



THE DEVELOPMENT OF TACTICAL SKILLS IN U-14 AND U-15 SOCCER PLAYERS THROUGHOUT A SEASON: A COMPARATIVE ANALYSIS

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ABSTRACT

Purpose. Players' tactical skills are crucial for a successful, high-standard career in soccer. Although recent studies propose and apply the analysis of young players' tactical skills through the understanding of their knowledge about tactical principles, no research has compared the development of these specific tactical skills throughout a soccer specific season in different youth academies. This article aimed to compare the development of tactical skills in U-14 and U-15 soccer players throughout a season.

Methods. The tactical skills of 30 athletes (16 U-15 and 14 U-14) of a sports club were evaluated during 10 months with the System of Tactical Assessment in Soccer (FUT-SAT). The incidence of tactical principles and the percentage of successful principles in offense and defence were compared with the use of a two-way ANOVA (category \times time).

Results. Reduction was observed in the incidence of actions of offensive unity in the U-15 athletes throughout the season and a higher incidence of offensive coverage compared with U-14. Moreover, U-15 athletes increased their percentage of successful actions, both offensive and defensive, and presented a higher performance than U-14 players.

Conclusions. Tactical performance of U-15 soccer athletes increases over a sports season, which is not observed in the U-14 category, although players from both groups presented changes in the incidence of offensive and defensive tactical principles. This supports the non-linearity of tactical skills acquisition and development in soccer, as well as justifies the need of constant assessment during the training process across the ages.

Key words: soccer, soccer players, tactical skills, FUT-SAT, sport season

INTRODUCTION

The high unpredictability of team sports, including soccer [1], requires players to constantly generate tactical options [2] and make decisions [3, 4] to solve problem situations that emerge from the game. The generation of these options is based on players' knowledge of the game [5], which results from the deliberate practice of the modality [6, 7]. Therefore, players' tactical skills are crucial for a successful, high-standard career in soccer [5, 8]. Investigation about tactical skills in soccer has increased in the last decades [3, 9], supported by observation and tactical analysis systems [10]. However, the paucity of longitudinal stud-

ies about the development of tactical skills in talented players limits the comprehension of the inherent dynamics of the tactical learning process in soccer.

Tactical actions in soccer are oriented by some principles [11] that constitute the guidelines for decision making and allow players – in a heuristic way – to solve game problems [11]. Authors suggest that in soccer, the fundamental tactical principles are the means by which players manage time and space during the game [12]. Considering that high level players are better at the ability of positioning and deciding and, consequently, at making suitable decisions [5], one can expect that players develop their knowledge about fundamental principles throughout a sports

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season, which has not been previously investigated. The incidence of these principles can be assessed through the field test System of Tactical Assessment in Soccer (FUT-SAT) [10] – which provides a measure of tactical behaviour during the offensive and defensive phases of the game, as well as the percentage of successful tactical principles (tactical performance) [13, 14]. Previous studies have found changes in the incidence of tactical principles performed by U-14 players after 20 soccer training sessions [15], indicating the sensitivity of FUT-SAT for assessing longitudinal changes in tactical skills of soccer players. However, few longitudinal approaches [15] have been conducted regarding the fundamental tactical principles, limiting the understanding about the development of players' knowledge of these principles in soccer.

Studies suggest that motor skills of soccer athletes change during a sports season [16] as a result of the training process. In contrast, Forsman et al. [17] reported that players' tactical skills remained relatively high and stable after 1 year. In their study, participants were up to 14 years old and changes in the knowledge structures as a result of the training process were expected (i.e., tactical learning). However, Forsman et al. [17] investigated the development of tactical skills in a task that was not game-related, which is not specific to match demands. Therefore, the scores presented by the U-14 athletes might not adequately represent the ability to solve problems in game situations, which are characterized by unpredictability, complexity, and time pressure [1, 18]. In this sense, the assessment of tactical skills development through representative tasks can better evaluate longitudinal changes in tactical skills. However, no study has investigated the development of tactical skills with the use of representative tasks.

Finally, in many countries, the number of national and international championships during a season is significantly higher in the U-14 and U-15 compared with younger categories. This leads many soccer clubs to start the development of structured tactical training within the U-14 category. For this reason, the assessment of tactical skills development in U-14 and U-15 athletes informs about the beginning of the training process in soccer and might help coaches to adjust the contents and the structure of the training sessions according to their objectives. On the basis of non-linear characteristics of tactical skills development, our hypothesis is that players will change their knowledge throughout a sports season differently according to the youth academy (U-14 or U-15) to which they belong. Therefore, this study aimed to compare tactical

skills related to fundamental tactical principles within and between U-14 and U-15 soccer players within 10 months along the season.

MATERIAL AND METHODS

Participants

Initially, 58 soccer players, 30 of the U-15 category and 28 of the U-14 category, from an elite club were selected to participate in this study. Throughout the year, 28 athletes were excluded from the study owing to dropouts and injuries. At the end, the analyses included data from 30 athletes – 16 U-15 (born in 2001, mean age of 14.5 years at inclusion, mean of 4.6 years of deliberate practice) and 14 U-14 (born in 2002, mean age of 13.6 years at inclusion, mean of 3.4 years of deliberate practice), who participated in at least 75% of data collections. All athletes and their legal guardians provided a written consent to participate in the study. The study was approved by the Research Ethics Committee of the Federal University of Minas Gerais, Brazil.

The U-14 athletes' sports season comprised 38 games and 247 training sessions of, approximately, 90 minutes, resulting in 21,030 minutes of practice. During the season, 61% of the training time was dedicated to technical-tactical activities (with ball in both representative and non-representative tasks), 12% to specific strength and speed training, and 27% to preparatory and regenerative activities. This category participated in 4 competitions, 2 national and 2 regional, over the season. The U-15 athletes participated in 48 games and performed 236 training sessions of, approximately, 90 minutes, which correspond to 20,511 minutes of practice. During the season, 65% of the training time corresponded to technical-tactical activities (with ball in both representative and non-representative tasks), 18% to specific strength and speed training, and 17% to preparatory and regenerative activities. This category participated in 5 competitions, 3 international and 2 regional. These contents and their distribution were registered by the manager of the club as part of the club's routine. Each category had its own coaching staff, composed by a coach, an auxiliary coach, a physical trainer, and a goalkeeper coach. Although the different coaching staff could have different training approaches, a head coaching team was responsible for coordinating and pointing out some technical guidelines, such as for the development of the tactical principles, making all coaching approaches more similar.

Procedures

Data collection occurred monthly (25–35 days apart) over a 10-month period between March and December of 2016 (excluding the month of July owing to holidays). All data collection sessions took place in the club's training facilities, in the same place where athletes regularly perform training sessions and prior to regular training session to reduce the influence of fatigue on observed behaviour during the protocol. Each session started with a 10-minute standardized preparatory activity. Then, athletes performed the FUT-SAT protocol. The test consists of a 4-minute game in the GR3-3GR structure (goalkeeper plus 3 line players per team) in a 36×27 meters soccer field and a 6×2 goalpost dimension with all the rules of formal games. In order to reduce the influence of the positional status on the observed behaviours, teams were composed of a defender, a midfielder, and a forward – the same players over all data collection sessions. In cases when an athlete was not able to participate (e.g., because of injury), he was substituted by another player of the same playing position and similar tactical performance (percentage of successful tactical actions) in the previous assessment (previous month). No verbal encouragement was given to the athletes. All tests were recorded with a digital camera JVC HD (Everio GZ-HD520, Yokohama, Japan).

Instrument: System of Tactical Assessment in Soccer

The FUT-SAT consists of the observation of the incidence of 10 tactical principles performed by athletes during the game [10]. Among these principles, 5 are related to the offensive phase (penetration, offensive coverage, width and length, depth mobility, and offensive unit) and 5 to the defensive phase (delay, defensive coverage, balance, concentration, and defensive unit). Two trained observers analysed the videos of the protocols and counted the number of actions related to each principle performed by each athlete with the use of Soccer Analyzer[®] software. The software allows to insert a field diagram upon the video image and establishes the game centre and ball line, references adopted for the definition of the tactical principles. The dependent variables were the incidence of each fundamental tactical principle and the percentage of successful tactical principles – offensive and defensive. The latter was calculated as the total number of successful principles divided by the total number of principles performed (for each game phase – offensive and defensive).

Data analysis

Statistical analyses were performed with the R software, version 3.4.1 for Windows (R Foundation for Statistical Computing, Vienna, Austria). Data are presented as mean \pm *SD*. The normality and sphericity of data were verified with Shapiro-Wilk and Mauchly's tests, respectively. As there was no significant evidence of deviations from normality by the Shapiro-Wilk test, a two-way ANOVA (category \times months) with repeated measures compared the incidence of the tactical principles performed by athletes during the games. When necessary, a Tukey post-hoc was used to identify the honest significant differences reported by the ANOVAs. In addition, the magnitude of the differences were calculated as eta squared (η^2) effect sizes (*ES*) (small = 0.01, medium = 0.06, and large = 0.14) [19].

Data quality

Inter- and intra-rater reliability was conducted to verify expert's observations agreement. In this sense, 4 of the 32 test situations performed during the season in both ages were re-evaluated (12.5%), as recommended in literature [20]. The re-analyses occurred after 21 days to minimize the familiarity of evaluators with the evaluated scenes [20]. Cohen's kappa coefficient and the standard error for the variables 'tactical principles' and 'place of action in the game field' were calculated. Agreement values above 0.8 for all variables were observed, with standard error not exceeding 0.017. Thus, intra- and inter-rater agreement were classified as 'perfect' [20].

Ethical approval

The research related to human use has been complied with all the relevant national regulations, institutional policies and in accordance the tenets of the Helsinki Declaration, and has been approved by the authors' institutional review board.

RESULTS

Table 1 shows the comparative analysis of the incidence of offensive tactical principles in U-14 and U-15 soccer players through the year. The results indicated interaction between factors only for offensive unity actions ($p = 0.001$). For this reason, in this variable, no main effects p -values were reported. For this principle, U-15 players presented higher incidences in the first and second month in comparison with all

other measures within the same category and between categories. For the ‘category’ factor, there was a main effect, with U-15 players presenting a higher incidence of offensive coverage actions compared with U-14 players ($p = 0.001$; $ES = 0.478$; large effect). For the main effect of ‘months,’ a higher incidence of penetration was observed in the first, second, sixth and

seventh month in comparison with the other moments in the U-14 players ($p = 0.013$; $ES = 0.533$; large effect).

Table 2 shows the comparative analysis of the incidence of defensive tactical principles in U-14 and U-15 soccer players throughout the season. Interactions between factors were reported for defensive coverage ($p = 0.009$) and balance ($p = 0.007$) actions.

Table 1. Comparative analysis of the incidence of offensive tactical principles of U-14 and U-15 players during a sports season

	Penetration		Offensive coverage		Width and length		Depth mobility		Offensive unity	
	U-14	U-15	U-14	U-15	U-14	U-15	U-14	U-15	U-14	U-15
1	5.2 (1.4) ^{a,b}	3.5 (2.1)	6.6 (3.3)	8.8 (3.5)	10.2 (4.1)	8.1 (3.0)	2.2 (1.7)	3.0 (2.7)	5.8 (3.5)	14.1 (5.1) ^{a,b}
2	3.7 (1.4) ^a	2.7 (1.8)	4.7 (2.9)	8.6 (4.4) ^b	11.7 (3.6)	10.6 (6.9)	3.1 (2.8)	1.6 (2.0)	5.2 (3.0)	9.7 (4.5) ^{a,b}
3	3.2 (2.4)	3.0 (1.8)	3.7 (3.1)	8.3 (3.9) ^b	11.0 (8.4)	8.2 (5.0)	2.7 (2.0)	1.4 (1.5)	4.7 (3.3)	6.0 (4.7)
4	2.7 (1.7)	2.5 (1.9)	3.9 (3.1)	9.9 (5.3) ^b	10.0 (5.2)	9.3 (6.3)	1.6 (1.0)	1.3 (1.3)	6.0 (3.6)	6.7 (4.7)
5	3.2 (2.2)	3.3 (2.1)	5.0 (2.8)	9.2 (4.6) ^b	9.0 (4.1)	10.3 (6.7)	1.7 (1.1)	0.9 (1.4)	5.1 (3.2)	8.5 (5.4) ^b
6	4.1 (2.6) ^a	2.9 (2.1)	5.7 (3.4)	8.1 (4.9)	9.8 (5.8)	8.6 (6.2)	2.2 (1.8)	1.3 (1.6)	5.0 (3.5)	5.7 (4.2)
7	4.2 (2.8) ^a	3.1 (2.1)	3.9 (2.5)	8.1 (3.4) ^b	7.9 (5.9)	10.5 (5.6)	1.7 (1.6)	2.1 (3.3)	5.1 (3.8)	6.5 (4.7)
8	2.8 (2.0)	3.3 (1.9)	7.4 (3.9)	8.0 (4.0)	7.7 (3.5)	8.6 (4.8)	1.8 (1.6)	1.7 (1.4)	4.5 (3.0)	4.7 (3.1)
9	2.0 (1.8)	2.9 (1.4)	5.7 (3.5)	9.2 (3.4) ^b	7.0 (4.4)	9.7 (3.9)	2.3 (2.0)	1.5 (2.3)	5.2 (3.6)	5.1 (3.4)
Main effect category: p -value	0.229		0.001*		0.876		0.246		0.001 ^{&}	
Main effect months: p -value	0.013*		0.577		0.653		0.224			

^a higher incidence than in the other moments within the category; ^b higher incidence than in the other category within the month
* significant values; [&] interaction between factors

Table 2. Comparative analysis of the incidence of defensive tactical principles in U-14 and U-15 players during a sports season

	Delay		Defensive coverage		Balance		Concentration		Defensive unity	
	U-14	U-15	U-14	U-15	U-14	U-15	U-14	U-15	U-14	U-15
1	5.5 (3.3)	5.6 (3.0)	3.1 (1.7) ^a	3.1 (3.0) ^b	4.6 (2.3)	3.9 (2.1)	4.5 (2.9) ^a	3.5 (1.7)	16.6 (5.4)	13.7 (6.0)
2	7.1 (3.0)	5.0 (2.8)	2.0 (1.9) ^a	2.1 (1.5)	6.3 (2.3) ^a	4.6 (3.9)	4.5 (4.3) ^a	3.6 (2.5)	15.6 (2.7)	12.8 (5.8)
3	4.7 (2.5)	4.3 (2.8)	2.3 (2.6) ^a	1.9 (1.6)	3.9 (3.0)	3.7 (2.4)	3.0 (2.3) ^a	4.1 (3.4)	15.4 (7.4)	9.6 (4.5)
4	5.2 (3.8)	4.8 (3.1)	1.1 (1.2)	1.8 (1.7)	3.8 (3.0)	3.8 (2.9)	4.3 (2.7) ^a	3.3 (3.8)	16.0 (8.2)	12.6 (6.6)
5	5.4 (3.0)	4.3 (2.8)	2.8 (1.7) ^a	2.1 (2.6)	6.5 (3.5) ^a	3.1 (2.6)	3.7 (1.7) ^a	3.2 (2.9)	17.0 (7.8)	12.6 (6.3)
6	4.9 (3.5)	4.5 (3.2)	1.0 (1.1)	1.8 (1.7)	3.6 (2.9)	3.5 (3.0)	2.2 (1.6)	3.1 (2.6)	18.1 (6.6) ^b	10.4 (5.9)
7	4.9 (3.6)	4.8 (3.1)	1.0 (0.6)	3.5 (2.5) ^b	3.7 (2.7)	5.2 (3.5) ^b	1.5 (1.4)	3.6 (1.6)	14.4 (9.7)	10.8 (4.7)
8	5.5 (2.4)	4.7 (2.6)	1.5 (1.0)	3.7 (1.9) ^{a,b}	3.9 (2.4)	3.6 (2.3)	3.9 (2.0) ^a	2.9 (2.5)	15.7 (6.7) ^b	10.9 (5.3)
9	5.8 (2.7)	4.1 (1.9)	1.7 (1.2)	3.8 (1.8) ^{a,b}	3.6 (2.2)	6.1 (3.0) ^b	2.0 (1.7)	3.3 (2.0)	14.4 (5.4)	11.5 (2.5)
Main effect category: p -value	0.258		0.009 ^{&}		0.007 ^{&}		0.255		0.001*	
Main effect months: p -value	0.744						0.142		0.687	

^a higher incidence than in the other moments within the category; ^b higher incidence than in the other category within the month
* significant values; [&] interaction between factors

U-14 players performed more defensive coverage actions at the beginning of the year (first, second, third, and fifth month). On the other hand, U-15 players performed more defensive coverage actions in the last two months compared with all other measurements. U-15 players also performed more balance actions than U-14 players in the seventh and ninth month, while U-14 players performed more balance actions in the third and fifth month compared with the other months. Finally, there was a main effect for 'category,' with a higher incidence of defensive unity actions for U-14 players in the sixth and eighth month in comparison to U-15 players ($p = 0.001$; $ES = 1.704$; large effect).

Figure 1 shows the comparative analysis of offensive performance during the sports season. No interaction between the factors of 'categories' and 'months' was found ($p = 0.282$). There was a main effect for 'category' ($p = 0.001$; $ES = 0.045$; small effect), with a higher mean performance for U-15 players (0.683 ± 0.266 ; large effect) compared with U-14 (0.583 ± 0.238 ; large effect). There was also a main effect of 'time' ($p = 0.009$; $ES = 0.862$; large effect), with higher performances in the eighth and ninth month among U-15 athletes. No significant improvements were observed for offensive tactical performance in the U-14 players. Figure 2 shows the comparative analysis of defensive performance during the sports season. There

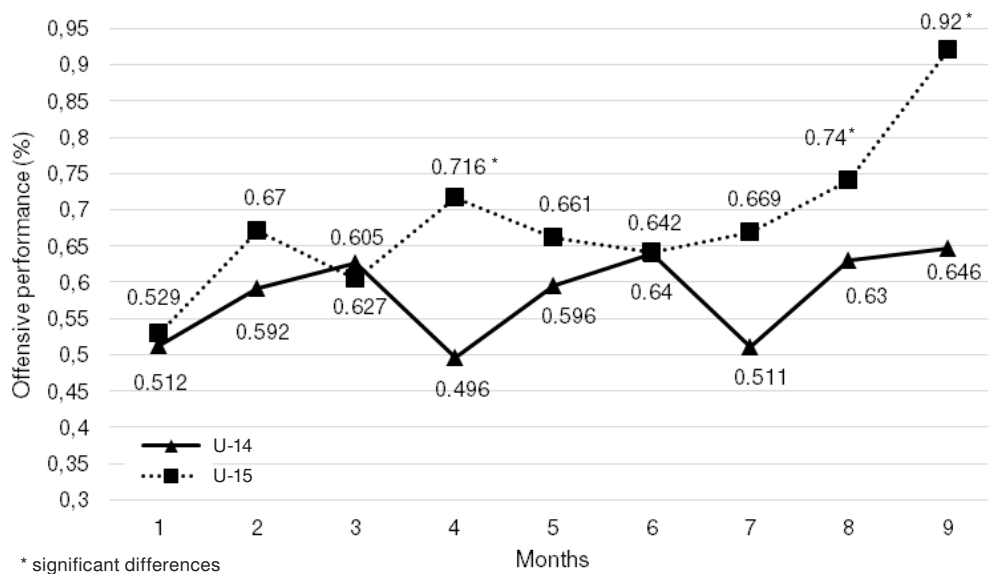


Figure 1. Offensive performance in U-14 and U-15 soccer players during a sports season

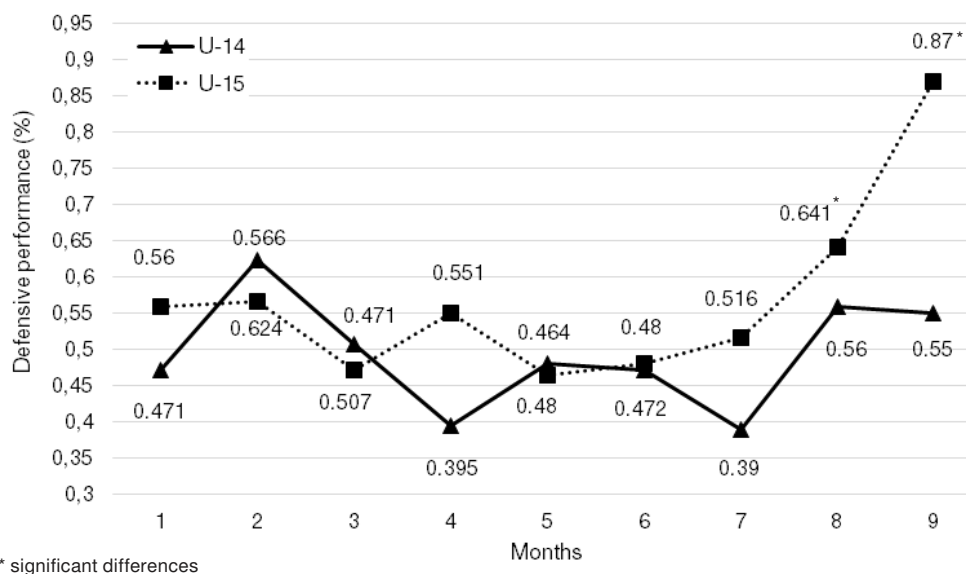


Figure 2. Defensive performance in U-14 and U-15 soccer players during a sports season

was a significant interaction between the factors of 'categories' and 'months' ($p = 0.031$). Similarly to the results of offensive actions, there was a higher performance for U-15 players compared with U-14 in the eighth and ninth month ($p = 0.001$; $ES = 0.101$; large effect). Measurements for the eighth and ninth month were also significantly higher than in the other months for the U-15 category ($p = 0.001$; $ES = 0.203$; large effect). No significant improvements were observed for defensive tactical performance in the U-14 category.

DISCUSSION

The study compared the development of tactical skills in U-14 and U-15 soccer players throughout a season. The results indicated no improvement in tactical skills (percentage of successful actions) in U-14 players, although there were significant changes in the incidence of penetration, defensive coverage, concentration, and defensive unity over time. In turn, U-15 players significantly increased defensive and offensive tactical performances throughout the season and presented higher performance in comparison with U-14 players. U-15 athletes also showed a decrease in the incidence of offensive unity and an increase in defensive coverage, as well as a consistently higher incidence of offensive coverage than U-14 players over the season. Thus, these results reflect a greater impact of the sports season on the modification of tactical behaviours in U-15 compared with U-14 athletes, which is mostly related with tactical actions quality (some principles did not change their incidence).

Forsman et al. [17] reported that the tactical skills of athletes aged 12–14 years remained high and stable throughout a sports season. The present study showed quite similar results for U-14 athletes since there were no significant differences in tactical performance over the season. However, these athletes presented moderate performance throughout the season (successful actions were up to 65%), differently from the results showed by Forsman et al. [17]. The lower tactical performance found in this study might be explained by differences in the instrument of assessment used (not game-related task vs. representative task). The high values found by Forsman et al. [17] in the assessment of tactical skills suggest a high level of tactical performance, which is unlikely in athletes aged 12–14 years. In the present study, values were classified as moderate and were collected in game-related situations, which is more specific to the modality. In this context, the use of representative tasks

guarantees an environment similar to formal games for the assessment of athletes' skills at solving real game problems [21, 22]. In addition to the specificity of assessment in representative situations, the evaluation of tactical skills based on fundamental tactical principles – specific to situational tactical actions in soccer [10, 11] – represents a better context for future investigations.

Additionally, the improvement in offensive and defensive tactical skills in U-15 athletes compared with U-14 might be related to a more advanced maturation process, which influences players' development in the modality [23] and is related to tactical performance [12]. Therefore, these athletes can achieve better skills of perception and action in game contexts compared with U-14 athletes. Besides, considering that the deliberate practice can lead to (tactical) expertise in soccer [7], we expected a higher development of tactical skills in U-15 athletes because they had a longer involvement with the modality. This was confirmed by the results of the study.

In addition, U-15 athletes presented better performance related to fundamental tactical principles at the end of the season (successful actions corresponded to 87%). This suggests that soccer athletes aged 15 years or more are able to start a systematic training process for the development of the specific tactical principles related to the team's game model [24, 25]. This good knowledge of the fundamental tactical principles at the end of the season is crucial for the understanding of the game model. Conversely, the moderate results for U-14 players suggest that the adoption of a training process oriented to specific principles for U-14 athletes should be progressive.

Literature suggests that decision-making skills, creative thinking, and in-game creative performance – essential for solving problems in sports-based contexts [26] – are better developed in game-based approaches [27]. The nonlinearity of the tactical development found in this study suggests that nonlinear pedagogy might promote players' development through game-based tasks [28, 29]. As athletes of similar categories – U-14 and U-15 – present significant differences in the development of tactical skills, it might be important that their training processes comprise these specificities, adjusting training content and expectations to the athletes' actual conditions. Since nonlinear pedagogy involves manipulating key task constraints to facilitate the emergence of functional movement patterns and decision-making behaviours [28], this approach may lead to practical advances in the soccer training process. Future longitudinal studies may

provide important information on the use of this approach in soccer training.

In regard to changes in the incidences of the fundamental tactical principles throughout the season in each category, literature indicates that U-15 athletes perform more actions of defensive coverage than younger players [30]. Moreover, some research shows that more mature athletes perform more offensive coverage than less mature ones [12]. Coverage actions refer to the support given by an athlete to the ball handler (player in offense) or to the teammate who marks the ball handler (player in defence) [10, 11]. Therefore, the results of this study corroborate the literature indicating a higher incidence of offensive coverage in U-15 athletes and the development of this principle throughout a season in this category. This indicates that the U-15 deliberate practice led to an improvement in athletes' ability to participate in actions near the game centre, which is a desirable behaviour during the organization of offensive and defensive phases of the game. The U-14 category did not present the same results, which suggests that additional explanations are necessary to understand tactical skills development in young soccer athletes.

In addition, the higher incidence (26%) of competitive games in the U-15 category might have led to a higher improvement of tactical skills in these athletes. This rationale is based on the belief that competition plays an important role in athletes' formation in team sports [31] because it provides higher motivation for practice and provides players with frequent challenging situations. This rationale should be further investigated to better understand the inherent characteristics of competition and its role in the development of tactical skills in young athletes.

Finally, this is the first study to investigate the development of tactical skills related to the fundamental tactical principles of young soccer players over a season. The results reinforce the non-linear characteristic of tactical skills development [17, 32]. As for practical applications, it is possible to propose that coaches should plan the training process with the aim to constantly provide situations that stimulate the learning of decision-making in different problem situations [33], even though periods of stabilization and performance decrease might be observed owing to the non-linearity of the learning process. Furthermore, the emphasis on specific training contents, such as a certain tactical principle [34], can be achieved by representation, exaggeration, sampling, or tactical complexity [27] when this principle presents a low incidence. This means that a longitudinal assessment of tactical knowl-

edge may allow to better design training tasks to emphasize specific tactical principles in each moment – preferably the ones that players do not show at a satisfactory performance level.

One of the limitations of the study regards the lack of a deeper description of training contents, as well as the impossibility of intervention in the training process. Therefore, the effects of different activities and pedagogical approaches on tactical skills development are unknown. Indeed, longitudinal studies on different intervention approaches are scarce in soccer training literature and should be comprised in future investigations. Besides, this study was focused on one club only, which might present potential specificities regarding the athletes' formation process. Future research should develop new approaches for comparing athletes of different clubs and competitive levels.

CONCLUSIONS

The tactical performance of U-15 soccer athletes increased over a sports season, which was not observed in the U-14 category, although players from both categories presented changes in the incidence of offensive and defensive tactical principles. This supports the non-linearity of tactical skills development in soccer and justifies the need of constant assessment during the training process across the ages. At this point, tactical skills development in young soccer athletes should be evaluated through game representative tasks, such as in the FUT-SAT protocol. Soccer clubs should designate professionals to elaborate observation protocols and assess the players' tactical skills to optimize the training process in different categories. A structured performance analysis throughout athletes' formation might be useful for supporting coaching staff adjustments in training contents according to players' needs.

Disclosure statement

Disclosure statement: No author has any financial interest or received any financial benefit from this research.

Conflict of interest

Authors state no conflict of interest.

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