Do tactical behavior efficiency and birthdate influence on tactical performance of under-11 soccer players?

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Abstract

The aim of this study was to check if the tactical behavior efficiency and birthdate quartiles influenced the tactical performance of under-11 soccer players. The sample comprised of 102 under-11 soccer players, participants in regional level competitions. The instrument used for the tactical performance assessment was FUT-SAT. Multinomial Logistic Regression tests were used to verify the association between the variables, through the division of tactical behavior efficiency and tactical performance into terciles ($p \leq 0.05$). Positive associations were verified between tactical behavior efficiency and tactical performance index for the defensive unity principle. Also, between the birthdate and the tactical performance index in players who were born within the last quartile of the year. It was concluded that tactical performance was influenced by birthdate and the tactical behavior efficiency.

Key Words: Soccer; Tactics; Relative age effect.

Introduction

In soccer, the high performance of players is related with the efficacy on the accomplishment of tactical actions. Such fact becomes more visible in youth categories of soccer clubs because this is an evaluation and selection period for players, that way, being a determining variable for these athletes' success until elite[1].

Literature pointed out tactical behavior efficiency as one of the factors that influences on tactical performance of players. Therefore there is a tendency that athletes with high efficiency on tactical principles, also present high performance on the modality[2-3]. In a study carried out by Teoldo et al.[4], with players from 11 to 17 years of age, it was found that nine of the tactical behavior efficiencies - from the ten fundamental principles of soccer - influenced positively the tactical performance of the players.

Another factor that seems to interfere on the soccer players' performance is the period of birth[5], as players born on the first months of the year are likely to show a better tactical performance than their peers born on the end of the year. According to Teoldo et al.[4], it was verified a positive association between the defensive tactical performance and the players born on the first semester of the year.

Several studies in youth categories[6-7] verified a higher frequency of players born on the first semester of the year than on the second semester. These studies also pointed out that a difference of almost one year on development of the older players compared to the youngest ones has consequences in important variables for the sports context, like greater physical and cognitive development on those with higher chronological age. This advantage of the players born on the first months of the year, compared with those born on the end of the year, is known as the relative age effect (RAE)[6, 8].

Another factor associated with RAE is the biological age that can be evaluated from the maturity development of each subject. Studies pointed out that the maturity development difference is higher in players between 13 and 15 years of age. For younger players, from 11 to 12 years, chronological age seems to influence more on the performance of the modality than maturity development[9-10].

Mush and Ray[11] analyzed the distribution of professional players in four countries, from all the

continents (except Africa), by the birth quartiles. It was verified a higher frequency of players born on the first two quartiles of the year, in all four populations. Gutierrez et al.[12] also founded similar distribution, by comparing the birth frequency of 4193 Spanish players from under-11 to under-18 categories. These results show that RAE can be observed in different parts of the world and also in different practice phases, like on youth and professional level.

As tactical behavior efficiency and birthdate are pointed as factors that can influence tactical performance, it is necessary to study and understand both of them. This way it is possible to get information that can guide coaches on training systematization, besides rethink the way players are grouped on categories, to achieve competitions on equal basis.

Therefore, the aim of this study is to check the influence of tactical behavior efficiency and birthdate on the tactical performance of under-11 soccer players.

Method

Sample

This is a transversal, descriptive and quantitative research. The sample comprised of 102 soccer players from under-11 category [11 years old players = 70 (68.6%); 10 years old players = 32 (31.4%)] from different clubs from Minas Gerais, competing on regional championships. As sample selection criteria, participants should be participating in a training program, with at least three practice sessions per week.

Players were divided into quartiles based on their birthdates: Q1 (January-March); Q2 (April-June); Q3 (July-September); Q4 (October-December), with the quartiles distribution: Q1 [n = 31 (30.4%)]; Q2 [n = 28 (27.4%)]; Q3 [n = 29 (28.5%)] e Q4 [n = 14 (13.7%)].

A total of 5277 tactical actions were observed in offensive tactical principles: "Penetration" [n = 263; (5.0%)]; "Offensive Coverage" [n = 716; (13.6%)]; "Depth Mobility" [n = 82 (1.5%)]; "Width and Lenght" [n = 1011 (19.2%)] and "Offensive Unity" [n = 417 (7.9%)]; and the defensive tactical principles: "Delay" [n = 534 (10.1%)]; "Defensive Coverage" [n = 127 (2.4%)]; "Balance" [n = 556 (10.5%)]; "Concentration" [n = 473 (9.0%)] and "Defensive Unity" [n = 1098 (52.8%)].

Ethical procedures

To collect birthdate and birthplace data and to perform FUT-SAT test, there was a prior approval from the legal responsible from the club and the players. This study has an ethical approval from Ethics Research Committee with Humans from Federal University of Viçosa, with protocol n. 164/2012/CEP/08-11-07, and were in accordance with the standards of the Declaration of Helsinki (2008) and of the Brazilian National Health Board (466/2012).

Instruments

The System of Tactical Assessment in Soccer "FUT-SAT" was used to collect and analyze data, which allows to evaluate tactical actions with and without the ball, executed by each one of the players[13]. This system allows evaluating the tactical action based in ten core tactical principles of soccer, in which five of them are from the offensive and the other five from the defensive phase (see FIGURE 1)[14]. The spatial references, the tactical actions and the performance index can be consulted on the instrument's conception and development article[15].

With this system it is possible to evaluate the tactical actions executed by players, taking into consideration the quality of the action, the tactical principle executed, the player's position on the playing field at the moment the action is executed, and the result of this action[14].

Phase	Principles	Definitions
Offensive	Penetration	Reduction of distance between the ball carrier and the goal or the opposing goal line.
	Offensive coverage	Offering offensive support to the ball carrier.
	Depth mobility	Create instability on the opponent's defensive organization.
	Width and length	Using and gaining effective game space in width and depth.
	Offensive unity	Moving forward or offensive support from player(s) that make(s) the last transversal line(s) of the team.
Defensive	Delay	Execute opposition to the ball carrier.
	Defensive coverage	Offering defensive support to the delay player.
	Balance	Stability or numeric superiority in opposition relation.
	Concentration	Increase in defensive protection in the highest risk zone of the goal.
	Defensive unity	Effective game space reduction of the opponent's team.

FIGURE 1 - Soccer's core tactical principles.

Design and procedures

To collect data, researchers contacted the legal responsible for the clubs and the coaches from under-11 category. The contact was made through telephone or technical visits to the clubs to explain the aims, proceedings and benefits from the research.

Tests lasted four minutes and happened on a field with 36 m length and 27 m width, and a goal with 6 m width and 2 m height was used. Participants were divided into two different teams, with three players each one, plus goalkeepers. To ease identification, players used numbered vests and each team wore different colors. Before starting the test, participants were asked to play according to official rules, with the exception of the offside rule. The offside rule was not used because the validation protocol of the test field was done without it[15]. Before each test, participants received 30 seconds of "familiarization" period to understand the test format.

A datasheet was used before the test to collect birthdate and birthplace data from the players that participated on the test.

Material and methods

A digital camera (SONY model HDR-XR100) was used to record the matches. Video material was analyzed in a notebook (TOSHIBA model Satellite L755 processor Intel Core™ i3) through USB cable, converting then in AVI files with Prism Video Converter Inc. software. The Soccer Analyzer® software was used for image processing and to analyze the matches. This software allows the insertion of spatial references from the test in the video and enables reliable evaluation of the tactical actions based on movements and position of the players on the field.

Data analysis

The independent variables were the birth quartiles of the athletes and the tactical behavior efficiency. The dependent variable was the tactical performance index. Tactical performance index and tactical behavior efficiency were divided into terciles (low, medium and high). To verify the association between the index of tactical performance with the tactical behavior efficiency and the players' birthdate (Q1, Q2, Q3 and Q4) it was used a Multinomial Logistic Regression. Odds Ratio (OR) (adjusted) were considered if $p < 0.05$.

Cohen's Kappa was used to measure the reliability, using SPSS statistical software for Windows, version 18.0. To check reliability of the test 966 tactical actions were evaluated that represent 18.3% of the sample, a value higher than the used in literature (10%)[16]. In these proceeding, two trained evaluators presented the values between the minimum 0.823 (ep = 0.015) and the maximum 0.875 (ep = 0.012), to intra-observer reliability. To inter-observer reliability, values were between the minimum of 0.851 (ep = 0.013) and the maximum 0.858 (ep = 0.013). For data analysis SPSS for Windows® software, version 18.0, was used.

Results

Comparison of Offensive Tactical Performance Index (OTPI) between moderate and low

It was observed that the birthdate is positively associated to moderate OTPI (TABLE 1). Results showed that players born on the last quartile of the year (Oct-Dec) present 3.3 times more chances to increase their OTPI from low to moderate comparing to those born on the first quartile (Jan-Mar). There was no relation between the tactical behavior efficiency with moderate OTPI for any of the offensive tactical principles.

TABLE 1 - Moderate and high percentage from Offensive Tactical Performance Index (OTPI) and factors associated to it (OPTI).

	Offensive Tactical Performance Index						
	Moderate				High		
Explanatory variables	% Low TPI	% Moderate TPI	Adjusted OR[a]	p	%High TPI	Adjusted OR[a]	p
Penetration							
High	11 (28.9%)	11 (28.9%)	1.0 (0.4-2.3)	1.000	16 (42.2%)	1.5 (0.7-3.1)	0.339
Moderate	7 (29.2%)	12 (50.0%)	1.7 (0.7-4.4)	0.257	5 (20.8%)	0.7 (0.2-2.6)	0.566
Low[b]	11 (47.8%)	7 (30.4%)	-	-	5 (21.7%)	-	-
Support/Depth							
High	21 (41.2%)	17 (33.3%)	0.8 (0.4-1.5)	0.517	13 (25.5%)	0.6 (0.3-1.2)	0.174
Moderate	4 (16.6%)	10 (41.7%)	2.5 (0.8-8.0)	0.121	10 (41.7%)	2.5 (0.8-8.0)	0.121
Low[b]	11 (45.8%)	7 (29.2%)	-	-	6 (25.0%)	-	-
Mobility							
High	13 (34.2%)	15 (39.5%)	1.2 (0.5-2.4)	0.706	10 (26.3%)	0.8 (0.3-1.8)	0.533
Moderate	1 (33.3%)	1 (33.3%)	1.0 (0.1-16.0)	1.000	1 (33.3%)	1.0 (0.1-16.0)	1.000
Low[b]	1 (25.0%)	3 (75.0%)	-	-	0 (0.0%)	-	-
Width							
High	8 (25.0%)	12 (37.5%)	1.5 (0.6-3.7)	0.374	12 (37.5%)	1.5 (0.6-3.7)	0.374
Moderate	12 (36.4%)	13 (39.4%)	1.1 (0.5-2.4)	0.842	8 (24.2%)	0.7 (0.3-1.6)	0.374
Low[b]	15 (46.9%)	9 (28.1%)	-	-	8 (25.0%)	-	-
Offensive Unit							
High	14 (29.8%)	17 (36.2%)	1.2 (0.6-2.5)	0.591	16 (34.0%)	1.1 (0.6-2.3)	0.715
Moderate	7 (33.3%)	8 (38.1%)	1.1 (0.4-3.2)	0.796	6 (28.6%)	0.9 (0.3-2.6)	0.782
Low[b]	10 (41.7%)	8 (33.3%)	-	-	6 (25.0%)	-	-
Birthdate							
Jan - Mar	16 (53.3%)	5 (16.7%)	0.3 (0.1-0.8)	0.023	9 (30.0%)	0.6 (0.2-1.3)	0.167
Apr - Jun	7 (25.9%)	13 (48.1%)	1.6 (0.7-4.7)	0.187	7 (25.9%)	1.0 (0.4-2.9)	1.000
Jul - Sept	11 (39.3%)	12 (42.8%)	1.1 (0.5-2.5)	0.835	5 (17.8%)	0.5 (0.2-1.3)	0.144
Oct - Dec[b]	2 (14.3%)	4 (28.6%)	-	-	8 (57.1%)	-	-

[a]Adjusted Odds Ratio for all model variables (main effects);
[b]Categorical reference: Low and Oct-Dec.

Comparison of Defensive Tactical Performance Index (DTPI) between high and low

The probability to increase DTPI from low to high was observed only for the "Defensive Unit" principle (Table 2). Players who showed high values on the tactical behavior efficiency for this principle showed three times more chances to achieve a high efficiency of DTPI in comparison with those players who presented low tactical behavior values. Tactical behavior efficiency from the principles "Delay", "Depth", "Balance", "Concentration" and the birth quartiles did not relate with high DTPI.

TABLE 2 - Moderate and high percentage from Defensive Tactical Performance Index (DTPI) and factors associated to it (DTPI).

Defensive Tactical Performance Index							
Explanatory variables	Moderate				High		
	% Low TPI	% Moderate TPI	Adjusted OR[a]	p	%High TPI	Adjusted OR[a]	p
Delay							
High	10 (31.3%)	8 (25.0%)	0.8 (0.3-2.0)	0.638	14 (43.8%)	1.4 (0.6-3.2)	0.416
Moderate	6 (20.0%)	14 (46.7%)	2.3 (0.9-6.1)	0.082	10 (33.3%)	1.7 (0.6-4.6)	0.323
Low[b]	18 (46.2%)	13 (33.3%)	-	-	8 (20.5%)	-	-
Depth							
High	13 (33.3%)	14 (35.9%)	1.1 (0.5-2.3)	0.847	12 (30.8%)	0.9 (0.4-2.0)	0.842
Moderate	8 (57.1%)	1 (7.1%)	0.1 (0.1-1.0)	0.050	5 (35.7%)	0.6 (0.2-1.9)	0.410
Low[b]	7 (53.8%)	5 (38.5%)	-	-	1 (7.7%)	-	-
Balance							
High	0 (0.0%)	12 (40.0%)	-	-	18 (60.0%)	-	-
Moderate	13 (39.4%)	14 (42.4%)	1.0 (0.5-2.3)	0.847	6 (18.2%)	0.5 (0.2-1.2)	0.117
Low[b]	22 (57.9%)	9 (23.7%)	-	-	7 (18.4%)	-	-
Concentration							
High	20 (28.6%)	25 (35.7%)	1.3 (0.7-2.3)	0.457	25 (35.7%)	1.3 (0.7-2.3)	0.457
Moderate	8 (50.0%)	3 (18.8%)	0.4 (0.1-1.4)	0.147	5 (31.3%)	0.6 (0.2-1.9)	0.410
Low[b]	6 (50.0%)	4 (33.3%)	-	-	2 (16.7%)	-	-
Defensive Unit							
High	6 (17.6%)	10 (29.4%)	1.7 (0.6-4.6)	0.323	18 (52.9%)	3.0 (1.2-7.6)	0.020
Moderate	13 (39.4%)	10 (30.3%)	0.8 (0.3-1.8)	0.533	10 (30.3%)	0.8 (0.3-1.8)	0.533
Low[b]	16 (45.7%)	15 (42.9%)	-	-	4 (11.4%)	-	-
Birthdate							
Jan - Mar	7 (22.6%)	12 (38.7%)	1.7 (0.7-4.4)	0.257	12 (38.7%)	1.7 (0.7-4.4)	0.257
Apr - Jun	12 (42.9%)	7 (25.0%)	0.6 (0.2-1.5)	0.257	9 (32.1%)	0.8 (0.3-1.8)	0.514
Jul - Sept	12 (41.4%)	10 (34.5%)	0.8 (0.4-2.0)	0.670	7 (24.1%)	0.6 (0.2-1.5)	0.257
Oct - Dec[b]	4 (28.6%)	6 (42.9%)	-	-	4 (28.6%)	-	-

[a]Adjusted Odds Ratio for all model variables (main effects);
[b]Categorical reference: Low and Oct-Dec.

Discussion

The aim of this study was to check the influence of tactical behavior efficiency and birthdate on tactical performance from under-11 soccer players. Results did not show any association between the player's tactical behavior efficiency and the OTPI. In relation to DTPI, statistically significant associations were found for the tactical principle of "Defensive Unit". Players' birthdate showed significant association for players born on the last quartile of the year (Oct-Dec) and OTPI.

Results for offensive tactical performance index did not show any positive relation with the tactical principles. This result can be related to the non-collective aspect of collaboration in this age and to the difficulty to understand the game, what does not show a logical application of the tactical principles according to the needs and the game context modification[17]. Such fact turns out not to influence decisively on the tactical performance of athletes from this sample.

Another relevant factor is the current motor, cognitive and social development phases of under-11 players. Fundamental soccer's tactical principles need abstract thinking and test of hypothesis that allow players to occupy space rationally. This could be better executed from 12 years of age or later, given the child's cognitive development would be in the final phase of maturation[18].

Some characteristics of this phase could also influence those results, like the systematic usage of vision of the ball, leading to a "limitation" to read the game, and the absence of movement from players without the ball[19]. Furthermore, the game becomes static, disoriented, and players indiscriminately pursue the ball, clumping up around it. There's also difficulty of understanding the game logic, making the complexity of the modality difficult to understand, besides acting too much individually[1].

Literature shows nine phases of the sports formation process, which drives the athletes' development in different ages. According to authors, under-11 players are on the universal phase, that is, there is more emphasis on the application of motor and coordination skills over tactical capacities, covered broadly on higher phases[20]. Given the fact that this phase does not work with greater emphasis on the tactical aspects of the game, it is not a surprise that tactical principles do not influence largely the athletes' performance, as it does in older categories, as shown in literature, that there is greater approaching of the modality's tactical specificity[2, 21-22].

Results also pointed out that improved efficiency on "Defensive Unit" behavior can increase significantly the DTPI.

"Defensive Unit" principle is characterized by a unitary concept of defense, with guidelines that ensure an organization able to coordinate cohesive movements in order to guide players away from the ball. Such way, defenders can automatically balance power divisions according to the game dynamics[14]. This indicates that under-11 players must have their spatial orientation and visual perception capacities stimulated and developed, to understand both their partner's and opponent's movements to achieve the cohesion needed to the success of this principle.

The importance of these findings comes from indicating that for this sample the players' performance interference is related to the principle that includes the good usage of the space and the cognitive processes related to the spatial notion, still in development for these athletes[22]. Thus, results shows specific aspects of the under-11 development phase and points out to the necessity to training with more emphasis the "Defense Unit" tactical principle, so that athletes can develop their capacity to better fill spaces and to ensure defensive cohesion for their team.

Birthdate influence was observed only in players born on the last quarter of the year, related to OPTI. Generally, players born on the last months of the year have more chances to show a less advanced maturity state than those born on the beginning of the year[5-6]. Some studies demonstrate differences on the players' physical capacities of those born in different periods of the year, since besides being larger and having higher body mass, older players present better results on velocity and agility tests[10, 23].

Due to physical differences between these athletes, one way for younger athletes to improve their soccer's performance to a level similar to older players' is by improving offensive tactical performance[24]. It happens because younger athletes are stimulated to find solutions to the constrains imposed by the game through tactical dimensions rather than physical advantages[6].

These results showed that there are particularities between different youth categories when compared with similar study carried out by Teoldo et al.[3], wich evaluated players between 13 to 18 years of age,

related to the influence of the tactical principles, since there were different principles that showed higher influence on the development in each category.

In the case of the players' birthdate, it was possible to observe a difference in results for development age, as under-11 players born on the end of the year showed high propensity to reach a better offensive tactical performance. Players from 13 to 18 years born on the first semester showed higher probabilities to have higher tactical performance on the defensive phase than those born on the second semester.

Data seems to highlight different specificities on offensive and defensive phases for soccer's development categories. Apparently, younger players are likely to perform better offensively, while older athletes trend to perform better defensively, taking advantage from their physic, where advantages like size are more decisive for success[25].

Coaches can guide training session through these results, adjusting then to the needs of players' category, for a higher development of athletes on the modality. Researchers who investigate factors that affect performance on the formation process also benefit from these results. The findings points out that it is important to training behaviors related to the tactical principles that emphasize the rational occupation of space.

It is suggested for future studies the evaluation of players' maturity development, including other age groups. Another important information to be included is the modality practice time, because it seams to influence on athletes' performance[26].

Data pointed out positive associations between tactical performance index and the tactical behavior quality on the defensive phase. The probability to achieve high defensive tactical performance index is increased when the execution efficiency of the "Defensive Unit" principle reach higher indexes.

There is a positive association between the offensive tactical performance index and birthdate for players born between October and December over those born from January to March.

It is possible to conclude that both players who presented better efficiency for tactical behavior from "Defense Unit", and those which were born on the last quarter of the year show higher chances to reach elevated tactical performance indexes, compared with the other under-11 soccer players.

Resumo

A eficiência do comportamento tático e a data de nascimento influenciam a performance tática de jogadores de futebol da categoria sub-11?

O objetivo do estudo é verificar se a eficiência do comportamento tático e os quartis de nascimento influenciam a performance tática de jogadores de futebol da categoria sub-11. A amostra foi composta por 102 jogadores de futebol da categoria sub-11, participantes de campeonatos regionais. O instrumento utilizado para avaliar a performance tática foi o FUT-SAT. Utilizou-se o teste de Regressão Logística Multinomial para verificar associação entre as variáveis, a partir da divisão da eficiência do comportamento e da performance tática em tercis ($p \leq 0,05$). Verificou-se associações positivas entre a eficiência do comportamento tático e os índices de performance tática para o princípio de unidade defensiva. Encontrou-se associações positivas entre data de nascimento e o índice de performance tática em jogadores nascidos no último quartil do ano. Conclui-se que a performance tática sofreu influência da data de nascimento e da eficiência do comportamento tático.

Palavras-chave: Futebol; Tática; Efeito da idade relativa.

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