International Journal of Performance Analysis of Sport
2010, 10, 82-97.

Influence of Relative Age Effects and Quality of Tactical Behaviour in the Performance of Youth Soccer Players

Israel Teoldo da Costa[1,2,3,4], Júlio Garganta[3,4], Pablo Juan Greco[2], Isabel Mesquita[3,4], André Seabra[3,4]

[1] University Centre of Belo Horizonte, UNI-BH, Belo Horizonte, MG-Brazil
[2] Federal University of Minas Gerais, UFMG, Belo Horizonte, MG-Brazil.
[3] Faculty of Sport, University of Porto, FADEUP, Porto, Portugal.
[4] Centre of Research, Education, Innovation and Intervention in Sport, CIFI[2]D, FADEUP, Porto, Portugal.

Abstract

The present study examines the associations between tactical performance indexes with quality of tactical behaviours and birth-date quarters of youth Soccer players. The sample comprised a total of 534 youth players classified into four seasons of 3 months (January-March; April-June; July-September; October-December). A system of tactical assessment in Soccer (FUT-SAT) was used to collect data. Descriptive statistics and multinomial logistic regression were applied. The tactical performance indexes were divided into tercis (low, moderate and high) in order to evaluate the influences of relative age effects and quality of tactical behaviours. The quality in the "penetration" and "offensive coverage" principles were positively related to moderate performance indexes. Players with the highest quality in the "depth mobility" and "unity defensive" principles were more likely to present higher performance indexes. Regarding the defensive phase, those with better qualities in the "delay", "concentration" and "defensive unity" principles were more likely to have moderate performance index. Additionally, better quality in the "defensive coverage" and "balance" principles corresponded to a higher likelihood of having a superior performance index. Relative age effects were observed only in high defensive performance index. The present results revealed a positive correlation between tactical performance indexes and quality of tactical behaviours.

Keywords**:** Quality of tactical behaviours, tactical performance index.

1. Introduction

Since the 1970s, many studies have investigated the relative age effects (RAEs) in sport (Barnsley, Thompson, & Barnsley, 1985; Helsen, Starkes, & Van Winckel, 2000; Malina, 1994; Mujika et al., 2009; Williams, Davies, Evans, & Ferguson, 1970). The RAEs, also called the age-group position effects, refer to the overall difference in chronological age between individuals within each age-group, and they may result in physical and cognitive (dis)advantages, which can induce statistical differences in performance (Barnsley et al., 1985; Cobley, Abraham, & Baker, 2008).

Grouping by chronological age is a commonly employed method in sport, in an attempt to ‘‘age-match’’ participants, hence reducing the potential physical and cognitive variation (Musch & Grondin, 2001). However, such a strategy does not seem to be sensitive enough to prevent the RAEs and to provide fair competition and an equal chance of success for all (Helsen, Van Winckel, & Williams, 2005). Some factors suggested as explanations for the skewed pattern of birth season distribution in sport have been recently examined with professional athletes (Costa, Simim et al., 2009; Glamser & Vincent, 2004; Vaeyens, Philippaerts, & Malina, 2005) and young players (Baxter Jones, 1995; Helsen et al., 2000; Musch & Hay, 1999). These include factors associated with chronological age and maturation, environmental factors during early life, different birth patterns within distinct socio-economic groups, urbanization effects, industrialization effects, and season of birth effects on personality traits.

In the context of Soccer, some investigations have divided the population under study into four quarters relative to the month of birth, having showed that players who are born at the beginning of the year are more likely to be selected to play in a team, since they are physically stronger and more experienced than those who are born at the end of the year (Helsen et al., 2000; Musch & Hay, 1999). According to some researchers, the RAEs may lead to a higher perception of competence, self-efficacy, motivation and other cognitive aspects that, in turn, have an impact on the quality of learning and on the players’ level of performance (Ashworth & Heyndels, 2007; Côté, Macdonald, Baker, & Abernethy, 2006; Williams & Ericsson, 2005). As a result, research suggests that children born at the beginning of the year will, on average, perform better than their peers who are born almost one year after the cut-off date, which leads them to have a greater likelihood of increasing extrinsic and intrinsic motivation to maintain their involvement with sport (Helsen et al., 2005). This increase in motivation, coupled with a superior perceived competence, will encourage those born early in the year to continue to practise and to further improve and refine their skills to a greater extent than those born later in that year (Shearer, 1967). Therefore, both physical and cognitive advantages may contribute to the existence of the RAEs in Soccer, mainly in young players (Mujika et al., 2009; Vaeyens et al., 2005).

Furthermore, the RAEs lead to a tendency for early-born players to present a higher likelihood to be identified as talented, and therefore transferred to top teams, thereby benefiting from a higher-quality coaching and from the experience of competing at a more advanced level (Johnson, Doherty, & Freemont, 2009; Malina, Bouchard, & Bar-Or, 2004). Considering that the sport’s infrastructures, the training intensity, and the level of competition are generally better in top clubs, the result will be reflected in the higher productivity of the players (Ashworth & Heyndels, 2007). This perspective for detecting and recruiting talented players implies that sport education can be seen as a way to develop the player’s Soccer skills (Reilly, Williams, Nevill, & Franks, 2000).

In Soccer games, the behaviours of players can range from the simplest reactive actions, such as running towards the ball, to complex reasoning that takes into account the behaviours and strategies of team-mates and opponents. Because of this range, researchers have considered that tactical behaviours are vital to the performance of players and teams (Gréhaigne & Godbout, 1995; McPherson, 1994). As such, researching information about the quality of the players’ movements (efficiency) can be

useful, since sports scientists have highlighted the importance of tactical aspects to the performance in Soccer matches (Garganta, 2006; Gréhaigne, Godbout, & Bouthier, 1997; McPherson, 1994; Vaeyens, Lenoir, Williams, Matthys, & Philippaerts, 2010). This information might contribute to setting appropriate training sessions according to the demands of certain stages of sports development and to the requirements of the game situations (Janelle & Hillman, 2003; Silva, Fernandes, & Celani, 2001; Wilson, 2002). Moreover, it is widely recognized that the rate of maturation impacts upon performance characteristics such as aerobic power, muscular strength, power and endurance, and speed, in addition to body size and fat-free mass (Charles & Bejan, 2009; Malina et al., 2004), but few studies have investigated the role of chronological age and of the skill level on the incidence of the relative age effects (Mujika et al., 2009). Regarding the tactical skills there has not been any investigation which has related its aspects with the relative age effects. Therefore, the purpose of the current investigation is to verify the associations of tactical performance indexes with quality of tactical behaviours and with birth-date quarters of youth Soccer players.

2. Methods

2.1. Sample

The sample included 534 male Soccer players aged 11-17 years from four clubs in the north of Portugal. The players of these clubs participated in regional tournaments. The players' dates of birth were classified into four seasons of 3 months each, considering the cut-off date fixed by FIFA from 1 January to 31 December. Therefore, the first quarter takes into account January, February and March (Q1), the second quarter includes April, May, June (Q2), the third quarter covers July, August, September (Q3), and the fourth quarter considers the months of October, November, and December (Q4).

2.2 Procedure

2.2.1 Applied Method

The System of Tactical Assessment in Soccer (FUT-SAT), developed in the Centre for Team Sports Studies of the Faculty of Sport, University of Porto, was used to collect data. The field test is designed in a space of 36 m long by 27 m wide and requires the player to perform during four minutes (3 vs. 3 with goalkeepers). With the exception of the offside rule, all laws of the game are applied in the field test.

This system considers two macro-categories, seven categories and 76 variables (Costa, Garganta, Greco, & Mesquita, 2009a), and was designed to assess the tactical actions performed by the players (with and without the ball), according to ten core tactical principles of the Soccer game (Costa, Garganta, Greco, & Mesquita, 2009b; Worthington, 1974). Additionally, the evaluation takes into account the action's place and outcome (for details see Table 1). Based on this information, three tactical measures were analyzed: the number of tactical actions performed by the players, the quality of tactical behaviours (tactical behaviours' efficiency), and the tactical performance indexes. Assessment of tactical behaviours' efficiency relies on the correction of the skill's execution, in agreement with the established approaches of mechanical execution (Rink, 1993). To calculate the tactical performance indexes, the tactical behaviours'

efficiency is taken into account, as well as the action's place and the obtained result, in agreement with the goal of the action, i.e., the actions' effectiveness (Rink, 1993).

Table 1. Definitions, categories and sub-categories of variables assessed by FUT-SAT.

Categories	Sub-Categories	Variables	Definitions
Tactical Principles	Offensive	Penetration	Movement of player with the ball towards the goal line.
		Offensive Coverage	Offensive supports to the player with the ball.
		Depth Mobility	Movement of players between the last defender and goal line.
		Width and Length	Movement of players to extend and use the effective play-space.
		Offensive Unity	Movement of the last line of defenders towards the offensive midfield, in order to support offensive actions of the teammates.
	Defensive	Delay	Actions to slow down the opponent's attempt to move forward with the ball.
		Defensive Coverage	Positioning of off-ball defenders behind the "delay" player, providing defensive support.
		Balance	Positioning of off-ball defenders in reaction to movements of attackers, trying to achieve the numerical stability or superiority in the opposition relationship.
		Concentration	Positioning of off-ball defenders to occupy vital spaces and protect the scoring area.
		Defensive Unity	Positioning of off-ball defenders to reduce the effective play-space of the opponents.
Place of Action	Offensive Midfield	Offensive Actions	Offensive actions performed in the offensive midfield.
		Defensive Actions	Defensive actions performed in the offensive midfield.
	Defensive Midfield	Offensive Actions	Offensive actions performed in the defensive midfield.
		Defensive Actions	Defensive actions performed in the defensive midfield.
Action Outcomes	Offensive	Shoot at goal	When a player shoots at goal, and (a) scores a goal, (b) the goalkeeper makes a save, (c) the ball touches one of the goalposts or the crossbar.
		Keep possession of the ball	When team players execute passes to each other and keep up with the ball.
		Earn a foul, win a corner or throw-in	When the match is stopped due to a foul, corner or throw-in; the team that was attacking KEEPS possession of the ball.
		Commit a foul, five away a corner or throw in	When the match is stopped due to a foul, corner or throw-in; the possession of the ball CHANGES to the team that was in defence.
		Loss of ball possession	When the attacking team loses the ball possession.
	Defensive	Regain the ball possession	When the defensive players regain the ball possession.
		Earn a foul, win a corner or throw-in	When the match is stopped due to a foul, corner or throw-in and the possession of the ball CHANGES to the team that was in defence.
		Commit a foul, five away a corner or throw in	When the match is stopped due to a foul, corner or throw-in; the team that was attacking KEEPS possession of the ball.
		Ball possession of the opponent	When the defensive players do not regain the ball possession.
		Take a shot at own goal	When the defensive team takes a shot at their own goal, and (a) takes a goal, (b) the goalkeeper makes a save, (c) the ball touches one of the goalposts or the crossbar.

2.2.2 Data collection

Data for this study was gathered in four different clubs with directors' permission. Managers from the clubs provided the players' birth dates. Prior to the test, a brief explanation of its purposes was given to the players. The teams were formed randomly and the players were wearing numbered vests in order to facilitate their identification. A

30s period had been granted to familiarize them with the test, after which the game began.

2.2.3 Materials

The games were recorded with a digital camera (PANASONIC NV – DS35EG). The digital videos were then transferred to a laptop (LG model E500 CPU Intel T2370) via cable (IEEE 1394) and converted into ".avi" files. Software Utilius VS® and Soccer Analyzer® were used for data processing. The first software was utilized to register and save the tactical actions observed, while the second was built specifically for the FUT-SAT, and it inserts special references in the video, allowing unerring evaluation of the position and movement of the players in the field.

2.2.4 Data Analysis

Data analysis comprises three steps. The first consists in analyzing the tactical actions performed by the players during the match. The unit of analysis is the ball possession, encompassing one of three situations: (a) the player touches the ball at least three consecutive times; (b) the player performs a positive pass (allowing the team to keep possession); (c) the player performs a kick to the goal (Garganta, 1997).

The second step involves the assessment, classification and registration of tactical actions analyzed during the first step. It is supported by a framework of tactical behaviour analysis of FUT-SAT and two software: Soccer Analyser® and Utilius VS®.

The third step involves the calculation of the variables' scores, with reference to the test, through a system developed for *Excel for Windows*® (Figure 1). Through the insertion of data from the second step, this system allows us to automatically calculate all variables present in FUT-SAT.

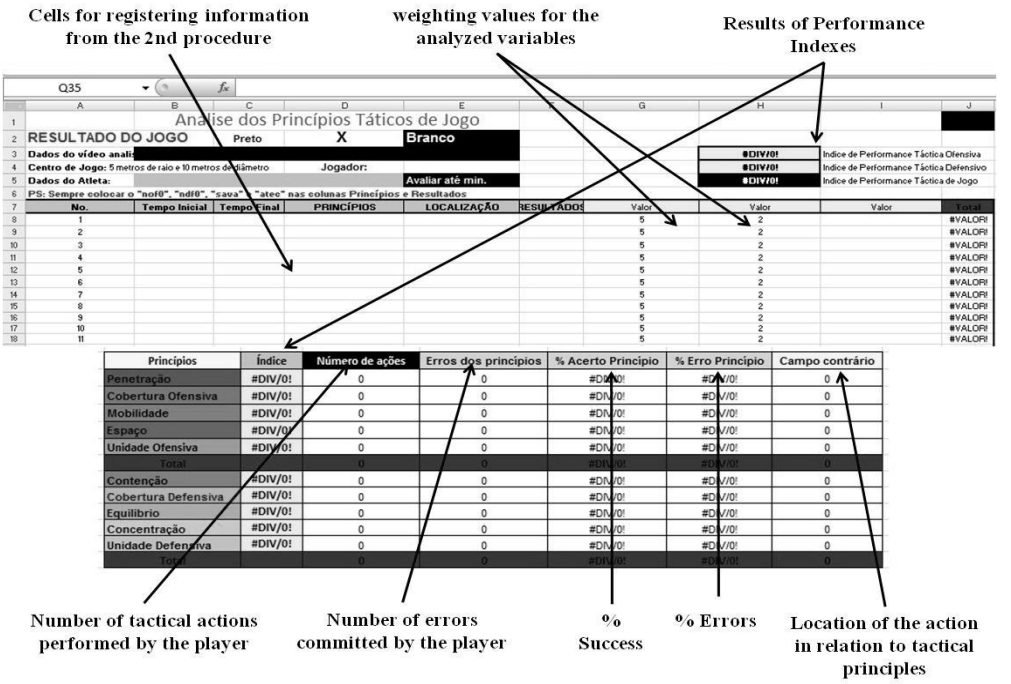

Figure 1. System for calculation of test variables; developed for *Excel for Windows*®.

2.3 Statistical Analysis

Descriptive statistics were used to provide information about different aspects of the sample. The tactical behaviours' efficiency and tactical performances indexes were divided into tercis: low; moderate; high. Multinomial logistic regression models were constructed where the dependent variable was the performance indexes: low (the reference), moderate and high. Independent variables included: tactical behaviours' efficiency (low, medium and high) and birth-date quarters (Q1, Q2, Q3 e Q4). Odds ratios (OR) and 95% confidence intervals for each correlate were adjusted for all other correlates in the models.

In addition, Kappa of Cohen coefficient was used to check the reliability of the observation (Robinson & O´Donoghue, 2007). The test-retest method was done on the same video of player performances to obtain the stability-reliability coefficient. Between test and retest was considered an interval of three weeks to minimize observer's familiarity with the task (Altman, 1991). Five observers were trained to review 4122 tactical actions, representing 14.3% of the sample, a percentage which is above the value of reference (10%) recommended by the literature (Tabachnick & Fidell, 2007). The results revealed inter-observers' agreement coefficients between 0.82 (SD=0.02) and 0.93 (SD=0.02), and intra-observers' agreement coefficients between 0.87 (SD=0.02) and 0.94 (SD=0.01). These values are above the conventional level of acceptance (0.61) (Landis & Koch, 1977). In addition, Kappa of Cohen coefficient was used to check inter- and intra-observers reliability. Statistical procedures were carried out in software EQS 6.1 for Windows® and SPSS for Windows®, version 17.0. The level of significance was set at $p \leq 0.05$. Statistical software EQS 6.1 and SPSS 17.0 were used for all analyses.

3. Results

The sample included similar number of youth Soccer players within the quarters of season of birth (Table 2). The offensive principle more commonly performed by players was "width and length" (34.3%), while the "penetration" was the offensive principle less performed (11.8%). The higher and lower prevalence of defensive principles were "defensive unity" (40.6%) and "defensive coverage" (7.4%), respectively.

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

After adjustment the main factors associated with moderate OTPI were related to "penetration" and "offensive coverage" principles (Table 3). Soccer players with medium to high values of efficiency of "penetration" and "offensive coverage" principles were more likely to have a moderate OTPI. The season of birth and the efficiency in performing actions related to the "depth mobility", "width and length" and "offensive unity" principles were not associated with moderate OTPI.

Table 2. Characteristics of explanatory variables.

Explanatory Variables	Total	
	N	%
Season of Birth		
Q1	144	27%
Q2	134	25%
Q3	121	23%
Q4	135	25%
Offensive		
Penetration	1605	11,8%
Offensive Coverage	3851	28,3%
Width and Length	4670	34,3%
Depth Mobility	1645	12,1%
Offensive Unity	1838	13,5%
Defensive		
Delay	2885	19,0%
Defensive Coverage	1131	7,4%
Balance*	2299	15,1%
Concentration	2726	17,9%
Defensive Unity	6182	40,6%

Comparison of high and low Offensive Tactical Performance Index (OTPI)

The bias of having high OTPI was increased in four offensive principles (Table 3). Players who had high values in the "penetration" and "depth mobility" principles had about twice more chance of getting a high OTPI than players with low tactical behaviours' efficiency in these principles. Athletes with medium worth in the "penetration", "offensive coverage" and "offensive unity" principles also had nearly twice more likelihood of getting a high OTPI when compared to players who had low tactical behaviours' efficiency in these principles. Season of birth and the "width and length" principle had no relation with high OTPI.

Table 3. Percentages of moderate and high offensive tactical performance Index (OTPI), and factors associated with OTPI.

		Offensive Tactical Performance Index							
		Moderate				High			
Explanatory variables	%Low OTPI	%Moderate OTPI	OR Crude	OR Adjusted[a]	p	%High OTPI	OR Crude	OR Adjusted[a]	p
Penetration									
High	45 (23.7%)	70 (36.8%)	2,8 (1,7-4,7)	2.9 (1.7-5.1)	<0.001	75 (39.5%)	2,7 (1,6-4,4)	2.4 (1.4-4.1)	0.002
Medium	39 (27.1%)	56 (38.9%)	2,6 (1,5-4,4)	2.6 (1.5-4.5)	0.001	49 (34.0%)	2,0 (1,2-3,5)	1.9 (1.1-3.4)	0.022
Low[b]	92 (46.0%)	51 (25.5%)	-	-	-	57 (28.5%)	-	-	-
Offensive Coverage									
High	50 (25.9%)	65 (33.7%)	2,0 (1,2-3,5)	2.0 (1.1-3.6)	0.033	78 (40.4%)	2,3 (1,4-3,8)	1.8 (1.0-3.2)	0.062
Medium	57 (31.5%)	68 (37.6%)	1,9 (1,1-3,1)	1.9 (1.1-3.4)	0.034	56 (30.9%)	1,4 (0,9-2,4)	2.0 (1.1-3.7)	0.032
Low[b]	69 (43.1%)	44 (27.5%)	-	-	-	47 (29.4%)	-	-	-
Depth Mobility									
High	50 (25.8%)	63 (32.5%)	1,8 (1,0-3,0)	1.8 (1.0-3.5)	0.071	81 (41.8%)	2,1 (1,2-3,5)	2.0 (1.1-3.8)	0.029
Medium	62 (34.4%)	68 (37.8%)	1,5 (0,9-2,5)	1.5 (0.8-2.6)	0.195	50 (27.8%)	1,0 (0,6-1,7)	1.1 (0.6-2.0)	0.797
Low[b]	64 (40.0%)	46 (28.8%)	-	-	-	50 (31.3%)	-	-	-
Width and Length									
High	51 (26.7%)	58 (30.4%)	1,4 (0,8-2,4)	1.0 (0.5-2.1)	0.903	82 (42.9%)	2,5 (1,5-4,3)	1.9 (1.0-3.7)	0.069
Medium	62 (32.6%)	69 (36.3%)	1,4 (0,8-2,3)	1.5 (0.9-2.7)	0.119	59 (31.1%)	1,5 (0,9-2,6)	1.7 (1.0-3.0)	0.069
Low[b]	63 (41.2%)	50 (32.7%)	-	-	-	40 (26.1%)	-	-	-
Offensive Unity									
High	59 (31.6%)	58 (31.0%)	1,0 (0,6-1,6)	1.0 (0.6-1.8)	0.925	70 (37.4%)	1,6 (1,0-2,7)	1.5 (0.9-2.7)	0.118
Medium	52 (30.6%)	55 (32.4%)	1,1 (0,6-1,8)	1.1 (0.7-2.0)	0.671	63 (37.1%)	1,6 (1,0-2,8)	2.1 (1.2-3.8)	0.010
Low[b]	65 (36.7%)	64 (36.2%)	-	-	-	48 (27.1%)	-	-	-
Season of Birth									
Jan-Mar	49 (34.0%)	47 (32.6%)	0,9 (0,5-1,5)	1.0 (0.5-1.8)	0.931	48 (33.3%)	0,8 (0,5-1,5)	1.0 (0.5-1.7)	0.860
Apr-Jun	46 (34.3%)	41 (30.6%)	0,8 (0,4-1,4)	0.9 (0.5-1.7)	0.732	47 (35.1%)	0,9 (0,5-1,6)	0.9 (0.5-1.7)	0.695
Jul-Sep	40 (33.1%)	43 (35.5%)	1,0 (0,5-1,8)	1.0 (0.5-1.9)	0.992	38 (31.4%)	0,8 (0,4-1,5)	0.8 (0.4-1.5)	0.450
Oct-Dec[b]	41 (30.4%)	46 (34.1%)	-	-	-	48 (35.6%)	-	-	-

[a] Odds ratio adjusted for all the variables in the (main effects) model.
[b] References categories: Low and Oct-Dec.

Table 4. Percentages of moderate and high defensive tactical performance Index (DTPI), and factors associated with DTPI.

		Defensive Tactical Performance Index							
		Moderate				High			
Explanatory variables	%Low DTPI	%Moderate DTPI	OR Crude	OR Adjusted[a]	p	%High DTPI	OR crude	OR Adjusted[a]	p
Delay									
High	25 (17.5%)	54 (37.8%)	4,0 (2,2-7,3)	4.3 (2.3-8.0)	<0.001	64 (44.8%)	5,5 (3,0-9,9)	5.7 (2.9-11.2)	<0.001
Medium	63 (29.3%)	78 (36.3%)	2,3 (1,4-3,8)	2.3 (1.4-3.8)	0.001	74 (34.4%)	2,5 (1,5-4,2)	2.62 (1.5-4.7)	0.001
Low[b]	88 (50.0%)	47 (26.7%)	-	-	-	41 (23.3%)	-	-	-
Defensive Coverage									
High	37 (20.4%)	59 (32.6%)	1,8 (1,1-3,1)	1.6 (0.9-2.8)	0.119	85 (47.0%)	4,0 (2,3-6,8)	2.9 (1.6-5.4)	0.001
Medium	65 (37.8%)	56 (32.6%)	1,0 (0,6-1,6)	1.0 (0.6-1.8)	0.951	51 (29.7%)	1,4 (0,8-2,3)	1.2 (0.6-2.3)	0.575
Low[b]	74 (40.9%)	64 (35.4%)	-	-	-	43 (23.8%)	-	-	-
Balance									
High	40 (23.8%)	58 (34.5%)	1,7 (1,0-2,9)	1.3 (0.8-2.4)	0.305	70 (41.7%)	2,8 (1,6-4,8)	2.0 (1.1-3.8)	0.025
Medium	64 (34.0%)	60 (31.9%)	1,1 (0,7-1,8)	0.9 (0.5-1.5)	0.608	64 (34.0%)	1,6 (1,0-2,7)	1.2 (0.7-2.2)	0.557
Low[b]	72 (40.4%)	61 (34.3%)	-	-	-	45 (25.3%)	-	-	-
Concentration									
High	54 (30.3%)	67 (37.6%)	1,9 (1,2-3,1)	1.3 (0.8-2.3)	0.313	57 (32.0%)	2,1 (1,2-3,5)	1.0 (0.5-1.8)	0.923
Medium	34 (20.6%)	54 (32.7%)	2,4 (1,4-4,1)	1.8 (1.0-3.3)	0.044	77 (46.7%)	4,4 (2,6-7,6)	2.4 (1.3-4.4)	0.007
Low[b]	88 (46.1%)	58 (30.4%)	-	-	-	45 (23.6%)	-	-	-
Defensive Unity									
High	27 (15.9%)	59 (34.7%)	3,3 (1,9-5,7)	3.1 (1.7-5.6)	<0.001	84 (49.4%)	12,6 (6,8-23,3)	12.5 (6.3-24.8)	<0.001
Medium	48 (28.1%)	53 (31.0%)	1,7 (1,0-2,7)	1.6 (0.9-2.7)	0.103	70 (40.9%)	5,9 (3,3-10,4)	6.0 (3.2-11.3)	<0.001
Low[b]	101 (52.3%)	67 (34.7%)	-	-	-	25 (13.0%)	-	-	-
Season of Birth									
Jan-Mar	47 (32.6%)	40 (27.8%)	0,8 (0,4-1,4)	0.9 (0.5-1.7)	0.815	57 (39.6%)	2,1 (1,2-3,9)	2.7 (1.3-5.4)	0.005
Apr-Jun	39 (29.1%)	36 (26.9%)	0,9 (0,5-1,5)	0.8 (0.4-1.5)	0.445	59 (44.0%)	2,7 (1,4-4,9)	2.6 (1.3-5.1)	0.009
Jul-Sep	39 (32.2%)	48 (39.7%)	1,1 (0,6-2,0)	1.2 (0.7-2.2)	0.559	34 (28.1%)	1,5 (0,8-2,9)	1.8 (0.8-3.7)	0.145
Oct-Dec[b]	51 (37.8%)	55 (40.7%)	-	-	-	29 (21.5%)	-	-	-

[a] Odds ratio adjusted for all the variables in the (main effects) model.
[b] References categories: Low and Oct-Dec.

Comparison of moderate and low Defensive Tactical Performance Index (DTPI)
The principles of "delay", "concentration" and "defensive unity" were positively associated with moderate DTPI (Table 4). Players who had high values in the "delay" and "defensive unity" principles have between three and four times more propensity to have a moderate DTPI than their colleagues with a low tactical behaviours' efficiency in these principles. Soccer players with medium worth in the "delay" and "concentration" principles had nearly twice more chance to obtain a moderate DTPI than players who had a low one. Season of birth and "balance" principle were not related to high DTPI.

Comparison of high and low Defensive Tactical Performance Index (DTPI)
All the analyzed variables (tactical behaviours' efficiency and birth-date quarters) were positively associated with high DTPI (Table 4). The highest propensity to present high DTPI was observed in players with medium to high values of efficiency in the "defensive unity" principle. High worth of efficiency in the "delay" principle also leads to about six times more likelihood of obtaining a high DTPI, when compared to players with low tactical behaviours' efficiency in this principle. Additionally, medium values of efficiency in the "delay" and "concentration" principles provided Soccer players with approximately twice the likelihood of having a high DTPI, than their partners who had low tactical behaviours' efficiency in these principles. High values of efficiency in the "defensive coverage" and "balance" principles gave the players with two to three times more likelihood of obtaining a high DTPI than players who had a low tactical behaviours' efficiency in these principles. Players born in the first two quarters of the year were almost three times more likely to have a high DTPI than those born in the second half of the year.

4. Discussion

The aim of this study was to examine the associations between tactical performance indexes with quality of tactical behaviours and birth-date quarters of youth Soccer players. Data showed that the number of tactical actions performed by players of all seasons of birth was similar, with only two statistical differences observed. However, a better tactical behaviours' efficiency in actions related to the "penetration" and "offensive coverage" principles, providing the players between two to three times more the likelihood of having a moderate offensive tactical performance index than those with low values in these principles. High offensive tactical performance index was observed in players who also had higher tactical behaviours' efficiency in the execution of the "depth mobility" and "offensive unity" principles. Regarding defensive tactical performance indexes, it was verified that the players who efficiently performed the tactical actions associated with the "delay", "concentration" and "defensive unity" principles had between two to four times more propensity to obtain a moderate defensive tactical performance index. Beyond this, the players who also executed the tactical actions of "defensive coverage" and "balance" principles with high efficiency had extended between two and twelve times their likelihood of having a high defensive tactical performance index.

These results indicate that the tactical behaviours' efficiency is associated with all performance indexes of youth Soccer players. For the training process, this suggests that

the organization of the sports developmental process according to tactical principles brings advantages to the learning and performance of players (Blomqvist, Vänttinen, & Luhtanen, 2005; Gréhaigne & Godbout, 1995; Oslin, Mitchell, & Griffin, 1998). This statement has been widely emphasized by researchers, because the high number of actions executed by Soccer players without the ball increases the requirement of the tactical and cognitive skills underlying decision-making (Garganta, 2006; Gréhaigne et al., 1997). Moreover, the planning based on tactical guidelines will largely facilitate the decision-making of the players and determine the success of the collective organization (McPherson, 1994; Vaeyens et al., 2010).

The tactical behaviours' efficiency in some principles changed the value of the likelihood of attaining some great offensive tactical performance indexes. The efficiency in the fulfilment of two offensive principles (penetration and offensive coverage) was sufficient for players to have a moderate offensive tactical performance index. However, to achieve a high offensive tactical performance index, the players had to have high tactical behaviours' efficiency in four of five offensive principles (penetration, offensive coverage, depth mobility and offensive unity). These two findings showed that to keep the ball possession and to meet the goals of the attack, all those teams position players who are ahead of, beside, and behind the player with the ball should move continuously in order to ensure that these areas are still filled (Costa, Garganta et al., 2009b; Worthington, 1974).

In addition, these results also indicate that if the players are trained and are able with efficiency to execute their tactical movements, namely the "penetration" and the "offensive coverage" principles, they can obtain a moderate offensive tactical performance index. Such a possibility had already been mentioned by some authors, who have indicated that training processes should begin by the teaching of these two principles, since they present reduced task complexity and are performed near to the ball, increasing the motivation of learners (Garganta & Pinto, 1998; Queiroz, 1983; Wilson, 2002).

Among all the offensive tactical principles, only the tactical behaviours' efficiency in the "width and length" principle was not correlated with any offensive tactical performance indexes. Unfortunately, research assessing behaviours of Soccer players according to these specific tactical principles were not found. While the reasons for the non-correlation are unknown, three arguments could relate to this: i) small-sided games can privilege the other offensive principles to the detriment of the "width and length" principle, due to the restricted number of players; ii) the absence of the "offside" rule can lead players to perform more "depth mobility" actions, since these principles have mutual spatial boundaries; iii) an idiosyncrasy of this sample can have biased these results, hence more studies are necessary to show if it is valid or not.

Concerning the defensive tactical performance indexes, some correlations were observed between them and the tactical behaviours' efficiency. Better tactical behaviour's efficiency in the "delay", "concentration" and "defensive unity" principles distinguished the low and moderate performance indexes. Athletes with high defensive tactical performance index have also performed with higher efficiency in the tactical actions related to the "defensive coverage" and "balance" principles. These results

indicate that successful defensive play depends primarily on the basic defensive positioning, whenever the goals of the defensive team are connected with recovering the ball possession, the prevention of scoring, or the restriction of the opponent's attempt to move forward (Wilson, 2002).

Moreover, results showed that, when applying all the defensive principles, players occupied vital areas that are placed between their opponents and the goal (Costa, Garganta et al., 2009b). This spatial management of the game by the players has been referred in sports literature as being decisive to the success of defensive tactical actions, because the attacker who has a large amount of space with no opponents near him has relatively more time to apply himself to the ball and to make decisions (Garganta & Pinto, 1998; Queiroz, 1983; Worthington, 1974). Perhaps that helps explaining why a high defensive performance index was correlated with the efficiency in the execution of all defensive principles, especially with "defensive unity". This result is not surprising if it is considered that the task of tightly marking players is made much easier when the available passing options of the attackers are reduced (Costa, Garganta et al., 2009b; Worthington, 1974).

As a whole, a high the performance index in the game requires more tactical behaviours' efficiency. Tactical skills and learning of the movements are closely related to the performance indexes of players in the game. Thus, it is possible to claim that developmental stages assume an extremely important role in the appropriate progress of young players, ensuring them the ability to respond to the dynamic configurations of play (Gréhaigne & Godbout, 1998; Williams, 2000).

Furthermore, the results study showed no strong evidence of RAEs in this sample. Only one statistical difference was found among four possibilities (high defensive performance index). The high defensive tactical performance index presented a distinction between players born in the first two quarters and those born in the last two. In this case, the players born in the first half of the year had about three times more likelihood of obtaining a higher index than those born in the last quarter. These findings partially corroborate the observations across social-cultural contexts made by other researches, which have indicated advantages in the selection and performance of the oldest boys (Ashworth & Heyndels, 2007; Cobley, Schorer, & Baker, 2008; Helsen et al., 2005; Helsen, Starkes, & Van Winckel, 1998; Johnson et al., 2009; Mujika et al., 2009; Musch & Hay, 1999; Simmons & Paull, 2001; Vaeyens et al., 2005). Beyond this, data does not confirm the statement of Jiménez and Pain (2008, p. 955) that "In youths, a year's difference can lead to a significant variation in cognitive skills (reflected in game analysis, perception, tactical ability or strategy)".

Therefore, the age grouping of this sample did not create a systematic advantage for early-born players considering the tactical aspects. It was observed that players born in all quarters had similar movement patterns and tactical performance indexes. Probably, this has occurred because the players have benefited from training and competing processes with better teammates and against better opponents, somehow affording them an equal development, and suggesting that tactical aspects are not affected by relative age effects like the physical and anthropometric variables (Helsen et al., 1998; Simmons & Paull, 2001).

The findings of this study show significant implications for those involved in talent detection and identification, because most of these processes are based on physical attributes rather than on tactical or technical skills. According to Helsen et al. (2005), this may be problematic after maturation, a period when this advantage is no longer present and tactical ability may be the overriding factor in achieving success. In this study, it was proved that younger players, although supposedly less developed physically, were able to present performances similar to those of the oldest peers, especially in offensive phase. Hence, it is suggested that, when selecting and identifying players for further development, skill assessments (e.g., technical and accuracy components) should be emphasised, with a lesser degree of importance being attributed to physical attributes (Cobley, Schorer et al., 2008).

5. Conclusion

The data revealed positive associations between tactical performance indexes and the quality of tactical behaviours. Superior performance index required higher quality in the execution of tactical actions related to game principles in both phases of the play. Players with better quality in the execution of "penetration" and "offensive coverage" were more likely to have moderate offensive performance indexes. Athletes with high offensive performance index also exhibited good quality in the "depth mobility" and "offensive unity" principles. For the defensive phase, the players with moderate performance index presented superior qualities in the "delay", "concentration" and "defensive unity" principles, and the players with high index also had better values in the "defensive coverage" and "balance" principles. The relative age effects were verified only in high defensive performance index.

These results suggest that the training process should focus in tactical aspects in order to improve the players' performance. Future research should be encouraged to examine the correlations between performance indexes and quality of tactical behaviours, reapplying FUT-SAT to other samples. It would be interesting to verify if the players' behaviours differ across positional specialization, if their behaviours in the "width and length" principle are distinct, and if the relative age effects occur or not in other samples. Moreover, it is recommendable that future studies apply the field test of FUT-SAT using the "off-side" rule, with the purpose of checking how the players' behaviours are conditioned for this rule. It would be especially helpful to assess longitudinal data and to look over the tactical development in players across the selection process.

6. Acknowledgment

Supported by the Programme AlBan, the European Union Programme of High Level Scholarships for Latin America, scholarship nº E07D400279BR".

7. References

Altman, D. G. (1991). **Practical Statistics for Medical Research.** London: Chapman & Hall.

Ashworth, J. and Heyndels, B. (2007). Selection Bias and Peer Effects in Team Sports: The Effect of Age Grouping on Earnings of German Soccer Players. **Journal of Sports Economics**, 8(4), 355-377.

Barnsley, R. H., Thompson, A. H. and Barnsley, P. E. (1985). Hockey success and birthdate: The relative age effect. **Journal of the Canadian Association of Health, Physical Education and Recreation**, 51, 23-28.

Baxter Jones, A. D. G. (1995). Growth and development of young athletes : should competition levels be age related. **Sports Medicine ACPE**, 20(2), 59-64.

Blomqvist, M., Vänttinen, T. and Luhtanen, P. (2005). Assessment of secondary school students' decision-making and game-play ability in soccer. **Physical Education & Sport Pedagogy**, 10(2), 107-119.

Charles, J. and Bejan, A. (2009). The evolution of speed, size and shape in modern athletics. **The Journal of Experimental Biology**, 212, 2419-2425.

Cobley, S., Abraham, C. and Baker, J. (2008). Relative age effects on physical education attainment and school sport representation. **Physical Education & Sport Pedagogy**, 13(3), 267-276.

Cobley, S., Schorer, J. and Baker, J. (2008). Relative age effects in professional German soccer: A historical analysis. **Journal of Sports Sciences**, 26(14), 1531-1538.

Costa, I., Garganta, J., Greco, P. and Mesquita, I. (2009a). Avaliação do Desempenho Tático no Futebol: Concepção e Desenvolvimento da Grelha de Observação do Teste "GR3-3GR" [Evaluation of Tactical Performance in Soccer: Conception and development of Framework of Tactical Behavior Analysis of "GK3-3GK" Test]. **Revista Mineira de Educação Física**, 17(2), 36-64.

Costa, I. T., Garganta, J., Greco, P. J. and Mesquita, I. (2009b). Princípios Táticos do Jogo de Futebol: conceitos e aplicação [Tactical Principles of Soccer Game: concepts and application]. **Revista Motriz**, 15(3), 657-668.

Costa, V. T., Simim, M. A. M., Noce, F., Costa, I. T., Samulski, D. M. and Moraes, L. C. (2009). Comparison of relative age of elite athletes participating in the 2008 Brazilian soccer championship series A and B. **Motricidade**, 5(3), 13-17.

Côté, J., Macdonald, D. J., Baker, J. and Abernethy, B. (2006). When "where"; is more important than "when": Birthplace and birthdate effects on the achievement of sporting expertise. **Journal of Sports Sciences**, 24(10), 1065-1073.

Garganta, J. (1997). **Modelação táctica do jogo de futebol – estudo da organização da fase ofensiva em equipas de alto rendimento** [Tactical Modelling of Soccer Game- Study of Offensive and Defensive Organization in Top Teams]. Tese de Doutoramento. Faculdade de Ciências do Desporto e de Educação Física da Universidade do Porto, Portugal.

Garganta, J. (2006). Idéias e competências para "pilotar" o jogo de futebol [Ideas and Competences to "drive" a Soccer game]. In **Pedagogia do Desporto** [Sport Pedagogy] (edited by G. Tani, J. O. Bento and R. D. S. Petersen), pp. 313-326. Rio de Janeiro: Guanabara Koogan.

Garganta, J. and Pinto, J. (1998). O ensino do futebol [Teaching of Soccer]. In **O ensino dos jogos desportivos** [Teaching Collective Sports] (edited by A. Graça and. J. Oliveira), pp. 95-136. Faculdade de Ciências do Desporto e de Educação Física da Universidade do Porto: Rainho & Neves Lda.

Glamser, F. D. and Vincent, J. (2004). The relative age effect among elite American youth soccer players. **Journal of Sport Behavior**, 27(1), 31-38.

Gréhaigne, J. F. and Godbout, P. (1995). Tactical Knowledge in Team Sports from a Constructivist and Cognitivist Perspective. **Quest**, 47(4), 490-505.

Gréhaigne, J. F. and Godbout, P. (1998). Formative Assessment in Team Sports in a Tactical Approach Context. **JOPERD**, 69(1), 46-51.

Gréhaigne, J. F., Godbout, P. and Bouthier, D. (1997). Performance assessment in team sports. **Journal of Teaching in Physical Education**, 16(4), 500-516.

Helsen, W., Van Winckel, J. and Williams, A. M. (2005). The relative age effect in youth soccer across Europe. **Journal of Sports Sciences**, 23(6), 629.

Helsen, W. F., Starkes, J. L. and Van Winckel, J. (1998). The influence of relative age on success and dropout in male soccer players. **American Journal of Human Biology**, 10, 791-798.

Helsen, W. F., Starkes, J. L. and Van Winckel, J. (2000). Effect of a change in selection year on success in male soccer players. **American Journal of Human Biology**, 12(6), 729-735.

Janelle, C. M. and Hillman, C. H. (2003). Expert Performance in Sport: Current Perspectives and Critical issues. In **Expert Performance in Sports: Advances in Research on Sport Expertise** (edited by J. Starkes and K. A. Ericsson), pp. 19-47. Champaign, IL: Human Kinetics Publishers.

Jiménez, I. and Pain, M. (2008). Relative age effect in Spanish association football: Its extent and implications for wasted potential. **Journal of Sports Sciences**, 26(10), 995-1003.

Johnson, A., Doherty, P. and Freemont, A. (2009). Chronological versus skeletal bone age in schoolboy footballers. In **Science and Football VI - Proceedings on the Sixth World Congress of Science and Football** (edited by T. Reilly and F. Korkusuz), pp. 132-137. London: Routledge.

Landis, J. R. and Koch, G. C. (1977). The measurement of observer agreement for categorical data. **Biometrics**, 33, 159-174.

Malina, R., Bouchard, C. and Bar-Or, O. (2004). **Growth, Maturation and Physical Activity**. Champaign, IL: Human Kinectics.

Malina, R. M. (1994). Physical growth and biological maturation of young athletes. **Exercise and Sport Sciences Reviews**, 22, 389-434.

McPherson, S. (1994). The Development of Sport Expertise: Mapping the Tactical Domain. **Quest**, 46(2), 223-240.

Mujika, I., Vaeyens, R., Matthys, S., Santisteban, J., Goiriena, J. and Philippaerts, R. (2009). The relative age effect in a professional football club setting. **Journal of Sports Sciences**, 27(11), 1153-1158.

Musch, J. and Grondin, S. (2001). Unequal competition as an impediment to personal development: A review of the relative age effect in sport. **Developmental Review**, 21(2), 147-167.

Musch, J. and Hay, R. (1999). The relative age effect in soccer: cross-cultural evidence for a systematic discrimination against children born late in the competition year. **Sociology of Sport Journal**, 16(1), 54-64.

Oslin, J. L., Mitchell, S. A. and Griffin, L. L. (1998). The Game Performance Assessment Instrument (GPAI): development and preliminary validation. **Journal of Teaching in Physical Education**, 17(2), 231-243.

Queiroz, C. M. (1983). Para uma teoria de ensino/treino do futebol [A theory of Soccer Teaching and Training] . **Ludens**, 8(1), 25-44.

Reilly, A. T., Williams, A. M., Nevill, A. and Franks, A. (2000). A multidisciplinary approach to talent identification in soccer. **Journal of Sports Sciences**, 18, 695-702.

Rink, J. (1993). Teacher education - A focus on action. **Quest**, 45, 308-320.

Robinson, G., and O'Donoghue, P. (2007). A weighted kappa statistic for reliability testing in performance analysis of sport. **International Journal of Performance Analysis in Sport**, 7, 12-19.

Shearer, E. (1967). The effect of date of birth in teachers' assessments of children. **Educational Research**, 10, 51-56.

Silva, F. M., Fernandes, L. and Celani, F. O. (2001). Desporto de crianças e jovens – um estudo sobre as idades de iniciação [Children and youth in Sport - A study about the ages of the beginning of sport practices]. **Revista Portuguesa de Ciências do Desporto**, 1(2), 45-55.

Simmons, G. and Paull, G. (2001). Season-of-birth bias in association football. **Journal of Sports Sciences**, 19, 677-686.

Tabachnick, B. and Fidell, L. (2007). **Using Multivariate Statistics** (5 ed.). New York: Harper & Row Publishers.

Vaeyens, R., Lenoir, M., Williams, A. M., Matthys, S. and Philippaerts, R. M. (2010). The mechanisms underpinning decision-making in youth soccer players: an analysis of verbal reports. In **International Research in Science and Soccer: Proceedings of the First World Conference on Science and Soccer** (edited by B. Drust, T. Reilly and M. Williams), pp. 21-28. London: Routledge.

Vaeyens, R., Philippaerts, R. M. and Malina, R. M. (2005). The relative age effect in soccer: A match-related perspective. **Journal of Sports Sciences**, 23(7), 747-756.

Williams, A. M. (2000). Perceptual skill in soccer: Implications for talent identification and development. **Journal of Sports Sciences**, 18, 737-750.

Williams, A. M. and Ericsson, K. A. (2005). Perceptual-cognitive expertise in sport: some considerations when applying the expert performance approach. **Human Movement Science**, 24, 283-307.

Williams, P. H., Davies, P., Evans, R. and Ferguson, N. (1970). Season of birth and cognitive development. **Nature**, 228(5276), 1033-1036.

Wilson, G. E. (2002). A framework for teaching tactical game knowledge. **Journal of Physical Education, Recreation and Dance**, 73(1), 20-26.

Worthington, E. (1974). **Learning & teaching soccer skills**. Califórnia: Hal Leighton Printing Company.

Correspondence
Israel Teoldo da Costa
Centro de Estudos em Cognição e Ação (CECA)
Escola de Educação Física, Fisioterapia e Terapia Ocupacional da UFMG
Av. Presidente Antônio Carlos, 6627– Pampulha
Belo Horizonte – MG
Cep: 31.310-250
Fone/Fax: 0XX (31) 3499-2325
e-mail: israelteoldo@gmail.com