender, a midfielder and a forward. This control team played against all other teams, reducing the effect of changing the opponents on the players' responses. The data provided by this team was not included in the analysis.

The athletes were allocated in each team in condition 1 according to players' performance on the field test of the System of Tactical Assessment in Soccer (FUT-SAT) [18]. The test comprised a 3v3 SSG, with four minutes of duration, in a 36x27 meters field. All trials were recorded and later analyzed by experts in regard to the accomplishment of the core tactical principles (offensive and defensive) [18]. The FUT-SAT assesses the tactical performance of each player, using the ratio between successful tactical actions and total tactical actions. Players from each playing position were ranked according to their tactical performance, which was used to compose balanced teams. Therefore, in condition 1, each team

was composed of a player ranked second, third, and fourth, one from each playing position group. The three best players on this test were selected for the control team. Goalkeepers were randomly allocated to each team. The Table 1 presents the details of the teams' composition procedures for the two experimental conditions.

The data collection regarding the SSG comprised a two-week period. During this period, all teams played against the control team once, totalizing six sessions of data collection. All the sessions took part in a natural grass soccer field of 36x27 meters. All soccer official rules, including the offside, were adopted. All the sessions started at the same time of the day.

A Global Positioning System (GPS) (Catapult OptimEye S5, 10Hz with a triaxial 100Hz accelerometer) was used to record the data regarding the physical responses of the players during the SSG. The following variables were considered for the analysis: distance covered at speeds level 1 (0-7,2Km/h); distance covered at speeds level 2 (7,3-14,3Km/h); distance covered at speeds level 3 (14,4-21,5 Km/h); distance covered at speeds level 4 (> 21,5 Km/h); distance covered at accelerations level 1 (accelerations between 2m/s^2 and 2,5m/s^2); and distance covered at accelerations level 2 (accelerations above 2,5m/s^2). For the distance-related variables, the values were relativized by the total distance covered during the SSG, and are expressed in percentages.

Statistical analysis

First, we checked data normality using the Shapiro-Wilk's test. We compared the variables between protocols using paired t-tests. The variable "distance level 4" presented significant deviations from normality Therefore, we used the Mann-Whitney's test to compare this variable between protocols. We also calculated the Cohen's d effect size for each comparison, which were classified as trivial (d<0.2), small (0.2<d<0.6), moderate (0.6<d<1.2), large (1.2<d<2.0), very large (2.0<d<4.0), or near--perfect (4.0<d) [19]. Considering the specificities regarding the physical skills of players from different positions in SSG [8], all analyses were performed within each position and data were presented separately. The SPSS 19.0 software was used for all analyses, except for effect size. The statistical significance was set at 0.05.

RESULTS

The defenders covered higher percentages of distance at level 1 (p=0.001; small effect) and level 4 (p=0.001; moderate effect) in condition 2 (playing with teammates from the same position) compared to condition 1 (playing with teammates from different positions). There were no differences in the acceleration responses between conditions. In general, we found a higher physical response when defenders played with teammates from the same playing position. (Table 2)

The midfielders covered a higher percentage of distance covered at speeds level 1 (p=0.040; small effect), level 3 (p=0.005; moderate effect), and level 4 (p=0.001; moderate effect), and a lower percentage of distance covered at speeds level 2 (p=0.014; moderate effect) in condition 2 compared to condition 1. There were no differences in the accelerations between conditions. In general, the condition 2 presented a higher physical demand for the midfielders, similarly to the results observed for the defenders. (Table 3)

Table 4 shows the results for forwards, which are contrary to the results previously presented for midfielders and defenders. There were no differences between conditions for any of the variables fro this playing position. Therefore, the change in the teams' composition based on the playing positions did not affect the physical responses of forwards.

Table 1. Teams composed during the study.

Team composition			
Condition 1			
Team A	D^2	M^4	F^3
Team B	D^3	M^2	F^4
Team C	D^4	M^3	F^2
Condition 2			
Team D	D^2	D^3	D^4
Team E	M^2	M^3	M^4
Team F	F^2	F^3	F^4
Control Team			
Control Team	D^1	M^1	F^1

D: defenders; M: midfielders; F: forwards. Superscript numbers indicate the relative position of each player in the FUT-SAT test.

Table 2. Physical responses of the defenders on the two experimental conditions.

Variables	Condition 1 (Players from different playing positions)	Condition 2 (Players from the same playing position)	p-value	Effect Size
Total Distance	428.63 (65.30)	445.92 (42.36)	0.333	0.301
Distances level 1	0.44 (0.06)	0.46 (0.06)	0.001*	0.333
Distances level 2	0.42 (0.06)	0.34 (0.11)	0.078	0.838&
Distances level 3	0.14 (0.05)	0.14 (0.05)	0.690	0.001
Distances level 4	0.00 (0.00)	0.04 (0.04)	0.001*	1.000&
Accelerations level 1	50.08 (7.06)	47.58 (5.98)	0.102	0.379
Accelerations level 2	99.50 (4.95)	101.92 (5.63)	0.093	0.454

* Valores significativos; & efeitos moderados.

Table 3. Physical responses of the midfielders on the two experimental conditions.

Variables	Condition 1 (Players from different playing positions)	Condition 2 (Players from the same playing position)	p-value	Effect Size
Total Distance	422.88 (38.12)	437.96 (30.97)	0.131	0.429
Distances level 1	0.46 (0.07)	0.48 (0.06)	0.040*	0.304
Distances level 2	0.41 (0.07)	0.32 (0.08)	0.014*	1.190&
Distances level 3	0.12 (0.04)	0.15 (0.04)	0.005*	0.750&
Distances level 4	0.01 (0.01)	0.04 (0.04)	0.001*	0.832&
Accelerations level 1	49.00(6.39)	50.96 (5.60)	0.246	0.324
Accelerations level 2	98.08 (6.04)	99.92 (6.15)	0.354	0.301

* Valores significativos; & efeitos moderados.

Table 4. Physical responses of the forwards on the two experimental conditions.

Variables	Condition 1 (Players from different playing positions)	Condition 2 (Players from the same playing position)	p-value	Effect Size
Total Distance	439.46(36.47)	426.63 (29.87)	0.206	0.381
Distances level 1	0.45 (0.05)	0.46 (0.06)	0.687	0.179
Distances level 2	0.41 (0.05)	0.41 (0.06)	0.743	0.000
Distances level 3	0.14 (0.04)	0.12 (0.03)	0.178	0.554
Distances level 4	0.01 (0.01)	0.01 (0.02)	0.267	0.000
Accelerations level 1	47.75 (6.85)	49.71 (7.05)	0.422	0.281
Accelerations level 2	98.17 (5.02)	99.92 (6.15)	0.343	0.308

DISCUSSION

This study aimed to analyze the influence of changing the teams' composition criteria, based on the players' playing position, on players' physical responses during soccer SSG. In general, playing with teammates from the same position increases the physical responses of defenders and midfielders, although it does not affect forwards' responses.

Previous studies showed differences in players' behavior when the teams were formed according to different composition criterion [4,5]. In this study, the SSG played by teams composed of athletes from the same playing position presented an increased physical demand compared to SSG played by teams composed of athletes of different playing positions. It

has been suggested that players from different positions present different physical, anthropometrical, technical, and tactical skills, which justify the specific behaviors observed in both official matches [15,16,20] and training situations [8,21,22]. Therefore, we suggest that in the SSG played by teams composed of a defender, a midfielder and a forward, which is usually adopted in the literature [8,23], players kept a similar playing dynamics compared to official matches. In contrast, when teams are composed of players from the same playing position, players are demanded to perform different non-specific actions in relation to what is expected in the commom teams' composition (defender-midfielder-forward) in both official matches and training sessions. This modification would lead, therefore, to an increased physical demand, which is in line with our results. However, the lack of influence of teams' composition on forwards physical responses, may be related to the heterogeneous physical, anthropometrical, and tactical-technical characteristics of these players (for example, center forwards and wings).Future studies should improve the comprehension of this phenomenon.

The choice of different SSG formats for each training session reflects the interest of the coaching staff to achieve specific training loads [24]. The results of the present study allow a better understanding of the use of the 3v3 SSG during soccer training. Specifically, if the coaching staff aims to increase the physical demands of the training, we suggest the adoption of teams composed of players from the same playing position. Moreover, considering the importance of avoiding the premature specialization of youth players during the early years of deliberate practice in soccer and guarantee a diversity of tactical and technical stimuli [25,26], we also suggest that the use of SSG with athletes from the same playing position allows a better pedagogical environment for teaching general, operational, and core tactical principles of soccer. Future studies should focus on the assessment of tactical behavior during SSG played by teams formed according to different teams' composition criteria, to reach a better comprehension of this variable on players' responses.

The novelty of this study regards the effects of the teams' composition criteria based on the players' playing positions on players' responses during SSG. few suggest future studies to investigate different participants (ages and levels of expertise). In addition, considering that the number of players per team influences the players' behavior during SSG [27,28], future studies should investigate the effect of the independent variable "teams' composition criterion" on players' physical responses within larger SSG formats.

CONCLUSION

We concluded that the teams' composition criterion influences the physical demands of the 3v3 SSG. Playing with teammates from the same position increases the physical responses of defenders and midfielders.

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