

Decision making in soccer: effect of positional role of U-13 soccer players

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Abstract:

Introduction: Making efficient decisions is an important characteristic for athletes to achieve superior performance in soccer. Due to the highly demanding environment of soccer, different functions are necessary to enable superior collective performance. With respect to the assessment of decision making according to playing positions, no studies have yet been carried out to assess the contents of the core tactical principles, and thus further investigations are necessary to address this issue. **Objective:** The aim of this study is to verify the influence of positional role on the decision-making skills of U-13 soccer players. **Methods:** Thirty U-13 male soccer players (12.9 ± 0.7 y/o) from regional soccer schools participated in this study. Players were classified according to three positional roles: defenders ($n = 9$), midfielders ($n = 11$) and forwards ($n = 10$). The instrument used to assess players' decision-making skills and decision-making time was the TacticUP® online platform. This instrument assesses the quality and time of decision making based on the core offensive and defensive tactical principles of soccer, in situations near and distant from the ball. Descriptive analysis, as well as the Shapiro-Wilk, ANOVA and Tukey's post-hoc tests were performed, and effect sizes were reported as eta-squared ($p < 0.05$). **Results:** Findings did not show differences in decision-making quality between the different positional roles. As for decision-making time, midfielders made quicker decisions, when compared to defenders and forwards, in situations near and distant from the ball ($p < 0.05$). **Conclusions:** It is concluded that positional role influenced the decision-making time of U-13 soccer players. In general, midfielders displayed greater ability to read the game and make quicker decisions when compared to defenders and forwards in offensive and defensive situations near and distant from the ball. Therefore, it implies that to fulfil the role/function of midfielder in the field, in addition to being assertive, players also have to be quick in making decisions.

Keywords: game reading; tactical awareness; perceptual-cognitive skills; tactical knowledge; playing position; talent identification and selection.

Introduction

Making efficient decisions is an important characteristic for athletes to achieve superior performance in sports (Forsman, Blomqvist, Davids, Kontinen, & Liukkonen, 2016; Gréhaigne, Godbout, & Bouthier, 2001). Decision making may be defined as a choice of action, whose result can be observed through a verbal or motor response (Macmahon & Mcpherson, 2009). Sports-related studies have assessed both the quality and time of athletes' decision making (Mann, Williams, Ward, & Janelle, 2007).

In soccer, decision-making skills appear to be associated to the players' sports development (Cardoso, González-Víllora, Guilherme, & Teoldo, 2019; Machado & Teoldo, 2020; Williams & Reilly, 2000). Besides, the profiles of players who achieve professional status in soccer include the ability to make decisions in less time (Kannekens, Elferink-Gemser, & Visscher, 2011; Mann et al., 2007). Due to the highly demanding environment of soccer, different functions are necessary to enable superior collective performance (Gréhaigne, Godbout, & Bouthier, 1997). These several functions are determined by the positional roles (e.g., forward, defender) performed by the players during a match, which consequently requires different characteristics from these individuals (Gouvêa et al., 2017; Machado, Padilha, González-Víllora, Clemente, & Teoldo, 2019; Rechenchosky et al., 2017). Literature indicates that professional players from different positional roles differ both in quality and time of decision making (Ruschel et al., 2011; Williams, Ward, & Smeeton, 2008), which is apparently associated to the development process of these players throughout the years (Machado, González-Víllora, Sarmento, & Teoldo, 2020). In addition, in the study by Kannekens, Elferink-Gemser and Visscher (2011) the authors observed that players who achieved professional status displayed better decision-making skills, regarding tactical skills, during adolescence. Therefore, the development of such skills should be accounted for since the start of the sports education process, and consequently associated to the contents recommended for the different development stages of the athletes (Roca, Williams, & Ford, 2012; Machado & Teoldo, 2016; Teoldo, Guilherme, & Garganta, 2017).

Decision-making skills are directly associated to the tactical dimension of the game, as tactics is defined as the management of playing space through players' movements and positioning (Teoldo et al., 2017). With respect to the contents, it is recommended that the teaching of the core tactical principles starts around 10 years of age (Américo et al., 2016; Barcellos, Teoldo, & Machado, in press). This is due to the fact that the egocentric stage was overcome, and individuals are more susceptible to learning contents that involve the awareness of spaces and movements of other individuals. Additionally, the incorporation of the core tactical principles requires abstract thinking, which is developed around this age (Piaget, 1993; Teoldo et al., 2017).

Also, during the sport education process, there are stages in which the focus should be on experiencing different playing functions and positions, while in others the focus should be on a more specific development. Considering the Developmental Model of Sports Participation, proposed by Côté and colleagues (2007), more experiences are recommended for the sports sampling phase, which goes on until around 12 years old. From 12 years old onwards, when the specializing phase begins, it is recommended to focus teaching on the development of specific functions and positions of each sport. Hence, it is expected that from this period onwards a greater differentiation will occur regarding the characteristics of players of different playing positions.

Padilha and colleagues (2013) observed that U-13 soccer players of different positions differ in relation to their tactical performance according to the core tactical principles, assessed in actual game contexts. As this study reports these differences in performance since this period, it is also necessary to understand the characteristics of this phase, with respect to decision making (Cardoso et al., 2019). Thus, it is necessary to resort to instruments that enable the assessment of athletes' decision-making skills, besides being aligned with the processes of teaching, learning and training during this phase (Badari, Machado, Moniz, Fontes, & Teoldo, 2021). To the best of our knowledge, our study provides two novelties: 1) concerning the assessment of decision making according to playing positions, no studies have yet been carried out to assess the contents of the core tactical principles, and thus further investigations are necessary to address this issue; 2) this is the first study to assess the decision making time (response time) of soccer players based on the core tactical principles, as suggested by Machado and Teoldo (2020). Another aspect to potentially improve the training process is the individualization of stimuli. Accordingly, information about these characteristics of decision making according to playing position may support the individualization of training following the needs of each athlete, as well as the characteristics of each function/position, so as to optimize training time and potentialize players' development (Teoldo, Cardoso, & Machado, 2021). Therefore, this study may help coaches, by supporting training-related decisions, as well as researchers, by providing objective information about the decision-making characteristics of soccer players from different playing positions. Thus, the aim of this study is to verify the influence of positional role on the decision-making skills of U-13 soccer players.

Material & Methods

Ethical Procedures

Data collection was carried out with previous approval from club officials and athletes. The present study was approved by the Ethics Committee for Research with Human Beings from the Universidade Federal de Viçosa (Protocol: 2.312.402) and is in accordance with the norms established by the National Health Council (466/2012) and by the Declaration of Helsinki (2013) for research with human beings. Participants' legal guardians signed an informed consent.

Participants

A total of 30 U-13 male soccer players (average age = 12.9 ± 0.7 years old), from regional soccer schools. Players were classified according to the technical/tactical assignment for their respective positional roles: defenders ($n = 9$), midfielders ($n = 11$) and forwards ($n = 10$). As inclusion criterion, players had to regularly take part in two weekly training sessions.

Experimental Design

In this study, the following methodological designs were used: observational, quasi-experimental and cross-sectional. Decision making was assessed through the test in the TacticUP® online platform. The test was applied before the training sessions, with groups of three athletes taking the test simultaneously, each one using a computer. The duration of the test was of 20 minutes for each group. Computers with internet access were provided to participants, and the test was conducted and supervised by the main researcher.

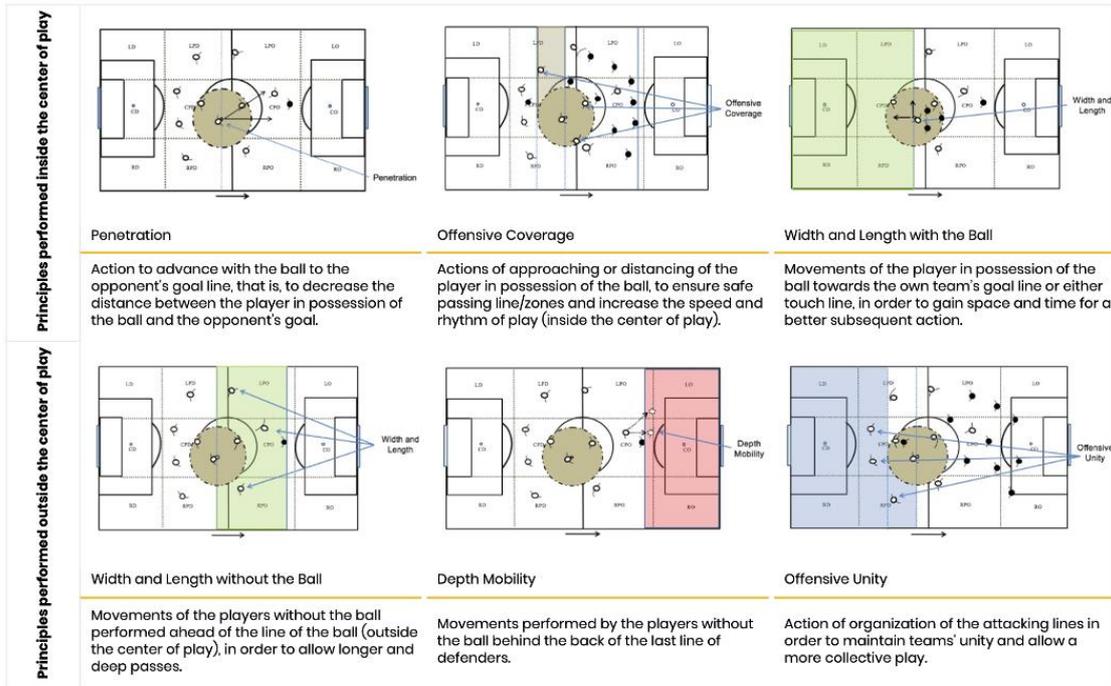
Instrument

Assessment of game reading and decision-making skills - TacticUP® video test for soccer

The instrument used to assess participants' decision making was the TacticUP® online platform (www.tacticup.com.br) (Machado & Teoldo, 2020). This platform enables the assessment of participants' decision-making quality and time, and is based on the core tactical offensive and defensive principles of soccer (see Figure 1) (Teoldo et al., 2017). These principles enable players to find effective solutions for game situations through the management of playing space, and were proposed because they present central aspects of the teaching process of tactical skills. Besides, these principles allow to obtain objective measures of players' movements regarding the management of playing space.

Before the start of the test, the online platform displays instructions to participants regarding the test structure and procedures, and three trial scenes are exhibited to familiarize the subjects with the assessment, thus excluding the possibility of low performance due to lack of comprehension of the task. These three trial scenes include: two offensive sequences (one in which the player being observed is in possession of the ball, and another in which he is not in possession) and one defensive sequence (the player being observed is in the defensive phase of play). These three conditions enable participants to familiarize themselves with the characteristics of the video sequences they were about to watch.

a) Offensive Principles



b) Defensive Principles

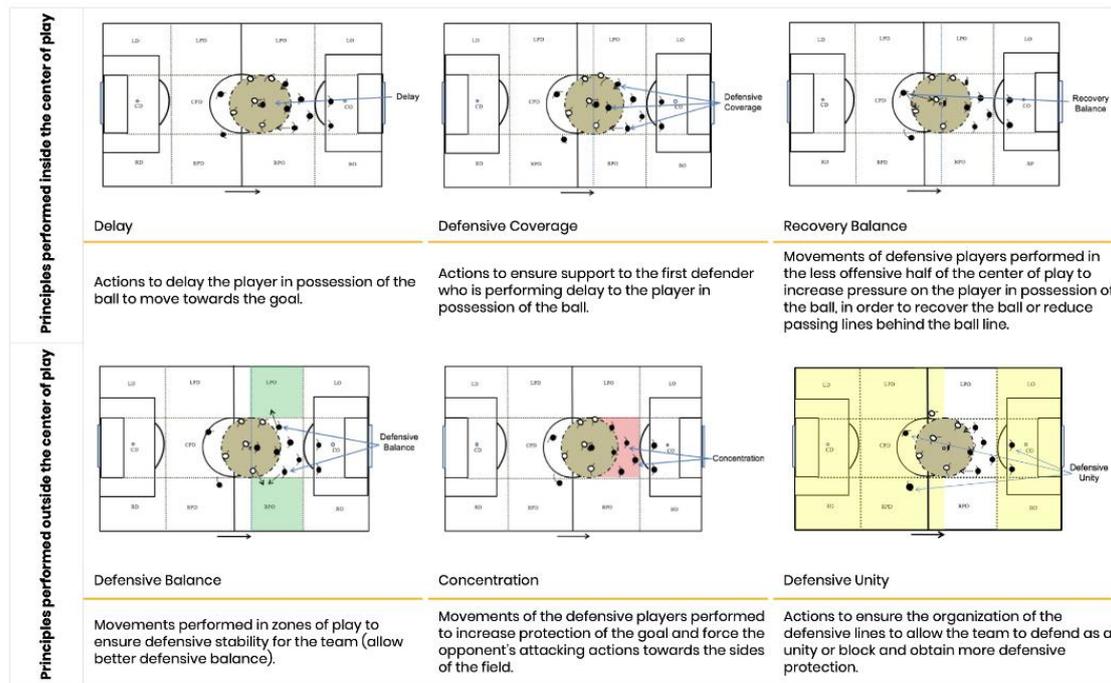


Figure 1. Description of the core tactical principles of soccer: a) offensive; and b) defensive (Source: Teoldo, Guilherme & Garganta, 2017)

Materials

The test was carried out using three Asus® laptop computers (model Z450L, Intel® i3-400SU processor) with internet, in order to enable the access to the tests in the TacticUP® platform.

Statistical Analysis

Descriptive analysis (means and standard deviations) was performed for data on decision-making quality and time. Subsequently, tactical principles were classified as: 1) offensive principles inside the center of play (OICP) (penetration, offensive coverage and width and length with the ball), 2) offensive principles outside the center of play (OOCp) (width and length without the ball, depth mobility and offensive unity), 3) defensive principles inside the center of play (DICP) (delay, defensive coverage and recovery balance), 4) defensive principles outside the center of play (DOCP) (defensive balance, concentration and defensive unity). This classification was carried out due to the spatial relation of these principles with the center of play and with their processes of teaching, learning and training. The tactical principles performed inside the center of play display lower complexity for execution when compared to the principles performed outside the center of play (Américo et al., 2016; Teoldo et al., 2017).

Defenders, midfielders and forwards were compared with respect to the dependent variables. The Shapiro-Wilk normality test and the One-Way ANOVA (with Tukey's post hoc) were performed. Significance level was set at $p < 0.05$. The effect size of the differences observed in the ANOVA was calculated through the values of partial eta-squared (η_p^2) (Fritz, Morris, & Richler, 2012). The magnitudes of η_p^2 were interpreted according to the following classification: large effect (> 0.14), moderate effect (from 0.06 to 0.14) and small effect (< 0.01) (Cohen (1988)). All statistical procedures were performed through IBM SPSS® for Mac (version 22.0).

Results

No significant differences were found for decision-making quality. As for decision-making time, the midfielders made quicker decisions, when compared to defenders and forwards, for the offensive principles inside the center of play [$F(2, 27) = 5.33$, $p = 0.011$, large effect]; for the offensive phase [$F(2, 27) = 585$, $p = 0.008$, large effect]; and overall [$F(2, 27) = 5.91$, $p = 0.007$, large effect] (Table 1). The midfielders also made quicker decisions than the defenders for the offensive principles outside the center of play [$F(2, 27) = 4.16$, $p = 0.026$, large effect]; for the defensive principles inside the center of play [$F(2, 27) = 3.42$, $p = 0.047$, large effect]; and for the defensive phase [$F(2, 27) = 3.76$, $p = 0.036$, large effect]. No significant differences in decision-making time were found between the different positions for the defensive principles outside the center of play.

Table 1. Means and standard deviations of decision-making quality and decision-making time among defenders, midfielders and forwards.

Indexes	Decision-Making Quality (a.u.)					Decision-Making Time (s)				
	Defender	Midfielder	Forward	p	η_p^2	Defender	Midfielder	Forward	p	η_p^2
Offensive										
Inside the center of play ¹	66.8 ± 17.2	67.2 ± 14.1	73.0 ± 12.9	0.585	0.04	8.6 ± 3.1	5.3 ± 1.4	8.5 ± 3.0	0.011**	0.28
Outside the center of play ²	56.1 ± 13.3	65.0 ± 13.3	57.5 ± 15.1	0.315	0.08	7.6 ± 3.4	4.7 ± 1.3	6.9 ± 2.4	0.026*	0.24
Offensive	61.5 ± 10.9	66.1 ± 10.9	65.2 ± 10.0	0.600	0.04	8.1 ± 2.9	5.0 ± 1.1	7.7 ± 2.6	0.008**	0.30
Defensive										
Inside the center of play ³	59.8 ± 16.3	52.1 ± 14.2	63.8 ± 13.3	0.191	0.12	8.6 ± 3.1	5.4 ± 1.4	7.5 ± 3.6	0.047*	0.20
Outside the center of play ⁴	53.7 ± 10.0	61.4 ± 11.8	66.3 ± 14.8	0.101	0.16	8.1 ± 3.6	5.1 ± 1.5	7.0 ± 3.1	0.068	0.18
Defensive	56.8 ± 10.1	56.8 ± 7.0	65.1 ± 9.9	0.075	0.17	8.3 ± 3.3	5.2 ± 1.3	7.3 ± 3.0	0.036*	0.22
Overall										
Overall	59.1 ± 7.8	61.4 ± 7.4	65.2 ± 4.4	0.154	0.13	8.2 ± 2.7	5.1 ± 1.0	7.5 ± 2.5	0.007**	0.30

¹principles of penetration, offensive coverage and width and length with the ball; ²principles of width and length without the ball, mobility and offensive unity; ³principles of delay, defensive coverage and recovery balance; ⁴principles of defensive balance, concentration and defensive unity.

* Difference between Midfielder vs. Defender; ** Difference between Midfielder vs. Forward

Discussion

The aim of this study was to verify the influence of positional role on the decision-making skills of U-13 soccer players. According to our findings, midfielders make quicker decisions when compared to defenders and forwards. In attacking situations, midfielders displayed lower decision-making time for the principles inside and outside the center of play, as well as in the overall offensive phase.

Midfielders were quicker than players from other positions for the offensive principles inside and outside the center of play. The offensive principles performed inside the center of play are related to offensive actions with the ball and movements executed closer to the ball, such as: 1) carrying the ball towards the opposing goal or goal-line (penetration), 2) movements with the ball towards the side line or own team's goal, to buy space and time (width and length with the ball), and 3) actions of offensive support near the player in

possession, through the creation of passing lanes or generating space in the opposing defense for the player in possession, in order to carry the ball forward (offensive coverage) (Teoldo et al., 2017). These principles are characterized by the execution of movements with higher intensity and speed. On the other hand, the offensive principles outside the center of play are related to the offensive actions more distant from the ball, such as: 1) organization of attacking lines behind the ball line (offensive unity), 2) movements ahead the ball line that enable longer passes in width and depth (width and length without the ball), 3) movements performed behind the back of the last defensive line (depth mobility) (Teoldo et al., 2017).

The ability of midfielders to respond quicker to game stimuli (near and distant from the ball) in offensive actions, when compared to players from other positions, may be associated to the field zones they usually occupy and the functions they perform, in relation to other positions. The functions of the midfielders in attack are mainly associated to the teams' buildup process and progression towards the opposing half, since they are the link between the players who play predominantly attacking or defensive roles within the team (Taylor, Mellalieu, & James, 2004).

Accordingly, their movements are related to the occupation and creation of free spaces near and distant from the ball, usually accomplished under tight marking from opponents, as midfield zones they occupy are often congested with opposing players (Padilha et al., 2013; Taylor, Mellalieu, & James, 2005). Such a high density of opponents results in a reduction of available playing space for players, and consequently demands quicker decision making so as to ensure the efficiency of their movements.

These demands are habitual in matches and training sessions, and lead to the accumulation of such stimuli throughout the player's sports development process. Accumulating stimuli leads to adaptations by the individuals' perceptual-cognitive system (Machado et al., 2020; Roca et al., 2012; Williams et al., 2008). These adaptations are apparently associated to the development of game-reading skills and quicker decision making by the midfielders (Den Hartigh, Van Der Steen, Hakvoort, Frencken, & Lemmink, 2018), as indicated by the findings in our study.

In a previous study that analyzed 60 games, Oliveira, Clemente and Martins (2016) observed that U-12 midfielders are key players within their teams, i.e., the players who receive and perform most passes during a game. In addition, they are the players who participate the most in their teams' offensive buildup. The findings in this study indicate the importance of the midfielder in a team, although the authors did not assess players' participation in defensive organization.

In the study by Kannekens and colleagues (2011) it was possible to verify that midfield players should display high tactical skills, so that in the future they could attain professional status. To achieve the highest level in soccer, midfield players should respond correctly to more than 80% of the problems related to decision-making and positioning skills. The findings of our study extend these data, as in addition to the high decision-making performance constraints, midfield players also need to respond quickly to stimuli. Our study provides a methodological improvement in comparison to the aforementioned paper, as we propose the assessment using actual match scenes, thus increasing the test's ecological value (Mann et al., 2007) as well as enabling the assessment of participants' response times.

With respect to the analysis of tactical behavior efficiency of academy players, Rechenchosky et al., (2017) observed that midfield and attacking players performed the principle of offensive unity more efficiently than defenders. The execution of efficient tactical actions in the field is related to both players' ability to respond adequately, and as fast as possible, to game stimuli. Therefore, the findings from our study are in line with those from the aforementioned research. Although the assessment methods are different, both studies analyzed the core tactical principles of soccer. As for the defensive principles, midfielders were quicker in making decisions, when compared to defenders, in actions inside the center of play. These are somewhat unanticipated results, as the main role of defenders is to perform defensive actions aimed at hold back opponents' progression and shooting, as well as at recovering ball possession (Bayer, 1992). The defensive principles inside the center of play are related to the defensive actions performed closer to the ball, such as: 1) actions aimed at delaying the progression of the player in possession (delay), 2) movements of defensive support near the player performing delay, such as blocking passing lanes (defensive coverage), and 3) movements near and behind the ball line, with the purpose of pressing the player in possession, for eventually recovering the ball or blocking passing lanes (recovery balance) (Teoldo et al., 2017). One likely explanation for these findings may be an adaptation of the perceptual-cognitive system of midfield players to perform quicker game reading and decision making, due to the reduced space and time generally available for playing, compared with other positions (Cardoso, Neves, Roca, & Teoldo, 2020).

In general, this reduced time and space midfielders are provided with during the game are related to the performance of offensive actions with and without the ball. However, the perceptual-cognitive skills employed by midfielders in the offensive phase are likely to be transferred to actions in the defensive phase of play (Roca & Williams, 2017). Among them, we could mention the utilization of more efficient visual search strategies, especially in defensive situations that demand quicker game reading and decision making from players, such as the actions performed inside the center of play (Machado, Cardoso, & Teoldo, 2017; Padilha et al., 2017).

In contrast to our findings, in the study by Rechenchosky et al., (2017), defenders displayed higher efficiency for the principle of defensive coverage, i.e., for a core principle performed inside the center of play, or

close to it, when compared to midfielders. Yet, in the aforementioned study, players' average age (14.85 ± 1.58 years) was slightly higher than of the participants in our sample (12.9 ± 0.7 years), which may indicate more practice time in the sport, and consequently more positional specialization of defenders to perform defensive tasks, due to their development stage (Ford, Ward, Hodges, & Williams, 2009; Sieghartsleitner, Zuber, Zibung, & Conzelmann, 2018). Taking into account the results from our study, it is possible to verify that midfielders differed from defenders and forwards regarding their game-reading skills and ability to make quicker decisions, either in offensive or defensive situations, near or distant from the ball. These differences are possibly associated to the adaptations of midfield players' perceptual-cognitive skills according to their positional roles and the usual demands in matches and training sessions (Cardoso et al., 2019; Oliveira et al., 2016; Roca et al., 2012).

Accordingly, it is important to emphasize that players' positions seem to influence their perceptual-cognitive skills of game reading and decision making in the early years of the sports development process, such as in the U-13 age group investigated in this study. To the best of our knowledge, this is the first study carried out with players of this age that included offensive and defensive situations, near and distant from the ball. The findings of the present study may substantiate the work of academy coaches and coordinators, as they reveal that players from different positions differ in relation to their game-reading and decision-making skills. Thus, this should be accounted for during the training process for the individualization of stimuli aimed at players' development, according to their limitations and potentialities (Machado et al., 2020; Teoldo, Cardoso, & Machado, 2021).

One limitation of this study is the fact that only a single competitive context (regional level players) was investigated. Hence, we recommend that future research expand the analysis by including other competitive levels (e.g., players competing at national or international level) and controlling the previous soccer developmental activities engaged by the soccer players. Another limitation is the absence of biological maturation data, as previous studies identified an imbalance between chronological and biological ages of young soccer players (Baxter-Jones & Malina, 2001), as well as a relationship between biological maturation and improved perception (Gonçalves, Noce, Barbosa, Figueiredo, Hackfort, et al., 2020; Gonçalves, Noce, Barbosa, Figueiredo, & Teoldo, 2020). Additionally, it would be relevant to investigate the influence of positional role on the decision-making skills of players from different age groups, as well as to follow up the development of this aspect.

Conclusions

It is concluded that positional role influenced the decision-making time of U-13 soccer players. In general, midfielders displayed greater ability to read the game and make quicker decisions when compared to defenders and forwards in offensive and defensive situations near and distant from the ball. Therefore, it implies that to fulfil the role/function of midfielder in the field, in addition to being assertive, players also have to be quick in making decisions. We also highlight that our study provided two novelties: 1) concerning the assessment of decision making according to playing positions, no studies have yet been carried out to assess the contents of the core tactical principles; 2) it was the first study to assess the decision-making time of soccer players based on the core tactical principles, as suggested by Machado and Teoldo (2020).

With respect to the practical applications, the results of the present study may support the design of training activities that include position-specific perceptual-cognitive demands. Consistent with the findings, we recommend that midfielders participate in activities with more constraints of time and space to read the game and make decisions, in relation to the players from other positions. It may also be effective that players from other positions (e.g., forwards and defenders) could experience stimuli that allowed them to develop their ability to make correct and quick decisions in the game. This would be particularly relevant in early ages, so that this ability does not become a limitation, in case these players choose to play as midfielders, for instance, throughout their soccer development process.

Besides, if a given player changes his/her positional role (e.g., a forward who now plays as a midfielder), either by recommendations of the coaching staff or by his/her own choice, it is essential that the player's game-reading and decision-making skills be assessed. In case coaches identify that the player has a different profile in relation to what is expected for the role he/she is about to perform, it is necessary to carry out proper preparation that enables the development of the game-reading and decision-making skills for that specific position, with the purpose of improving performance. Another possibility for benefiting from this information is to identify the most suitable position for the player, according to his/her game-reading and decision-making skills, along with other competences (e.g., technical, physical).

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