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Birth month distribution and anthropometric measures of U-15 national elite soccer players

Distribuição do mês de nascimento e medidas antropométricas de jogadores de futebol de elite nacional sub-15

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Abstract – The aim of this study was to analyze the birth month distribution and anthropometric measurements of U-15 elite soccer players. The sample consisted of 400 athletes (15.4 ± 0.4 years, 171.0 ± 10.6 cm and 63.0 ± 8.8 kg) participants of the 11th edition of the Brazil U-15 Soccer Cup, who had their birth month information and height and body mass measures obtained from data available on the organization's website. Athletes were separated according to the categorization of chronological age into four-month periods: 1st quarter (1st QDT), athletes born between January and April; 2nd quarter (2nd QDT), those born between May and August, and 3rd quarter (3rd QDT), those born between September and December. The non-parametric chi-square test (X^2) was used to analyze the possible differences between observed and expected birth date distributions in the four-month periods. The significance level was $P<0.05$. The results show that the number of players born in 1st QDT was higher when compared to 2nd QDT and 3rd QDT ($P<0.05$), and higher when compared to 2nd QDT with 3rd QDT ($P<0.05$). For variables height and body mass, it was observed that players born in 1st QDT presented values significantly higher than those born in 2nd QDT and 3rd QDT ($P<0.05$). In the same way, players born in 2nd QDT presented higher values than those born in 3rd QDT ($P<0.05$).It could be concluded that the relative age effect exerts an influence on the selection of Brazilian U-15 soccer players because it is associated with differences in the anthropometric characteristics of these young players.

Key words: Adolescent; Antrhopometric; Soccer.

Resumo – *O propósito deste estudo foi analisar a distribuição do mês de nascimento e a influência do efeito relativo da idade (ERI) sobre as medidas antropométricas de jogadores de futebol de elite nacional sub-15. Para tanto, a amostra foi composta por 400 atletas (15,4 ± 0,4 anos; 171.0 ± 10,6 cm e 63,0 ± 8,8 kg) participantes da 11ª edição da Copa Brasil de Futebol Sub-15, e que tiveram suas informações de datas de nascimento e medidas de estatura e massa corporal, obtidas a partir de dados disponíveis no site da organização do evento. Os atletas foram separados de acordo com a categorização de idade cronológica em quadrimestres: 1° quadrimestre (1° QDT) jovens nascidos entre janeiro e abril; 2° quadrimestre (2° QDT) os nascidos entre maio e agosto, e o terceiro quadrimestre (3° QDT) os nascidos entre setembro e dezembro. Os resultados demonstraram diferença estatisticamente significativas entre as frequências de datas de nascimento dos jogadores nos quadrimestres. Da mesma forma, as variáveis antropométricas estatura e massa corporal, apresentaram diferenças significativas entre os quadrimestres. Pode-se concluir que o ERI exerce influência na seleção de jovens jogadores brasileiros de elite por estar associado à diferenças nas características antropométricas.*

Palavras-chave: *Antropometria; Futebol; Jovens.*

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INTRODUCTION

In the sports context, many factors are relevant to determining the success of a soccer player and the requirement for practice at high competitive level is multifactorial, justifying the complexity in predicting the athletic performance of young athletes[1].

In addition, many professionals responsible for the training of young athletes, unaware of the various body transformations that occur during puberty, submit young athletes to training loads incompatible with their ability to support them due to a possible delay in their biological development, which may compromise the athletic development of young athletes[2].

In some situations of sports practice, there are young athletes at different maturational stages within the same training group or competitive category[3]. Due to the interindividual difference in the physical component, these situations may favor the most advanced in the biological development process, and discourage and automatically exclude later ones, with real possibilities of becoming excellent athletes in the future[4,5].

Scientific evidence shows that, young people in advanced maturational stages compared to those with delayed maturation of the same training group present advantages in sports performance[6,7]. In this sense, many of these differences can be influenced by the relative age effect (RAE)[8], defined by a difference in chronological age among individuals of the same age group[2]. RAE has been observed not only in soccer, but also in several other sports[9,10].

Some studies have analyzed the relationship between birth month distribution and body dimensions of young athletes[11-13]. Studies by Brewer, Balsom, and Davis[14], and Musch and Hay[9] have already demonstrated an asymmetric distribution of birth dates of professional soccer players from Sweden, Germany, Japan, and Australia, with a tendency for births in the first half, more specifically in the first quarter of the competitive year. However, there are few studies that included samples of young elite Brazilian soccer players, seeking to analyze the relationship between somatic indicators such as height and body mass and RAE.

Thus, the present study aimed to analyze the birth month distribution and the influence of RAE on the anthropometric measures of elite U-15 soccer player participants in the U-15 Brazil Soccer Cup.

METHODOLOGICAL PROCEDURES

The sample was composed of 400 elite male soccer players (15.4 ± 0.4 years, 171.0 ± 10.6 cm and 63.0 ± 8.8 kg) of the U-15 category, which is biannual, and includes athletes born between 1998 and 1999, who were involved in a soccer training program for at least 6 years, participating in the 11th edition of the Brazil U-15 Soccer Cup held in 2012 in the metropolitan region of Londrina - PR (Apucarana, Uraí and Cornélio Procópio), which had the participation of 20 Brazilian clubs, most of which are teams participating of the series A Brazilian Soccer Championship.

All athletes registered in the competition and officiated by the organization of the event that had the partnership of the Soccer Federation of the state of Paraná (FPF), Brazilian Soccer Confederation (CBF) and Soccer Training Center of Paraná (PSTC), with logistical support from Futbase were considered in the analyses. Birth dates, training time and anthropometric measures of height and body mass of athletes were obtained from data available on the registration form of teams made available by the organization on the FPF website (www.federacaopr.com.br). Although public data available on the internet for RAE analysis have been used in other studies without the approval of the research ethics committee[15-17], team leaders were informed on the study proposal and then signed a free and informed consent form to participate in the present research that is part of a project that investigates issues related to "Relative Age and Young Soccer Players", approved by the Ethics Committee of the State University of Londrina (protocol No. 494.315 / CAAE: 25223313.0.0000.5231).

In order to determine the absolute frequency (F) and relative frequency (FR) of players born in different periods of the year, they were separated according to the chronological age categorization into quarters. Thus, the first four months (1st QDT) was composed of athletes born between January and April; the second quarter (2nd QDT), those born between May and August, and the third quarter (3rd QDT), those born between September and December, with January 1st as the starting date of the sports season.

For the analysis of the birth dates of the Brazilian population, a survey of information was performed in the database of the IBGE Automatic Recovery System (SIDRA), session Statistics of the Civil Registry (https://sidra.ibge.gov.br/pesquisa/registro-civil/quadros/brasil/2016, accessed on 01/19/18), referring to the number of births of male subjects in each year between 2003 and 2016 (~ 1,449,309 million births per year), per month of birth, for equivalence of data with the present sample. Subsequently, they were classified by four-month periods, where F and FR of births were obtained.

All the information was initially analyzed through descriptive statistics, using the Statistica™ 7.0 statistical package (STATSOFT INC., TULSA, OK, USA). The non-parametric chi-square test (X^2) was used to analyze possible differences between observed and expected birth date distributions in the four-month periods. The expected birth date distributions were calculated based on data of the Brazilian general population, considering the births of male subjects available between 2003 and 2016 on the IBGE webpage in spreadsheet format (https://sidra.ibge.gov.br/tabela/2680#resultado, accessed on 01/19/18). For analysis of numerical variables height and body mass, expressed in the ratio scale, after verification of data normality by the Kolmogorov-Smirnov test and variance homogeneity by the Levene test, one-way ANOVA was used, followed by Scheffé *post hoc* test to detect possible differences among the four quarters. The significance level was $P < 0.05$.

RESULTS

The results of the present study demonstrated statistically significant dif-

ferences (X^2= 120.72, P <0.001 / expected X^2 = 5.99, P <0.05) among the birth date frequencies of U-15 soccer players, divided into four-month periods throughout the year. The results show a greater number of players born in 1st QDT compared to 2nd QDT and 3rd QDT, as well as in 2nd QDT in relation to 3rd QDT. In addition, the distribution of birth dates for U-15 soccer players was different from the distribution presented by the Brazilian male population from 2003 to 2016 (IBGE), as shown in table 1.

Table 1. Distribution of birth dates of U-15 soccer players (born between 1998 and 1999) and the Brazilian male population (born between 2003 and 2016) for four-month periods throughout the year.

	Four-month periods							
	1st QDT		2nd QDT		3rd QDT			
	F	FR	F	FR	F	FR	X^2	P
U-15 players	236	59,0	122	30,5	42	10,5	120,72	< 0,001
Brazilian population	504.605	34,9	494.997	34,2	448.707	30,9		

1st QDT: Jan-Apr; 2nd quarter (2nd QDT); Mai-Aug; 3rd quarter (3rd QDT): Sep-Dec; absolute frequency: F; relative frequency (%): FR; X2: chi-square test.

For anthropometric variables height and body mass, significant differences were observed among the four quarters (F = 12.19, P <0.05 and F = 14.47, P <0.05, respectively). It was also observed that, for both variables, height and body mass, players born in the months corresponding to the 1st QDT presented values significantly higher than those born in months corresponding to 2nd QDT and 3rd QDT (P <0.05). It was also observed that for the same variables, players born in the months corresponding to the 2nd QDT presented significantly higher values than those born in the months corresponding to the 3rd QDT (P <0.05) (Figure 1 and 2, respectively).

DISCUSSION

Considering the current categorization of competitions of young soccer players in biannual periods, based on chronological age, it is not difficult to observe physical, cognitive disadvantages and less experience of game for those presenting biological age below chronological age, mainly, those that compose the group of beginners in the category[18,19]. In addition, the process of detection and selection of athletes is highly questionable in Brazilian clubs, which favors those physically superior, especially regarding body size[6].

Few national studies have analyzed the effects of age (chronological or biological) on somatic indicators in groups with systematic sports practice. It is important to emphasize that in our country, soccer has a great socio-economic-cultural importance, being much practiced by the young population, indicating the need for studies that analyze the possible influences of this practice on children and adolescents[20].

Thus, the present study sought to investigate the distribution of height and body mass measures in relation to the birth month of soccer players participating in the Brazil U-15 Soccer Cup, in order to observe whether

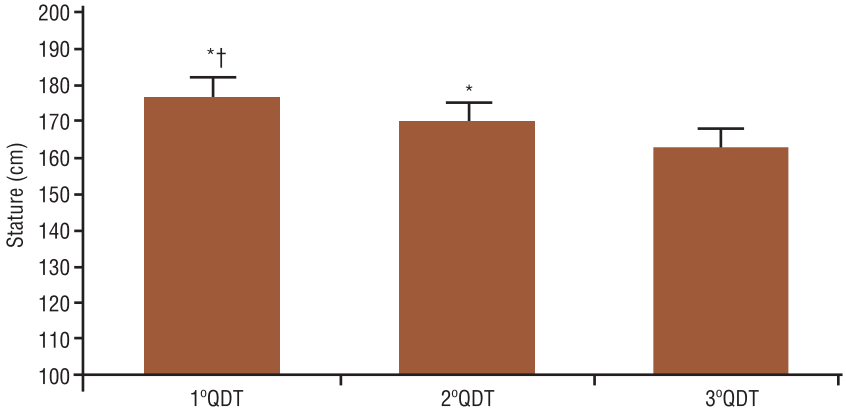

Figure 1. Stature values of U-15 soccer players (mean ± SD). 1st quarter (1st QDT): Jan-Apr; 2nd quarter (2nd QDT); Mai-Aug; 3rd quarter (3rd QDT): Sep-Dec. * Significant differences of 3rd QDT (P <0.05); † Significant differences of 2nd QDT (P <0.05).

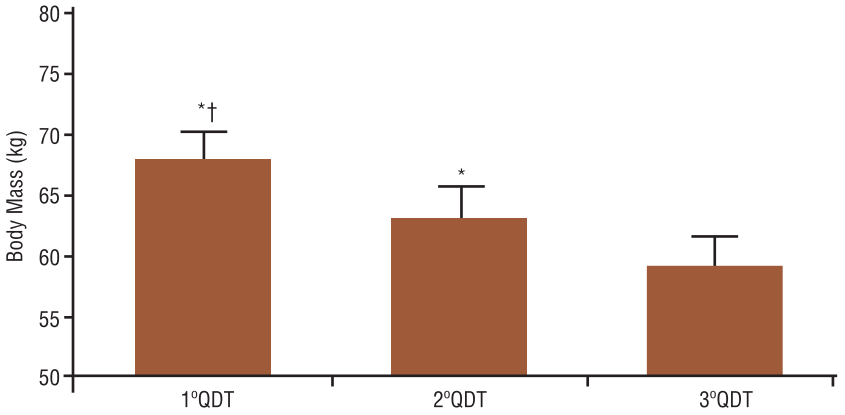

Figure 2. Body mass values of U-15 soccer players (mean ± SD). 1st quarter (1st QDT): Jan-Apr; 2nd quarter (2nd QDT); Mai-Aug; 3rd quarter (3rd QDT): Sep-Dec. * Significant differences of 3rd QDT (P <0.05); † Significant differences of 2nd QDT (P <0.05).

Brazilian clubs in their base categories, present such characteristics, with the perspective of assisting in the choice of methods and training contents, adapted to the physiological reality according to age.

Initially, it was possible to observe that most players are born in the 1st QDT (~ 60%), that is, between January and April, followed by ~ 30% born in the 2nd QDT, between May and August. Similar findings were observed by Altimari et al.[15], where the number of athletes selected to join the Brazilian Soccer Team in the U-15 category, born in the months corresponding to the 1st QDT (65%) was significantly higher than the 2nd QDT (30%) suggesting that RAE influences the selection of athletes in Brazilian soccer at younger ages, and individuals born in the 1st QDT are preferred in the selection of athletes to compose their teams. Similarly, Costa et al.[16] reported that the Brazilian clubs of the series A and B demonstrated a preference for athletes born in the first four months, concluding that RAE stands out as a variable in the selection and training of athletes.

Additionally, the present study presented data consistent with scientific literature on the RAE phenomenon. Studies by Brewer et al.[14], and Musch and Hay[9] already demonstrated an asymmetric birth date distribution of professional soccer players from Sweden, Germany, Japan, and Australia,

with a tendency for births in the first half, more specifically in the first quarter of the competitive year. An important study by Helsen et al.[6] involving European U-15 and U-18 soccer players showed a prevalence of players born in the first quarter of the competitive year. Likewise, recent data from Mujika et al.[21] and Wiium et al.[22] demonstrated the existence of RAE in Spanish professional and base soccer players and Norwegian professional players, respectively.

Corroborating the hypothesis that differences in body size, influenced by RAE, influence the asymmetry of birth month distribution in young soccer players [23], our findings showed significant differences, where the majority of players born in the 1st QDT (between January and April), showed higher stature and body mass, followed by players born in the 2nd QDT (between May and August).

A study by Helsen et al.[6] reported that players born in the first months of the year compared to those born in the last months had considerable physical advantages (stature, body mass and strength), which could affect selection and prediction of sporting success. Similarly, Hirose et al.[3], after investigating the relationship between birth month distribution, maturation and anthropometric characteristics in young soccer players aged 9-15 years, found that asymmetries in the birth month distribution are results of the relationship with biological maturation, which could indicate that players who mature early are favored in the selection of young soccer players.

In order to observe whether RAE and physical advantages are related to the process of selection of young players, different studies have used several physical tests in soccer players[24,25]. A better understanding of this relationship may be important in determining how advantageous it would be to be born in the first months to reach an advanced state of biological maturation over the last months (increasing the chances of an athlete born in the first months to be selected by an important team)[26]. In the same way, it helps to explain the large number of players in important teams born in the beginning of the selection year[15,27]. For example, players who were born in the first months of the year showed better results in 10 and 15 m speed trials, proving to be faster and more skilled than athletes who were born in the last quartile of the same year[13,23]. These athletes tend to present higher VO_2 maximum, maximum anaerobic power and maximum concentric force values[13].

In the same way, players born in the first months of the year revealed advanced skeletal maturation, were taller, heavier, and had longer legs[13,23]. In this sense, the study by Wong et al.[28] showed that heavier young soccer players are able to kick the ball faster and perform better in the 30 m speed test, while taller players perform better vertical jump, 10 and 30 m speed tests, intermittent running resistance and running time in VO_2 max. However, it is not all physical capacities that seem to be influenced by RAE. When submitted to the Yo-Yo Intermittent Recovey Test Level 1, there was no significant advantage in terms of soccer-specific resistance among players[27].

Finally, considering the above, many talented young people can be underestimated simply by being born at the end of the year and, consequently, by the lower physical attributes. Thus, we believe that understanding the impact of RAE on young athletes can change the way athletes, parents, coaches, and federations perceive potential talent and predict athletic success. These findings indicate the need to investigate in future studies the relationship between RAE and biological maturation in order to confirm its influence on the motor performance parameters of young soccer players. One of the limitations of our study was not to verify RAE in the different positions and functions of the field, since different positions can be influenced by specific physical and maturational characteristics.

CONCLUSION

Based on the results of the present study, it was possible to conclude that RAE exerts influence in the selection of young elite Brazilian players because it is associated with differences in the anthropometric characteristics of these young players, which may be related to an early biological maturation.

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