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original article

Relative age effect on anthropometry, biological maturation and performance of young soccer players

Efeito da idade relativa na antropometria, maturação biológica e desempenho em jovens futebolistas

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Abstract – The study examined the presence of the relative age effect (RAE) and association between birth quartile and anthropometry, biological maturation and physical and technical performance of young Brazilian soccer players. The sample included 119 male players, 74 of U-15 category and 45 of U-17 category, which were divided into quartiles according to the birth year. Biological maturation was assessed using the method of skeletal age of Fels. Anthropometric measurements included body weight, stature and subcutaneous adiposity. Physical fitness assessment included strength tests in the lower limbs, speed, aerobic endurance and anaerobic power. Technical skills included ball control, dribbling and kicking accuracy. Overall, 65.5% of soccer players were born on the first half of the year (c^2= 8.069, p = 0.04); however, in the analysis by category, there was no significant difference in the distribution of birth dates for quartile when compared with the reference population (U-15: c^2=6.322, p=0.10; U-17: c^2=2.339, p=0.50). MANCOVA revealed no significant differences between anthropometry, biological maturation and physical and technical performance in both competitive categories. These results suggest that there is a higher proportion of young Brazilian soccer born on the first months of the year, but that RAE does not necessarily constitute an advantage under the anthropometric, physical and technical standpoint. The process of biological maturation of individuals should be considered by coaches in the selection of athletes.

Key words: Biological maturation; Chronological age; Performance; Soccer.

Resumo – *O estudo teve como propósito investigar a presença do efeito da idade relativa e a influência do quartil de nascimento na antropometria, maturação biológica e desempenho físico e técnico de jovens futebolistas. Foram amostrados 119 futebolistas do sexo masculino, sendo 74 da categoria infantil (sub-15) e 45 da categoria juvenil (sub-17). A data de nascimento dos atletas foi dividida em quatro quartis. Foram avaliadas a massa corporal, a estatura e as dobras cutâneas. A maturação biológica foi acedida através da idade esquelética, pelo método de Fels. O desempenho físico incluiu testes de força de membros inferiores, velocidade, resistência aeróbica e potência anaeróbica. O desempenho técnico foi avaliado pelas provas de controle da bola, condução da bola e precisão de chute. No geral, 65,5% dos futebolistas nasceram no primeiro semestre do ano (c^2=8,069, p=0,04), porém, na análise por categoria, não houve diferença significante na distribuição das datas de nascimento por quartil quando comparado com a população de referência (sub-15: c^2=6,322, p=0,10; sub-17: c^2=2,339, p=0,50). A MANCOVA não revelou diferenças significantes entre os quartis na antropometria, maturação biológica e desempenho físico e técnico em ambas as categorias competitivas. Estes resultados sugerem que existe maior proporção de jovens futebolistas brasileiros nascidos nos primeiros meses do ano, mas que o EIR não constitui necessariamente uma vantagem sob o ponto de vista antropométrico, físico e técnico. Os processos individuais de maturação biológica devem ser considerados pelos técnicos na seleção dos atletas.*

Palavras-chave: *Desempenho; Futebol; Idade cronológica; Maturação biológica.*

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INTRODUCTION

The identification and selection of young talents in soccer is a task that begins at increasingly early ages because these individuals should be involved increasingly early in organized and systematic training and competition processes, adjusted to their growth and development[1]. Throughout this process aimed at high sports performance, young soccer players have to face competitive situations solely defined by chronological age (birth year).

The Fédération Internationale de Football Association (FIFA) has proposed January 1 of each calendar year for the selection year of international sports competitions[2.] Therefore, any young soccer player born between January 1 and December 31 of the respective calendar year participates in a given competitive category. This procedure is intended to provide a more balanced training and sports competition, where opportunities to achieve success are similar among practitioners[3,4]. However, significant interindividual variations in relation to growth, development and biological maturation, which are especially evident in the period of childhood and adolescence, may condition the goal of this procedure.

Although all young people experience the same steps in the process of growth and development, some of them show maturational events earlier or later than their peers at the same chronological age[1]. Differences in chronological age (CA) in a timeline less than 12 months have little importance in adulthood, but may be relevant, particularly during adolescence. This difference in CA among subjects of the same age group is called relative age; and the possible advantage of participation and performance in sports as result of the relative age effect (RAE)[3].

The main explanation for RAE has been the existence of differences in physical and biological maturation. Relatively older athletes tend to show higher physical characteristics and to enter puberty earlier compared to their relatively younger peers, leading coaches to select physically more qualified athletes[1,3,5,6]. RAE was first identified in Canada due to the bias created in the distribution of birth dates of young hockey players selected for national teams, and those born in the first quarter of the respective birth year were the most represented [7].

In soccer, RAE has been consistently observed in several countries, with higher representation of athletes born in the first six months of the year[4,8-11], especially in the age group 15-18 years[4] and in higher competitive levels[8]. However, literature is contradictory as to the possible anthropometric and physical performance advantage that athletes born on 1st quartile would take over those born in the 4th quartile. There are studies that show that relatively older athletes are taller[5,6,10,12] and heavier[5,6] than relatively younger athletes, while others did not find such significant differences[13-16].

It is believed that physical performance is better[12] or shows a tendency [11] in soccer players born on the 1st quartile. On the other hand, there are studies that found no significant differences[13,15,16], and there is a study that found faster motor development in relatively younger soccer players[14]. In

addition, studies on the influence of RAE on the technical performance of soccer players are scarce. Malina et al.[13] did not find tendency of better technical performance in U-14 soccer players relatively older compared to younger ones. According to Votteler & Honer[14], technical skills are less affected by RAE when compared to physical performance.

Given the inconsistent results and the lack of studies on this topic in young Brazilian soccer players, further studies should be carried out. Therefore, the aim of this study was to investigate the presence of the relative age effect and the influence of the birth quartile on anthropometry, biological maturation and physical and technical performance of young Brazilian soccer players.

METHODOLOGICAL PROCEDURES

Sample

Overall, 119 male Brazilian soccer players were sampled, 74 from the Children category (U-15) and 45 from the Juvenile category (U-17), belonging to three teams that competed in competitions organized by the Soccer League of Juiz de Fora, MG and regional-level Soccer Federation of Minas Gerais. According to previous studies[9], the reference population consisted of live births in the city of Juiz de Fora-MG from 1994 to 1997, corresponding to the age group of analyzed categories. Data were obtained from the Live Birth Information System (SINASC), Ministry of Health, and were extracted from the Internet through DATASUS. The study was approved by the Ethics Research Committee of the Federal University of Juiz de Fora, protocol No. 009/11. Soccer players and their parents signed the free and informed consent form.

Relative Age Effect (RAE)

To investigate RAE, the birth date of soccer players was distributed into birth quartiles. The first quartile (Q1) includes players born in January, February and March; the second quartile (Q2), those born in April, May and June; the third quartile (Q3), players born in July, August and September; and the fourth quartile (Q4) included, those born in the months of October, November and December.

Chronological and skeletal age

CA was calculated from the difference between birth date and date on which radiography was performed. Using the radiography of the left hand in pronation with fingers apart and extended and third finger (middle finger) aligned with the radius and the ulna, the skeletal age (SA) was determined by the FELS [17] method and evaluated by an expert (A.F.). This procedure was performed by observing twenty-two bones in a total of ninety-eight different judgment criteria. After determining the parameters for each criterion, data were entered in software (FELShw-1.0 Software), which calculated SA and the estimated standard error. The skeletal age was then

divided by the chronological age (SA / CA ratio) to provide an indicator of skeletal maturation at the time of the study. Ratio greater than 1 (one) means that SA is advanced with respect to CA, while ratio below 1 (one) indicates that SA is delayed in relation to CA[1].

Anthropometry

Height, body mass and skinfolds (triceps, subscapular, supra iliac and geminal) were measured as anthropometric indicators, which was carried out by a single evaluator according to protocol proposed by Lohman et al.[18].

Physical performance

The explosive power of the lower limbs was evaluated by static vertical jump (SJ) and a jump with countermovement (JCM) according to protocol proposed by Bosco et. al.[19]. Each soccer player performed two jumps in an CEFISE ergo-jump device, and the study considered the best value. Aerobic resistance was assessed through the Yo-Yo intermittent endurance test – level 2 (YY-IE2), developed by Bangsbo[20]. To evaluate the relative anaerobic power, the running-based anaerobic sprint test (RAST) proposed by Zacharogiannis et al.[21] was used. Speed was evaluated from the time in seconds obtained in maximum sprints at distance of 5 and 30 meters[22], checked by a system of CEFISE photoelectric cells. Subjects started at 0.3 meters from the initial mark from the stopped position. Subjects made two attempts separated by an interval of 3 minutes. The best value was considered for the study.

Technical performance

For the evaluation of the technical fitness, some tests used in previous studies were used[23,24]. For the evaluation of ball control, in an area of 9x9 meters, the player was asked to keep the ball in the air without using arms or hands. Performance was measured by the number of touches on the ball before it touched the ground. Every soccer player made two attempts and the best result was considered. For the evaluation of dribbling, the player was asked to lead the ball in slalom for 9 flags in a straight line and separated by a distance of 2 meters from the starting line to the last flag and return. The proposal was to complete the path in the shortest time possible without tipping the flags. If some of them were tipped, the player should stop and put it up again. The time was recorded through the system of CEFISE photoelectric cells. The best result of two attempts was considered for the study. The kicking accuracy test consisted of performing three kicks in one minute to a goal of 2.44 meters high and 7.32 meters wide at a distance of 16.5 meters. Through 4 elastics, 2 vertically and 2 horizontally arranged, the goal was divided into nine target areas, and player should put the ball over the goal scored zone. The central quadrant scored 6, the lower quadrants scored 1 and the remaining quadrants scored 3. The performance of this test consisted of the sum of three kicks. In all tests, official ball recommended by the Soccer Federation of Minas Gerais number 5 with pressure of 0.8

bar was used, and all players were asked to carried out the kick with the highest power possible.

Years of sports practice

Soccer players were asked about the number of years of experience in processes of organized and systematized training and competition.

Data collection procedures

The collection of information in this study was conducted in February and March 2011, using three days within one week for the application of tests. On the first day, measurements of height, body mass, skinfolds were performed, as well as some technical and physical fitness tests (speed at 5 and 30 meters and YY-IE2). On the second day, physical fitness, vertical jump, agility and RAST tests were performed. On the third day, X-ray of hand and wrist was performed for SA assessment.

In order to estimate the reliability of results, 15 players were measured and evaluated a second time within an interval of seven days. The technical error of measurement for the anthropometric characteristics was 0.16 cm for height, 0.09 kg for body weight and 0.3 mm to 0.8 mm for skinfolds. The intraclass correlation coefficient values were: 0.87 and 0.93 for SE and SCM, respectively; 0.95 and 0.94 for speed 5 and 30 meters; 0.91 for RAST, 0.86 for ball control, 0.89 for dribbling and 0.75 for the kicking accuracy test. The YY-IE2 test was not replicated.

Statistical procedures

Descriptive data are presented using measures of central tendency (mean) and dispersion (standard deviation). The Chi-square test (χ^2) was used to compare the expected distribution (reference population) and observed distribution (athletes) of birth quartiles. Multivariate analysis of covariance was used (MANCOVA) in each of the competitive categories (U-15 and U-17) to test differences in anthropometry (height, weight and sum of skinfolds), chronological age and biological maturation (skeletal age, SA-CA difference and SA/CA ratio), physical performance (static jumps and countermovement, speed at 5 m and 30 m, YY-IE2, RAST) and technical performance (ball control, dribbling, kicking accuracy) according to the birth quartile. The birth year was considered as a covariate (1997 and 1996 for U-15; and 1995 and 1994 for U-17). When MANCOVA detected statistically significant effect, univariate analysis was used by paired comparison of averages, adjusted by the Bonferroni test. Statistical analysis of F was made from Pillai Trace test. In all analyses, the SPSS v.19 software for Windows was used. The significance level was set at $p < 0.05$.

RESULTS

The distribution of soccer players according to competitive category into birth quartiles is shown in Table 1. Considering all U-15 and U-17 soccer

players, there was a higher representation of athletes born on 1st and 2nd quartiles compared to those born on the 3rd and 4th quartiles. Most athletes (65.5%) were born on the first half of the year. However, in the analysis separated by category, there was no significant difference in the distribution of birth dates for quartile when compared with the reference population.

Table 1. Distribution of birth date quartiles of U-15 and U-17 soccer players compared to the reference population.

	N	1st quartile n (%)	2nd quartile n (%)	3rd quartile (%)	4th quartile n (%)	X^2
Juiz de Fora-MG	29.280	7.892 (27.0%)	7.752 (26.5%)	7.173 (24.5%)	6.463 (22.0%)	
U-15	74	24 (32.4%)	26 (35.1%)	14 (18.9%)	10 (13.6%)	6.322 p=0.10
U-17	45	12 (26.7%)	16 (35.6%)	10 (22.2%)	7 (15.5%)	2.339 p=0.50
All	119	36 (30.2%)	42 (35.3%)	24 (20.2%)	17 (14.3%)	8.069 p=0.04

(X2: chi-square test; 1st Quartile: Jan-Mar; 2nd Quartile: Apr-Jun; 3rd Quartile: Jul-Sep; 4th Quartile: Oct-Dec)

Tables 2 and 3 show the MANCOVA results for anthropometric characteristics, biological maturation and physical and technical fitness of U-15 and U-17 soccer players of different birth quartiles. Multivariate

Table 2. Age, biological maturation, practice time, anthropometry and physical and technical performance of U-15 soccer players according to birth quartiles.

Variables	1st quartile n=24	2nd quartile n=26	3rd quartile n=14	4th quartile n=10
Chronological age (years)	14.61±0.14*	14.37±0.13*	14.12±0.18*	13.86±0.21*
Skeletal age (years)	15.72±2.45	15.57±2.34	14.99±3.23	15.66±3.80
SA-CA difference (years)	1.10±2.45	1.20±2.35	0.87±3.23	1.80±3.81
SA/CA ratio (years)	1.08±0.17	1.08±0.16	1.06±0.22	1.13±0.27
Years of practice (years)	3.39±5.56	4.06±5.34	3.65±7.07	3.70±6.91
Anthropometry				
Height (cm)	167.27±12.56	166.56±12.01	165.27±16.52	168.17±19.50
Weight (kg)	56.92±15.09	53.85±14.43	54.66±19.85	56.15±23.43
Σ skinfolds (mm)	46.75±36.56	39.32±34.96	49.00±48.10	36.32±56.79
Physical performance				
Static jump (cm)	27.25±7.17	28.16±6.86	25.96±9.44	28.62±11.14
Counter-movement (cm)	31.17±7.624	31.96±7.29	28.99±10.02	32.84±11.84
Speed at 5 m (sec)	1.20±0.16	1.17±0.15	1.20±0.22	1.18±0.26
Speed at 30 m (sec)	4.70±0.62	4.70±0.0.59	4.88±0.82	4.59±0.96
YY-IE2 (meters)	792.47±696.19	799.19±665.78	748.79±915.91	860.57±1081.36
RAST (w/kg)	7.73±3.43	8.14±3.29	7.99±4.52	8.74±5.33
Technical performance				
Control (touches)	61.35±58.99	44.79±56.42	45.14±77.62	58.50±91.63
Conduction (sec)	19.10±3.57	20.14±3.41	20.68±4.69	20.05±5.54
Precision (score)	7.72±5.95	8.46±5.69	5.69±7.83	8.90±9.25

Values adjusted by birth year 1996/1997, except for variable chronological age. * Significant difference among birth quartiles.

difference was observed among birth quartiles in both U-15 ($F_{9.207}$=10,82; Pillai trace=0.96; p<0.001) and U-17 players ($F_{9.120}$=7,74; Pillai trace=1.10; p<0.001) in the linear combination of variables chronological age and biological maturation.

From the univariate analysis, it was found that in both competitive categories, the difference that can be attributed to the birth quartile was due to chronological age (U-15 - $F_{3.69}$ = 260.27 p <0.001; U-17- $F_{3.40}$ = 192.07, p <0.001). In both categories studied, no significant differences were observed in anthropometry (U-15: $F_{9.207}$ = 0.75; Pillai Trace = 0.09; p = 0.67; U-17: $F_{9.120}$ = 0.47 ; Pillai Trace = 0.10; p = 0.89), physical fitness (U-15: $F_{18.198}$ = 0.54; Pillai Trace = 0.14; p = 0.93; U-17: $F_{18.111}$ = 1.11; Pillai Trace = 0.46; p = 0.35) and technical performance (U-15: $F_{9.207}$ = 1.65; Pillai Trace = 0.20; p = 0 10, U-17: $F_{9.120}$ = 0.75; Pillai Trace = 0.16; p = 0.66) among quartiles. Significant differences were not observed among birth quartiles in relation to the practice time (U-15: $F_{3.43}$ = 0.32; p = 0.81; U-17: $F_{3.30}$ = 0.75; p = 0.53).

Table 3. Age, biological maturation, practice time, anthropometry and physical and technical performance of U-17 soccer players according to birth quartiles.

Variables	1st quartile n=12	2nd quartile n=16	3rd quartile n=10	4th quartile n=7
Chronological age (years)	16.53±0.13*	16.29±0.12*	16.01±0.15*	15.83±0.18*
Skeletal age (years)	16.53±2.72	16.80±2.39	17.47±2.98	16.91±3.61
SA-CA difference (years)	0.00±2.69	0.51±2.36	1.46±2.94	1.09±3.56
SA/CA ratio (years)	1.00±0.16	1.03±0.14	1.09±0.18	1.07±0.22
Years of practice (years)	6.10±5.76	4.21±4.61	3.67±7.21	5.25±8.00
Anthropometry				
Height (cm)	171.40±11.16	172.65±9.77	170.06±12.19	169.09±14.77
Weight (kg)	62.20±13.45	62.09±11.78	61.59±14.70	57.55±17.80
∑ skinfolds (mm)	39.10±20.82	38.69±18.23	41.27±22.74	37.10±27.55
Physical performance				
Static jump (cm)	28.57±7.27	28.72±6.37	27.81±7.95	27.39±9.63
Counter-movement (cm)	34.62±7.54	33.29±6.60	33.43±8.24	31.96±9.98
Speed at 5 m (sec)	1.13±0.16	1.13±0.14	1.15±0.17	1.15±0.21
Speed at 30 m (sec)	4.43±0.52	4.56±0.45	4.63±0.57	4.42±0.69
YY-IE2 (meters)	833.83±558.80	994.10±489.22	700.34±610.37	921.58±739.37
RAST (w/kg)	9.24±1.98	8.56±1.73	8.06±2.16	8.77±2.61
Technical performance				
Control (touches)	58.98±68.33	51.49±59.82	58.76±74.64	55.54±90.41
Conduction (sec)	19.18±4.46	19.36±3.91	18.85±4.87	18.29±5.90
Precision (score)	7.35±5.64	8.34±4.94	8.40±6.16	10.34±7.46

Values adjusted by birth year 1994/1995, except for variable chronological age. * Significant difference among birth quartiles.

DISCUSSION

The results showed that 65.5% of players were born in the first two quartiles, confirming the presence of RAE in this group. However, those born in the first half of the selection year showed no significant advantage in anthropometry, biological maturation, physical and technical performance compared to those born in the second half.

In relation to the presence of RAE, similar results were observed by Mujikaet al.[8] and Gil et al.[12] in Spanish soccer players (55.3% and 66%, respectively), for Votteler and Honer[14] in Germany (61%) and Deprez et al.[15] in Belgium (64%). This asymmetry may be even greater in higher competitive levels, as reported by Massa et al.[9] in U-14 (78%) and U-16 Brazilian soccer players (71%), by Carling et al.[11] in France (77 %), Hirose[5] in Japan (80.5%) and Helsen et al.[2] in national teams from various European countries (71%).

Competition in the selection process has been identified as one of the possible causes for RAE[2,3]. In the Program of Identification and Development of Talents in Germany, soccer players born on 1st quartile are twice as likely to be selected in relation to those born on the 4th quartile. In elite teams, the probability of selection of those born on the 1st quartile can be four times higher compared to athletes born on the 4th quartile. In Brazil, Massa et al.[9] found 50.8% and 41.9% of soccer players born on the 1st quartile in U-14 and U-16 categories, respectively, compared to 6.3% and 12.9% in the 4th quartile, respectively, in a case-study carried out at "São Paulo Futebol Clube". In Japan, the proportion of elite soccer players born on 1st quartile ranged from 37.9% to 58.8% compared to 3.2% to 13.5% of those born on the 4th quartile[5]. Similar results are observed in Europe in U-15 to U-18 categories[2].

In amateur and / or regional school-level teams, as in the present study, in which selection processes are less demanding, the differences among birth quartiles tend to be smaller[4,8]. In the present study, RAE has not been confirmed when U-15 and U-17 categories were analyzed separately. The lower competitive level of soccer players could be a possible explanation for the lack of significance in values found. However, in the analysis by half (data not shown), RAE was confirmed in the U-15 category (67.5% born on 1st semester) and the absolute percentage observed in the U-17 (62.3% born in the 1st half) were similar to those found in U-17 players who competed in FIFA's world competitions[10]. Thus, the issue of the lack of significance within categories is probably due to the small sample size, featuring a limitation of this study.

Another explanation that RAE is due to the physical advantages of relatively older athletes[3,4,11,12], of this hypothesis has not been confirmed by some researchers[13-16]. In this study, it was found that relative age has no influence on anthropometric characteristics and physical performance of U-15 and U-17 soccer players. Similar results were described by Carling et al.[11], who found no significant differences among birth quartiles for body weight and physical performance except for height. Deprez et al.[15] found

no significant differences in anthropometry and aerobic fitness, but only a trend of soccer players on the 1st quartile to be taller and heavier. In another study[16], the same authors found no influence of birth quartiles in vertical jump performance and speed at 5m and 30m. However, in agility and speed events, Gil et al.[12] observed a better performance in soccer players born on the 1st quartile, who were also taller and heavier.

According to Malina et al.[13], soccer players born in late second half are not always in disadvantage compared to those born in the first half. In fact, there is evidence that relatively young athletes can show better performance than older ones[14], and the explanation for this may be the biological variability. Malina et al.[13] found no differences in size, experience, physical and technical performance in U-14 soccer players, arguing that the low pubertal variation within the sample was the possible cause of results. The sample homogeneity in terms of biological maturation is also the explanation given by Deprezet al.[15] for differences found in aerobic performance among players aged 10-19 years.

In this study, the similarity in skeletal age among quartiles is a possible explanation for the lack of differences in size and physical performance. Higher absolute values of this indicator for players born on the 4th quartile in relation to those born on the 1st quartile were found, although not significant. Thus, as maturation greatly influences the physical and physiological characteristics, especially during adolescence, it is speculated that relatively younger soccer players benefit from a compensation effect. As reported by Deprezet al.[15] younger players tend to reach peak growth velocity earlier, making them physically capable of competing with relatively older players.

It is important to understand that the performance in soccer does not depend solely on a single performance factor, but it is rather the result of an interaction between these factors. Some authors point out that the disadvantage that a young soccer player may show in a certain performance factor may be offset by a better expression in another factor[25]. Reilly et al.26 state that to be a successful soccer player, it is not necessary to be extraordinary in every performance dimension, but rather to be reasonable in most of them.

In this study, no RAE was observed in the technical performance of young soccer players. Similar results were observed by Malina et al.[13] and Votteler and Honer[14].The biological maturation and sport experience are factors that influence the performance level of soccer players[13,26,29]. Matta et al.[29] found that the technical performance of young Brazilian soccer players aged 14-17 years is related to biological maturation, subcutaneous fat, body weight and years of experience and the importance of each of these indicators varies among age categories. Within a relatively homogeneous sample, soccer players born on the first months of the year would have more hours of practice compared with those born at the end of the year, and with advanced biological and with higher maturation, they would have better technical performance [25]. In the present study, no differences in weight body, skeletal age or experience in sports among birth quartiles were found, which may be a possible explanation for the lack of significance

in technical skills among quartiles. It is also possible that relatively young athletes show better tactical skills and decision making compared to older players[27], but these aspects were not measured in this study.

From the practical point of view, the greater representation of soccer players born on the first months of the year may suggest that coaches are selecting athletes with better physical attributes. This potential advantage can decisively influence the training course of these young people, since it may contribute to an increase in behavioral variables such as self-esteem and motivation, as well as the possibility of experiencing more demanding training and competition stimuli[3]. The results of this study indicate that caution must be taken in assessing relationships between RAE and performance. Physical advantages related to age and / or maturation stage during adolescence are highly transient and tend to disappear or even reverse in adulthood. Research has found that the birth date does not influence the opportunity of progression to professional level[11] and a higher proportion of players who at the age of 14 were biologically late has been observed in high-level adult teams[28].

The results found are of great importance for coaches and other professionals responsible for the process of identification, selection and training of young soccer players. These professionals should have knowledge of human growth and biological maturation and respect the development stage that young people show in the different dimensions. They need to understand that players born in the last months of the year are not always late in maturation. It is possible to find young people born on the last quarter of the selection year able to show physical and technical performance similar or even better that those born on the first quartile, so that relative age should be considered a secondary factor[27] in the process of identification, selection and development of young soccer players.

The small sample size, especially the U-17 category and the inability to generalize results to other categories and for players of higher competitive levels are among the study limitations. Moreover, the previous experience of players was not controlled, for example, involvement and practice of other sport before soccer.

CONCLUSION

In conclusion, higher representation of athletes born on the first half of the selection year was observed, confirming the presence of RAE. However, no significant differences were observed among birth quartiles for anthropometry, biological maturation, physical and technical performance of U-15 and U-17 Brazilian soccer players. The causes related to RAE and possible solutions should be better investigated in future studies.

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