The effects of structural and technical constraints on the profiles of football-based passing drill exercises

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Published in:
Science and Medicine in Football

DOI:
10.1080/24733938.2017.1384561

Published: 04/10/2017

Document Version
Peer reviewed version

The effects of structural and technical constraints on the profiles of football-based passing drill exercises: suggestions for periodization planning and skill development

Running head: Football-based drills' performance analysis

Original Investigation

Abstract Word Count: 200

Text-Only Word Count: 4149

Number of Figures and Tables: 1 Figure and 2 Tables

Acknowledgements

The authors wish to thank all the players who volunteered to participate in this study. There are no conflicts of interest in this paper. This study was not supported by any sources of funding.

ABSTRACT

Objectives: The aim of this study was to profile the physiological, time-motion and technical responses induced by football passing drills, and to analyse the influence of structural and technical constraints.

Methods: Twenty-two male footballers performed 5-sets of intermittent passing drill bouts lasting 3-min each, interspersed by 1 min of passive recovery. The experimental protocols consisted of either a triangle-shaped or a Y-shaped drill format, in which the number of players (8 vs. 6) and the technical demands (single vs. double pass) were manipulated. The physiological responses (heart rate, rating of perceived exertion), external load measures (GPS-related) and technical performances (pass speed and accuracy) were analyzed.

Results: The results highlighted specific profiles for the experimental protocols: 1) a higher number of players involved led to greater internal and external load responses and higher technical scores; 2) additional technical requirements, such as for the double-pass task, determined lower internal load responses and a greater amount of acceleration and deceleration actions, but *trivial* or *unclear* effects on the technical performances.

Conclusions: In light of these outcomes, coaches could include passing drill formats with a variable number of players and technical demands, within appropriate long-term programs that address both physical adaptations and skill development.

KEYWORDS: Ecological validity; Exercise physiology; Global Positioning System; metabolic demand; team sport; testing and training

Introduction

The investigation of the key performance outcomes in football practice provides sport scientists and coaches with a reference framework that can be a useful means for optimal planning of training. Accordingly, in the last two decades the responses to internal and external physical loads during official matches have been the object of scientific interest (Stolen et al. 2005). With regard to time-motion characteristics, analyses of team and individual players` movement patterns highlight important variables – such as total distance covered, high-intensity running bouts and impulsive actions including accelerations, sprints and repeated sprints – as prerequisites for successful participation at the elite level (Faude et al. 2012). In addition, technical abilities such as dribbling and accurate or successful passing of the ball over a range of distances and in different directions, have been shown to discriminate top players from their less-talented counterparts (Lago and Martin 2007; Redwood-Brown 2008).

In light of the current scientific knowledge, optimal performance in football results from the interaction between several physical and physiological constraints, as well as technical-tactical capacities. The current data have been reported previously for both young (Aslan et al. 2012) and professional adult football players (Bangsbo et al. 1991) with regard to competition level and position during official matches. As a common practice, during football-based drills the main focus is directed towards developing technical and tactical skills, while the intensity and the variability of the physiological and time-motion demands may be unrestrained or even neglected. However, to promote an effective transfer to the competitive environment, it is suggested that the sport-specific training should include technical and tactical training in conditions similar to those that occur during match play (Williams and Hodges 2005).

According to the above-mentioned evidence, the use of training methodologies which can simultaneously improve technical and tactical skills under specific physical loads, such as small-sided games (SSGs) (Aguiar et al. 2012), has increased over the years. For instance, certain structural (e.g., pitch size, number of players, type and number of goals) (Aguiar et al. 2012) and rule (e.g., number of ball touches) (Dellal et al. 2011) constraints have shown to induce different physiological responses and greater variability when players attempt to repeatedly perform a technical action correctly. Most studies (Aguiar et al. 2012; Castellano et al. 2013; Hill-Haas et al. 2011) have reported that SSGs containing smaller numbers of players elicit higher heart rate (HR) and perceptual responses. Castellano et al. (2013) concluded that the number of players per side in SSGs formats is the variable that has a greatest influence on the HR responses and the energy demands placed on players. The effects on the rating of perceived exertion (RPE) due to the player number changes are in accordance with those found for the HR responses. In general, SSG formats with fewer players elicit greater RPE in the athletes than the larger formats (Aroso et al. 2004; Gaudino et al. 2014; Hill-Haas et al. 2010). These results clearly show that exercise-constraining manipulation can affect physiological responses and likely influence functional adaptations.

Additionally, previous investigations have focused their attention on the technical requirements and technical performance responses of different SSG formats. Nevertheless, Hill-Haas and colleagues (2011) concluded in their review article that the majority of these studies were not conducted very systematically, and suggested the need for detailed notational analysis to provide an improved understanding of the technical skill requirements of various SSGs. To the best of our knowledge, there is only one published study that adopted a valid and reliable evaluation method for specificly assessing the technical performance of players involved in different SSG formats (Dellal et al. 2011). Briefly, Dellal et al. (2011) found that SSGs played with a technical constraint, represented by the one ball touch rule, induced more high-intensity physical performance, but the poorest quality of technical actions. However, the authors limited their interest to reporting the percentage of successful passes, the number of balls lost and the ball possessions occurring during the SGG formats. Conversely, neither quantitative nor qualitative measures for analysing the passing performances in terms of ball speed or accuracy were provided. As previously shown (Dellal et al. 2010), at elite level, players having better technical skills and being able to play with a lower number of ball touches and higher passing accuracy per possession, ensure greater team collective performances. As a consequence, factors associated with both individual and collective successful play, such as passing speed and accuracy, which also represent key variables associated with goals and goal scoring opportunities (Wright et al. 2011), should to be favorably considered when technical performance improvements are sought. In summary, only limited valid and reliable data are available with regard to football-based training drills commonly applied to regular training sessions including specific technical constraints. The availability of the responses referred to the above football-based drills could help coaches in their daily training planning by helping them to select task constraints that may optimize the players' performance development.

Therefore, the aims of this study were (i) to describe the physiological, time-motion and technical skills' responses of regular training sessions performed during the competitive season by under-19 (U19) elite players; (ii) to analyze the effects of either isolated or combined structural (number of players: 8 vs. 6) and technically demanding (single vs. double pass) constraints on performance outcomes.

Methods

Participants

Twenty-two elite male football players, participating in the UEFA Youth League during the 2015-16 season, took part in the study (age 18.3±1.1 years, height 179.4±2.3 cm, body mass 74.3±4.1 kg, maximal HR 202.5±2.9 beats min^{-1} and percent of body fat 8.9±1.4%). All the players and/or their parents/guardians gave their written informed consent after receiving a detailed explanation about the aims of the study and potential risks. The study was conducted according to the Declaration of Helsinki, and the protocol was fully approved by the Institution's Ethics Committee.

Experimental Design

This study attempted to profile the influence of specific training constraints on physiological, time-motion and technical skills' outcomes of regular training sessions in football. In this regard, a *post-only cross-over design* was used to analyze the between-trial differences that occurred due to the experimental drill protocols. The study was conducted during the competitive season over a 9-week period (September to November), when 16 experimental trials took place and a total of 1056 samples were collected.One week before the initiation of the study the subjects took part in a familiarization session, in order to become acquainted with the protocol's procedures. Finally, the subjects repeated the same drills on two separate occasions, with the aim of assessing the test-retest reliability of the measures. The order in which the protocols were carried out was counter-balanced and determined by block randomisation (www.random.org).

Methodology

All the experimental sessions were performed at the same time of day (from 4:30 to 6:00 p.m.), on natural turf pitches, and under similar environmental conditions (temperature 22-25°C, relative humidity 56-61%). None of the players were involved in any sport activity other than the regular football training sessions,. A standardized warm-up lasting 15-min (e.g., general physical preparation with articular and muscular mobilization) was performed prior to the training sessions. The experimental trials consisted of performing exercises with both a triangle-shaped and a Y-shaped drill format of 15-m length per side, combining locomotor and technical activities such as standing, walking, accelerating, decelerating, sprinting and passing. Specifically, for both formats the following constraints were applied:

– Structural: Where the number of players was manipulated. Accordingly, either 8 or 6 players were involved in the experimental trials.

– Technical: Either a single pass (sequences of pass-control-pass between consecutive players) or a double pass (sequences of double passes between consecutive players performed through one ball touch).

The protocol was organized into intermittent bouts lasting 3 min each and interspersed by 1 min of passive recovery. An example of the passing drill formats is presented in Figure 1. For comparison of the protocols' outcomes, each player performed 5 bouts of each drill format and the results were used for further analysis.

****Figure 1 near here****

Physiological responses

HR was continuously monitored throughout the training sessions by HR monitors (Polar Team Sport System, Polar-Electro OY, Kempele, Finland) recording at 5-sec intervals. Individual mean HR was determined in order to indicate the internal load and was expressed as percentage of maximal heart rate (%HRmax), whose values were previously determined by completion of the Yo-Yo Intermittent Running Test Level 1 (Krustrup et al. 2003). Players indicated their RPE using the category rating 10 (CR-10) scale modified by Foster et al. (2001), 30 min after the end of the experimental sessions, using a standardized questionnaire. We then calculated the RPE training load (RPE-TL) by multiplying training duration (min) by the subjective RPE for each individual player.

External load data collection

The time-motion variables were collected with 22 GPS units working at a sampling frequency of 15 Hz (SPI-Pro X II, GPSports, Canberra, Australia). Studies involving the use of such technology (Abade et al. 2014) reported acceptable ranges of variability for all measures of distances and speeds in common football-based movements. Therefore, the variables recorded in our study were: relative distance covered per minute (RD; m/min), relative distance covered per minute at high speed (HSD; m/min; >19 km/h) (Abade et al. 2014) and relative sprint distance covered per minute (SD; m/min). Another time-motion parameter object of investigation in our study was the quantitative evaluation of the relative high intensity deceleration and acceleration (< -2 m·s^2 or > 2 m·s^2, respectively) efforts per minute (HAD; nr/min) (Abade et al. 2014). As suggested by Dwyer and Gabbett (2012), we avoided using an absolute value for the sprinting threshold definition. Instead, we adopted the same thresholds' calculation method, which uses acceleration events exceeding the highest 5% of accelerations, to identify sprints.

Technical performance

The passing performances were assessed by four cameras (Casio Exilim FH100, Hi-speed, 240 fps, Tokyo, Japan), positioned (sagittal planes) on a tripod at a height of 3-m and a distance of 8-m from the drill perimeter. A validated open source software (Kinovea, http://www.kinovea.org/) converted measures of pass times (s) and ball displacements (m) to speeds (m·s^{-1}, 0.027 m·s^{-1} accuracy related to standard calibration) (Dello Iacono et al. 2016).

A hand notational system, combined with the video recordings, was used to evaluate the individual percentages of accurate passes (accuracy %). This method has been described as reliable (Dellal et al. 2011), and the same experienced observer performed all the analyses to prevent inter-observer variability.

Statistical analyses

All data are presented as means ± standard deviation (SD) with a 95% confidence interval (95% CI). The Kolmogorov-Smirnov test was used to ensure normal distribution of the variables. The Intra-Class Correlation Coefficient (ICC) was used to determine the test-retest reliability of the measures. For the intra-day reliability, the spreadsheet of Hopkins (2000) was used to determine the typical error of measurement, expressed as a Coefficient of Variation (CV%) with a 95% confidence interval (95% CI). In addition, the data were also assessed for clinical significance using the approach based on the magnitudes of change. Knowledge of the Typical Error of Measurement (TE) allowed the calculation of the smallest worthwhile changes at the 95% confidence interval (SWC_{95}) (Hopkins et al. 2009). Quantitative chances of substantial differences were assessed qualitatively, as follows: <1%, most unlikely; 1-5%, very unlikely; 5-25%, unlikely; 25-75%, possible; 75-95%, likely; 95-99%, very likely; and >99%, most likely. If the chance of having substantial effects was >10% in both directions, the true difference was assessed as unclear. The Cohen's *d* was used to assess effect size (ES). According to Hopkins et al. (2009) ES of above 4, between 4 and 2, between 2 and 1.2, between 1.2 and 0.6, between 0.6 and 0.2 and between 0.2 and 0 were considered as huge, very large, large, moderate, small and trivial, respectively. Statistical analysis was performed using SPSS Statistics 21 software (SPSS Inc., Chicago, IL, USA).

Results

The 95% CVs% and ICCs of the inter-day and intra-day test-retest measurements are reported in Table 1, and indicate good to excellent agreements between trials. Meaningful differences in the between-trial comparisons were evident, as supported by the moderate to very large ESs and qualitative outcomes (Table 2). The comparison between the 8-player and 6-player formats suggested that there were *possibly* greater effects on the RPE-TL responses when performing the drills with a higher number of players. As for the time-motion parameters, the 8-player format induced *likely* to *most likely* greater responses with small to moderate ESs for all the external load data, when compared with the 6-player format. In addition, the ball speed of the first pass and both pass accuracy scores also showed results of *likely* to *very likely* higher with large to very large ESs when comparing the 8-player format with the 6-player one. The comparison between the single and double pass formats suggested that there were *likley* greater effects on the RPE-TL responses when performing the drills through sequences of pass-control-pass between consecutive players. Similarly, *most likely* greater responses with very large ESs were induced by the single pass format on RD and HSD. However, the double pass format determined *very likely* greater HAD responses with very large ES. Finally, no meaningful differences were found when comparing the two formats for any of the technical skills scores.

****Table 1 near here****

****Table 2 near here****

Discussion

In this study we aimed to profile the physiological, time-motion and technical responses induced by passing drill formats commonly used in football training, and to analyze the effects elicited by specific constraints in terms of involved players (i.e., 8 vs. 6) and technical requirements (i.e., single vs. double pass). Our results show specific and different profiles of the experimental training protocols; the 8-player format resulted in greater RPE-TL responses, and led to longer running distances and higher-intensity efforts than the 6-player format. Moreover, both pass speeds and pass accuracies were higher when a greater number of players performed the passing drill. The comparison between the protocols – focusing on the technical constraints – showed that the inclusion of an additional technical requirement, such as for the double-pass format, determined the following: lower RPE-TL responses as well as lower RD and HSD demands; a greater amount of acceleration and deceleration actions; and, *trivial* or *unclear* effects on pass speed and accuracy.

While this study is the first to report the effects of format and technical constraints on responses during passing drills, the present outcomes are comparable to those that were previously reported relative to match outcomes (Aslan et al., 2012; Dello Iacono et al. 2016). The results showed that during the experimental protocols, the players ran between 118.2 ± 0.2 $m \cdot min^{-1}$ and 119.6 ± 0.3 $m \cdot min^{-1}$ (Table 2). The overall results of the running pattern were slightly higher than those previously reported for official matches of youth football players (Buchheit et al. 2010a; Buchheit et al. 2010b; Dello Iacono et al., 2016) (ranging from 93.5 to 112.4 $m \cdot min^{-1}$), indicating that all the passing drill formats were performed at relatively higher running demands. Moreover, distances covered during sprinting (i.e., SD), accounting for between 5.2 and 6.7% of the total distance, were slightly greater than those found in previous research (Buchheit et al. 2010a; Dello Iacono et al. 2016) that used the identical activity categories as those applied in our study and were assessed by means of time-motion analysis technology (i.e., GPS).

The systematic comparison of training session and official matches outcomes is commonly suggested (Abade et al. 2014; Carling 2013). Interestingly, it has been proven that due to the collective game pace imposed, as well as other contextual factors (Paul et al., 2015), players do not fully utilise their physical potential during matches, despite being physically fit. On the other hand, Sporis et al. (2011) found differences in a wide range of overall physical fitness indicators when comparing starter and non-starter players at the end of the season. In practical terms, both circumstances may likely cause detrimental effects over time, thus compromising an optimal physical development process of football players. In this context, it is worth mentioning that the aim of each conditioning session is to overload or maintain the relevant fitness components relative to the match demands. In addition, one of the challenges for coaches is to ensure an optimal work/recovery balance from one day to the next, thus limiting the risk of overloading the players in the imminence of the match day. Finally, superior levels of fitness and football-related physical capabilities may help players in coping with potentially adverse playing scenarios. Accordingly, a comparison between training sessions and official match outcomes may be useful for a greater understanding of what methodologies and drills formats would better fit the required demands of the players` performance development.

In this study, it was observed that the relative distances covered during the 8-player format, both as absolute values and at high-speed running, were *very likely* and *likely* greater that the 6-player format, respectively. These findings follow a trend commonly highlighted in studies investigating different SSG-based training profiles (Castellano et al. 2013; Hill-Haas et al. 2011), which found an increase in distance covered in higher speed categories, with a concurrent higher number of players involved. However, a detailed analysis of the physical and physiological demands should also take into account the massive metabolic load imposed on players by the repetitive and intermittent accelerations, decelerations and sprinting actions, which also represent essential elements of the football performance model (Stolen et al. 2005). In this context, a greater amount of HAD demands and SD was observed as the number of players involved increased. For both parameters, the responses of the 8-player format were *most likely* greater than the corresponding 6-player one. The literature on SSGs responses (Gaudino et al. 2014) shows opposite trends to those deduced in our study, with the total number of changes in velocity being greater as the number of players decreased. A plausible reason for this outcome may be a 'pacing effect', which occurred due to the relatively longer duration of recovery that took place in the 8-player protocol in comparison to the 6-player one. In fact, the intermittent nature of the experimental formats, with the presence of in-between bouts of passive recovery phases, may have helped the players in recovering better during the 8-player format, thereby allowing the players to perform the designed drills with a greater number of explosive actions. Moreover, as oppposed to the SSG training design, where the pitch dimensions are commonly modified according to the number of players and expressed in terms of relative areas (Aguiar et al. 2012; Hill-Haas et al. 2011), in our study the experimental formats were developed according to preset dimensions in terms of the distance between the fixed passing positions (Figure 1). Therefore, the combination of locomotor demands along fixed distances (i.e., 15 m) and lower work-to-rest time ratios in the 8-player format may likely have led the players to perform the drills quantitively and qualitatively better, due to a possibly greater chance of having fully recovered from the short-term repetitive explosive actions featuring the passing drill protocols.

Our data also highlighted a *possibly* greater effect of the 8-player format on the RPE-TL responses when compared with the 6-player one. Recently, Dello Iacono et al. (2016) and Gaudino et al. (Gaudino et al. 2015) demonstrated the high correlation between RPE-TL measures and high-speed running and accelerations during football training. Our results conform to the conclusions of these authors, who showed that sprint distances and accelerations are likely to be strong predictors of RPE-TL in football. As a consequence, the higher values of RPE-TL reported following the 8-player format may have been dictated by the *most likely* greater values of relative HSD and HAD compared to those of the 6-player format.

Another finding of this study was that the double-pass formats led to a *very likely* and *likely* greater decrease of RD and HSD, respectively, associated with a *very likely* higher solicitation of high-intensity actions like HAD. In a previous study, Dellal et al. (2011) analyzed the effects of the number of ball contacts on physical demands, technical performances and physiological responses during 4-a-side SSGs, and found that forcing players to play with only one touch resulted in a greater decrease of sprint and high intensity running activities. Our study confirmed these findings, with lower distances covered in absolute and at high speed during the double-pass formats in comparison to single-pass ones. These results may imply a lower metabolic loading due to this specific technical constraint, as further confirmed by the *likely* lower RPE-TL responses associated with the same experimental protocols. It is reasonable that the presence of a double-pass task, matching the one-touch rule used in the study of Dellal et al. (2011), commit the players to a greater technical difficulty, because playing balls with one touch requires the player to process information about the teammate before receiving the ball, to decide faster, to have the technical skill to play quickly and to be able to repeat high-intensity actions. This conclusion is further supported by the results relative to the second-pass accuracy in the double-pass format. As shown in Table 2, the pass-accuracy scores decreased when performing the second pass, and the consequent interruption of the drill`s flow may likely have been caused by the higher technical difficulty associated with this open-skill task which, in turn, *most likely* induced lower locomotor demands in terms of RD and HSD compared to the single-pass formats. On the other hand, the results highlighted that a greater amount of HAD was *very likely* performed in the double-pass format than in the single-pass one, which could mean a higher mechanical loading of the neuromuscular system due to this specific technical constraint.

The improvement of technical and tactical skills in team sports has captured the attention of researchers and practitioners (Davids et al. 2001). In this regard, Carling (2010), describing the activity profile of running with the ball and the patterns of ball possession in French professional football players, suggested that passing drills designed to improve technical abilities should be carried out at high speed and with players moving, so that emphasis could be placed on simulating match conditions. In practical terms, during practice players need to learn to perform according to the action possibilities afforded by a particular competitive team game, by constantly adjusting their decisions and actions to changes in dynamic performance environments as patterns of play unfold (Travassos et al. 2012). In our study, specific effects were induced by the technical constraints` demands. The combination of the 6-player format and a double-pass task resulted in greater detrimental effects on both ball speed and pass accuracies, with *likely* and *very likely* lower scores. In addition, the double-pass formats *per se* led to *very likely* lower accuracy responses than the single-pass formats. Finally, it was clear that the best performances, in terms of passing speed and accuracy, were achieved during the 8-player formats, when players were required to continuously control and pass the ball with lower technical complexity. Our data confirmed how the manipulation of some task constraints from predetermined (single-pass task) passes to emergent passes (double-pass task), in which players needed to use information from other players' action possibilities, constrained passing (Travassos et al. 2012) performances. Particularly in the latter task, the findings imply that a ball carrier needs to perceive when a teammate is available according to his actions and positioning without the ball. Therefore, a higher complexity of possibilities for action in emergent passes led to lower scores in passing speeds and accuracy. Interestingly, the use of technical skill scores based on the quantitative and qualitative measures of ball displacement, such as ball speed and passing accuracy, as well as the degree of correspondence between them in passing practice tasks and competitive performance environments, may provide useful information for understanding whether a successful transfer of performance has occurred (Araujo et al. 2007). The concept associated with such a method of assessing performance outcome measures using kinematic scores is known by the term ‘action fidelity’ (Stoffregen et al. 2003). Indeed, in the football context, by utilizing the means of the ‘action fidelity’ method it may be possible to compare individual or team behaviors that emerge under the constraints of specific practice tasks and competitive performance.

Training-load monitoring and the detailed analysis of the associated responses is critical, as this allows an in-depth understanding of the workload imposed, which consequently has practical implications for the prescription of the adequate type and amount of stimulus during exercise training. In light of the outcomes of our study, coaches could include passing drill formats with a variable number of players and technical demands, within appropriate long-term programs addressing specific physical and physiological adaptations as well as skill development. The large mean differences in both the physiological and time-motion profiles of the passing drill formats may suggest a selective *a priori* choice of the training exercise aiming to achieve intended responses according to the specific periodization plan. In addition, these valuable findings could be used for planning training strategies, including the different passing formats in a sequential order to ensure a gradual generalization of skill acquisition.

From a methodological perspective, including the accurate periodization of passing drills into the training schedule should require the accurate selections of different formats, volumes and intensities according to the current and specific phase of the season. In addition, the planned modifications of the training contents, such as locomotor activities at different paces, a number of high-intensity efforts such as sprints over variable distances and COD performed with different directional angles and specific technical demands, would likely lead to the long-term specific performance development of elite young players. The findings provide the coaches with valuable information for designing – within the weekly training plan

– passing drills formats with selective exercises constraints, according to which component (technical and/or physical) they would like to emphasize. It appears that passing drills formats, performed with a higher number of players (i.e., an 8-player format) are the best for soliciting concomitantly greater physiological responses and high-intensity actions, and for inducing better technical skills. Finally, the inclusion of an additional technical requirement (i.e., a double pass format), such as for the double-pass task, likely influences only the physical and physiological responses, with no effect on the technical skill components.

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Table 1. Intra-day and test-retest reliability of the physiological, time-motion and technical skills measures.

Variable	CV%	ICC	SWC
	95% CI	**95% CI**	**95% CI**
Physiological responses			
Heart rate (%HRmax)	-	0.983-0.994	3.34-2.75
RPE-TL (AU)	-	0.883-0.938	4.3-8.3
Time-motion parameters			
RD (m/min)	2.89-3.90	0.867-0.896	3.62-4.71
HSD (m/min)	2.34-3.25	0.811-0.856	7.06-8.81
SD (m/min)	4.47-4.72	0.869-0.914	0.69-0.71
HAD (nr/min)	1.07-1.32	0.912-0.931	0.32-0.39
Technical skills scores			
Ball speed – first pass (m/s)	4.23-6.16	0.849-0.928	0.42-0.51
Ball speed – second pass (m/s)	3.83-5.76	0.844-0.863	0.30-0.37
Pass accuracy – first pass (%)	4.64-5.55	0.900-0.919	2.60-2.95
Pass accuracy – second pass (%)	2.28-4.71	0.879-0.898	1.82-2.27

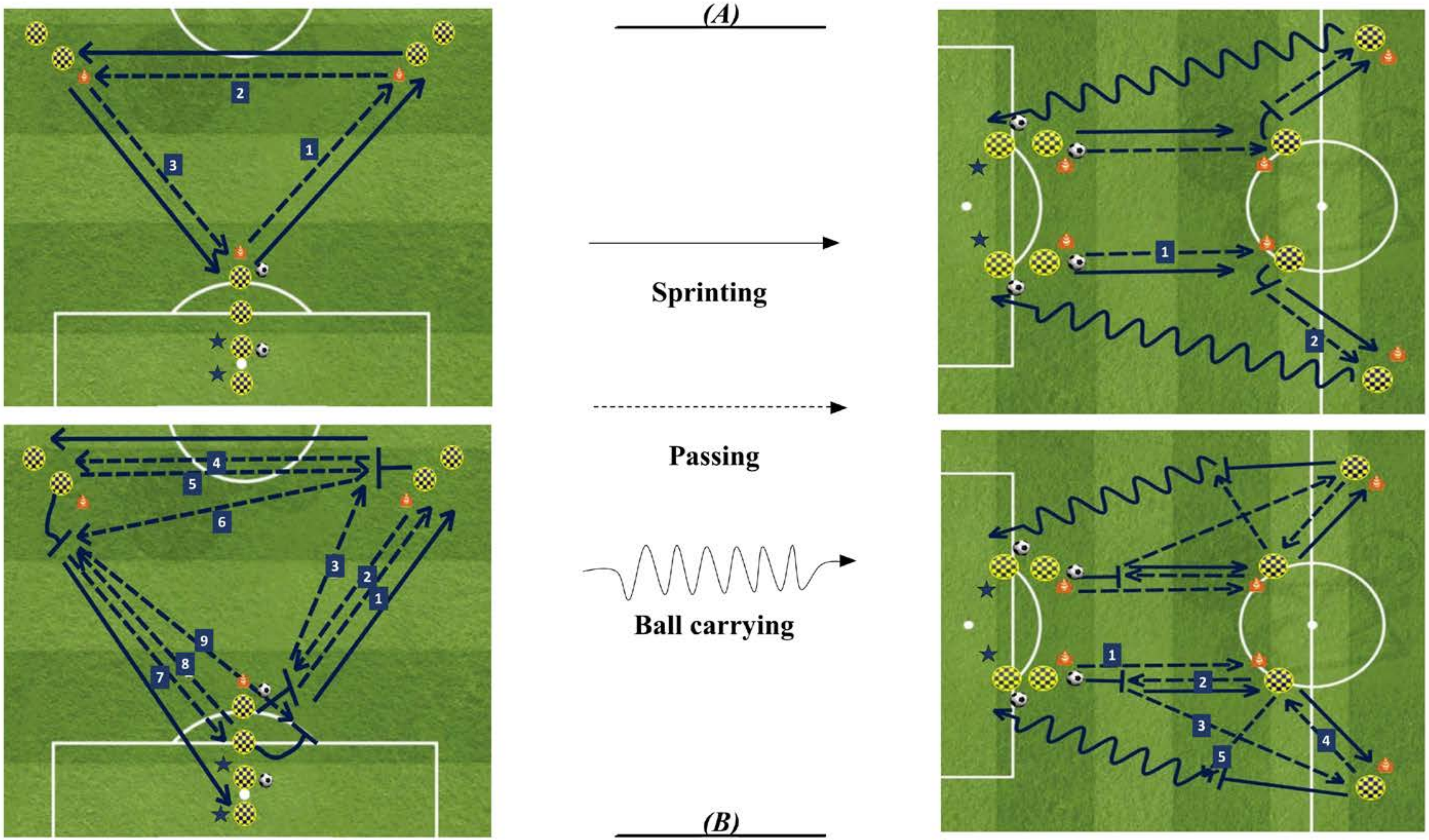
Notes: CV%, Coefficient of Variation; ICC: Intra-class Correlation Coefficient; 95% CI: 95% Confidence Interval; SWC: Smallest Worthwhile Changes; RPE-TL: Rating of Perceived Exertion Training Load; RD: Running Distance; HSD: High-Speed Distance; SD: Sprint Distance; HAD: High Intensity Acceleration/Deceleration; %HRmax: percentage of the maximal Heart Rate; AU: Arbitrary Unit; m/min: meters per minute; nr/min: number per minute; m/s: meters per second; %: percentage.

Table 2. Physiological, time-motion and technical response comparisons between the experimental training formats.

Variable	Mean ± SD				Effect size 95% CI		Inference	
	8 players	6 players	Single pass	Double pass	8 vs. 6 players	Single vs. double pass	8 vs. 6 players	Single vs. double pass
							Chances	
Physiological responses								
Heart Rate (%HRmax)	72.5 ± 1.14	72.1 ± 1.53	73.4 ± 0.8	73.2 ± 1.11	0.3 (0.28 – 0.31) ***Small***	0.21 (0.19 – 0.22) ***Small***	***Likely Trivial*** 0/94/6	***Possibly Trivial*** 0/61/39
RPE-TL (AU)	77 ± 2.7	69 ± 1.43	72.5 ± 1.87	68.2 ± 1.55	3.87 (2.61 – 4.52) ***Very Large***	2.51 (1.68 – 3.25) ***Very Large***	***Possibly Greater*** 67/33/0	***Likely Greater*** 91/9/0
Time-motion parameters								
RD (m/min)	119.3 ± 0.3	108.6 ± 0.3	119.6 ± 0.2	108.3 ± 0.2	1.13 (0.58 – 1.65) ***Moderate***	2.02 (1.38 – 2.59) ***Very Large***	***Very Likely Greater*** 98/2/0	***Most Likely Greater*** 100/0/0
HSD (m/min)	81.7 ± 0.4	70.5 ± 0.3	87.8 ± 0.5	64.3 ± 0.2	0.49 (-0.02 – 0.98) ***Small***	3.45 (2.61 – 4.16) ***Very Large***	***Likely Greater*** 93/7/0	***Most Likely Greater*** 100/0/0
SD (m/min)	7.96 ± 0.7	5.7 ± 0.05	7 ± 0.6	6.48 ± 0.5	1.03 (0.48 – 1.54) ***Moderate***	0.58 (0.07 – 1.08) ***Small***	***Most Likely Greater*** 100/0/0	***Most Likely Trivial*** 100/0/0
HAD (nr/min)	4 ± 0.4	2.96 ± 0.3	3.32 ± 0.4	4.25 ± 0.3	0.93 (0.39 – 1.43) ***Moderate***	2.58 (2.47 – 2.68) ***Very Large***	***Most Likely Greater*** 100/0/0	***Most Likely Lower*** 0/1/99
Technical skills scores								
Ball speed first pass (m/s)	11.11 ± 0.55	10.2 ± 0.49	10.82 ± 0.53	10.49 ± 0.23	1.75 (1.02 – 1.92) ***Large***	0.81 (0.18 – 1.41) ***Moderate***	***Likely Greater*** 92/8/0	***Very Likely Trivial*** 5/95/0
Ball speed second pass (m/s)	3.6 ± 0.6	3.4 ± 0.6	-	3.5 ± 0.4	0.33 (-0.27 – 0.92) ***Small***	-	***Likely Trivial*** 13/87/0	
	70.71 ±	63.5 ±	68.34 ±	65.86 ±	2.4 (1.59 – 3.12)	1.14 (0.98 – 1.75)	***Very Likely Greater***	***Possibly Trivial***

Pass accuracy first pass (%)	3.2	2.8	2.19	1.18	***Very Large***	***Moderate***	97/3/0	31/69/0
Pass accuracy second pass (%)	47.40 ± 1.33	43.59 ± 2.4	-	45.4 ± 3.11	1.96 (1.21 – 2.64) ***Large***	-	***Very Likely Greater*** 98/2/0	

Notes: 95% CI: 95% Confidence Interval; RPE-TL: Rating of Perceived Exertion Training Load; RD: Running Distance; HSD: High Speed Distance; SD: Sprint Distance; HAD: High Intensity Acceleration/Deceleration; %HRmax: percentage of the maximal Heart Rate; AU: Arbitrary Unit; m/min: meters per minute; nr/min: number per minute; m/s: meters per second; %: percentage.


(A)
Sprinting
Passing
Ball carrying
(B)
1
2
3
4
5
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7
8
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