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Section: Original Investigation

Article Title: The Effects of Long Sprint Ability Oriented Small-Sided Games Using Different Players-to-Pitch Area on Internal and External Load in Soccer Players

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Abstract

Purpose: The aim of this study was to examine the internal and external load imposed by Long Sprint Ability (LSA) oriented small-sided games (SSG) using different players-to-pitch area ratio (densities) in soccer players. **Methods:** Nineteen professional soccer players from the same soccer club (age 17.1±0.3 years, height 1.76±0.69 m, body mass 69.7±9.4 kg) participated in this study. Players performed 4x30s (150s recovery) all-out 1v1 SSG considering 300, 200 and 100 m^2 per player (48h apart). Players' external-load was tracked with GPS technology (20Hz). Heart rate, blood lactate concentration (BLc) and rating of perceived exertion characterized players' internal-load. Peak BLc was assessed with a 30s all-out test on a non-motorized treadmill (NMT). **Results:** SSG_{300} produced higher BLc than SSG_{200} (moderate) and SSG_{100} (large). The SSG_{300}, SSG_{200} and SSG_{100} BLc were 97.8±34.8 (trivial), 74.7±24.9 (moderate) and 43.4±15.7% (large) of the NMT30s peak BLc, respectively. Players covered more distance at high-intensity during the SSG_{300} than in other SSG conditions (huge to very-large differences).. High-intensity deceleration distance was largely lower in SSG_{200} than in SSG_{300}. SSG_{100} elicit very-large to huge and large to very-large lower external load values than SSG_{300} and $SSG_{200,}$ respectively. **Conclusions**: The main finding of this study showed an inverse association between ball-drill density and internal/external loads in LSA oriented SSG. The SSG_{300} attested to provide BLc closer to individual maximal, and thus, satisfying the all-out construct assumed for LSA development. Further studies using the SSG_{300} as training intervention and/or investigating other different SSG formats using the same density are warranted.

Key words: association football, sprint training, high-intensity intermittent exercise, anaerobic capacity, sprint endurance.

Introduction

Technical, tactical and physical performance are relevant constructs of soccer performance with match high-intensity acting as casual indicator[1]. Ball drills in the form of small-sided games (SSG) are assumed as functional paradigms useful to train players to cope with the match demands [2]. Impelllizzeri et al. [3] were the first to demonstrate the effectiveness of SSG in inducing changes in match performance and aerobic fitness of soccer players. The cited authors provided evidence of the practical value, either for physiological or match relevant variables, of proposing SSG, with the players training at imposed heart rate (HR) intensities (i.e., ≥90% HR_{max}). More recently, all-out SSG aiming to develop players' anaerobic performance were proposed [4-6]. This with the aim to condition players to cope with the very high-intensity, predominantly anaerobic, phases of the game [7,8]. Originally, the proposed methodological principle related to the speed-endurance construct, suggesting maintenance of players' maximal speed for a selected amount of time (i.e., 30-60s) [4]. Speed endurance training revealed to improve the abilities supposed to be useful to perform high-intensity, more frequently and for longer periods of time, in soccer players [4,7-9]. Recently, the speed endurance construct was replaced with the long sprint ability (LSA) concept, considered as more suitable in soccer training context[4]. The logical validity of long sprint ability (LSA) was supported by empirical descriptive studies that showed the relevance of acceleration and deceleration, more than sustained speed in the determinism of external load in all-out SSG [4,5]. In this regard, emphasis on players' maximal or near maximal effort maintenance for a prolonged period of time (i.e., 30-40s) has been proposed as a LSA training aim [4]. The long sprint construct was validated by descriptive studies in which SSG and running drills were compared [4,5]. All-out SSG were reported to elicit largely lower and higher coverage in speed and higher acceleration/deceleration in arbitrary high-intensity categories compared to running drills, respectively [4]. Recovery mode showed to play a role on SSG internal load with production (i.e., work/rest 1:5) drills, inducing higher post-exercise blood lactate concentrations (BL_c) compared to maintenance drills (i.e., work/rest 1:2) [4,5]. Apparently, players' density (i.e., playing area/number of players) seem to play a role in all-out SSG, with wider playing space per player inducing higher physical and physiological demands [4,5]. However, no structured study comparing different SSG density paradigms was published for SSG aiming at developing LSA, leaving the question of what is the appropriate area per player unanswered. Information in this regard would result of great practical interest for training prescription when the aim is the functional (i.e., related to match demands) development of players' anaerobic capacity, specifically, LSA.

The literature that addressed SSG demands reported a wide range of players' density showing contrasting results as per physiological responses [2]. Recently, densities of 300 m^2 were proposed to develop anaerobic performance in soccer players using all-out SSG (i.e., SSG_{300}; functional training) [4]. The SSG_{300} showed to induce BLc in the range of those achieved in studies with higher densities but repeated for longer exercise time [4,5]. With the aim to clarify the dose-response to protocols useful to optimize LSA training, comparative studies using different playing densities are warranted in soccer.

Therefore, the aim of this study was to examine the internal and external load imposed by LSA oriented SSG using different densities, in male professional youth soccer players. An inverse association between SSG density and imposed demands was assumed as work hypothesis [10].

Methods

Subjects

Nineteen male professional academy-level soccer players belonging to the same soccer club (mean ± SD; age 17.1 ± 0.3 years, height 1.76 ± 0.69 m, body mass 69.7 ± 9.4 kg) participated in this study. The players trained 4 times per week with a competitive match performed during the weekend. This study testing procedures took place two months before the end of the competitive season when players successfully competed in their category championship. The training sessions duration was of approximately 90 min and consisted in mainly technical-tactical individual and team drills (70-80% of the training time). Strength and conditioning exercises (change of direction and SSG drills) were performed twice a week and covered approximately 20-30% of the total training time. All participants were fully informed about the study’s procedures receiving both verbal and written instructions about the risks and benefits deriving from participating in this study. Before starting the study, written informed consent was obtained from each player and their parent/guardian. All players were aware that they could withdraw from the study at any time without penalties. The study design received clearance from the Institutional Research Board before the commencement of the experimental measures.

Design

Using a repeated measurements design, the players’ internal and external loads were assessed during SSG of different densities. With the aim to warrant maximal anaerobic-capacity responses, all the considered ball-drills were performed using the production mode suggested by Castagna et al. [4], consisting in 4 bouts of 30s with a 1:5 work-to-rest ratio. The SSG_{300} protocol was assumed as reference of soccer specificity and its demands compared with SSG considering 200 and 100 m^2 (i.e., SSG_{200} and SSG_{100}, respectively). Drill specificity was assumed for SSG_{300}, since 300 m^2 is the usual theoretical match density encountered by players during regular size pitch matches (i.e., 11v11) [4,11]. Comparisons were made against arbitrary players’ densities reported to be current in use in competitive soccer training for mainly anaerobic performance development [2,5,6]. According to Castagna et al.[4], the considered SSG were played as 1v1 all-out games. Small-sided games reliability (i.e., 1v1) was assessed before the commencement of this study providing, for the same variables here considered, intraclass correlation coefficients (ICC) ranging from very large to almost perfect (0.77, 0.91) [12]. Peak BL_c after a 30s all-out sprint on a non-motorized treadmill (NMT30s, Force, Woodway INC, Milwakee, USA) test was considered as representative of maximal individual anaerobic capacity and used for data normalisation. After each 4x30s SSG drill and non-motorized 30s all-out test, BL_c was evaluated sampling blood at 6 min in the post-exercise recovery. Preliminary studies performed in these authors' laboratory showed BL_c peaking at this recovery time after multiple sampling (0, 3, 6, 9 and 12 min) for the same exercises used in this study [4]. Small-sided games internal load was also assessed monitoring heart rate (HR) and rating of perceived exertion (RPE) using the CR10 Börg scale [10]. The external load was assessed using Global Positioning Technology (K-GPS, Montelabbate, Pesaro, Italy) with units sampling at an actual 20 Hz during each of SSG drill. The GPS system was tested for validity and reliability before the commencement of the study, and it provided results comparable to the GPS systems currently used for match analyses in soccer [4,13]. With the aim to warrant this study internal validity power calculation was performed before the commencement of the study to determine the sample size suggesting consideration for 12 players to obtain a power of 0.80.

Methodology

All the procedures were performed on separate days, at least 48 h apart from each SSG condition and before or after a match, in a random order, under similar weather conditions (18-22 C°, 70-75% humidity) and on the same artificial grass soccer pitch. During the SSG protocols, the players' recovery was performed walking (i.e., performing some steps to avoid complete standing) to avoid post-exercise leg blood-pooling [4]. The considered SSG densities were achieved with the players exercising on 30x20, 20x20 and 20x10 m pitches for the SSG_{300},

SSG_{200}, and SSG_{100} conditions, respectively. Unattended small goals (1.5x2m) were in place during all the SSG drills to stress maximal space coverage in players [4]. Aiming to stress maximal effort during each S-SSG bout, the ball was replaced as fast as possible when out of play and strong verbal encouragements were provided throughout the drills [10]. Furthermore, the players were matched considering NMT performance and individual soccer technical-skills. During the S-SSG the players were free to score from any distance. Ball repositioning was made with the foot and no corners or free-kicks were considered. No ball touches limit was considered during the S-SSG. The players were told to cover as much distance as possible in each of the 4x30s repetition to enforce maximal effort [4]. All the SSG drills started and ended with a whistle (i.e., 0 and 30s, respectively). Exercise external load was tracked using GPS technology with units set between shoulder-blades in purpose-built vests. The external-load was monitored using arbitrary speed, acceleration and metabolic-power categories as follows[4]:

- Total distance covered (TD);
- High-Intensity running distance (speed≥16 $km \cdot h^{-1}$, HI-Speed);
- High-Intensity Metabolic Power distance (≥20 $watt \cdot kg^{-1}$, HI-MP);
- High-Intensity Acceleration distance (≥2 $m \cdot s^{-2}$, HI-Acc);
- High-Intensity Deceleration distance (-2≤ $m \cdot s^{-2}$, HI-Dec).

During this study procedures, the GPS units were connected with, at least, 24 satellites (range 24-26).

The HR was monitored with long-range telemetry (Polar T2, Polar Electro Oy, Kempele, Finland) during each of the considered drills. The individual maximal HR (HR_{max}) was determined using the Yo-Yo Intermittent Recovery level 1 test, that was performed the week before this study procedures in a dedicated testing session [14]. Subjective internal load (i.e., CR10 Börg scale) was evaluated immediately post-drill using the CR10 Börg scale to rate muscular (RPE_M), cardiorespiratory (RPE_{CR}) and global (RPE_G) drill effort perception [4,15-20]. Players' maximal anaerobic capacity was assessed by monitoring power, distance produced and post-exercise BL_c during NMT30s. In this study, BL_c were determined from earlobe blood samples using an automated analyser (Lactate Pro2 LT-1730, Arkray, Kyoto, Japan) [4,5]. Testing procedures took place at the same time of the day (3-5 p.m.) in order to avoid possible circadian bias. Before each test-session players performed a standardized warm-up consisting of 10 min self-paced jogging (score 2 of CR10 Borg scale average intensity), followed by 2 min of skipping and striding exercises over 10 and 30 m, respectively [4]. After the standardized warm-up, the players actively rested for 2 min before starting the testing procedures. All players were familiarized with the considered procedures during the training sessions performed before the commencement of the data collection.

Statistical Analyses

Results are expressed as means ± standard deviations and 90% confidence intervals (90% CI)[12]. Normality assumption was verified using the Shapiro-Wilk W-test. A one-way repeated measures analysis of variance (ANOVA) with post-hoc Tukey test was used to compare SSG conditions (pitch size: 300, 200, 100 m^2) [21]. The Cohen's *d* was used to evaluate the effect size with values considered as huge>4, 4<very-large≤2, 2<large≤1.2, 1.2<moderate≤0.6, 0.6<small≤0.2 and trivial<0.2 [12]. A paired comparisons design was used for evaluating drills across conditions according to Hopkins et al.[12]. Within drill variability was expressed as coefficient of variation (%CV). Significance was set at 5% (p≤ 0.05). Effect size calculation was performed using R software (Foundation for Statistical Computing, Vienna, Austria). All other statistical procedures were carried-out with SPSS version 25 software (IBM SPSS Statistics, Chicago, USA).

Results

Players' intermittent high-intensity endurance fitness reported as Yo-Yo intermittent recovery test was 1830±150 m. During the NMT test the players covered 119±8 (115–124) m, producing 3527±484 (3270–3785) watts that corresponded to 50.87±4.10 (48.68–53.05) watt·kg^{-1}. External and internal load variables' values are reported in table 1. Very large ($p<0.0001$) differences between SSG_{300} and SSG_{200} were reported for TD, HI-MP, HI-Speed and HI-Acc (table 2). Between SSG_{300} and SSG_{200} a large ($p<0.001$) difference in Hi-Dec distance was found. The external load produced during the SSG_{300} was significantly higher ($p<0.001$) than in SSG_{100} with very-large to huge effects for all the considered variables (table 2). During the SSG_{100} the players covered significantly ($p<0.05$–0.001, large to very-large effect) less distances in all the arbitrary match categories compared to the SSG_{200} condition.

Post-exercise BLc were significantly higher in the SSG_{300}, compared to SSG_{200} ($p=0.01$, moderate) and SSG_{100} ($p<0.0001$, large). Players showed significantly higher BLc in the SSG_{200}, compared to SSG_{100} ($p<0.0001$, moderate). Mean exercise HR was higher in the SSG_{300} than in SSG_{200} ($p=0.004$, moderate), and SSG_{100} ($p=0.0003$, large). The HR_{mean} during the SSG_{200} resulted moderately higher than in the SSG_{100} drills ($p=0.001$). Small differences in HR_{peak} were found between SSG_{300} and SSG_{200} ($p=0.13$). Large-to-moderate differences were observed between SSG_{100} and SSG_{300} and SSG_{200} ($p<0.001$), respectively.

Significantly higher global and fractional RPE (i.e., cardiorespiratory and muscular) values were observed after SSG_{300}, compared to SSG_{200} ($p<0.001$, moderate), and SSG_{100} ($p<0.001$, large). Similarly, higher global and fractional RPE values were noted after SSG_{200} compared to SSG_{100} ($p<0.001$, moderate).

Peak post-NMT30s BL_c were 12.02±1.94 (11.14–12.90) mmol·L^{-1}. Post-SSG_{300} BL_c was not significantly lower ($p=0.49$; $d=0.19$, trivial) than post-NMT30 BL_c. The BL_c after

SSG_{200} (p=0.001; *d*=1.07, moderate), and SSG_{100} (p<0.001; *d*=3.87, very-large) were significantly lower than the post-NMT30 BL_c. They corresponded to 97.8±34.8 (83−113), 74.7±24.9 (64–85), and 43.4±15.7% (37−50) of the NMT30s peak BL_c, for the SSG_{300}, SSG_{200}, and SSG_{100} conditions, respectively.

Players' RPE_G were 103 (96–111), 90±23 (80–99) and 67±27% (55−78) of NMT30s post-test values for SSG_{300}, SSG_{200}, and SSG_{100} conditions, respectively (p<0.001, *d*=1.21–1.85, large). For the SSG_{300}, SSG_{200}, and SSG_{100} post drills RPE_M were 103±18 (96−111), 102±37 (86−118) and 71±33% (57−85) of the corresponding NMT values (p<0.001, *d*=1.42–1.95, large), respectively. The RPE_{CR} were 120±30 (107−132), 110±28 (98−122) and 79±27 (67–90) in the post SSG_{300}, SSG_{200}, and SSG_{100} conditions, respectively (p<0.001, *d*=1.58–1.97, large).

Discussion

The physical (i.e., external load) and physiological (i.e., internal load) demands imposed by SSG (1 vs. 1) aiming at developing LSA using different pitch dimensions (i.e., match density) have not been studied thus far. These reported results confirmed the original work hypothesis of a supposed (i.e., linear) inverse association between SSG density and internal and external load responses. Indeed, the SSG_{300} condition elicited very larger players' coverage in the selected match activities compared to SSG_{200} and SSG_{100}. Similarly, post-drills BL_c RPE modes and HR_{mean} and HR_{peak} were moderate to largely higher in the SSG_{300} compared with the other SSG conditions. This study results provide descriptive empirical evidence, to further support the interest of the SSG_{300} paradigm [4]. Indeed, the SSG_{300} revealed to elicit internal and external responses in line with the LSA construct (i.e., all-out mode) [4].

Construct specificity in soccer is context-dependent and mainly associated to coach playing strategy [4]. Ball drills in the form of SSG were considered as a training method useful to concurrently develop players' specific fitness and technical-tactical skills in competitive soccer [2]. During a soccer match, each player ideally plays over a playing area of 300 m^2, suggesting its consideration as reference for training specificity (i.e., functional training) [4].

The literature that addressed SSG' demands reported an effect of players' number, pitch dimension and coach encouragements on physiological and subjective effort perception [10]. With the aim to reduce the variables that may affect SSG responses, players' density was considered for the implementation of training drills[2]. Descriptive studies showed relative consistency of the physiological demands for a given player density [2]. However, these researches only addressed SSG aiming at players' aerobic fitness development, consequently, mainly examining exercise intensities at 90% of the individual HR_{max} [2]. All-out drills (i.e., running drills at 90-95% of maximal speed) aiming to develop players' anaerobic capacity were first proposed by Thomassen et al. [9] considering 30s bouts (i.e., 6 to 9 bouts including change of direction and ball contact). More recently, Nyberg et al. [22] reported positive effects on anaerobic performance of additional sprint training (i.e., 30s all-out runs) in professional soccer players. SSG (i.e., 1v1) performed all-out (i.e., 30s bouts) were then proposed to provide sport specificity using SSG with 300 m^2 per player performed in the production mode [4]. In the present study, the supposed construct specificity of SSG_{300} was tested for its external and internal load LSA derived construct relevance. This was undertaken using players' density as independent variable to examine the best practice among SSG using 300, 200 and 100 m^2 per player as reported in the published literature [2,4]. These study findings have shown that in LSA oriented SSG, higher internal and external loads are provided to players when considering lower players' densities.

During the SSG_{300}, the players accumulated 26% more TD than when performing SSG_{200}. The difference in drill coverage between SSG_{300} and the directly higher density condition (i.e., SSG_{200}) was higher when considering HI-Speed with a 76% very large difference. When playing SSG_{300} the players performed 24 and 18% more distance accelerating and decelerating at high-intensity compared to SSG_{200}, respectively. This providing evidence for greater lower limbs neuromuscular involvement in reduced density conditions.

The metabolic approach was used in this study to provide external load completeness, despite the existing controversy regarding its supposed validity [18,23-25]. According to its supposed higher sensitivity to track high-intensity bouts during actual match-play, the MP-HI coverage resulted 45% higher compared to HI-Speed for the SSG_{300}. The differences exponentially increased according to players' density with 210 and 415% more distance covered when comparing HI-MP vs. HI-Speed in the SSG_{200} and SSG_{100}, respectively. Similar results were reported by Gaudino et al. [17,26] confirming the supposed higher sensitivity of the metabolic metrics in tracking sprint activities in soccer. The remarkable differences in the arbitrary chosen match categories should possibly have been the consequence of the effect of accelerations and decelerations intervening during actual match-play as per provided metabolic power assumptions [24]. However, the difference in HI-Acc and HI-Dec were in the range of 18 and 50% in favour of the lower densities SSG, suggesting that probably not only positive or negative variations in velocity are informing HI-MP determinism. In light of this study results, the lower densities are favourable for inducing superior external loads on players when submitted to LSA aimed SSG. The interest about the possible cause/s in the determinism of SSG external load warrants further studies using same densities with various number of players and accounting for technical-tactical performance (i.e., passes, transitions, shots at goal, etc.).

Internal load quantification plays a key role in training prescription as it tracks the possible physiological adaptations that a player may experience during training [27]. In the present descriptive study, the players' internal load was examined measuring BL_C, exercise HR and considering post-exercise differential RPE [16,28]. The SSG_{300} elicited significant moderately and largely higher BL_C compared to SSG_{200} and SSG_{100}, respectively (table 1). The post SSG_{300}

BL_C were higher (*d*=-0.61, moderate) than those reported by Castagna et al. [4] in a field study performed using similar procedures and male soccer players.

The large variability (27-30%) in BL_C often found in SSG for LSA may partly explain the difference in anaerobic involvement in SSG_{300} between these studies [4,5]. Normalizing peak BL_C using the NMT30s, the relative anaerobic involvement was of 98 and 73% of peak BL_C for this study and a previously published one, respectively [4]. The reported higher BL_C promotes the SSG_{300} condition as a more suitable training paradigm for LSA development in competitive soccer. The SSG_{100} elicited the lowest BL_C of the three ball-drill conditions, suggesting its limited interest when near maximal anaerobic pathway involvements are aimed.

Despite the supposed limited physiological relevance of HR in this kind of short-duration ball drills, the players were able to achieve 91% of the individual HR_{peak} during the SSG_{300}, with moderate to large differences with SSG_{200} and SSG_{100} conditions, respectively. The average HRs during all three SSG conditions were practically lower than the intensity proved effective in inducing aerobic fitness improvements in competitive soccer (i.e., ≥90% HR_{max}) [3]. The internal training load measured as the product between RPE_G and exercise time (4x30s plus in between recovery time) was higher (moderate to large) in the SSG_{300} than in the other SSG conditions. The SSG_{100} induced differential RPE (i.e., global, cardiorespiratory and muscular) that were largely lower than that after the SSG_{300}. Interestingly, the three considered SSG modes induced RPE_M that were perceived as largely lower in magnitude than the cardiorespiratory and global RPE. Players seemed to perceive SSG as affecting more central than peripheral fatigue with global RPE in line with cardiorespiratory perception rate. It could be speculated that the accumulated fatigue and progressive involvement of aerobic metabolism in the determinism of SSG bouts may have affected the localisation of exertion perception [28,29]. The reported internal load responses support the internal validity of this research design (i.e., maximal effort provided by the players) and promote the interest of SSG_{300} for the development of LSA in soccer.

In this study, only 1v1 SSG were considered. Given the variety of ball drills currently used with the aim to train soccer players for endurance and sprint-endurance, further studies using different SSG paradigms are warranted (i.e., 2v2 to 5v5) [2]. Furthermore, the use of SSG with lower densities (i.e. >300m^2/player) may result of interest if LSA is the aim of the training session.

Practical Applications

During the SSG_{300} the players attained external and internal load values that were practically higher than those achieved during the comparison paradigm here considered (i.e., SSG_{200} and SSG_{100}). Given that the playing area per player of 300 m^2 was assumed as reflection of match conditions, the results of this study confirm the validity of using this players' density in the form of 1v1 as LSA training drill in soccer. Indeed, during the SSG_{300} paradigm the players achieved BL_C that were practically not different from those achieved in the NMT30s, considered as reference for anaerobic capacity (i.e., construct gold standard) [4]. Nevertheless, the high demands imposed by SSG_{300} either on players' internal and external load, may suggest its use in the later stage of the LSA development. Assuming the logic of training progression, the SSG_{100} could be introduced in the preliminary stages of LSA development and prior to SSG_{200}. In this regard, this progression logic should be tested with ecologically designed empirical studies. According to the all-out nature of SSG for LSA, players should be encouraged to provide their near maximal effort (i.e., training effort) during this kind of functional training. The use of exercise RPE may result a practically viable modality of evaluating players' effort during the LSA drills. Using the differential RPE approach, players' perceived effort should not be lower than "very strong" and "strong", when referring to global or cardiorespiratory and muscular RPE, respectively.

Conclusions

Physiological training in football should focus on the development of players' ability to cope with the crucial game demands [4,5,9,30]. LSA has been suggested as a relevant component in anaerobic performance development in male competitive soccer [4,5,9]. In previous studies, running bouts in the form of field and laboratory drills were suggested as preferential training strategies when searching for maximal anaerobic players involvement [4,5,22]. The SSG_{300} attested to provide physiological demands closer to individual maximal and thus, satisfying the all-out drill construct when performed with 1v1 format. Furthermore, coverages in the activities performed at high-intensity during the SSG_{300} were similar to those reported during crucial parts of the game [31] .

This study results confirmed the interest for players' densities higher than those previously proposed for SSG when LSA development was the aim of the training intervention. Coaches and fitness trainers aiming to develop LSA in male football should consider players' densities close to match conditions. Higher SSG densities should be considered as introductory drills or when lower internal demands are targeted for the players. Further studies considering different number of players with the same densities here used are warranted. The supposed functional interest of SSG_{300} as a LSA training drill should be tested with ecological training studies.

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Table 1. Descriptive values of the Small-Sided Games drills considered in this study.

Variable		Ball Drill Mode		
		SSG_{300}	***SSG_{200}***	***SSG_{100}***
TD (m)	Mean	601±54	446±63	378±46
	90%CI	(577–625)	(418–475)	(357–399)
	%CV	8.90	14.10	12.22
HI-Speed (m)	Mean	146±25	37±18	15±9
	90%CI	(135–157)	(28–44)	(11–19)
	%CV	17.00	50.40	59.60
HI-MP (m)	Mean	212±24	114±21	75±19
	90%CI	(201–223)	(104–123)	(67–84)
	%CV	10.56	18.50	24.80
HI-Acc (m)	Mean	145±14	110±15	82±16
	90%CI	(139–151)	(103–117)	(75–89)
	%CV	9.40	14.00	19.00
HI-Dec (m)	Mean	69±6	57±8	34±6
	90%CI	(67–72)	(54–60)	(32–37)
	%CV	8.80	13.30	17.60
Lactate ($mmol \cdot L^{-1}$)	Mean	11.38±3.31	8.75±2.75	5.30±2.27
	90%CI	(9.88–12.89)	(7.50–10.00)	(4.27–6.33)
	%CV	29.10	31.40	42.80
HR_{mean} ($beats \cdot min^{-1}$)	Mean	169±6	163±5	157±8
	90%CI	(166–172)	(160–165)	(157–160)
	%CV	3.5	3.2	5.4
HR_{peak} ($beats \cdot min^{-1}$)	Mean	186±4	184±4	177±5
	90%CI	(184–188)	(182–186)	(174–179)
	%CV	2.3	2.1	2.8
$\%HR_{max}$ (mean)	Mean	83±3	79±3	76±4
	90%CI	(81–84)	(78–81)	(74–78)
	%CV	3.5	3.2	4.8
$\%HR_{max}$ (peak)	Mean	91±2	90±2	86±2
	90%CI	(90–92)	(89–91)	(85–87)
	%CV	2.24	2.07	2.8
RPE_G				

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Variable		***Ball Drill Mode***		
		SSG_{300}	***SSG_{200}***	***SSG_{100}***
	Mean	8±1	7±1	5.07±1.62
	90%CI	(7.48–8.52)	(6.25–7.52)	(4.33–5.81)
	%CV	14.20	20.20	32.00
RPE_{CR}				
	Mean	7.6±1.3	6.6±1.3	4.7±1.4
	90%CI	(7.0–8.2)	(6.0–7.2)	(4.1–5.3)
	%CV	17.60	20.20	29.40
RPE_{M}				
	Mean	7.7±1.0	6.9±1.2	5.0±1.8
	90%CI	(7.2–8.1)	(6.3–7.4)	(4.2–5.8)
	%CV	13.4	17.3	35.5

SSG= Small-Sided Games; TD= Total Distance; HI-MP=High-Intensity Metabolic Power; Hi-Speed= High-Intensity Speed; HI-ACC= High-Intensity Acceleration; HI-Dec= High-Intensity Deceleration; Lactate= Blood Lactate Concentration; HR= Heart Rate; *$\%HR_{max}$ (mean)= Mean HR in percentage of HR max; $\%HR_{max}$ (peak)= Peak HR in percentage of HR max;* RPE_G = Global Rate of Perceived Exertion; RPE_{CR}= Cardio Respiratory RPE; RPE_M=Muscular RPE.

Table 2. Between Small-Sided Games drills comparisons.

Variable		***SSG_{300} vs SSG_{200}***	***SSG_{300} vs SSG_{100}***	***SSG_{200} vs SSG_{100}***
TD	*d*	2.03 (very *large*)	3.16 (very *large*)	1.34 (*large*)
(m)	Difference	154.7±76.9	222.7±71.9	68.0±97.0
	90%CI	(119.76–189.70)	(190.01–255.44)	(23.88–112.11)
	Diff%	25.74***	37.6***	15.23*
HI-MP	*d*	3.35 (*very large*)	5.17 (*huge*)	1.70 (*large*)
(m)	Difference	98.4±29.4	136.7±26.70	38.34±34.20
	90%CI	(84.98–111.76)	(124.56–148.85)	(22.76–53.91)
	Diff%	46.40***	64.49***	33.74***
HI-Speed	*d*	3.77 (very *large*)	6.31 (*huge*)	1.56 (*large*)
(m)	Difference	110.2±31.6	131.2± 24.0	21± 23.5
	90%CI	(95.80–124.54)	(120.14–142.27)	(10.36–31.71)
	Diff%	75.55***	58.99***	4.71***
HI-Acc	*d*	2.16 (*very large*)	3.29 (*very large*)	1.55 (*large*)
(m)	Difference	35.26±16.3	63.10±22.15	27.84±25.28
	90%CI	(27.79–42.74)	(53.03–73.18)	(16.34–39.34)
	Diff%	24.28***	43.45***	25.32***
HI-Dec	*d*	1.44 (*large*)	5.20 (*huge*)	2.48 (*very large*)
(m)	Difference	12.44±8.67	34.98±6.74	22.54±10.26
	90%CI	(8.49–16.38)	(31.91–38.05)	(17.87–22.21)
	Diff%	17.92***	50.38***	39.56***
Lactate	*d*	0.74 (*moderate*)	1.64 (*large*)	1.11 (*moderate*)
(mmol·L^{-1})	Difference	2.66±3.56	6.08± 3.79	3.42± 3.12
	90%CI	(1.04–4.28)	(4.36–7.81)	(2.00–4.84)
	Diff%	23.37*	53.44***	39.24***
HR_{mean}	*d*	0.90 (*moderate*)	1.25 (*large*)	0.66 (*moderate*)
(beats·min^{-1})	Difference	6.33±7.06	12.54±10.34	6.21±10.00
	90%CI	(3.12–9.54)	(7.84–17.24)	(1.66–10.76)
	Diff%	3.74**	7.41**	3.82*
HR_{peak}	*d*	0.43 (*small*)	1.47 (*large*)	1.19 (*moderate*)
(beats·min^{-1})	Difference	2.40±5.64	9.46±6.47	7.06±6.51
	90%CI	(-0.16–4.97)	(6.52–12.41)	(4.10–10.02)
	Diff%	1.29	5.08***	3.84***
RPE_G	*d*	0.86 (*moderate*)	1.54 (*large*)	1.01 (*moderate*)
	Difference	1.12±1.33	2.93±1.94	1.81±1.81
	90%CI	(0.51–1.72)	(2.04–3.81)	(0.99–2.64)
	Diff%	13.94**	36.61***	26.34**

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Variable		***SSG300 vs SSG200***	***SSG300 vs SSG100***	***SSG200 vs SSG100***
RPE_{CR}	*d*	1.04 (*moderate*)	1.76 (*large*)	1.17 (*moderate*)
	Difference	0.97±0.93	2.87±1.88	1.90±1.63
	90%CI	(0.55–1.39)	(2.02–3.72)	(1.16–2.64)
	Diff%	12.76**	37.83***	28.74***
RPE_{M}	*d*	0.62 (*moderate*)	1.51 (*large*)	1.03 (*moderate*)
	Difference	0.82±1.33	2.67±2.21	1.85±1.86
	90%CI	(0.21–1.43)	(1.66–3.67)	(1.00–2.69)
	Diff%	10.70*	34.87***	26.97**

SSG= Small-Sided Games; TD= Total Distance; HI-MP=High-Intensity Metabolic Power; Hi-Speed= High-Intensity Speed; HI-ACC= High-Intensity Acceleration; HI-Dec= High-Intensity Deceleration; Lactate= Blood Lactate Concentration; HR= Heart Rate; *$\%HR_{max}$ (mean)= Mean HR in percentage of HR max; $\%HR_{max}$ (peak)= Peak HR in percentage of HR max;* RPE_G = Global Rate of Perceived Exertion; RPE_{CR}= Cardio Respiratory RPE; RPE_M=Muscular RPE; ***=P<0.0001; **=P<0.001; *=P<0.01.