International Journal of Sports Science & Coaching

Original Research Article

Analysis of tactical behavior in full- and small-sided games: Comparing professional and youth academy athletes to enhance player development in soccer

International Journal of Sports Science & Coaching
1–11

DOI: 10.1177/17479541221074992
journals.sagepub.com/home/spo
SAGE

Israel Teoldo da Costa and Marcos Paulo de Freitas Silvino

Abstract

The present study aims to compare the tactical behavior of youth academy and professional players, in order to ascertain the contribution of full- and small-sided games for the development process. One hundred and eighty individuals were selected from three age groups (U-8, U-10 and U-12). A competition was held in which all teams faced each other once in each format (Full- and Small-Sided Games). In addition, 9 matches of the 2018 Brazilian Championship were analyzed. The paired t tests, Wilcoxon and Mann-Whitney tests was performed to the comparison between the tactical behavior of youth academy players in each game format with the professional players ($p < 0.05$). Youth academy matches generated more and shorter offensive sequences, interactions were less frequent and less variable, and players cooperated less with one another. In the small-sided game, specifically, there was a demand for ball circulation in terms of velocity and amplitude similar to that of professional matches. Elements were found that support the need to use small-sided games in training, as it provides similar stimuli to what players will find in the professional category in the future. The speed and width of ball circulation, a large number of shots on goal, and the constant exchanges of ball possession - which helps in the development of cooperative and oppositional relationships between the phases and moments of the game - are enough elements to sustain that the game settings discussed here are beneficial for player development.

Keywords

Tactical behavior, youth development, small-sided games, football, full-sided games, association football, ball possession, performance analysis

Introduction

The complex and unpredictable nature that distinguishes the game of soccer is founded on tactical and strategic aspects, as players execute movements and place themselves depending on given spatial and temporal constraints, determined by the organization and information available within the game environment[1–3]. Therefore, it is possible to assume that players and teams' performances are associated to the structure and intent of the game, considering that they need to manage space according to a certain strategy and collective tactical organization.[4,5] Hence, any variations in the space and time available for players to act are likely to influence behaviors during a match.

In that sense, considering that, in recent years, official youth soccer matches have been played in adapted formats, according to the motor, physiological and cognitive differences between children and adults.[6–8]The purpose of these changes is to provide playing structures that are tailored to the competences and needs of children from different ages, as well as to their respective development stages.[6,9,10] However, this adaptation of the game formats of the youth categories is still not something consolidated in all training scenarios worldwide, as is the case in some countries in South America and Brazil per se.

Although the literature already indicates that the formal structure of the game, utilized in professional tournaments, engenders a high degree of complexity and demands physical and mental skills to cover spaces that young players are still not able to deal with appropriately,[6,11] there are also

Reviewer: Bruno Travassos (University of Beira Interior, Portugal)

Department of Physical Education, Centre of Research and Studies in Soccer, Universidade Federal de Viçosa, Viçosa, Brazil

Corresponding author:
Israel Teoldo da Costa, Universidade Federal de Viçosa – Minas Gerais, Brazil; Departamento de Educação Física, Avenida Peter Henry Rolfs, s/n – Campus Universitário, Viçosa – MG, 36570-900 – Brazil.
Email: israelteoldo@gmail.com

many youth category competitions held in-game settings similar to those found in professional games. In some cases, the lack of structuring of federations and entities responsible for organizing competitions are the elements that condition these practices, in others, rarer, the belief that the reduction of spaces and the number of players can distort the game, from so that it loses its essence and does not contribute to the developing of players.[12] However, as mentioned at the beginning of the paragraph, the literature on this topic already indicates that the players should participate in games with a manageable scale, so as to be enabled to deal with problem-solving situations, as long as the properties that characterize the game[11,12] as well as its logic – typified by the pursuit of the goal, along with teammates, and by the attempt to prevent opponents from scoring – are not overlooked, thus resulting in a context of constant cooperation and opposition.[2,3,11,13]

Thus, an appropriate environment for evolution should be designed to enhance the development process,[11,14] through a progressive increase in the number of players and field dimensions, up to the adult version of the 11vs.11 format.[6,11] Yet, until adulthood is reached, players have to undergo a process of constant building, in which higher degrees of complexity are gradually incorporated into several elements of the game.[11,14] Also, it should be taken into account that the greatest contribution to the development process is to assist children and adolescents in finding and environment in which their competencies can be fully established and harnessed, so that they can feel prepared and fulfilled.[15]

Therefore, it is part of the objectives of this study to understand not only the differences between the behavior of players in full- and small-sided games but mainly to understand what these differences mean. In other words, this study seeks to identify in which game configurations the process of training and development of players can be enhanced, to train them to be able to solve the problems that the game presents at the end of this process, which is when reaching the professional.

In order to be able to assess these aspects, we assume that in soccer, the process of modeling can contribute to carry out analyzes of tactical behaviors during matches, as the utilization of models aims to afford an approximation with reality, so as to enlighten and enable the comprehension of the logic related to the behaviors exhibited by the system.[16] Tactical modeling allows to detect behavior patterns that emerge during matches and are analyzed based on technical and tactical variables, whose information may uncover potential indicators of success or failure by players and teams.[1,16] Variables such as the frequency and duration of offensive sequences, the amplitude and velocity players circulate the ball, in addition to the outcomes of each process, in both phases of play and in the transitions, are information deriving from the modeling process of the games that contribute to the understanding of tactical behaviors and demands that emerge from the matches.

Besides, based on the rapport of forces of the game of soccer, arising from a context of constant cooperation and opposition,[13,17,18] the analysis of teams' interaction dynamics may add to these information on the demands of the game and of the individual, group and collective tactical behaviors. According to Grund,[19] Ribeiro and colleagues[20] and Wäsche and colleagues[21] the analysis of the interactions between players allows the identification of patterns of communication established between them, for instance, through passes completed, thus setting up a network of interactions built from individual actions and the respective links between players.

Hence, considering that the main purpose of the development process is to improve players so as to enable them to respond to the demands of the game whenever they reach professional status, understanding players' tactical behavior – which emerges from games with formats adapted to the respective age groups – may contribute to achieving an optimal environment for their progress. After all, it is known that there are differences in the demands of the game and, consequently, in players and teams' behaviors in different formats. Nonetheless, it is necessary to understand what these differences mean, i.e., how they contribute to the players' development process. Comparing tactical behaviors exhibited by young players and those displayed by professional athletes and teams, might be a means to provide empirical evidence that supports the formats proposed in youth academy games.

Accordingly, in order to preserve the properties of the game, the structure upon which these adaptations are founded (i.e. 11vs.11) cannot be overlooked. The players' development process, through the adaptation of the structures of the games, runs through aspects such as their current development stage, the preparedness to achieve professional status, the contents to be taught in each stage, and the incorporation of the tactical behaviors that emerge during the games, which enables the comprehension of the tactical and strategic nature of soccer. Thus, the purpose of the present study is to compare the tactical behaviors of youth (U-8, U-10 and U12) academy players and professional players, as a way to identify the differences and similarities of the full- and small-sided games compared to the professional (PRO) category matches, as well as discussing the meaning of these differences and similarities for the players' training process.

Method

Sample

The sample was comprised of 180 soccer players between 6 and 12 years old, from three age groups: U-8 (7.20 ± 0.85 y/o), U-10 (9.36 ± 0.58 y/o) and U-12 (11.30 ± 0.70 y/o). In each age group, 3 teams were formed with 20 players each, in order to participate in a competition. As inclusion

criteria, all players had to play a minimum of 50% of match time, in one match, at least, and four, at most

Players and their respective legal guardians were informed on the purposes of the study, and also signed an Informed Consent. All procedures were approved by the Ethics Committee for Research with Human Beings and were carried out following the guidelines of the Declaration of Helsinki (1996) and of the National Health Council (466/2012).

In addition, 9 matches of the 2018 Brazilian Serie A Championship were analyzed. The matches were randomly chosen and obtained from the Wyscout® platform, and used as a performance benchmark for youth academy players and teams, for being the highest competitive level in the scenario in which the players are inserted.

Procedures

In each age group, three teams were arranged, and played each other in a double-round robin schedule. The teams played each other once every round, and participated in four matches (2 full-sided games – FSGs and 2 small-sided games – SSGs). The matches were played on Saturdays, at the same time of day (from 09:00 AM to 01:00 PM) and following the same order – 1st match: U-8 s; 2nd match: U-10 s; 3rd match: U-12 s. Matches were played under the official rules of the game, except for the offside rule in the small-sided games. Substitutions were unlimited in all matches, given that the rule for minimum participation (50% of total match time) was observed.

Each team's coach was responsible for organizing the lineups, formation and substitutions during the matches. All coaches were allowed to give instructions to their players during the matches. The standard playing times for each age group were: 3 periods of 12 min (U-8 s); 3 periods of 15 min (U-10 s) and 3 periods of 20 min (U-12 s). A 5-min interval between periods was given in all age groups. The format and dimensions of the FSGs were standardized for all age groups (Goalkeeper - GK + 10vs.10 + GK; 100 × 68 m), whereas the SSGs formats and dimensions were determined according to each age group: U-8 s (GK + 4vs.4 + GK; 36 × 20 m); U-10 s (GK + 7vs.7 + GK; 52.5 × 34 m); U-12 s (GK + 10vs.10 + GK; 68 × 45 m). The goalposts also had different sizes, according to each age group: 3 × 2 m (SSGs, U-8 s); 6 × 2 m (SSGs, U-10 s and U-12 s); 7.32 × 2.44 m (FSGs, all age groups). The full-sided games were carried out in this configuration because, in the scenario in which these players are inserted, it is common for them to play official matches in spaces with these dimensions and with this amount of players.

All matches were played in a natural grass field. Full-sided games were officiated by a main referee and two assistant referees, whilst small-sided games were officiated only by a main referee. In all matches, extra balls were available near the sidelines and goal-lines, so that the ball could be replaced as quickly as possible.

The study design was designed so that players would first participate in a game in an already known structure since it is common for them to play official matches in these settings in the environment in which they are inserted. In a second moment, adaptations were made in the game formats thinking about a structure that we believe is ideal for each category, to analyze how these game spaces and these configurations can be beneficial to the development of players. The comparison with professional players was carried out to identify the elements present in the games with the highest competitive level in the scenario in which these evaluated players are inserted. That is, we aim to know the common and/or different elements between the full-sided games (FSGs) in the youth academy and professional categories, in the same way as the common and/or different elements of the small-sided games (SSGs) in the categories of the youth academy games compared to professional games.

All matches were video recorded at approximately four meters high, by a camera placed parallel to sideline, with focus towards the halfway line. Match footage was analyzed afterwards, according to the definition of the variables of the tactical modeling and interaction dynamics approaches (Table 1). As presented during the paper introduction, these methods were chosen to analyze the behaviors because they complement each other and it is possible, from them, to identify behavior patterns and elucidate the demands present in each game configuration and context analyzed in terms of tactical-technical behavior and how players interact during matches, that is, how they relate to each other in each context analyzed.

All data were obtained through notational analysis and registered in a spreadsheet. Interactions were analyzed based on the social network analysis method, whereas all completed passes between players were considered as the linking criteria. Data was registered in adjacency matrixes.

In addition to the youth academy matches, professional soccer matches of the 2018 Brazilian Serie A Championship were analyzed, in order to establish the reference standards regarding tactical behaviors. Matches were randomly chosen, and the analysis process was based on the same methods and criteria established for the youth full-sided games. In both cases, a spatial reference of the playing field,[16,22] with 12 zones formed by the interception of three corridors (right, central and left) and four sectors (defensive, pre-defensive, pre-offensive and offensive), was employed for the analysis of spatial data.

To address the comparison of tactical behavior between youth and professional matches, the frequency of actions was normalized, following their occurrence per minute of play and/or per offensive sequence, due to the longer duration of professional matches. After data collection and analysis, data were organized in spreadsheets for statistical purposes. It is worth noting that the comparison between professionals and players in these age groups (06 to 12

Table 1. Tactical modeling and interaction dynamics variables.

Variable	Criteria	Reference
TACTICAL MODELING		
Offensive Sequence (OS)	Moment that starts in the first ball touch by a player, and ends in the last contact performed by this player or by a teammate in the same sequence. The criteria that define this variable is the concept of ball possession (GARGANTA, 1997).	Garganta, 1997
Number of Variations of Corridor (NVC)	Number of times the ball is circulated, through passing, towards a different corridor, during an offensive sequence.	Garganta, 1997
Number of balls Received (NR)	Number of balls received by players in each offensive sequence.	Dugrand, 1989
Number of ball touches (Nt)	Number of ball touches by the players during a given sequence.	Morris, 1981; Withers et al. 1982; Gréhaigne, 1989; Dugrand; 1989)
Velocity of Ball Transmission (VBT)	Index obtained through NR and Nt, where VBT = NR/Nt. Values range from 0 to 1, and values closer to 1 denote higher velocity, whereas values closer to 0 denote lower velocity.	Dugrand, 1989
Duration of the Offensive Sequence (DOS)	Duration, in seconds, of each offensive sequence.	
Form of ball Acquisition and Recovery (FAR)	Refers to the start of the offensive process, and is classified in four categories: (I) tackle; (II) interception; (III) opponent's error; (IV) fragments of the game.	Garganta, 1997
Offensive Sequence Outcome (OSO)	Refers to the end of the offensive process, and is classified in four categories: (I) goal; (II) shot at goal; (III) positive offensive sequence; (IV) negative offensive sequence.	Adapted from Garganta, 1997
INTERACTION DYNAMICS		
Total Interactions (TI)	Absolute number of all interactions.	Clemente, Martins and Mendes, 2016
Network Density (D)	Ratio of maximum possible connections between nodes. Quotient between the number of existing connections and the number of potential connections. Values range from 0 to 1, and density is higher when values are closer to 1, and lower when values are closer to 0.	Clemente, Martins and Mendes, 2016
Clustering Coefficient (CC)	Measures the degree of interconnectivity between teammates. Values range from 0 to 1, whereas 1 is the maximum cooperation value, and 0 denotes absence of cooperation.	Clemente et al. 2014
Reciprocity (R)	Measures the tendency of pairs of players to form connections between them. Subdivided in: Link reciprocity (LR) and Dyad reciprocity (DR). Values range from 0 to 1, and network is more symmetric when values are closer to 1, and more asymmetric when values are closer to 0.	Clemente, Martins and Mendes, 2016
Network Centrality (C)	Measures the degree of distribution of a network, and is associated to the degree of homogeneity. Values range from 0 to 1, whereas higher homogeneity is represented by values closer to 1, and lower homogeneity to values closer to 0.	Clemente et al. 2014
Network Influence (I)	Identifies the specific value of team participation. Values range from 0 to 1, and network influence closer to 1 indicates higher dependency on smaller group of players, and when closer to 0, represent a more regularly distributed network.	Clemente, Martins and Mendes, 2016

years old) was never carried out in the sense of wanting them to be similar or seeking these similarities. On the contrary, the comparisons were carried out to seek support in the idea that the youth academy players should play official matches in adapted structures and not in structures identical to those of the professionals, as is customary in the competitive and training scenario of these analyzed players.

Therefore, for clarification purposes, the performance of youth players in full-sided games (FSGs) was compared with those of professionals to find differences that confirm the need not to place youth academy players in these competitive structures. In contrast, we compared the performance of youth players in small-sided games (SSGs) with the professionals to find elements that support the need to adapt the official game formats to the youth categories.

Therefore, the analysis and interpretation of results will be carried out accordingly, to meet the objective of this study.

Material

A video camera (Sony® HDR-XR100) and a tripod (Lightweight Tripod, WT3770) were used for recording video footage of the match. A laptop computer (HP, 15-AY103DX, Intel Core i5 processor) was used to analyze matches, supported by spreadsheets of the Microsoft Excel 2013 for Windows. The Social Network Visualizer (SocNetV 2.5 beta) was used to insert matrices and generating quantitative data from network analysis. All statistical procedures were carried out through SPSS (Statistical Package for Social Sciences), v. 24.0.

Statistical analysis

Descriptive analysis (means and standard deviation) was performed. Normality of data distribution was verified through the Shapiro-Wilk test Players' behavior in full-sided games and small-sided games was compared through the paired t-test for the variables with normal data distribution (OS, NR, Nt, NVC, VBT, DOS, TI, D, R and C). As for the variables whose data did not meet normality criteria (CC and I), the Wilcoxon test was performed to examine the differences in behavior between both match formats. The categories of variables *form of ball acquisition and recovery* (FAR) and *offensive sequence outcome* (OSO) were analyzed separately, due to the temporal equivalence that was performed. Hence, for the variables with normal distribution (tackle and positive offensive sequence) the independent t-test was performed, whereas the Mann-Whitney test was performed for the variables with non-normal distribution (interception, opponent's error, fragments of the game, goal, shot at goal and negative offensive sequence). Effect sizes (d) were obtained through the subtraction of average values and the division of the result by the combined standard deviation.[23] The obtained values were converted to *r*,[24] which can be classified as small (0.10); medium (0.30); and 0.50 (large).[25] Significance level was set to $p < 0.05$.

Results

Tactical modeling

Table 2 displays the means and standard deviation of the variables offensive sequence (OS), number of variations of corridor (NVC), number of balls received (NR), number of ball touches (Nt), offensive sequence outcome (OSO) and form of ball acquisition and recovery (FAR). The number of OS per minute was significantly higher in full-sided games (FSGs) for the U-8 ($t = 7.74$, $p < 0.001$, $r = 0.75$), U-10 ($t = 4.79$, $p < 0.001$, $r = 0.65$) and U-12 age groups ($t = 2.54$, $p = 0.018$, $r = 0.40$), comparing to FSGs professionals games. This superiority was also found in small-sided games (SSGs) for the U-8 ($t = 9.81$, $p < 0.001$, $r = 0.86$), U-10 ($t = 7.51$, $p < 0.001$, $r = 0.80$) and U-12 age groups ($t = 2.24$, $p < 0.001$, $r = 0.78$), comparing to FSGs professionals games. Also, professional teams displayed significantly higher values of NVC in full-sided games, in comparison to the U-8 ($t = -4.74$, $p < 0.001$, $r = 0.56$), U-10 ($t = -6.32$, $p < 0.001$, $r = 0.59$) and U-12 age groups ($t = -5.59$, $p < 0.001$, $r = 0.63$), while no difference was found in the comparison between the small-sided games (SSGs) and the professional games.

Professional players also received significantly more balls (NR) in FSGs, when compared to youth players in SSGs, for the U-8 ($t = -3.98$, $p < 0.001$, $r = 0.44$), U-10 ($t = -2.42$, $p = 0.019$, $r = 0.33$) and U-12 age groups ($t = -2.27$, $p = 0.028$, $r = 0.27$). When only the full-sided game format is considered, professional players displayed significantly higher values of NR when compared to the U-12 age group ($t = -3.93$, $p < 0.001$, $r = 0.43$). Values of Nt followed a similar pattern, whereas professional players performed more ball touches when compared to youth players in SSGs, for the U-8 ($t = -4.66$, $p < 0.001$, $r = 0.49$), U-10 ($t = -4.26$, $p < 0.001$, $r = 0.45$) and U-12 age groups ($t = -3.57$, $p < 0.001$, $r = 0.40$). As for FSGs, professional players performed significantly more ball touches only when compared to the U-12 age group ($t = -2.92$, $p = 0.043$, $r = 0.75$).

With respect to the OSO, the frequency of goals per minute was significantly higher for the U-12 age group in FSGs ($z = -3.02$, $p = 0.003$, $r = 0.50$), and for the U-8 age group in SSGs ($z = -3.82$, $p = 0.001$, $r = 0.64$), when compared to professional players in FSGs. The amount of shots at goal per minute was significantly higher in FSGs for the U-8 ($z = -2.64$, $p = 0.008$, $r = 0.50$), U-10 ($z = -2.33$, $p = 0.020$, $r = 0.49$) and U-12 age groups ($z = -4.13$, $p < 0.001$, $r = 0.58$) when compared to professional matches in FSGs. This superiority was also found in SSGs for the U-8 ($z = -5.26$, $p < 0.001$, $r = 0.79$), U-10 ($z = -5.57$, $p < 0.001$, $r = 0.73$) and U-12 age groups ($z = -4.37$, $p < 0.001$, $r = 0.61$). Positive offensive sequences were significantly more frequent in SSGs for the U-10 ($t = 3.48$, $p = 0.002$, $r = 0.52$) and U-12 age groups ($t = 4.87$, $p < 0,001$, $r = 0.57$) when compared to professional matches in FSGs. As for the frequency of negative offensive sequences, values for the U-8 age group ($z = -2.69$, $p = 0.007$, $r = 0.46$) in SSGs were significantly higher than those of professional teams.

Regarding the forms of ball acquisition and recovery (FAR), the frequency of tackles per minute was significantly higher for the U-8 ($t = 6.06$, $p < 0.001$, $r = 0.75$), U-10 ($t = 5.90$, $p < 0.001$, $r = 0.76$) and U-12 age groups ($t = 5.75$, $p < 0.001$, $r = 0.71$) in FSGs, when compared to professional teams. The same results were found in SSGs for the U-8 ($t = 5.33$, $p < 0.001$, $r = 0.70$), U-10 ($t = 4.75$,

Table 2. Means and standard deviation for the tactical modeling variables: offensive sequence (OS), number of variations of corridor (NVC), number of balls received (NR), number of ball touches (Nt), offensive sequence outcome (OSO), form of ball acquisition and recovery (FAR).

		U-8		U-10		U-12	
Variables (p/min)	PRO	FSG	SSG	FSG	SSG	FSG	SSG
OS	1.06 (± 0.15)	1.50 (± 0.26)[a]	1.67 (± 0.24)[c]	1.39 (± 0.26)[a]	1.64 (± 0.31)[c]	1.22 (± 0.24)[a]	1.54 (± 0.26)[c]
NVC	1.90 (± 0.54)	1.24 (± 0.34)[b]	1.58 (± 0.74)	1.21 (± 0.26)[b]	1.69 (± 0.49)	1.13 (± 0.32)[b]	1.64 (± 0.35)
NR	5.02 (± 1.45)	4.44 (± 0.86)	3.78 (± 0.84)[d]	4.32 (± 1.03)	4.09 (± 1.08)[d]	3.81 (± 0.80)[b]	4.32 (± 0.84)[d]
Nt	11.85 (± 3.81)	10.38 (± 2.46)	8.04 (± 2.19)[d]	10.36 (± 2.02)	8.43 (± 2.08)[d]	9.39 (± 2.34)[b]	8.99 (± 2.07)[d]
OSO (p/min)							
Goal	0.02 (± 0.02)	0.06 (± 0.08)	0.12 (± 0.10)[c]	0.07 (± 0.08)	0.09 (± 0.12)	0.07 (± 0.07)[a]	0.06 (± 0.07)
Shot at goal	0.04 (± 0.04)	0.10 (± 0.07)[a]	0.28 (± 0.15)[c]	0.12 (± 0.11)[a]	0.25 (± 0.16)[c]	0.12 (± 0.08)[a]	0.14 (± 0.10)[c]
Positive OS	0.69 (± 0.16)	0.87 (± 0.34)	0.79 (± 0.29)	0.82 (± 0.35)	0.94 (± 0.28)[c]	0.77 (± 0.22)	0.94 (± 0.22)[c]
Negative OS	0.31 (± 0.14)	0.45 (± 0.35)	0.48 (± 0.20)[c]	0.38 (± 0.32)	0.36 (± 0.18)	0.26 (± 0.16)	0.39 (± 0.18)
FAR (p/min)							
Tackle	0.10 (± 0.06)	0.35 (± 0.17)[a]	0.26 (± 0.13)[c]	0.40 (± 0.21)[a]	0.27 (± 0.14)[c]	0.26 (± 0.11)[a]	0.24 (± 0.12)[c]
Interception	0.15 (± 0.06)	0.19 (± 0.10)	0.25 (± 0.12)[c]	0.19 (± 0.21)	0.21 (± 0.13)	0.14 (± 0.09)	0.26 (± 0.13)[c]
Opp. Err.	0.20 (± 0.07)	0.50 (± 0.23)[a]	0.36 (± 0.18)[c]	0.40 (± 0.18)[a]	0.42 (± 0.22)[c]	0.36 (± 0.11)[a]	0.40 (± 0.15)[c]
Frag. of the Game	0.62 (± 0.14)	0.45 (± 0.15)[b]	0.80 (± 0.24)[c]	0.40 (± 0.14)[b]	0.74 (± 0.24)[c]	0.46 (± 0.19)[b]	0.64 (± 0.15)

[a] PRO < Youth Academy (FSG); [b] PRO > Youth Academy (FSG); [c]PRO < Youth Academy (SSG); [d]PRO > Youth Academy (SSG). Significant value: $p < 0.05$; r values: 0.10 (small); 0.30 (medium); 0.5 (large).

$p < 0.001$, $r = 0.67$) and U-12 age groups ($t = 4.93$, $p < 0.001$, $r = 0.64$). As for the interceptions, values for the U-8 ($z = -3.13$, $p = 0.002$, $r = 0.57$) and U-12 age groups ($z = -3.36$, $p = 0.001$, $r = 0.52$) in SSGs were significantly higher when compared to professionals in FSGs. Ball acquisition and recovery through opponent's errors displayed significantly higher values in FSGs for the U-8 ($z = -5.08$, $p < 0.001$, $r = 0.72$), U-10 ($z = -4.28$, $p < 0.001$, $r = 0.65$) and U-12 age groups ($z = -4.85$, $p < 0.001$, $r = 0.68$), and also in SSGs for the U-8 ($z = -3.78$, $p < 0.001$, $r = 0.56$), U-10 ($z = -3.92$, $p < 0.001$, $r = 0.62$) and U-12 age groups ($z = -5.41$, $p < 0.001$, $r = 0.70$) when compared to professional teams. In addition, fragments of the game were significantly more frequent in professional matches, when compared to the U-8 ($z = -3.20$, $p < 0,001$, $r = 0.51$), U-10 ($z = -4.29$, $p < 0.001$, $r = 0.58$) and U-12 age groups ($z = -2.78$, $p = 0.005$, $r = 0.45$) in FSGs. In contrast, in SSGs, the U-8 ($z = -2.76$, $p = 0.006$, $r = 0.45$) and U-10 age groups ($z = -2.21$, $p = 0.043$, $r = 0.32$) displayed significantly higher values when compared to professionals.

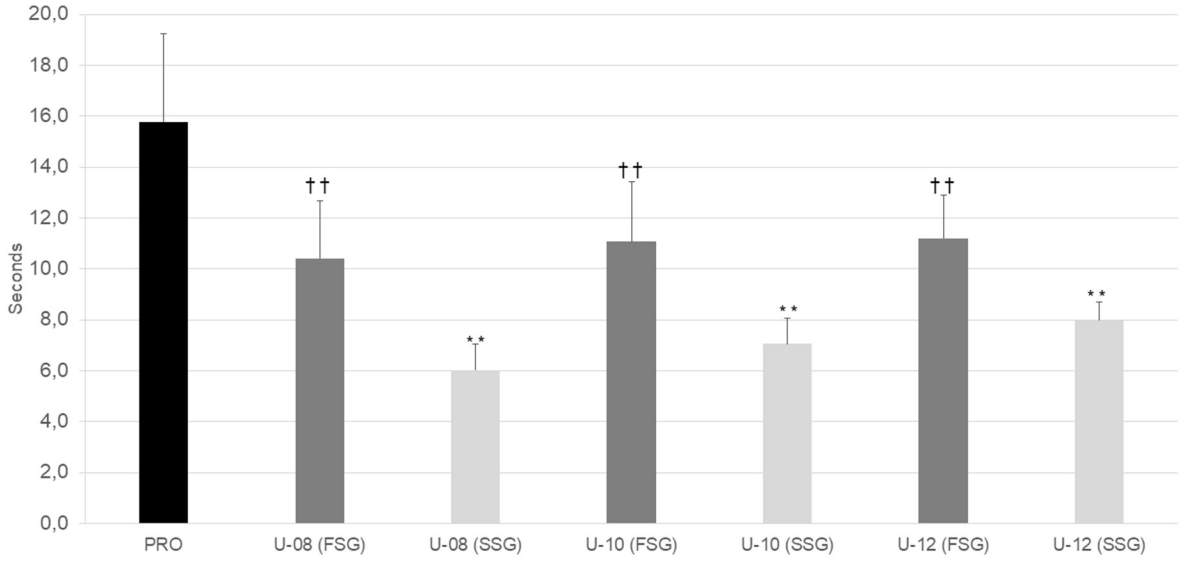
Figure 1 displays the significant superiority of professional teams, with respect to the duration of offensive sequences (DOS), when compared to the U-8 ($t = -6.84$, $p < 0.001$, $r = 0.65$), U-10 ($t = -5.21$, $p < 0.001$, $r = 0.60$) and U-12 age groups ($t = -5.30$, $p < 0.001$, $r = 0.61$) in FSGs, as well as in SSGs (U-8: $t = -11.70$, $p < 0.001$, $r = 0.86$; sub-10: $t = -14.00$, $p < 0.001$, $r = 0.83$; U-12: $t = 13.02$, $p < 0.001$, $r = 0.81$).

The velocity of ball circulation (VBT) was also higher for professional teams, when compared to the U-8 ($t = -2.36$, $p = 0.022$, $r = 0.37$), U-10 ($t = -4.00$, $p < 0.001$, $r = 0.55$) and U-12 age groups ($t = -3.51$, $p < 0.001$, $r = 0.50$) in full-sided games. In contrast, when compared to SSGs, VBT in professional matches was significantly lower when compared to the U-10 age group ($t = 2.17$, $p = 0,034$, $r = 0.23$) and no difference were observed in the U-8 e U-12 age groups.

Interaction dynamics

Table 3 displays the means and standard deviation of the variables related to teams' interaction dynamics. Professional teams displayed significantly higher values of total interactions, when compared to the full-sided games of the U-8 ($t = -16.37$, $p < 0.001$, $r = 0.88$), U-10 ($t = -13.19$, $p < 0.001$, $r = 0.84$) and U-12 ($t = -12.82$, $p < 0.001$, $r = 0.82$) age groups. Also, significant differences were found between professional matches and the SSGs of the U-8 ($t = -22.75$, $p < 0.001$, $r = 0.92$), U-10 ($t = -15.18$, $p < 0.001$, $r = 0.88$) and U-12 age groups ($t = -12.90$, $p < 0.001$, $r = 0.82$). Similarly, professional matches also displayed higher values of network density, when compared to youth FSGs (U-8: $t = -12.35$, $p < 0.001$, $r = 0.82$; U-10: $t = -11.04$, $p < 0.001$, $r = 0.80$; U-12: $t = -11.22$, $p < 0.001$, $r = 0.80$) and SSGs (U = 8: $t = -4.65$, $p < 0.001$, $r = 0.56$; U-10: $t = -6.70$, $p < 0.001$, $r = 0.71$; U-12: $t = -9.60$, $p < 0,001$, $r = 0.77$).

As for the clustering coefficient variable, teams displayed higher cooperation in professional matches, in comparison with youth FSGs (U-8: $z = -4.15$, $p < 0.001$, $r = 0.56$; U-10: $z = -4.90$, $p < 0.001$, $r = 0.65$; U-12: $z =$



PRO – Professional; YA – Youth Academy; FSG – Full-Sided Games; SSG – Small-Sided game; †PRO < YA (CM); †† PRO > YA (CM); *PRO < YA (SSG); **PRO > YA (SSG)

Figure 1. Means and standard deviation for the variable Duration of the Offensive Sequence (DOS).

Table 3. Means and standard deviation for the variables regarding the interaction dynamics.

		U-8		U-10		U-12	
Variables (p/ match part)	PRO	FSG	SSG	FSG	SSG	FSG	SSG
Total Interactions	73.25 (± 15.06)	26.44 (± 5.81)[a]	13.06 (± 3.55)[c]	31.67 (± 8.10)[b]	25.22 (± 8.17)[d]	33.94 (± 7.47)[b]	36.94 (± 5.40)[d]
Density	0.51 (± 0.12)	0.22 (± 0.04)[b]	0.33 (± 0.16)[d]	0.24 (± 0.05)[b]	0.28 (± 0.10)[d]	0.23 (± 0.06)[b]	0.25 (± 0.07)[d]
Clustering coefficient	0.25 (± 0.14)	0.07 (± 0.09)[b]	0.08 (± 0.19)[d]	0.04 (± 0.05)[b]	0.06 (± 0.08)[d]	0.10 (± 0.16)[b]	0.08 (± 0.09)[d]
Link reciprocity	0.18 (± 0.07)	0.22 (± 0.14)	0.18 (± 0.18)	0.18 (± 0.09)	0.16 (± 0.11)	0.22 (± 0.12)	0.19 (± 0.08)
Dyad reciprocity	0.17 (± 0.06)	0.16 (± 0.10)	0.14 (± 0.12)	0.14 (± 0.07)	0.13 (± 0.08)	0.16 (± 0.09)	0.15 (± 0.06)
Centrality	0.29 (± 0.08)	0.27 (± 0.07)	0.23 (± 0.11)[d]	0.25 (± 0.07)	0.24 (± 0.08)	0.24 (± 0.09)	0.28 (± 0.10)
Influence	0.04 (± 0.08)	0.03 (± 0.01)	0.07 (± 0.03)[b]	0.03 (± 0.01)	0.05 (± 0.02)[c]	0.04 (± 0.04)	0.04 (± 0.04)[c]

[a]PRO > Youth Academy (FSG); [b]PRO < Youth Academy (SSG); [c]PRO > Youth Academy (SSG).

−3.43, $p < 0.001$, $r = 0.42$) and SSGs (U-8: $z = -4.34$, $p < 0.001$, $r = 0.48$; U-10: $z = -4.54$, $p < 0.001$, $r = 0.61$; U-12: $z = -4.15$, $p < 0.001$, $r = 0.56$). The U-8 age group displayed significantly higher values ($t = -2.08$, $p = 0.48$, $r = 0.31$) of network centrality in SSGs, when compared to professionals. Finally, network centrality was significantly higher for the U-8 ($z = -5.03$, $p < 0.001$, $r = 0.21$), U-10 ($z = -4.15$, $p < 0.001$. $r = 0.07$) and U-12 age groups ($z = -2.51$, $p = 0.012$, $r = 0.00$) in SSGs, when compared to professional matches (Figure 2).

Discussion

The aim of this study was to compare the tactical behavior of youth (U-8, U-10 and U-12) academy players and professional players, as a way to identify the differences and similarities between the full- and small-sided games compared to the professional category matches, as well as discussing the meaning of these differences and similarities for the players' training process. According to the results, it was possible to observe the demands of each proposed game format, based on the tactical modeling of these games, in order to understand the transitions between phases from the results of the outcome of the offensive sequences (OSO) – for the attack-defense transition – and the form of ball acquisition and recovery (FAR) – for the defense-attack transition, in addition to elements such as the participation of the players, the velocity and amplitude of movement of the ball. Furthermore, in order to complement this information, the interactions dynamics performed by the players in each game format can be observed. However, these demands and/or characteristics seem to be

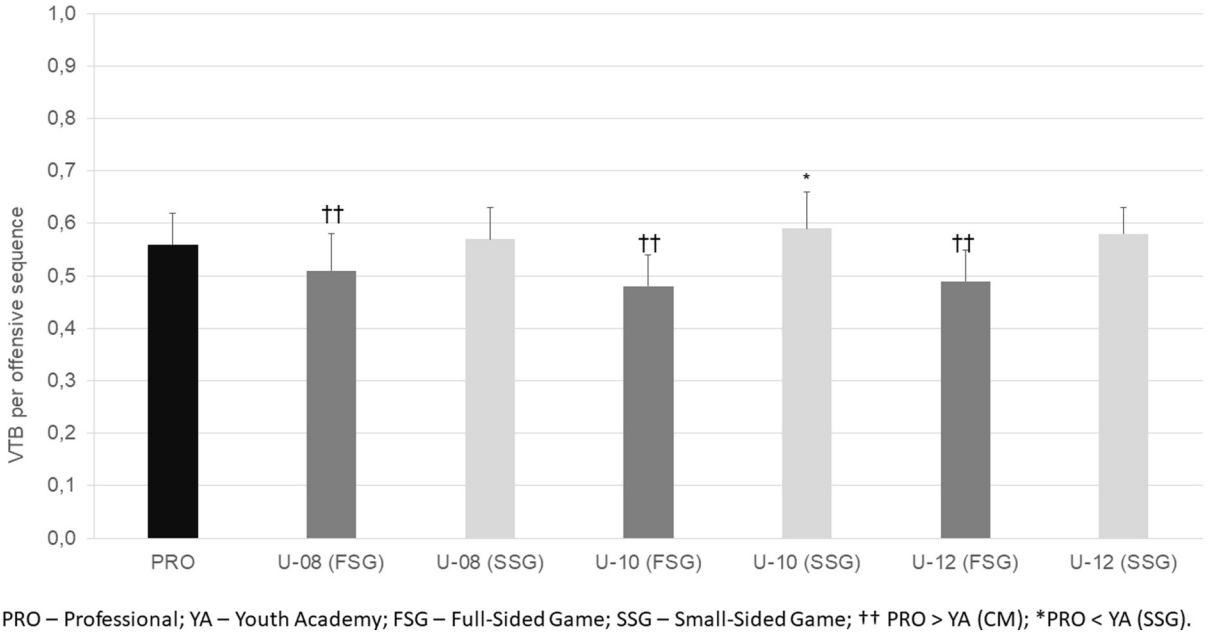


Figure 2. Means and standard deviation for the variable Velocity of Ball Transmission (VBT).

influenced of some aspects such as the differences between academy and professional players, as well as the current development stages of the players from each age group.

Tactical modeling

The youth academy players participating in this study are still not capable of covering – both physically and mentally – the entire length of an official soccer field,[11] as they are undergoing a period in which these competencies are still under development.[8,26] These aspects engender some unique behavioral features, such as the characteristics of the offensive sequences, as during youth academy matches, regardless of their format, offensive sequences (per minute) were more frequent and of shorter duration. These results are somewhat analogous to those reported by Olthof, Frencken & Lemmink,[27] as the authors observed that in games played in larger dimensions, teams maintained possession for longer periods. However, it is suggested that the players' more limited technical skills affect the competences necessary to maintain ball possession for longer periods, thus indicating that, in addition to field dimensions, the time teams are able to maintain possession is also influenced by players' current development stages.

With respect to ball circulation during offensive sequences, results indicate distinct characteristics of behavior in youth full- (FSGs) and small-sided games (SSGs), when compared to professional matches. As for the amplitude of ball circulation, youth FSGs displayed significantly lower values, when compared to professional matches. In contrast, in SSGs, behaviors were not different to those observed in professional matches, which may imply that these formats preserve some properties of official professional matches, besides accounting for the differences between players' development stages. In addition to the amplitude, the same features were observed for the velocity of ball circulation (VBT) in each game format, whereas the VBT for the academy players was lower in FSGs and similar in SSGs (except for the U-10 age group, that displayed significantly higher values), when compared to professional matches.

Spaces available during the game and players' respective development stage determine how they behave with respect to the circulation of the ball. The number of players and field dimensions have an effect on time and space available for plays to act upon,[28] which results in the need to increase ball circulation. Besides, there is greater proximity to the goal, thus forcing players to position themselves closer to their own goals, in attempting to protect them, as reported by Teoldo and colleagues.[29] Thus, it is necessary to perform more actions in amplitude, with greater speed, in order to generate spaces in the opposing defense and, consequently, to score a goal.

In the two previous paragraphs, it is possible to notice how some elements are more related to space and game and, consequently, to the relative game space per player, as in the case of velocity ball transmission and amplitude in small-sided games. Other behaviors, in turn, are related to the athletes' maturational level and their ability to perform certain actions, as already mentioned in the first paragraph of this topic. Therefore, it is clear that the reduction and adaptation of playing spaces for young players will provide them with a game closer to the reference standard - official games of the professional category - due to the need

to circulate the ball at a greater velocity and amplitude, bringing benefits for the development of young players.

Subsequently, when analyzing the attack-defense transition through the outcome of the offensive sequences (OSO), it is observed that the frequency of shots at goal per minute was significantly higher in academy matches when compared to professionals, both in FSGs and SSGs. The quality of opposition, the ability to cover spaces, the pressure on opponents to prevent them to reach the goal, the greater distance between players and the proximity to the goal, may be elements that influence such superiority regarding the shots at goal. According to Folgado and colleagues,[30] greater distances between attackers and defenders result in an increased number of shots at goal, which may explain the results observed in FSGs. As for the SSGs, the proximity to the intent of the game might be a reasonable justification, as there is an increase in the number of shots at goal due to the reduction of field dimensions, in addition to more actions being performed, due to the restriction in the number of passing options.[31–34]

On the other hand, under the perspective of the development process, findings regarding the offensive sequence outcomes are beneficial. After all, the expanding shooting possibilities is a positive aspect in the development process, if it is understood as a motivating element, reinforcing the idea that the intent of the game cannot be overlooked.[11,35] Therefore, one more favorable aspect is added to the use of small-sided games for young players. In the sense that it will bring them closer to reaching the goal of the game, enabling them to better solve game problems and also in an affective dimension, that is, it will allow young people to connect and enjoy the game.

As for the defense-attack transition, i.e., the restart of the offensive process, divergent results were found for the form of ball acquisition and recovery (FAR). In the comparison between academy and professional players, in both game formats, a lower number of transitions through fragments of the game (FG) in FSGs was observed, whilst in SSGs the opposite occurred – except for the U-12 age group. A reduction in the number of players and field dimensions results in an increase in the number of fouls, corners, goal kicks or throw-ins, and the game becomes more fragmented and with more turnovers in possession,[29,34] due to the decrease in the distances between players, as well as to spatial limitations.

However, there were more transitions through tackles and opponent's errors in both game formats for the youth teams, when compared to professionals. These findings reinforce the idea of how the lower technical competencies, related to the player's current development stage, have an impact on their behaviors, as they have difficulties in maintaining possession for longer periods, either individually or collectively. Yet, these results may be expected throughout the development process, as errors are more frequent, and should, therefore, be interpreted as indicators of a process of constant adaptation. Therefore, it is possible to analyze and adjust actions towards the improvement of performance, through the development of processes of self-evaluation[15,36] that benefits the teaching and learning process.

Although the participants of the present study are all academy players, there are differences in players' development between age groups. For instance, with respect to the participation in the game, analyzed through the number of balls received (NR) and the number of ball touches (Nt), the U-8 and U-10 age groups displayed values similar to professional teams in FSGs. Some authors endorse a higher participation in games played in smaller areas and with a lower number of players.[37,38] However, the results of the present study suggest the opposite. As mentioned earlier, Fradua and colleagues[31] observed greater pressure from opponents in smaller fields, which demands faster actions. Hence, by being provided with more space and time to act in FSGs, U-8, and U-10 players exchanged more passes and performed more ball touches in an environment with less pressure by the opponents.

For the U-8 age group, there was a higher number of shots at goals and goals per minute in SSGs, when compared to professionals, whereas for the U-12 age group the number of goals was higher in FSGs. These findings accord to those of some studies that indicated that, due to the proximity to the intent of the game, the number of goals in smaller games is higher,[39] as a result of the increase in the number of shots.[32,40] However, findings from both age groups may be related to the limited ability to cover spaces across the field other than those surrounding the goal itself. As for the U-8 age group, although goalposts were adapted in the SSGs, the technical skills required to perform defensive actions, as well as many other (e.g. passes, receptions), are still under an initial stage of development. Throughout this period, players become capable of covering greater distances and of occupying the playing space more efficiently.[6,41] Yet, their ability to cover spaces is still inferior, when compared to professional players,[11,42] particularly with respect to protecting the entire dimension of official goalposts, which may explain the higher occurrence of goals per minute for the U-12 teams, in full-sided games.

Interaction dynamics

Regarding the interaction dynamics, results of the present study accord to those of tactical modeling, as it was observed that at the youth level, interactions between players are less frequent and less variable. In addition, players cooperate less with one another during the offensive phase. As mentioned earlier, limited technical skills, greater proneness to errors and lower ability to occupy playing spaces, are aspects that are part of this process. In contrast, these findings might be related to the contents taught in

these age levels, which aim the teaching of the logic of the game during the offensive and defensive phases through the operational tactical principles,[5] so players are able to learn the relations of cooperation and opposition, according to the purpose of the game, in both phases of play.[2,43] These elements are part of players' actions, as they seek for the goal, during the offensive phase, and, consequently, try to avoid conceding, during the defensive phase.

Another aspect that can be observed through the interactions, and that confirms what has already been mentioned, is that the decrease in the number of players and in the space of play is likely to change behaviors, as passing options become limited and goalposts are closer, thus requiring more straightforward actions when searching for the goal. This claim is justified based on the findings regarding the influence of a player on the interaction networks analyzed in this study, since in SSGs players' passes were aimed towards a smaller group of teammates, who began to act as intermediaries of ball circulation.

Ultimately, it was observed that the game formats proposed in this study prompted players and teams to perform certain tactical behaviors that varied according to the number of players and field dimensions, thus changing the way they interacted and managed these spaces when searching for solutions to the game scenarios. However, the differences between their respective development stages and their age groups were also relevant to this analysis, as they influenced players' behaviors. Therefore, the present study provides more depth to the current literature, with respect to the exploration of behaviors in each game format.

Naturally, this study also has some limitations, which need to be addressed in future research. For instance, the sampled competition had a limited number of participating teams, thus resulting in a reduced number of matches in each age group. Although the objective was not to compare adults (professional players) with children, the demands of the games in each category and condition, it might be interesting to carry out reduced games in the same formats for professional players in future studies to gain knowledge about the performance of adults in these conditions. In addition, a comparison between professional and academy players in SSG format was not carried out. Literature still needs further research on teams' tactical modeling and interactions dynamics in different game formats, and more investigations addressing this subject are necessary.

Conclusions

Our findings allowed to conclude that small-sided games (SSGs) are essential in players' development process, not only due to their adequacy to their maturational and technical capabilities, but also to the benefits in terms of tactical behavior, and their relation with the contents and demands appropriate to each player's stage. SSGs force players to pass the ball faster and more widely, looking for gaps to reach the goal, thus resulting in an increase in the number of shots. Besides, they engender games with a more straightforward attitude of players in search for the goal, as the interactions between them are less frequent and variable. Yet, providing similar stimuli to those found at the professional level may be beneficial, in order to prepare them for such scenarios. This study contributes to the design of games for youth academy players. The definition of structures for official youth soccer matches needs to consider a range of aspects, as mentioned throughout this study, as longs as the properties and the logic of the game are not overlooked, and the athletes are respected.

Declaration of conflicting interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: This work was supported by the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (grant number 001).

ORCID iD

Marcos Paulo de Freitas Silvino https://orcid.org/0000-0001-9603-1482

References

1. Garganta. Trends of tactical performance analysis in team sports: bridging the gap between research, training and competition. *Rev Port Ciências do Desporto* 2009; 9: 81–89.
2. Teoldo I, Guilherme J and Garganta J. *Training football for smart playing: on tactical performance of teams and players*. 1st ed. Curitiba: Appris, 2017.
3. Gréhaigne JF, Bouthier D and David B. Dynamic-system analysis of opponent relationships in collective actions in soccer. *J Sports Sci* 1997; 15: 137–149.
4. Teoldo I. Comportamento Tático no Futebol: Contributo para a Avaliação do Desempenho de Jogadores em situações de Jogo Reduzido. 2010. 244 f. Tese (Doutorado). Faculdade de Desporto da Universidade do Porto- FCDEF-UP, Porto, 2010.
5. Teoldo I, Guilherme J and Garganta J. *Para um futebol jogado com ideias: concepção, treinamento e avaliação do desempenho tático de jogadores e equipes*. 1st ed. Curitiba: Appris, 2015.
6. Brito A, Roriz P, Duarte R, et al. Match-running performance of young soccer players in different game formats. *Int J Perform Anal Sport* 2018; 18: 410–422.
7. Capranica L, Tessitore A, Guidetti L and Figura F. Heart rate and match analysis in pre-pubescent soccer players. *Journal of Sports Sciences* 2001; 19 (6): 379–384.
8. Joo CH, Hwang-Bo K and Jee H. Technical and physical activities of small-sided games in young Korean soccer players. *J Strength Cond Res* 2016; 30: 2164–2173.
9. Randers MB, Andersen TB, Rasmussen LS, et al. Effect of game format on heart rate, activity profile, and player

involvement in elite and recreational youth players. *Scand J Med Sci Sport* 2014; 24: 17–26.
10. Tessitore A, Perroni F, Meeusen R, et al. Heart rate responses and technical-tactical aspects of official 5-a-side youth soccer matches played on clay and artificial turf. *J Strength Cond Res* 2012; 26: 106–112.
11. Garganta PJ. O ensino do futebol. In: *O ensino dos jogos desportivos colectivos*. Porto Alegre: Dinalivro, 1994, pp.95–135.
12. Edis C, Vural F and Vurgun H. The importance of postural control in relation to technical abilities in small-sided soccer games. *J Hum Kinet* 2016; 53: 51–61.
13. Garganta J and Gréhaigne JF. Abordagem sistêmica do jogo de futebol: moda ou necessidade? *Movimento* 1999; 5: 40–50.
14. Garganta J. Ideias e competências para 'pilotar' o jogo de futebol. In: JO Bento, G Tani and RdS Petersen (eds) *Pedagogia do desporto*. Rio de Janeiro: Guanabara Koogan, 2006, pp.313–326.
15. Garganta GJ, Barreira D, et al. Fundamentos e práticas para o ensino e treino do futebol. In: F Tavares (ed) *Jogos desportivos coletivos. Ensinar a jogar*. Porto: Editora FADEUP, 2013, pp.199–263.
16. Garganta J. *Modelação táctica do jogo de futebol: estudo da organização da fase ofensiva em equipas de alto rendimento*. Tese (Doutorado). Faculdade de Desporto da Universidade do Porto- FCDEF-UP, Porto, 1997.
17. Gréhaigne J-F, Godbout P and Bouthier D. The foundations of tactics and strategy in team sports. *J Teach Phys Educ* 1999; 18: 159–174.
18. Gréhaigne JF and Godbout P. Tactical knowledge in team sports from a constructivist and cognitivist perspective. *Quest* 1995; 47: 490–505.
19. Grund TU. Network structure and team performance: the case of English premier league soccer teams. *Soc Networks* 2012; 34: 682–690.
20. Ribeiro J, Silva P, Duarte R, et al. Team sports performance analysed through the lens of social network theory: implications for research and practice. *Sports Med* 2017; 47: 1689–1696. https://doi.org/10.1007/s40279-017-0695-1
21. Wäsche H, Dickson G, Woll A, et al. Social network analysis in sport research: an emerging paradigm. *Eur J Sport Soc* 2017; 8171: 1–28.
22. Gréhaigne JF, Mahut B and Fernandez A. Qualitative observation tools to analyse soccer. *Int J Perform Anal Sport* 2001; 1: 52–61.
23. Lenhard W and Lenhard A. Calculation of Effect Sizes. https://www.psychometrica.de/effect_size.html. Epub ahead of print 2016. DOI: 10.13140/RG.2.1.3478.4245 (Accessed 8th August 2020).
24. Cooper H, Hedges L V and Valentine JC. *Handbook of research synthesis and meta-analysis*. 2nd ed. New York: Russel Sage Foundation, 2009.
25. Cohen J. Quantitative methods in psychology - A power primer. *Psychol Bull* 1992; 112: 155–159.
26. Brito MJ, Garganta JM, et al. The game variants in Europe. Trends and perspectives during youth competitive stages. *Mot Rev Educ Física* 23. Epub ahead of print 2017. DOI: 10.1590/s1980-6574201700030023.
27. Olthof SBH, Frencken WGP and Lemmink KAPM. Match-derived relative pitch area changes the physical and team tactical performance of elite soccer players in small-sided soccer games. *J Sports Sci* 2018; 36: 1557–1563.
28. Fradua L, Zubillaga A, Caro O, et al. Designing small-sided games for training tactical aspects in soccer: extrapolating pitch sizes from full-size professional matches. *J Sports Sci* 2013; 31: 573–581.
29. Teoldo I, Garganta J, Grego PJ, et al. Relação entre a dimensão do campo de jogo e os comportamentos táticos do jogador de futebol. *Rev Bras Educ Física e Esporte* 2011; 25: 79–96.
30. Folgado H, Bravo J, Pereira P, et al. Towards the use of multidimensional performance indicators in football small-sided games: the effects of pitch orientation. *J Sports Sci* 2019; 37: 1064–1071.
31. Clemente FM, Sarmento H, Costa Id, et al. Variability of technical actions during small-sided games in young soccer players. *2Journal Hum Kinet* 2019; 69: 201–212.
32. Owen AL, Wong DP, McKenna M, et al. Heart rate responses and technical comparison between small- vs. Large-sided games in elite professional soccer. *J Strength Cond Res* 2011; 25: 2104–2110.
33. Kelly DA and Drust B. The effect of pitch dimensions on heart rate responses and technical demands of small-sided soccer games in elite players. *J Sci Med Sport* 2009; 12: 475–479.
34. Silva B, Garganta J, Santos R, et al. Comparing tactical behaviour of soccer players in 3 vs. 3 and 6 vs. 6 small-sided games. *J Hum Kinet* 2014; 41: 191–202.
35. Queiroz C. Para uma teoria do ensino/treino de futebol. *Ludens* 1983; 8: 25–44.
36. Lee TD, Swinnen SP and Serrien DJ. Cognitive effort and motor learning. *Quest* 1994; 46: 328–344.
37. Clemente FM. *Small-Sided and conditioned games in soccer training: the science and practical applications*. Melgaço, Portugal: SpringerBriefs in Applied Sciences and Technology, 2016.
38. Katis A and Kellis E. Effects of small-sided games on physical conditioning and performance in young soccer players. *J Sports Sci Med* 2009; 8: 374–380.
39. Rebelo ANC, Silva P, Rago V, et al. Differences in strength and speed demands between 4v4 and 8v8 small-sided football games. *J Sports Sci* 2016; 34: 2246–2254.
40. Castelão D, Garganta J, Santos R, et al. Comparison of tactical behaviour and performance of youth soccer players in 3v3 and 5v5 small-sided games. *Int J Perform Anal Sport* 2014; 14: 801–813.
41. Serra-Olivares J, Garcia Lopez LM and Goncalves B. Effects of the players' level and age group category on positional tactical behaviour during 7-and 8-a-side football youth games. *Int J Perform Anal Sport* 2019; 19: 236–247.
42. Côté J and Erickson K. (2015). "Diversification and deliberate play during the sampling years," in *Routledge Handbook of Sport Expertise*, eds J. Baker and D. Farrow. 1st ed. (Abingdon: Routledge), 2015, pp. 305–316.
43. Garganta J. O ensino Dos jogos desportivos colectivos. Perspectivas e tendências. *Movimento* 1998; 4: 19–27.