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Effect of the Number of Ball Contacts Within Bouts of 4 vs. 4 Small-Sided Soccer Games

Alexandre Dellal, Carlos Lago-Penas, Del P. Wong, and Karim Chamari

Purpose*:* The aim of this study was to examine the influence of the number of ball touches authorized per possession on the physical demands, technical performances and physiological responses throughout the bouts within 4 vs. 4 soccer small-sided games (SSGs). ***Methods:*** Twenty international soccer players (27.4 ± 1.5 y, 180.6 ± 2.3 cm, 79.2 ± 4.2 kg, body fat 12.7 ± 1.2%) performed three different 4 vs. 4 SSGs (4 × 4 min) in which the number of ball touches authorized per possession was manipulated (1 touch = 1T; 2 touches = 2T; Free Play = FP). The SSGs were divided in 4 bouts (B1, B2, B3 and B4) separated by 3 min of passive recovery. The physical performances, technical activities, heart rate responses, blood lactate and RPE were analyzed. ***Results:*** The FP rule presented greater number of duels, induced the lowest decreases of the sprint and high-intensity performances, and affected less the technical actions (successful passes and number of ball losses) from B1 to B4 as compared with 1T and 2T forms. Moreover, the SSG played in 1T form led to reach higher solicitation of the high-intensity actions while players presented more difficulty to perform a correct technical action. ***Conclusions:*** The modification of the number of ball touches authorized per possession affects the soccer player activity from the first to the last bout of SSG, indicating that the determination of this rule has to be precisely planned by the coach according to the objectives of the training.

Keywords: fitness training, elite soccer players, technical actions, time-motion characteristics, physiological responses

The demand of an elite match play requires that players present the capacity to repeat high-intensity actions[1,2] and to perform more than 700 turns, and 30-40

tackles and jumps.[3] Players have to cover a total distance considered as sprinting (speed > 24.1 km·h^{-1}) ranging between 193.6 m and 278.2 m whereas the total distance covered in high-intensity run (HIR, speed: 21–24 km·h^{-1}) range from 226.1 m to 334.0 m according to the playing positions at high level.[4] Moreover, the high-intensity actions concern the technical requirement inasmuch it has been shown that players have the ball only between 1.2% and 2.4% of the total duration of the match play[2] or 1.18 min.[5] Dellal et al[4] indicated that elite players are characterized by the capacity to play with the smallest number of ball touches per possession in order to increase the pace of the game. In this context, the number of ball touches per possession is between 1.74 (central defenders) and 2.26 touches (central attacking midfielders) in the Spanish and English first division.[4]

These characteristics are essential in modern elite soccer, and therefore, coaches need specific training exercises in order to solicit these capacities. In response to this, soccer coaches frequently use small-sided games (SSGs) to concomitantly train the tactical, physical and technical components in the way similar to match play.[6,7] Small-sided games induce heart rate responses (HR) comparable to short-duration intermittent exercise,[6] and include greater proportion of high-intensity actions such as sprint, HIR, directional changes, duels and tackles as compared with competitive match play.[8,9] For these reasons, SSGs are commonly used in the soccer training.

The physiological responses, technical and physical demands during SSGs are influenced by the rules changes and game format such as the pitch size,[10] the number of players[11] or the number of ball touches authorized per possession.[12] However, changes in pitch size did not alter both HR responses and the technical demands during SSG.[9] These differences of results justify that the determination of the workload within SSGs needs to be improved. Kelly and Drust[9] have proposed to examine the SSG according to the number of bouts. The results of their investigation demonstrated that during 4 × 4 min SSGs the HR responses increased significantly from the first to the last bout of 4 vs. 4 SSGs whereas the number of technical actions decreased. This type of analysis is interesting but it appears appropriate to link the special demands within bouts with rules changes. To the best of our knowledge, no studies have examined the influence of rule changes in the different bouts within SSGs. It could be interesting to investigate whether the decrease of the physical performance traditionally described from the first half to the second half in competitive match play[5,13,14] would be observed from the first to the last bout during 4 × 4 min SSGs. These findings are essential for the accurate prescription of soccer-specific fitness training.

Consequently, the aim of the present study was to examine the variation of the physical performance, technical actions and physiological responses throughout the different bouts (4 × 4 min) of 4 vs. 4 SSGs when the number of ball touches authorized by possession was manipulated (1 touch, 2 touches, and free play). We hypothesized that there is a decrease in high-intensity actions throughout the bouts of SSGs. On the basis of these findings, it is hoped that the understanding of the training load during SSGs would be improved, thus providing the coach with valuable information for the prescription of SSG training.

Methods

Subjects

Twenty internationals outfield male soccer players from the Côte d'Ivoire national team participated in the study (means ± *SD*: age 27.4 ± 1.5 y, height 180.6 ± 2.3 cm, body mass 79.2 ± 4.2 kg, HR_{max} 199.9 ± 4.1 beats per minute [bpm], body fat 12.7 ± 1.2%). All players were notified of the aim of the study, research procedures, requirements, benefits, and risks before giving written informed consent. Goalkeepers were excluded from the study, as they did not participate in the same physical training program as the remainder of the squad. The study was conducted according to the Declaration of Helsinki and the protocol was fully approved by the Clinical Research Ethics Committee. The authors have no conflicts of interest that are directly relevant to the content of this article. All players were not notified about the influences of the rule changes on physiological response and technical and physical performances during all 4 vs. 4 SSGs.

Study Design

To examine this topic, the 4 vs. 4 SSG was employed, as it is the most frequently used training drill in elite soccer. Each player performed simultaneously three 4 × 4 min SSGs over a 3 wk time span during the middle of in-season period. In this regard, the number of ball touches authorized by individual possession (1 touch = 1T, 2 touches = 2T, and free play = FP) was randomized for each of the three 4 × 4 min SSGs. During each 4 × 4 min SSG (B1, B2, B3, and B4), there was 3 min of passive recovery between plays. Finally, the physiological responses (RPE, blood lactate concentration, and heart rate), technical (number of duels, percentage of successful passes, number of ball losses, and total number of ball possessions) and physical (total distance covered, total distance covered in sprinting, and total distance covered in HIR) performance during the SSGs of different ball touch rules and bouts were compared.

Methodology

All SSGs were performed at the same time of day in order to limit the effects of the circadian variations on the measured variables, particularly on HR measures.[15] All SSGs were played at the start of each training session with consistent verbal encouragement to maintenance a high work rate. Each SSG was preceded by a 20 min standardized warm-up and with at least 2 d separating each session. Players have been familiarized with the 4 vs. 4 formats and regimes during the first period of the season. The pitch size is the same for all SSGs (30 × 20 m; ie, a player:area ratio of 1:75 m^2). The SSGs were performed with the instructions to keep the ball as long as possible for a given team, with the help of four supports players (out of the playing area and not allowed to perform more than 1 touch for each involvement). Several balls were disposed all around these areas for immediate availability. The total duration of the SSGs was thus an effective playing time.

Physiological Responses.

The global ratings of perceived exertion (RPE, 10-point) scale proposed by Foster et al[19] was used to determine the internal load in soccer training,[20] and consequently, at the end of each 4 min SSG, players provided the RPE value corresponding to the effort of the 4 min played.

Capillary blood [La] samples were collected 3 min after each 4 min SSG by a calibrated portable analyzer (Lactate Pro, Arkray, Japan), which has been previously validated.[17,18]

Heart rate responses were measured (5 s recording intervals) throughout the SSGs via HR monitors (Polar S-810, Polar-Electro, Finland). Maximal heart rate (HR_{max}) and resting HR were determined for each player according to previous studies.[6,16] Individual mean HR during the SSGs was determined to indicate the overall intensity. Heart rate data were therefore expressed as percentages of HR_{max} ($\%HR_{max}$) and HR reserve ($\%HR_{reserve}$) according to the formula previously used by Dellal et al.[6]

Technical Performance.

In order to examine the player technical activity, all SSGs were video-recorded using four digital cameras positioned 10 m behind each corner of the SSG area (elevated at 1 m above the ground). A hand notational system combined with the video recordings, which were played back several times, was used to evaluate the duels (one player facing an other player with the aim to keep or gain ball possession), individual percentage of successful passes, individual number of ball losses and individual total number of ball possessions in each bouts within the SSG. This method has been described as reliable evaluation of movement in soccer.[22]

Physical Performance.

The time-motion characteristics were measured using a portable global positioning system (GPS) unit (GPSports SPI Elite System, Canberra, Australia). This system was previously validated in soccer for the monitoring of high-intensity and sprint activity.[21] Therefore, the total distance covered, especially in sprinting and HIR, were measured according to the previous time-motion analysis in SSG[8] in which the thresholds to evaluate the distances run in these categories of running speeds were 13–17 $km \cdot h^{-1}$ (HIR) and >17 $km \cdot h^{-1}$ (sprinting).

Statistical Analysis

Data are presented as means and standard deviations (*SD*). The normality distribution of the data was checked using the Kolmogorov-Smirnov test and the statistical analysis variance homogeneity was provided by the Hartley test. After confirming normal distribution, a two-way ANOVA with repeated measures was used to examine differences in performance with two factors (bouts × ball touch rules). Significant *F*-ratios were followed up with Tukey's procedure using Bonferroni's correction. All statistical analysis was performed using SPSS for Windows, version 17.0 (SPSS Inc., Chicago, USA). Statistical significance was set at $P < .05$.

Results

There was a significant effect of bout and ball touch rule (Table 1) for the total distance covered in HIR and sprint ($P < .001$). The total distance covered in sprint decreased from B1 to B4 for SSGs played in 2T and FP form, whereas no difference was observed for SSGs played in 1T form. The total distance covered in HIR in B3 increased significantly for SSGs played in 1T and 2T form when compared with SSGs played in FP form. The total distance covered in HIR and sprinting were

greater in B1 than B3 and B4 ($P < .001$) among all SSGs played (1T, 2T and FP, Table 2). Specifically, although results showed similar decreases of the total distance covered in HIR and in sprinting from B1 to B4 in SSGs played in 1T, 2T and FP, the percentage of sprint activity was more affected when the SSGs was played in 1T and 2T as compared with FP ($P < .01$, Figure 1) with decreases of 27.4–26.1% (1T and 2T) vs. 24.6% (FP), respectively. In the same context, the percentage of the total distance covered in HIR presented significantly greater decreases from B1 to B4 when the SSG was played in 2T (–6.9%, $P < .05$ with respect to 1T and FP, Figure 2). Moreover, the amount of activity in low and moderate intensities presented an increase from B1 to B4 ($P < .05$), independently of the rules (1T = from 59.6% to 65.0%, 2T = from 61.6% to 69.6%, and FP = from 65.7% to 69.5%, of the total distance covered from B1 to B4, respectively), with a greater increase from B1 to B4 when the SSG was played in 2T or 1T.

The physiological responses ([La], $\%HR_{reserve}$, $\%HR_{max}$ and RPE) increased from B1 to B4 whatever the number of ball possession authorized (1T, 2T and FP, Table 2). However, the results of the present study showed that the increase of the HR responses from B3 to B4 was significantly greater when the SSG was played in 2T form ($P < .001$) whereas the increase of the [La] was higher from B1 to B2 and from B3 to B4 for the SSG played in FP form as compared with the SSG played in 1T and 2T forms ($P < .001$).

The variation in the number of ball possessions throughout the bouts presented no significant difference for all the rules tested (1T, 2T and FP). Furthermore, there was a significant decrease in the number of duels from B1 to B4 played in 1T, 2T or FP (Table 2) but the greatest decreases occurred in 2T and FP forms (respectively, –47.4% and –46.8% vs. –37.7% for the 1T form, $P < .001$, respectively). Moreover, players presented greater difficulty to perform successful passes from B1 to B4 when the SSG was played in 1T form (–15.8% vs. –10.0% and –7.9% in 2T and FP forms, respectively). In the same context, players lost a lower number of balls in the FP rule as compared with the two other forms of SSG ($P < .01$).

Discussion

The aim of the present investigation was to examine whether the variation of the number of ball touches authorized per possession (1T, 2T, FP) influenced the physical and technical performance, and physiological responses throughout the different bouts within 4 vs. 4 SSG. The main findings of the present study demonstrated that the free-play (FP) rule showed greater number of duels in each bout, induced the lowest decreases of performance at high intensities (sprint and HIR) and affected less the technical actions (successful passes and number of ball losses) from the first bout (B1) to the last bout (B4) as compared with the SSG played in 1T and 2T form. The HR responses and RPE increases were similar for the three forms of SSG. Moreover, the SSGs played in 1T form induce more high-intensity physical performance while the players presented poorest quality in technical actions.

Physical Activities Throughout the Different Bouts of the 4 vs. 4 SSGs

Although SSGs have been commonly described as a type of training to maintain and improve the physical capacity of the soccer players,[6,10] the majority of previous

studies did not examine and differentiate the physical activities and the physiological responses during the different bouts of SSGs. The present study demonstrated that the physical demand differed throughout the different bouts with significant differences between B1 and B4, particularly the high-intensity activities. This suggests that the number of ball contacts authorized per possession is a rule altering the physical demand probably leading to lower muscle creatine phosphate (CrP) and muscle pH values, and higher blood lactate concentration.[12] Furthermore, it has been found that the temporary fatigue during high-intensity exercise is caused by an accumulation of potassium in the muscle interstitium, and subsequently depolarize the muscle membrane potential and reduce force development.[23] Specifically, FP rule induced a lower decrease of sprints and HIR activities from B1 to B4 as compared with 1T and 2T forms, whereas the total distance covered in low and moderate intensity were the highest in each bout as compared with those of 1T and 2T. The objective of the SSG is to confront the players with physical and technical patterns similar to those of match play (ie, a combination of directional changes, tackles, sprints or high-intensity actions) but in shorter duration of play, with greater intensities and greater repetitions of high intensity efforts per minute of play. In this context, the FP form appears to be less intense as compared with 1T or the 2T forms that induced greater intensity of play and thus, greater physiological adaptations. However, the increase of [La] was greater in FP form from B1 to B4, probably owing to the fact that the players presented lower total number of ball possessions in FP ($P < .05$ with 2T and $P < .001$ with 1T). Consequently, players had a greater total duration of ball possession with greater number of contact with the ball, performed more dribbles and duels which affected the peripheral component and physiological responses, especially the [La] as it has been described.[24] To consider the SSG as a high-intensity training in soccer, the technical and physical activity should be analyzed simultaneously. It was related that the technical actions (of which the total number and the total duration of the ball possession) induced an increase in the cardiorespiratory system.[24] Indeed, the results of the present study revealed that the players presented greater HR responses when the total number of ball possession was the highest (ie, 1T form) as compared with FP form of play during all bouts. This finding could be also explained by the fact that SSG played in 1T included a higher proportion of high-intensity activities and a lower proportion of total distance covered in low and moderate intensity, as compared with the FP. In this context, it appears that the number of ball contacts induces different HR responses but the increases from B1 to B4 were similar. This would indicate that the number of ball contacts per possession has to be clearly defined and notify players in order to induce an appropriate physical and physiological training stimulus.

Technical Actions Throughout the Different Bouts of the 4 vs. 4 SSGs

The interest of the use of the SSG in soccer training is that this method simultaneously stimulates the physical and technical performances in a pattern close to the game. Nevertheless, it is difficult to control the technical activity of the players due to the tactical component and the higher coefficient of variation.[5] In this context, the precise determination of the game rules could help the coaches to better control the technical activities and physical demand during the SSG. The results of the present study indicate that when the SSG is played with four support players and without goalkeeper, the number of ball touches authorized per possession influences

the number of duels and the quality of technical actions (percentage of successful passes and total number of ball losses) while the total number of ball possessions could stay similar. Specifically, the SSG played in 1T form induced a smaller decrease in the number of duels but a larger decrease in the number of successful passes from B1 to B4. The 1T form of play is a rule confronting the players with a greater technical difficulty because balls played in one touch requires the player to process information about the partners and the opponents before receiving the ball, to decide faster, to have the technical ability to play quickly and to be able to repeat high-intensity actions. The players have a reduced time to make decisions and to analyze the game, which explains the lower quality of their technical actions in 1T form as compared with the 2T and FP. Because the technical and the physical activities are linked, if the coaches would like to elicit the technical component, they could choose a 4 vs. 4 played in 2T form, reflecting the same condition of play as those found in match play,[4] while the high-intensity activity remains predominant. According to these findings, it appears that the number of ball contacts authorized per possession influences both the physical and the technical activities of the players within the different bouts of a 4 vs. 4 SSG. Combined with the choice of the number of ball touches per possession, the number of bouts traditionally used for the application of a 4 vs. 4 could vary in order to alter or reduce the modification of the physical or technical performances. Fanchini et al[25] have found that the modification of bouts duration during a 3 vs. 3 (from 2 min to 6 min) altered only the percentage of successful passes. However, the duration of the bouts proposed (ie, 6 min) for the 3 vs. 3 is not a possible practical application due to the longer duration of the bout, which induces too great a difference in fatigue and a greater heterogeneity of the players' activity. It could be interesting for future investigations to examine if the variation in the duration of the different bouts within a 4 vs. 4 SSG improves the control of the training stimulus.

Practical Applications

Small-sided games are commonly used in soccer training to solicit the tactical, physical and technical components similar to match-play conditions.[26] However, it is difficult to precisely estimate the physical load and technical activities induced by the SSG. The present study demonstrated that the modification of the number of ball contacts authorized per individual possession influences the high-intensity activities and the quality of the technical actions within the different bouts of the SSG, when it was played with support players and without goalkeeper. According to the training objectives, coaches and sport scientists could favor a precise number of ball touches authorized per possession, but they could also vary both the number and the duration of bouts used. In this context, the present study showed that 4 vs. 4 SSG of same durations induced different physiological responses by varying the number of ball touches rules (1T, 2T, and FP). In addition, it has been shown that it is possible to favor an aerobic training in the recommended range of 90–95% of HR_{max}[27,28] with SSGs played in 1T or 2T forms. Thus, 1T and 2 forms could be interesting rules of SSGs when the players are in the midseason and in-season whereas the free-play rule could be favored during the preseason. In addition, coaches could manipulate the duration and number of bouts, and this should be investigated.

Conclusions

The number of ball touches authorized per possession appears to be a useful tool for improving the control and the physical and technical performances of the players within the SSG. More specifically, an SSG played in 1T form induced higher physical demands with a greater total distance covered at high intensities in each bout whereas the decrease of their high-intensity actions and percentage of successful passes were greater as compared with the SSGs played in 2T or FP forms, probably as a result of the repetition of sprints, which induce an increase of the physiological responses and elicit anaerobic metabolism.

The modification in the number of ball touches per possession differentially affects the player activity from the first to the last bout, indicating that the determination of this rule has to be precisely planned by the coach according to the training objectives. Coaches should determine which component (technical and/or physical) they would like to favor, and, therefore, they should define the number of ball authorized[AUQ1] per possession. Finally, it appears that the 4 vs. 4 played in 2T form is the best SSG to solicit concomitantly high-intensity actions and to confront the players with technical situations similar to those found during match play. Based on these findings, it is hoped that the understanding of the training load would be improved, providing to the coach valuable information for the use of SSG training.

Acknowledgments

We thank all the players of the national soccer team of Côte d'Ivoire for their collaboration.
The authors have no conflicts of interest that are directly relevant to the content of this article.
The present study was partly financially supported by the Ministry of High School Teaching and Scientific Research, Tunisia.

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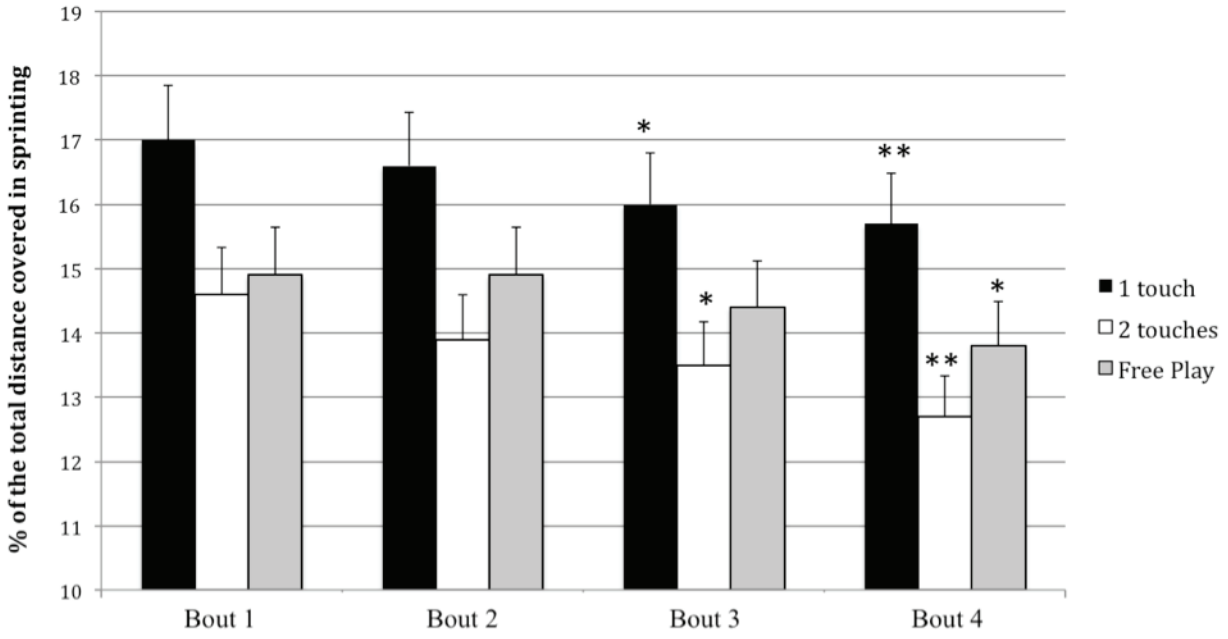

Figure 1 — Percentage of the total distance covered in sprinting in the different bouts of a 4 vs. 4 SGG. *Significant difference with the bout 1; **P* < .05; ***P* < .01.

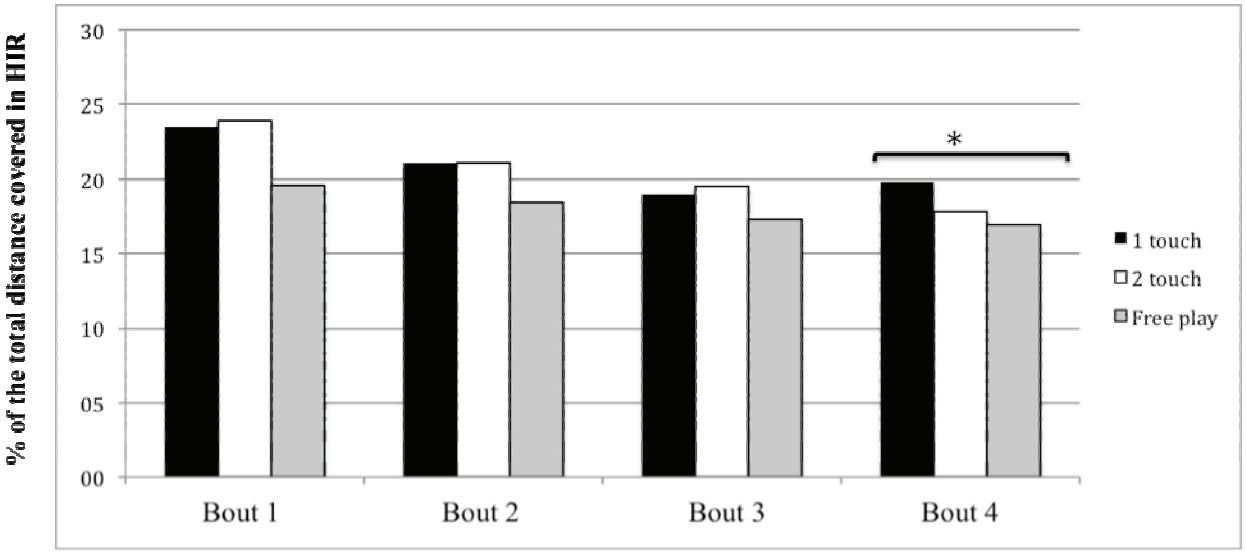

Figure 2 — Percentage of the total distance covered in high-intensity run (HIR) in the different bouts of a 4 vs. 4 SGG. *Significant difference with the bout 1; $P < .05$.

Table 1 ANOVA results and effect size of the bout and ball touch rule on the measured variables

	Within-Subjects Factor (*P* value)			Effect Size		
	Bouts	Rules	Bouts × Rules	Bouts	Rules	Bouts × Rules
RPE (CR-10)	0.00	0.01	0.32	0.96	0.43	0.36
Blood lactate ($mL \cdot L^{-1}$)	0.00	0.26	0.02	0.99	0.14	0.62
$\%HR_{max}$	0.00	0.00	0.00	0.98	0.68	0.71
%HR reserve	0.00	0.00	0.00	0.99	0.68	0.71
Number of duels	0.00	0.00	0.07	0.96	0.71	0.53
% of successful passes	0.00	0.00	0.02	0.97	0.91	0.60
Number of ball lost	0.00	0.01	0.13	0.91	0.44	0.47
Total number of ball possession	0.31	0.00	0.85	0.19	0.84	0.16
Total distance covered (m)	0.00	0.00	0.01	0.98	0.89	0.65
Total distance covered in sprinting (m)	0.00	0.00	0.27	0.98	0.91	0.38
% of the total distance covered in sprinting	0.00	0.00	0.67	0.78	0.64	0.23
Total distance covered in HIR (m)	0.00	0.00	0.04	0.98	0.85	0.57
% of the total distance covered in HIR	0.00	0.00	0.05	0.97	0.69	0.55

Note. HIR: high-intensity run; HR: heart rate.

Table 2 Means (*SD*) of physical performance, technical actions and physiological responses during the bouts of the 4 vs. 4 small-sided games played in 1 touch, 2 touches and free play (1T, 2T, FP)

Variables	Bout 1 (B1)	Bout 2 (B2)	Bout 3 (B3)	Bout 4 (B4)
RPE (CR-10)				
1 Touch	6.8 ± 0.8	7.8 ± 0.8***	7.9 ± 0.8***	8.9 ± 0.8***
2 Touches	6.9 ± 0.8	7.7 ± 1.0***	8.1 ± 0.7***	8.9 ± 0.5***
Free Play	6.3 ± 0.5	7.1 ± 0.5***	7.3 ± 0.7***	8.2 ± 0.9***
Blood lactate ($mL \cdot L^{-1}$)				
1 Touch	2.5 ± 0.2	2.8 ± 0.3*	3.1 ± 0.4***	3.5 ± 0.5***
2 Touches	2.5 ± 0.1	2.7 ± 0.2	3.0 ± 0.2***	3.2 ± 0.3***
Free Play§§§	2.4 ± 0.3	3.1 ± 0.2***	3.3 ± 0.2***	4.5 ± 0.3***
$\%HR_{max}$				
1 Touch	85.0 ± 2.3	86.7 ± 2.4	88.2 ± 2.6	90.4 ± 2.7*
2 Touches	83.4 ± 2.8	84.7 ± 2.9	86.1 ± 3.1	89.7 ± 3.2*
Free Play	82.7 ± 2.6	84.1 ± 2.6	85.1 ± 2.7	86.8 ± 2.9*
%HR Reserve				
1 Touch	80.1 ± 3.0	82.5 ± 3.3	84.5 ± 3.3*	87.0 ± 3.3*
2 Touches	78.0 ± 4.3	79.8 ± 3.9	81.6 ± 3.8	83.8 ± 4.4*
Free Play	77.2 ± 3.0	78.9 ± 3.5	80.3 ± 3.6	82.6 ± 3.8*
Number of Duels				
1 Touch§§§	5.3 ± 1.1	5.0 ± 0.9	4.4 ± 1.1*	3.3 ± 0.9***
2 Touches	5.7 ± 1.1	4.6 ± 1.0*	4.1 ± 0.9**	3.0 ± 0.8***
Free Play	7.7 ± 1.2	7.1 ± 1.3*	5.9 ± 1.2***	4.1 ± 0.9***
% of successful passes				
1 Touch	53.1 ± 5.3	51.9 ± 5.7	49.5 ± 5.3**	44.7 ± 5.6***
2 Touches	70.8 ± 5.1	69.3 ± 4.9	67.0 ± 5.1	63.7 ± 5.6***
Free Play	75.9 ± 6.7	74.2 ± 7.5	73.2 ± 7.1	69.9 ± 7.8***
Number of ball lost				
1 Touch§§	2.5 ± 0.9	3.0 ± 0.9*	3.5 ± 1.2***	5.7 ± 1.9***
2 Touches§§	2.6 ± 0.9	3.7 ± 1.1**	4.2 ± 1.2***	6.0 ± 1.7***
Free Play	2.4 ± 1.2	3.0 ± 1.2*	3.3 ± 1.2***	4.4 ± 1.5***
Total number of ball possession				
1 Touch§§§	12.6 ± 2.1	9.8 ± 1.9***	10.1 ± 2.9***	9.1 ± 2.8***
2 Touches	8.7 ± 2.4	8.6 ± 2.5	8.9 ± 2.0	8.5 ± 2.1
Free Play	7.7 ± 1.7	7.3 ± 1.4	8.2 ± 1.7	8.3 ± 2.1*
Total distance covered (m)				
1 Touch§§§	835.7 ± 61.1	793.6 ± 61.2	759.8 ± 69.3**	668.7 ± 73.9***
2 Touches	711.9 ± 65.5	689.2 ± 71.1	667.8 ± 74.0*	604.9 ± 55.2***

Free Play	726.3 ± 65.4	679.4 ± 66.1	659.5 ± 66.2*	597.6 ± 56.7***
Total distance covered in sprinting (m)				
1 Touch§	140.7 ± 20.4	130.5 ± 17.5*	119.8 ± 14.3***	102.1 ± 12.6***
2 Touches§	103.6 ± 14.6	95.5 ± 12.4	89.3 ± 12.7***	76.5 ± 13.4***
Free Play	107.3 ± 15.6	100.1 ± 15.1	93.4 ± 14.3***	80.9 ± 13.4***
Total distance covered in HIR (m)				
1 Touch	195.7 ± 14.9	166.9 ± 18.2***	143.8 ± 19.8***	132.0 ± 16.6***
2 Touches§§§	169.8 ± 20.5	144.8 ± 17.1***	130.5 ± 16.6***	107.7 ± 13.2***
Free Play	142.3 ± 25.7	124.9 ± 10.8**	114.1 ± 17.7***	101.3 ± 12.1***
% of the total distance covered in low and moderate intensity				
1 Touch	59.6	62.5	65.2	65.0
2 Touches	61.6	65.2	67.2	69.6
Free Play	65.7	66.9	68.6	69.5

Note. HIR: high-intensity run; HR: heart rate.

*Significant difference with bout 1; *$P < .05$; **$P < .01$; ***$P < .001$.

§Significant difference between rules of game (1T, 2T, FP); §$P < .05$; §§$P < .01$; §§§$P < .001$.

Author Queries

[AUQ1] should be the number of ball contacts authorized?

[AUQ2] Please update.

[AUQ3] Please provide the missing volume number in this journal reference (in reference 8, "Hill-Haas, Coutts, Dawson, Rowsell, 2009").

[AUQ4] Please supply additional bibliographic information if available.

[AUQ5] Medline reports the journal title should be "Eur J Appl Physiol" not "Eur J Sport Sci" in reference 16 "Rampinini, Sassi, Azzalin, et al, 2010".

[AUQ6] Medline reports the journal title should be "Eur J Appl Physiol" not "Eur J Sport Sci" in reference 17 "Pyne, Boston, Martin, Logan, 2000".

[AUQ7] Medline reports the first page should be "453" not "28" in reference 25 "Fanchini, Azzalin, Castagna, Schena, Mc Call, Impellizzeri, 2010".

[AUQ8] Please provide the missing volume number in this journal reference (in reference 25, "Fanchini, Azzalin, Castagna, Schena, Mc Call, Impellizzeri, 2010").

[AUQ9] Reference has only first page number. Please provide the last page number if article is longer than one page. (in reference 25 "Fanchini, Azzalin, Castagna, Schena, Mc Call, Impellizzeri, 2010").