Rev Andal Med Deporte. 2020; 13(2): 65-70

Revista Andaluza de Medicina del Deporte

https://ws072.juntadeandalucia.es/ojs

Original

The relative age effect in Brazilian soccer: so what?

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ARTICLE INFORMATION: Received 13 May 2019, Accepted 12 March 2020, Online 13 March 2020

ABSTRACT

Objective: Our purpose was: a) to describe the Relative Age Effect occurrence in Brazilian elite youth soccer players; b) to identify the association between Relative Age Effect and technical skills and c) to examine how Relative Age Effect can affect Physical Fitness.
Method: Eighty-one Brazilian elite soccer players from three age-group teams (U-15, U-17 and U-20) were classified by birth quartiles according to their date of birth. Relative Age Effect was determined when there was a statistically significant difference between players who were born in BQ1 (January through March) to the other birth quartiles (Chi-Square). The association between Relative Age Effect and Technical Rankings was verified by the correlation. The partial correlation controlled for date of birth and for maturity offset was also performed. Relative Age Effect on Physical Fitness was verified by the variance (ANOVA) of its components on each team's birth quartiles.
Results: Players born in BQ1 were the most selected in U-15 (60%) and U-17 (35%) teams, but not in U-20 (25%). A low to moderate (Rho = 0.04 to 0.53) correlation was found between birth quartiles and Technical Rankings, while date of birth and maturation (partial correlation) effects were identified in the U-15 team. Although birth quartiles do not affect Physical Fitness (ANOVA), it may favour some Physical Fitness components ($p < 0.05$).
Conclusions: The greater risk of Relative Age Effect in younger teams is due to the greater emphasis on technical skills. When date of birth and maturation are controlled for, the association between Technical Rankings and birth quartiles is reduced. There was no evidence that Relative Age Effect affected the players' game performance.
Keywords: Sports, Adolescent, Biological Maturation, Soccer, Athletes.

El efecto relativo de la edad en el fútbol brasileño: ¿y qué?

RESUMEN

Objetivo: Nuestro propósito fue: a) describir la ocurrencia del efecto de la edad relativa en jugadores de fútbol juveniles brasileños; b) identificar la asociación entre el efecto de la edad relativa y habilidades técnicas, y c) examinar cómo el efecto de la edad relativa puede afectar la aptitud física.
Método: Ochenta y un jugadores de fútbol de élite brasileños de tres grupos de edad (U-15, U-17 y U-20) fueron clasificados por cuartiles de nacimiento. El efecto de la edad relativa se determinó cuando hubo diferencia estadísticamente significativa entre los nacidos en QN1 (enero a marzo) con los otros cuartiles de nacimiento (Chi-Cuadrado). La asociación entre el efecto de la edad relativa y las clasificaciones técnicas se verificó mediante correlación. También se realizó la correlación parcial controlada por fecha de nacimiento y por madurez. El efecto de la edad relativa en aptitud física se verificó (ANOVA) en sus componentes de los cuartiles de nacimiento.
Resultados: Los jugadores nacidos en QN1 fueron los más seleccionados en los equipos U-15 (60%) y U-17 (35%), pero no en U-20 (25%). La correlación fue de baja a moderada (Rho = 0.04 a 0.53) entre cuartiles de nacimiento y las clasificaciones técnicas, mientras que los efectos de fecha de nacimiento o madurez (correlación parcial) se identificaron en el equipo U-15. Aunque los cuartiles de nacimiento no afectan a la aptitud física (ANOVA), puede favorecer algunos componentes de aptitud física ($p < 0.05$).
Conclusiones: El mayor riesgo del efecto de la edad relativa en el equipo más joven es debido al mayor énfasis en la habilidad técnica. Cuando se controla la fecha de nacimiento así que la madurez, la asociación entre las clasificaciones técnicas y cuartiles de nacimiento baja. No hubo evidencia de que el efecto de la edad relativa afectara a la aptitud física ni el rendimiento de los jugadores.
Palabras clave: Deportes, Adolescente, Maduración biológica, Fútbol, Atletas.

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https://doi.org/10.33155/j.ramd.2020.03.007

O efeito da idade relativa no futebol brasileiro: e daí?

RESUMO

Objetivo: Nosso propósito foi: a) descrever a ocorrência do Efeito da Idade Relativa em equipes de base do futebol brasileiro; b) identificar a associação entre o Efeito da Idade Relativa e habilidades técnicas, e c) examinar como o Efeito da Idade Relativa pode afetar a Aptidão Física.
Método: Oitenta e um jogadores da base de elite (sub-15, sub-17 e sub-20) foram classificados por Quartis de Nascimento. O Efeito da Idade Relativa foi determinado quando houve diferença ($p<0.05$) entre nascidos no QN1 (janeiro a março) em relação aos demais (Chi-Quadrado). A associação entre o Efeito da Idade Relativa e o Ranqueamento Técnico foi determinada por teste de correlação (Rho). Também foi realizada a correlação parcial controlada pela data de nascimento e maturação (Maturity Offset). O efeito da Efeito da Idade Relativa na Aptidão Física foi verificado pela variação (ANOVA) de seus componentes nos Quartis de Nascimento de cada equipe.
Resultados: Os jogadores nascidos no QN1 foram os mais selecionados nos times Sub-15 (60%) e Sub-17 (35%), mas não no Sub-20 (25%). A correlação foi de baixa a moderada (correlação = 0.04 a 0.53) entre os Quartis de Nascimento e Ranqueamento Técnico, enquanto o maior efeito do nascimento ou maturação (correlação parcial) ocorreu para Sub-15. Embora o Quartis de Nascimento não afete a Aptidão Física (ANOVA), pode favorecer alguns componentes da a Aptidão Física ($p<0.05$) em qualquer equipe.
Conclusões: O maior risco de o Efeito da Idade Relativa nas equipes mais jovens é devido à maior ênfase nas habilidades técnicas. Quando a data de nascimento ou maturação é controlada a associação entre Ranqueamento Técnico e Quartis de Nascimento reduz. Não ficou evidente que o Efeito da Idade Relativa afete a Aptidão Física no desempenho do jogo desses atletas.
Palavras-chave: Esporte, Adolescente, Maturação biológica, Futebol, Atletas.

Introduction

The relative age effect (RAE) is a bias in the selection system of athletes in youth sports, where athletes born in the first months of the year receive preference during the selection process (try-outs) due to their early physical development.[1] This phenomenon occurs, in part, because athletes are grouped by age, with the assumption that this system guarantees equitable opportunities, similar development and fair competition.[2] However, grouping athletes this way neglects that humans develop and mature at different rates and periods in their lives, and as a result, provide physical advantages for those who mature early.[3] Consequently, athletes who are born early in the year may reach maturation and development faster than their peers (who are born late in the year) and be considered more advanced and selected to play in older age groups.[4]

In the selection system of sports, coaches may look firstly at players' Physical Fitness (PF; e.g., speed and agility) or inherent physical characteristics (e.g., taller and stronger bodies) .[5] These qualities may help players' performance, especially when observing in game situations (competition or training matches). Additionally, coaches may not emphasize objective characteristics such as intelligence, coaching-capacity and potential talent. The social perspectives, including self-efficacy, self-esteem, mastery and self-image, has been indicated as reasons for the occurrence of factors responsible for the RAE phenomenon.[5,6] To the best of our knowledge, these factors have not been verified empirically and there are suggestions that although athletes may be seen as more talented, in reality they may end up being selected only because of advantages related to maturity in body size, strength, speed and endurance.[7] Therefore, the criteria used in the selection system is questionable since it is a temporary condition and advantage, leading to the risk of missing potential sports talent.

This bias (RAE) is present in Brazilian soccer[8] as well as in other parts of the world,[3,9-11] especially in the younger age groups.[8] Soccer in Brazil is certainly the most practiced sport in the country, with millions of young players dreaming of becoming a professional player and reaching fortune and fame. However, few studies that have investigated RAE in Brazilian youth elite soccer players. The RAE distortion could compromise the selection process of high-level athletes,[12] who are often exported to play in professional teams around the world. While the existence of RAE is supported by the literature, the association with technical skills (game performance), which may be the major issue of the bias caused by RAE,[12] has not yet been empirically confirmed. The real impact of early maturity on PF and the role of RAE in this process needs clarification.

Therefore, the objectives of this study were (a) to describe the RAE occurrence in three elite Brazilian youth soccer players, (b) to identify the association between RAE and technical skills, and (c) to examine how RAE can affect PF of this soccer players.

Methods

Sample

This cross-sectional study was conducted with 81 youth elite male soccer players from Botafogo F. C., Ribeirão Preto, São Paulo. All participants were players in the youth age-group teams Under-15 (n = 35), Under-17 (n = 26) and Under-20 (n = 20), following the classification of the Brazilian Soccer Confederation (Confederação Brasileira de Futebol). These teams were among the top eight teams participating in the Brazilian interstate tournament (comprising 26 states and the Federal District) and have participated in international competition. These athletes train around 40 weeks per year, participate in five training sessions per week (≈ 90-120 min. each session), and play up to two matches per week (usually Wednesdays and Saturdays). The *Botafogo Futebol Clube* has revealed several athletes to professional teams competing in the 1st division of the national league (highest level of competition), both in Brazil and in international clubs.

Experimental Design

To identify RAE occurrence in the teams, the athletes were grouped into four Birth Quartiles (BQs) according to their date of birth: BQ1 (January-March), BQ2 (April-June), BQ3 (July-September) and BQ4 (October-December) .[10] RAE was confirmed when the composition of each team had statistically significant greater frequency of players born in BQ1 than the other BQs of the same year. This criterion is supported by studies with a similar approach that report that during adolescence, older boys born at the beginning of the year are significantly taller and heavier than younger ones.[5-7,13] The grouping of athletes by quartiles should provide better sensitivity of differences, if any.

To verify the RAE associations, the players' Technical Rankings (TR) and technical skills (game performance) were determined.

TR was defined in this study as the system that analyses an athlete's performance in sports competitions and the player's technical quality on the team. In order to determine TR, coaches ranked their players' technical performance (game situation or training), from best to worse, one time considering all players on the team (General TR) and another according to their field position (Position TR). Additionally, the athletes' maturity offset was determined by calculating the age for peak height velocity (PHV), according to a non-invasive method.[11] In this model, interactions and rates between anthropometric measurements (leg height, sitting height, age and weight) are used to determine years for PHV. Detailed PHV procedures applied to young males has been previously described.[14]

RAE's effect on PF was identified by the variance between BQs' and performance tests for specific PF components, namely: a) speed (30m run-in m/min); b) agility (t-test in sec); c) power (six bounding jumps in m); d) average, minimum, maximum and relative (fatigue index/kg) power (RAST anaerobic test in watts), and e) maximum oxygen uptake (Lèger multi-stage test in VO_2máx.). These components are usually part of physical tests for youth soccer players.

Statistical Analysis

Descriptive statistics were used to compare the mean values of the variables studied. The relative frequency analysis identified the higher occurrence of births in BQ1 of each team. RAE was confirmed when there was a statistically significance difference, identified by Chi-square (Goodness of Fit test). The association between BQ and technical skills (TR by coach ranking) was tested by Spearman's rank correlation coefficient (Spearman's Rho), followed by partial correlation of the effect controlled for date of birth and maturity offset (by PHV). ANOVA (one-way) was used to indicate PF differences between BQs of each team. All analyses were performed using SPSS for Windows (version 20.0) with significance level previously stablished ($\alpha = 5\%$).

This study was conducted according to the legal recommendations in the Declaration of Helsinki and approved by the Research Ethics Committee of the School of Physical Education and Sport, University of São Paulo. All subjects and their parents or guardians (when appropriate) signed a Free and Informed Consent forms.

Results

Figure 1 shows the birth quartiles' relative frequencies (%) in each team. Players born in BQ1 were selected the most in the U-15 team (60%), followed by a gradual decrease in the U-17 (34.6%) and U-20 (25.0%) teams. These results indicated a strong trend of RAE occurrence in the youngest age group and decreasing trend in the older teams.

The observed and expected values for each QB is shown for each team (Chi-square Goodness of Fit test). Only the BQ1 in the U-15 team had a statistically significant difference in frequency of players ($X^2 = 23.400$; df = 3; $p<0.001$). The same was not true for U-17 ($X^2 = 3.231$; df = 3; $p = 0.357$) or for U-20 ($X^2 = 0.400$; df = 3; $p = 0.940$). This result supports the existence of RAE only in the U-15 team.

Table 1 shows the association between BQs and TR (general and field position) of each team and the partial correlation results, controlled for date of birth and maturity offset (years for PHV).

The association between BQs and technical skills ranged from low to moderate (0.22 to -0.53) in General TR and was even lower (0.04 to -0.25) in Field Position TR. When controlled for date of birth and for the effect of maturity offset (partial correlation), the association between BQs and technical skills slightly decreased for both comparisons. Thus, the influence of RAE on TR cannot be excluded. In the U-15 team, the control of the date of birth and maturation practically cancelled the effect of BQ on General TR ($r = 0.07$; $r = 0.08$, respectively). The adjusted average ages of the teams were 14.43 ± 0.66, 16.15 ± 0.76 and 18.55 ± 0.61 for U-15, U-17 and U-20, respectively. The PHV of growth occurred for all teams, around 0.43 ± 1.06, 2.31 ± 0.65, 3.83 ± 0.59 for U-15, U-17 and U-20, respectively.

The mean values of PF components, standard deviation, and ANOVA analysis are given in Table 2.

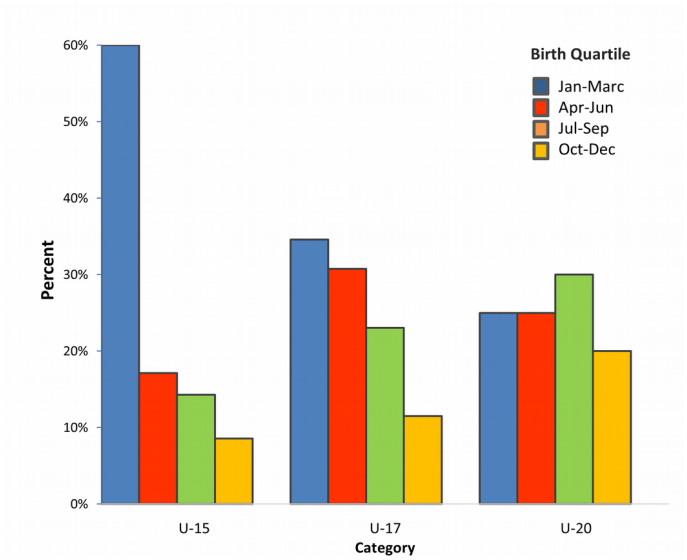

Figure 1. Relative frequency of Birth Quartiles (Jan-Mar; Apr-Jun; Jul-Sep and Oct-Dec) of soccer players in U-15, U-17 and U-20 teams.

Table 1. Correlations between Birth Quartiles and General and Field Position Technical Ranking, controlled separately for date of birth and maturity offset of elite youth soccer players.

	Birth Quartiles of Male Elite Soccer Age Group Teams		
	Under-15 (n=35)	Under-17 (n=26)	Under-20 (n=20)
Technical Skills	Spearman's Rho (partial correlation controlled by date of birth)		
General Technical Ranking	0.30 (0.07)	0.22 (0.19)	-0.53 (-0.61)
Position Technical Ranking	0.04 (0.02)	-0.25 (0.09)	-0.21 (-0.28)
Technical Skills	Spearman's Rho (partial correlation controlled by maturity offset)		
General Technical Ranking	0.30 (0.08)	0.22 (-0.20)	-0.53 (-0.55)
Position Technical Ranking	0.04 (-0.26)	-0.25 (-0.17)	-0.21 (-0.24)

Comparisons of PF components between teams' BQs showed that BQ4 of U-20 performed better in the Agility test ($F = 6.457$, $p = 0.005$) than BQ1 and BQ3. In addition, the Relative Power (Fatigue index) of the U-15 was statistically different of the values found for BQ1 and BQ2 ($F = 3.206$, $p = 0.038$). Any other statistically significant difference was found. Based upon our findings, the differences are not substantive to support the fact that the RAE may be a measure that affects the PF of these youth teams.

Discussion

The findings from our study provided strong evidence of RAE occurrence in the U-15 team, with a diminished prevalence in older teams (U-17 and U-20). Our findings also pointed out that coaches seem to select youth players based on their technical performance, determined by the rankings of the best players. These TR factors are strongly influenced by maturity and date of birth, which should also be determinant in the best technical performance. However, this advantage was not confirmed by the performance in the PF tests. It was not possible to confirm if RAE

Table 2. Descriptive values of Physical Fitness Components and Birth Quartiles analysis of variance (ANOVA) comparison by age-group teams of elite youth soccer players.

Physical Fitness Components	*Birth Quartile*	Under-15 (n = 35)			Under-17 (n = 26)			Under-20 (n = 20)		
		ANOVA			ANOVA			ANOVA		
		Mean ± SD	F	Sig.	Mean ± SD	F	Sig.	Mean ± SD	F	Sig.
Speed 30m run (m/min)	Jan-Mar	5.9 ± 0.40	0.361	0.782	6.0 ± 0.31	2.206	0.119	6.2 ± 0.53	0.358	0.784
	Apr-Jun	6.0 ± 0.55			6.3 ± 0.47			6.5 ± 0.63		
	Jul-Sep	5.8 ± 0.54			6.4 ± 0.33			6.5 ± 0.38		
	Oct-Dec	5.8 ± 0.53			5.9 ± 0.27			6.4 ± 0.26		
Agility T test (sec.)	Jan-Mar	9.4 ± 0.32	1.434	0.252	9.0 ± 0.32	0.999	0.413	9.8 ± 0.31	6.457	0.005
	Apr-Jun	9.4 ± 0.29			8.7 ± 0.35			9.4 ± 0.33		
	Jul-Sep	9.6 ± 0.59			8.9 ± 0.37			9.8 ± 0.32		
	Oct-Dec	9.8 ± 0.30			8.7 ± 0.78			**9.0 ± 0.25**[a,c]		
Power Six bounding jumps (m)	Jan-Mar	13.9 ± 0.89	0.306	0.821	14.4 ± 0.92	0.160	0.922	15.0 ± 1.08	0.411	0.747
	Apr-Jun	14.1 ± 1.59			14.7 ± 1.48			15.0 ± 0.55		
	Jul-Sep	13.5 ± 2.17			14.7 ± 0.83			15.0 ± 1.14		
	Oct-Dec	14.3 ± 0.87			14.3 ± 0.85			15.6 ± 0.99		
Average Power RAST Anaerobic Test (Watts)	Jan-Mar	290.6 ± 77.54	0.138	0.937	318.0 ± 57.05	1.480	0.250	408.4 ± 23.26	1.653	0.220
	Apr-Jun	303.5 ± 64.04			342.7 ± 24.64			466.5 ± 74.36		
	Jul-Sep	279.0 ± 69.24			366.7 ± 46.93			427.9 ± 24.00		
	Oct-Dec	309.9 ± 100.42			353.39 ± 6.75			457.6 ± 41.10		
Maximum Power RAST Anaerobic Test (Watts)	Jan-Mar	372.4 ± 101.67	0.976	0.418	428.7 ± 66.72	0.995	0.416	562.0 ± 89.13	0.231	0.873
	Apr-Jun	444.5 ± 104.29			426.9 ± 105.26			594.8 ± 85.66		
	Jul-Sep	375.8 ± 96.10			497.4 ± 90.56			604.2 ± 75.50		
	Oct-Dec	436.0 ± 119.86			490.1 ± 111.75			608.9 ± 135.55		
Minimum Power RAST Anaerobic Test (Watts)	Jan-Mar	218.7 ± 55.31	0.459	0.713	247.5 ± 46.00	0.602	0.621	318.3 ± 37.90	1.822	0.186
	Apr-Jun	201.7 ± 27.56			268.3 ± 52.10			284.5 ± 111.10		
	Jul-Sep	195.8 ± 41.11			253.7 ± 39.90			290.4 ± 39.22		
	Oct-Dec	234.3 ± 86.45			283.7 ± 32.43			316.0 ± 40.01		
Fatigue Index RAST Anaerobic Test (Watts/sec.)	Jan-Mar	5.0 ± 2.42	0.027	0.994	4.7 ± 1.21	1.059	0.389	6.7 ± 1.89	1.644	0.221
	Apr-Jun	4.9 ± 2.59			4.1 ± 2.45			6.0 ± 2.29		
	Jul-Sep	4.6 ± 2.32			6.4 ± 3.24			8.7 ± 1.60		
	Oct-Dec	4.8 ± 2.94			5.6 ± 3.09			8.4 ± 3.18		
Relative Power (Fatigue Index/Kg)	Jan-Mar	6.0 ± 1.08	3.206	0.038	6.5 ± 0.69	1.686	0.202	7.8 ± 1.10	0.399	0.756
	Apr-Jun	**7.6 ± 1.09**[a]			6.1 ± 0.99			8.2 ± 1.30		
	Jul-Sep	6.8 ± 1.99			7.3 ± 1.12			8.4 ± 0.94		
	Oct-Dec	7.2 ± 0.40			6.9 ± 1.24			8.6 ± 1.50		
Maximum Oxygen Uptake Leger Multi-Stage Test (VO_2max.)	Jan-Mar	48.0 ± 3.75	1.598	0.210	47.4 ± 3.12	1.908	0. 158	45.8 ± 2.69	1.615	0.228
	Apr-Jun	45.2 ± 1.11			45.4 ± 3.21			48.2 ± 2.51		
	Jul-Sep	48.1 ± 2.32			48.4 ± 3.07			49.6 ± 3.63		
	Oct-Dec	49.3 ± 1.56			49.7 ± 1.60			48.6 ± 1.73		

[a, b, c] BQs' Statistically significant differences.

occurrence in the U-15 has given them any advantage in the performance of PF tests, as expected.

Current literature indicates that the RAE phenomenon is present in any form of birth grouping, including by semester,[7,15,16] quartiles (BQ)[10,11] or month.[6,9] The relative frequency of BQ1 (January - March) in our study (Figure 1) revealed a significant RAE occurrence in the U-15 team ($p<0.001$), with only a tendency for the U-17. On the other hand, the U-20's relative frequency supported the non-existence of RAE in this team. The decrease in number of players in BQ1 in the older age groups (U-17 and U-20) suggests that other factors may be more important in the evidenced maintenance of sport talent as well as in the likelihood of becoming a professional player.[9] Although our findings showed a higher frequency of players born in the first half of the year (BQ1 and BQ2), especially in U-17 (BQ2), the main differences in the last quartile occurred markedly in the U-20 team, suggesting a decrease of RAE's effect as athletes get older. Our findings are supported by the literature[8] indicating a decreasing trend in the percentage of selected athletes in BQ1 with increasing age, with the adult team showing no evidence of RAE. The tendency of RAE in elite youth players, especially at younger ages,[2] was observed in the current study. In short, the occurrence of RAE in the selection system of youth soccer players seems to be more frequent at younger ages. Athletes without potential sports talent end up being cut before reaching full potential and only the truly talented athletes reach the highest levels. The relative frequency distribution observed in U-20 (Figure 1) suggests the inexistence of RAE. At this age, players have their careers consolidated, which reinforce the idea of having enough talent to keep them in the sport's elite levels. This assumption is supported by the observation of some of FIFA's top-rated legend-players' date of birth over the years: Maradona (October 30), Pele (October 23), Luis Figo (November 4), Ronaldo (September 18), Alfredo di Stéfano (July 4) and Franz Beckenbauer (September 11), all born close to BQ4. This reinforces the idea that their talent did not come from the date of birth. However, there are also talented athletes who were born in BQ1: C. Ronaldo (February 5), Neymar (February 5); and BQ2: Messi (June 24), among others. Perhaps in older teams (from the U-20 onwards) the chances of the RAE effect prevailing are very small, when the athletes remain in the sport due to their real talent. In this sense, despite the date of birth, talented athletes are identified at an early age.

Players' talent is confirmed as athletes progress (and remain) in their careers, as they advance into the older age groups in their sport. It would be expected that older athletes who were born at the beginning of the year (BQ1), would have PF advantages over athletes born at the end of the year. These advantages may be capable of inducing scouts and coaches to select players for their best physical and technical performance.[3,9,10] However, our findings did not confirm this assumption. With rare exceptions, the best performances in the PF components were not from BQ1 of any team. This suggests that technical decisions are made in response to maturation as game intelligence, self-perception components (self-steam, self-image, self-efficacy, self-mastery, etc.), and other attitudinal elements may support the occurrence of the RAE phenomenon.[5,6] This difference between biologically older athletes (born in the beginning of the year) and younger athletes (born in the end of the year) is commonly reported in development, behaviour and sexual maturation.[7,9,17] However, these differences result in inconsistent (not permanent) physical fitness, temporarily presented by an athlete within the group. That is, it is only a temporary advantage that may decrease as peers on the team advance their maturational stages, equalling the capabilities of those who matured earlier.[18,19]

Specifically in the sporting context, maturation rates seem to have an important influence on the emergence of RAE,[20] since the age difference of up to 364 days may provide a substantial advantage in terms of physical attributes or abilities in adolescence.[12] However, skill is as much of a product of maturity[1] as it is ability.[12] Thus, basing selection decisions on the observed

skill can often result in systematic selection errors due to the influence of maturity. The game performance of youth players in this study was assessed by the TR in each team, based on the overall performance on the team and the field position. The highest association coefficients observed between BQ and TR was in the U-15 team, indicating the effect of RAE in the choice of coaches. When the association was controlled for date of birth and for maturation alone, the coefficients of both fell close to zero. This suggests the explanatory power of date of birth and maturational as factors that explain RAE's occurrence in the U-15 team. A partial inverse correlation was observed up to the U-20 team (Table 1), confirming that effects are reduced as players get older.

Another objective of this study was to examine the effect of RAE on PF, a topic that is seldomly investigated empirically in studies with RAE. Although there were differences in some PF components among the age groups (i.e., agility and relative power), the best performance of these attributes was never related to BQ1, as shown in post-hoc comparisons (Table 2). The relationship between BQs and TR seems to be less evident, despite studies indicating otherwise.[3,21,22] This may happen because the selection of players works mainly in the analysis of the player's performance in the context of the game. Thus, coaches and other decision makers in the selection process generally rely on the observed skill as a proxy for the underlying skills.[12] This suggests that in determining sports talent, other factors may be more important for coaches and scouts when selecting players, regardless of the players' motor skills or their physical attributes. In this sense, coaches need to be informed of the existence of RAE in order to develop more realistic expectations about the PF of their athletes[10] and avoid selection errors, when maturational advantage or early date of birth is confused with talent. This requires more accurate decisions in the selection process of athletes, especially those of younger teams.[16] In addition to a thorough discussion of the current age categorization of teams, the actual systems of competition of youth players could be reduced from 24 to 12 months or even 12 to 6 months to reduce differences among players due to earlier physical development. Other factors such as psychological (perception of competence), physiologic (speed, strength, power) and years of training may also contribute to advantages in youth soccer,[23] but were not explored in our study.

The results from this study did not confirm the real effects of the RAE on PF. However, it does not mean that it does not occur. RAE cannot always be associated with a significant advantage in physical components.[3] Coaches should have realistic expectations regarding athletes' physical abilities, but these expectations should be based more in the context of biological characteristics than in chronological age-based standardization.[3,10,12] This type of questioning is justified by the simple assumption that, in practice, coaches could be more interested in match results than test numbers. For this reason, the use of TR (as used in our study) makes more sense to RAE investigations than PF tests. Thus, the analysis of coaches' perception about players' performance seems as more productive than non-contextualized physical tests, although this technical feeling has not yet been scientifically explained or systematized. A strong assumption from our results is that non-contextualized PF tests do not necessarily have an impact on game performance. As such it should be take carefully by coaches when selecting players.

A limitation of our study was that other emotional factors (e.g., self-control, game intelligence and behaviours that could influence the selection process) were not considered. In addition, although this study suggests that there is RAE in the selection of younger age groups such as the U-15 team, it came from an intentional sampling, and there is no evidence that these young athletes will reach the professional level. Future research may carry out an in-depth analysis on this subject, related to the offer or denial of opportunities to youth soccer players born later in the year.[12] Additionally, studies may conduct a longitudinal monitoring of these processes, even if in a retrospective perspective.

In conclusion, the findings from our study revealed that the current selection system in youth soccer teams, which considers players' date of birth, promoted the occurrence of RAE in the U-15 age group. Additionally, it was not possible to conclude that RAE can affect the performance of PF especially when a check on maturation status or control for date of birth is not done. Perhaps because they do not have a genealogic relationship. RAE is mainly a biased product of coaches' subjective perception of players' performance (what is important during competition) and their goals to win matches.

Authotship. All the authors have intellectually contributed to the development of the study, assume responsibility for its content and also agree with the definitive version of the article. **Funding.** This study was financed in part by the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior. Brasil (CAPES). Finance Code 001. **Acknowledgements.** We are thankful for the Botafogo Futebol Clube's Sports Directorate at Ribeirao Preto, team coaches, athletes and their parents or guardians' permission for the participation in this study. **Conflicts of interest.** The authors declare that there is no conflicts of interest. **Provenance and peer review.** Not commissioned; externally peer reviewed. **Ethical Responsabilities.** *Protection of individuals and animals:* The authors declare that the conducted procedures met the ethical standards of the responsible committee on human experimentation of the World Medical Association and the Declaration of Helsinki . *Confidentiality:* The authors are responsible for following the protocols established by their respective healthcare centers for accessing data from medical records for performing this type of publication in order to conduct research/dissemination for the community. *Privacy:* The authors declare no patient data appear in this article.

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