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Relative age effect in Brazilian Basketball Championship: Under 15 players

Efeito da idade relativa no Campeonato Brasileiro de Basquete: Categoria sub-15

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Abstract – In sport, the relative age effect (RAE) refers to the advantages of participation and performance that athletes born in the first months of the selection year have in relation to those within the same age category. The aim of the present study was to investigate the RAE in athletes of the Brazilian Basketball Championship of the U-15 category in 2015, analyzing differences between sexes, geographic region, competitive level and performance of teams. The information of teams and the birth quarter (quartile) of 530 basketball players were obtained through the website of the Brazilian Basketball Confederation (www.cbb.com.br). The results showed greater representation of male athletes born in the first months of the year, the first and second divisions, of the Southeastern, Northern and Mid-Western regions and in female medalists. It was concluded that the RAE is present in Brazilian U-15 male basketball players, being higher in athletes of higher competitive level, particularly in the Southeastern, Northern and Mid-Western regions of Brazil. In addition, RAE proved to be associated with the winning of women's medals.

Key words: Athletes; Basketball; Relative age.

Resumo – *No esporte, o efeito da idade relativa (EIR) refere-se a vantagens de participação e desempenho que os atletas nascidos nos primeiros meses do ano de seleção possuem em relação aos demais atletas dentro de uma mesma categoria etária. O objetivo do presente estudo foi investigar o EIR nos atletas do Campeonato Brasileiro de Basquetebol da categoria sub-15 em 2015, analisando diferenças entre os sexos, região geográfica, nível competitivo e desempenho das equipes. As informações das equipes e o trimestre de nascimento (quartil) de 530 basquetebolistas foram obtidas através do site da Confederação Brasileira de Basketball (www.cbb.com.br). Foi observada maior representação de atletas nascidos nos primeiros meses do ano da primeira e segunda divisões, das regiões Sudeste, Norte e Centro-Oeste do sexo masculino e nas equipes medalhistas do sexo feminino. Conclui-se que o EIR está presente em basquetebolistas brasileiros da categoria sub-15 do sexo masculino, sendo maior nos atletas de nível competitivo mais elevado, particularmente nas regiões Sudeste, Norte e Centro-Oeste do Brasil. Além disso, o EIR mostrou-se associado à conquista de medalhas no sexo feminino.*

Palavras-chave: *Atletas; Basquetebol; Idade relativa.*

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INTRODUCTION

The need to understand sports excellence, performance and the selection of athletes promotes the interest of several researches, becoming an important field of investigation in the scientific community[1,2]. Several aspects may interfere with the performance of young athletes, including the month of birth. Considering January 1 and December 31 as the start and end of the selection year, respectively, and that young athletes are normally grouped into age categories with an interval of 2 years, there may be a difference of up to 24 months in the chronological age of participants of a same age category, according to their birth date[3].

The difference in chronological age among individuals of the same age category is called relative age[4]. When the birth date distribution of a selected group of athletes differs from the expected normal distribution, with a greater representation of athletes born in the first months of the year, there is a phenomenon known as the relative age effect (RAE)[4]. RAE has directly and indirectly interfered with the selection or dropout of young athletes, as selection considers body size and physical performance, and coaches tend to choose the tallest, strongest and most agile, and most of them are older[5]. Thus, RAE has been observed mainly in contexts of selection of young athletes for national teams and athlete development programs[6].

RAE is more evident in sports in which performance is related to strength, power and body size, predominantly in young athletes, and in teams with higher competitive level[7]. In addition, some studies have shown that RAE may also be associated with better performance[8], being observed in athletes belonging to winning teams, finalists and semi-finalists[9].

In international basketball, RAE was often observed[8,10-13], although such phenomenon is not always observed[14,15]. In the context of Brazilian basketball, the only study with adult athletes did not find RAE in basketball players participating in the 2012 London Olympic Games[16]. In young athletes, Cortela et al.[17] found higher proportion of athletes born in the first half of the year, but only among male Schoolchildren athletes. In athletes of the 2015 Brazilian U-17 Championship, Oliveira et al.[18] found RAE in both sexes, also associating the results to the best teams.

Although studies partially analyzed RAE in Brazilian base category of basketball, no research was found in the U-15 category alone and associated with other variables. It is important to point out that the first official national championship takes place in this category, involving all states of the country. This competition, the Brazilian U-15 Basketball Championship, the target of the present study, is the first selection process for the formation of national and state teams, which attracts the attention of all those involved in the training of athletes in Brazilian basketball. Therefore, investigating the existence of RAE and possible relationships with other variables in this category may contribute to a more appropriate selection process to formation of basketball players.

Thus, the aim of the present study was to investigate RAE in U-15 athletes of the 2015 Brazilian Basketball Championship, analyzing possible differences

between sexes, geographic region, competitive level and team performance.

METHODOLOGICAL PROCEDURES

All participants of the Brazilian U-15 Basketball Championship who played in 2015 were analyzed (n = 530). Male athletes presented on average 15.0 ± 0.5 years, 70.4 ± 13.2 kg and 1.80 ± 0.09 m; female athletes 14.6 ± 0.8 years, 58.2 ± 9.3 kg and 1.68 ± 0.08 m. The information for the study was obtained from the website of the Brazilian Basketball Confederation (CBB) (http://www.cbb.com.br). The use of public data available on the internet for analysis has been described in other studies without need for approval of the ethics research committee[16,18-20].

The championship was played by 27 men's teams and 26 women's teams, each representing one of the Brazilian States and the Federal District. The teams are ranked in divisions (1st division: 10 teams, 2nd division: 8 teams, 3rd division: 9 teams), according to the classification obtained in the previous year's championship. The championship is conducted separately by sex and division. At the end of the championship, the three top-ranked teams ascend to the top division, while the three worst teams are downgraded.

The month of birth of each player was categorized into quartiles: 1st quartile (Q1): January to March; 2nd quartile (Q2): April to June; 3rd quartile (Q3): July to September; 4th quartile (Q4): October to December. In order to investigate the presence of RAE, the distribution of birth quartiles was compared with the expected distribution in the reference population of live births in Brazil in the years 2000 and 2001, using the Chi-Square test (X^2) and Odds Ratio (OR) with 95% confidence interval (CI). OR compared the distribution of the first three quartiles with the last quartile, as recommended by Cobley et al.[7]. Data from the reference population were obtained from the Live Birth Information System (SINASC), extracted from DATASUS (http://datasus.saude.gov.br/). In order to analyze possible factors involved in RAE, the analysis of data was performed separately by gender, geographic region, competitive level and performance (medalists - athletes of teams that obtained the first three places; downgraded - athletes of teams that finished in the last three places; and intermediaries - other athletes). All analyses were performed in the SPSS statistical software version 23.0 (IBM Corp., Armonk, NY), adopting significance level of 5%.

RESULTS

Table 1 shows the X2 test values for the distribution of birthdates. Greater representation of athletes born in the first two quartiles in relation to the last two quartiles for all male athletes was observed.

Table 2 shows the X2 test values and the distribution of athletes by quartile, taking into account the championship divisions. RAE was verified in the 1st division and 2nd division for males.

Table 3 shows the RAE in the Southeastern, Northern and Mid-Western regions only for males, not being found for females.

Table 1. Evaluation of birth quartiles of athletes of the Brazilian U-15 Basketball Championship

	N	Number (%) of athletes per quartile				X^2	p	OR(95% Confidence Interval)		
		Q1(%)	Q2(%)	Q3(%)	Q4(%)			Q1xQ4	Q2xQ4	Q3xQ4
Population	6.322.235	1611004 (25.5)	1659471 (26.2)	1584085 (25.1)	1472675 (23.3)	N/A	N/A	N/A	N/A	N/A
All	530	179 (33.8)	154 (29.1)	114(21.5)	83 (15.6)	31.91	<0.001*	1.97 (1.38-2.81)	1.65 (1.15-2.37)	1.28 (0.88-1.85)
Female	260	71 (27.3)	81 (31.2)	59(22.7)	49 (18.8)	5.56	0.133	1.32 (0.80-2.19)	1.47 (0.90-2.41)	1.12 (0.67-1.87)
Male	270	108 (40.0)	73 (27.0)	55(20.4)	34 (12.6)	38.06	<0.001*	2.90 (1.73-4.85)	1.90 (1.12-3.25)	1.50 (0.87-2.60)

X^2: chi-square test; 1st Quartile (Q1): Jan-Mar; 2nd Quartile (Q2): Apr-Jun; 3rd Quartile (Q3): Jul-Sep; 4th Quartile (Q4): Oct-Dec. p <0.005; N / A: Not applicable.

Table 2. Evaluation of birth quartiles of athletes of the Brazilian U-15 Basketball Championship

Division	Number (%) of athletes per quartile					X^2	P	OR(95% Confidence Interval)		
	Q1(%)	Q2(%)	Q3(%)	Q4(%)	Total			Q1xQ4	Q2xQ4	Q3xQ4
Female										
1st Division	28(28.0)	33(33.0)	18(18.0)	21(21.0)	100	4.25	0.236	1.21 (0.54-2.70)	1.40 (0.64-3.05)	0.80 (0.34-1.85)
2nd Division	20(25.0)	25(31.3)	19(23.8)	16(20.0)	80	1.22	0.748	1.14 (0.46-2.83)	1.39 (0.57-3.37)	1.09 (0.44-2.75)
3rd Division	23(28.8)	23(28.8)	22(27.5)	12(15.0)	80	3.082	0.379	1.75 (0.68-4.70)	1.71 (0.67-4.35)	1.70 (0.66-4.36)
Male										
1st Division	43(43.0)	33(33.0)	15(15.0)	9(9.0)	100	26.642	<0.001*	4.37 (1.75-10.87)	3.26 (1.29-8.22)	1.55 (0.57-4.20)
2nd Division	36(45.0)	15(18.8)	19(23.8)	10(12.5)	80	17.705	<0.001*	3.28 (1.28-8.41)	1.33 (0.48-3.68)	1.76 (0.65-4.74)
3rd Division	29(32.2)	25(27.8)	21(23.3)	15(16.7)	90	3.495	0.321	1.76 (0.75-4.17)	1.47 (0.61-3.52)	1.29 (0.53-3.15)

X^2: chi-square test; 1st Quartile (Q1): Jan-Mar; 2nd Quartile (Q2): Apr-Jun; 3rd Quartile (Q3): Jul-Sep; 4th Quartile (Q4): Oct-Dec. p <0.005

Table 3. Evaluation of birth quartiles of athletes of the Brazilian U-15 Basketball Championship by geographic region

Region	Number (%) of athletes per quartile					X^2	P	OR(95% Confidence Interval)		
	Q1(%)	Q2(%)	Q3(%)	Q4(%)	Total			Q1xQ4	Q2xQ4	Q3xQ4
Female								N/A	N/A	N/A
Northern	21(30.0)	14(20.0)	23(32.9)	12(17.1)	70	4.404	0.221	1.60 (0.60-4.25)	1.04 (0.37-2.88)	1.78 (0.67-4.68)
Southern	5(16.7)	12(40.0)	5(16.7)	8(26.7)	30	4.099	0.251	0.57 (0.13-2.63)	1.33 (0.34-5.15)	0.58 (0.12-2.66)
Southeastern	14(35.0)	15(37.5)	7(17.5)	4(10.0)	40	7.31	0.062	3.19 (0.77-13.2)	3.32 (0.80-13.63)	1.63 (0.36-7.43)
Northeastern	21(26.3)	24(30.0)	19(23.8)	16(20.0)	80	0.891	0.828	1.19 (0.48-2.96)	1.33 (0.54-3.25)	1.10 (0.44-2.75)
Mid-western	10(25.0)	16(40.0)	5(12.5)	9(22.5)	40	5.458	0.141	1.01 (0.29-3.59)	1.57 (0.47-5.24)	0.52 (0.12-212)
Male										
Northern	28(40.0)	20(28.6)	13(18.6)	9(12.9)	70	10.397	0.015*	2.85 (1.03-7.80)	1.98 (0.71-5.55)	1.32 (0.45-3.91)
Southern	10(33.3)	9(30.0)	7(23.3)	4(13.3)	30	2.206	0.531	2.30 (0.49-10.80)	1.99 (0.42-9.45)	1.63 (0.33-8.11)
Southeastern	17(42.5)	14(35.0)	6(15.0)	3(7.5)	40	11.639	0.009*	5.17 (1.13-23.51)	4.13 (0.90-19.04)	1.86 (0.36-9.67)
Northeastern	32(35.6)	25(27.8)	21(23.3)	12(13.3)	90	7.611	0.055	2.43 (1.00-5.93)	1.84 (0.75-4.56)	1.62 (0.64-4.08)
Mid-western	21(52.5)	5(12.5)	8(20.0)	6(15.0)	40	15.914	0.001*	3.19 (0.90-11.36)	0.73 (0.17-3.24)	1.24 (0.31-4.96)

X2: chi-square test; 1st Quartile (Q1): Jan-Mar; 2nd Quartile (Q2): Apr-Jun; 3rd Quartile (Q3): Jul-Sep; 4th Quartile (Q4): Oct-Dec. p <0.005. N / A: Not applicable

Regarding the team performance, RAE was verified only in females, since in males, RAE was observed in all groups.

Table 4. Evaluation of birth quartiles of athletes of the Brazilian U-15 Basketball Championship by team classification

Division	Number (%) of athletes per quartile					X^2	p	OR(95% Confidence Interval)		
	Q1(%)	Q2(%)	Q3(%)	Q4(%)	Total			Q1xQ4	Q2xQ4	Q3xQ4
Female										
Medalists	24(26.7)	35(38.9)	22(24.4)	9(10.0)	90	12.439	0.006*	2.43 (0.92-6.41)	3.44 (1.34-8.81)	2.26 (0.85-6.01)
Intermediaries	26(28.9)	24(26.7)	18(20.0)	22(24.4)	90	2.397	0.985	1.07 (0.47-2.45)	0.97 (0.42-2.20)	0.76 (0.32-1.80)
Lowest ranking	21(26.3)	22(27.5)	19(23.8)	18(22.5)	80	0.149	0.985	1.06 (0.44-2.59)	1.08 (0.45-2.62)	0.98 (0.40-2.40)
Male										
Medalists	33(36.7)	27(30.0)	19(21.1)	11(12.2)	90	10.218	0.017*	2.74 (1.10-6.77)	2.17 (0.87-5.43)	1.60 (0.62-4.14)
Intermediaries	37(41.1)	24(26.7)	19(21.1)	10(11.1)	90	14.933	0.002*	3.37 (1.35-8.44)	2.12 (0.83-5.46)	1.76 (0.67-4.63)
Lowest ranking	38(42.2)	22(24.4)	17(18.9)	13(14.4)	90	14.402	0.002*	2.67 (1.12-6.33)	1.50 (0.61-3.70)	1.20 (0.47-3.08)

X^2: chi-square test; 1st Quartile (Q1): Jan-Mar; 2nd Quartile (Q2): Apr-Jun; 3rd Quartile (Q3): Jul-Sep; 4th Quartile (Q4): Oct-Dec. p <0.005.

DISCUSSION

The aim of the present study was to investigate the presence of RAE in Brazilian U-15 basketball athletes, analyzing possible intervening variables. The presence of RAE was verified in males, in teams in the Southeastern, Northern and Midwestern regions, and in first and second division athletes, regardless of the team's final classification. However, for females, RAE was found only in the best ranked teams.

The results found in the present study corroborate those of the international literature[10-12,21,22]. Multiple factors related to the individual (birth date, sex and maturation), task (type of sport, competitive level and game position) and environment (sports system-division into categories, popularity of sport, influence of family and coaches) interact for the occurrence of RAE[4,19,23]. Of these factors, the emphasis on the physical aspects related to the sport performance for the selection of talents and the grouping into age categories that last about two years are pointed out as the main responsible for the occurrence of RAE.

Regarding gender, RAE is particularly evident in males in various modalities[24], including basketball, so the results found confirm the findings of other studies with U-15 basketball players in France[5,11] and Spain[21,22]. Studying RAE in this category becomes important, since from 13 to 15 years, boys are in a period of great biological variability, as a function of the growth spurt. In this period of adolescence, due to maturational processes, chronologically older boys are generally taller and heavier, stronger and faster, and exhibit greater cognitive abilities and greater sports experience, resulting in temporary performance advantages over their peers chronologically within the same age category[4].

In female athletes, RAE is not so evident[20] and tends to disappear in adulthood[8,14] and there are situations in which inverse RAE is observed[25]. Our findings for females do not corroborate the available literature. In young female basketball players, RAE was observed in French girls aged 7-18 years[5,11], in Brazilian schoolchildren[17] and in U-17 athletes of the 2015 Brazilian Basketball Championship[18]. Some factors could explain the inconsistency of findings in females such as: less competition in selective processes and lower maturational variability in girls at ages when athletes are usually selected[20,26].

In relation to the competitive level, the presence of RAE is directly proportional to higher demand levels[4,7], starting from sports training programs[21]. In the present study, RAE was verified in the 1st and 2nd division of the men's Brazilian championship. This result corroborates results found in Spanish basketball[12], where the effect was found in the first three divisions. The presence of RAE at higher competitive levels was found in a meta-analysis with athletes of different modalities and countries[7]. Thus, the results of the present study corroborate the premise that greater competition in the selective process may aggravate RAE[25].

In fact, the chronological age of young athletes in relation to their peers has been considered a relevant factor, which affects the athlete's chance of achieving higher performance levels[7,19]. However, coaches and managers should be careful in the conduction of selective processes, since the quality of the evidence of the relationship between birth date and athletic success is insufficient[27]. In the present study, for example, RAE was not associated with the performance of men's teams, but it was observed that RAE could somehow influence the results for females, since this phenomenon was found only in athletes from the best classified teams. Similar result was found in U-17 Brazilian basketball players[18].

The association of RAE with the final classification of the team found in this study and in the study of Oliveira et al.[18] suggest as a consequence of RAE in the Brazilian Women's Championship a better performance of teams in the U-15 and U-17 categories. However, the same cannot be said about the final classification of men's teams. Other studies on the relationship between RAE and performance in young basketball players found that athletes born in the first months of the year had better performance in three-point shot in the U-17 category of the world basketball championship[8] and improved performance in some technical foundations for both sexes in Polish basketball players of various categories[28].

In the present study, caution is required in interpreting the relationship between RAE and classification of teams in the championship, since the birth year of athletes was not controlled in this analysis. It is known that in the short term, coaches end up selecting older athletes based on their immediate performance, implying better conditions and development opportunities, unlike younger athletes who end up leaving the sport more frequently[5,29].

Another relevant aspect in the analysis of RAE relates to the birth place of athletes, in this study represented by the geographic region of each

team. RAE was observed in male athletes belonging to the Northern, Southeastern and Mid-Western basketball federations. Some studies attribute the cause of RAE to the context, more specifically between RAE and the number of inhabitants of the city[15,20]. Although it is not possible to attribute cause or relationship between the results found and other studies, it is noteworthy that the Southeastern region has greater number of teams, and also, have the states with more titles won in all editions of the Brazilian Basketball championships.

As a practical implication, it is recommended that coaches, federations and confederations know about RAE, the variables associated with this phenomenon and its consequences in order to avoid early dropout of sports practice[29]. In the base categories of French basketball, in boys, the highest dropout occurs in those born in the 4th quartile, especially at 13-14 years, while in girls, it occurs earlier, around 11-12[5]. According to the study[5], athletes born in the 3rd and 4th quartiles tend to abandon basketball because they are smaller, have lower performance, play less time and therefore experience fewer positive experiences, reducing their perceived competence.

Possible solutions to minimize this problem include, for example, dividing age categories into intervals of at least 12 months[4,11], and more recently the combination of the annual rotation of the selection cutoff point (January 1 and July 1) and additional training support to relatively younger athletes has been considered a very effective strategy[24]. According to Werneck et al.[24], the strategy adopted must take into account not only available scientific evidence, but also the logistics for its implementation in practice, which often implies changes in the structure of competitions. The way the Brazilian Base Basketball Championship was organized may need to be adjusted to reduce RAE in the process of selecting young basketball players.

CONCLUSION

The present study brings new contributions to the knowledge of the relative age effect in basketball in the hope that the selection of athletes in basketball will advance in order to avoid athletes being early excluded from the process of sports formation. It was concluded that RAE is present in the U-15 category of basketball players who competed in the 2015 Brazilian Basketball Championship. The presence of RAE was statistically significant in male athletes, in athletes in the 1st and 2nd divisions, athletes in the Southeastern, Northern and Mid-Western regions and presented a relationship with the winning of medals in women.

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