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Relative age effect on student-athletes of Mato Grosso state (Brazil) participating in the National School Games depending on sex, age category, and sport type

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ABSTRACT

Purpose. The relative age effect (RAE) is a widely reported phenomenon in elite sports context. However, little is known about its occurrence in other levels of practice, such as school sports. Thus, this study aimed to investigate the presence of RAE on Mato Grosso state (Brazil) student-athletes participating in National School Games depending on sex, age category, and sport type.

Methods. Data from 440 student-athletes of Mato Grosso state (Brazil) who participated in 2 National School Games: 2019 Youth School Games (n = 250) and 2021 Brazilian School Games (n = 190) were organized depending on their quarters of birth. Chi-square tests were performed to compare their birthdates distribution in accordance with sex (male and female), age category (12–14 years old and 15–17 years old), and sport type (team and individual sports).

Results. Athletes born in the first months of the year were more frequent than athletes born in the last months of the year in the overall sample, in males, in the younger age category, and in team sports ($p < 0.008$). On the other hand, no differences were found for females, athletes from the older age category, or athletes practising individual sports ($p > 0.05$).

Conclusions. RAE is pervasive in the student-athletes of Mato Grosso state (Brazil), specifically for male athletes in early categories of team sports. Educating coaches regarding this effect and implementing specific counter-RAE interventions are warranted to minimize selection bias in this sports context.

Key words: youth sports, selection bias, aptitude

Introduction

The identification and improvement of skills are arduous tasks for teachers and coaches since predicting the potential of athletes is multidimensional and complex [1]. There is still a long way to go in improving the process of identifying and selecting talent, which follows scientific evolution [2]. Therefore, acknowledging whether talent selection processes are affected by the relative age effect (RAE) is crucial within specific sports contexts [3]. One of the main explanations for this effect is the maturation-selection hypothesis, which proposes that relatively older athletes are more likely to succeed in many activities owing to physical maturation differences [4]. This is particularly pronounced during adolescence, when

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greater individual variations may lead to biased evaluations of the athletes' skill level, favouring relatively older athletes within the same age group [3, 5].

In sports, athletes' training categories are grouped in accordance with their year of birth, in order to provide equality in maturity in competitions [4]. However, studies have shown that some athletes are predisposed to obtain higher anthropometric, physical, and cognitive development, as well as psychological factors than relatively younger ones, even at the same chronological age or within the same age category [5, 6].

Relative age and maturation have been observed to influence the athlete's selection of different sports features, such as playing positions [7], chronological age and performance [8], effectiveness in the match [9], and the laterality in individual sports [10]. When evaluating the potential of a young athlete, the maturational factor must also be considered and monitored [1]. In this sense, it is necessary to dissociate the sexes, relative age, and maturation, as the constructions can occur independently [11, 12]. Therefore, a fair selection process must incorporate such decoupling.

Despite the significant number of investigations involving RAE in the sports context, only a few studies assessed simultaneously different modalities, age categories, and sexes in the sports training stage, as verified by the review studies [2, 5, 13]. In addition, few studies involving RAE have specifically analysed student-athletes in the context of school sports [14]. Reed et al. [14] conducted a study at the 2013 London Youth Games and demonstrated the occurrence of RAE, presenting itself differently in boys and girls. However, no study with student-athletes selected for the National School Games has been carried out for more than one season, especially in Brazil. Considering that RAE can be influenced by the individual, task, and environmental constraints [15], and the importance of identifying the pervasiveness of RAE in a given sports context owing to its influence on talent identification, sports system organization, practitioners, and athletes [16] in different countries [17], the present research is justified. It is also aimed to achieve greater contributions regarding the knowledge of RAE in sports training, specifically at the school level.

In this line, in Brazil, the National School Games aim to promote sports educational activities, research, social integration, and cultural exchange [18]. The competition is disputed by athletes aged 12–14 and 15–17 years in team sports (basketball, futsal, handball, and volleyball) and individual sports (athletics, badminton, cycling, rhythmic gymnastics, judo, wrestling, swimming, table tennis, beach volleyball, and chess). Teams that were classified in the state stages are eligible to compete in the National School Games. In addition, the national championship promotes an index for international championships.

Although the main objective of school sports is not to develop athletes, it is undeniable that in Brazil, the school sports system ends up being the entry point for many elite athletes because of an insufficient structure of clubs for the development of talents. Accordingly, in many cases, the competition for sports in competition teams can be fierce, depending on the type of sport, its popularity in the region, and even the age group of the athletes [3, 5, 7]. Considering that RAE is a context-specific phenomenon [15] and that investigation on school sports is still scarce, it is still unknown if this phenomenon is widespread in the Brazilian school sports system. That being said, studies that examine the occurrence of RAE in specific contexts of school sports may provide important evidence about talent selection and development policies in the Brazilian school sports context. On the basis of these findings, it will be possible to identify whether interventions are necessary or not to make this sport system fairer for all participants.

Thus, the present study aimed to analyse the presence of RAE on Mato Grosso state (Brazil) student-athletes participating in National School Games (2019 Youth School Games and 2021 Brazilian School Games) depending on sex, age category, and sport type. Previous evidence indicates that RAE is more prevalent in highly competitive environments, such as Olympic sports [13], and female contexts [5]. In scholar contexts specifically, RAE was more pervasive in younger age groups and in male athletes, as well as in team sports [14]. Consequently, we expected that RAE would be more prevalent in male athletes, in the younger categories, and in team sports.

Material and methods

Participants

This retrospective and descriptive study with a cross-sectional design involved 440 student-athletes of Mato Grosso state (Brazil) who participated in 2 National School Games. The total sample size used in the study (n = 440) conferred a statistical power of 99% (β = 0.99) with a significance level of 5% (α = 0.05) and medium effect size (ω = 0.3) [19]. The 2019 Youth School Games (n = 250), played in Blumenau (Santa Catarina state) in November, and the 2021 Brazilian School Games (n = 190), played in Rio de Janeiro (Rio de Janeiro state)

in October/November, were organized by the Olympic Committee of Brazil and the Brazilian Confederation of School Sports, respectively. Data from 2020 were not reported: because of the COVID-19 pandemic, there were no National School Games in that year. The sample included all student-athletes enrolled in Mato Grosso state schools that were classified to play in the 2019 and 2021 National School Games. Athletes whose information was incomplete or incorrect were not considered for the study. One male student-athlete in cycling who participated in the 2021 games was excluded from the sample owing to incorrect birth data.

Data collection and procedures

The data were provided by the Coordination of School Sports Events of the Assistant Secretary of Sports and Leisure of the Mato Grosso state (Brazil) in March, 2022. The information included: sex, date of birth, age category, sport type, and championship played and year. For ethical reasons, the players' full names were not provided. All data were under the responsibility of the researches involved and were used exclusively for the research. The data collection procedures were in accordance with the principles expressed in the Declaration of Helsinki.

The athletes were organized depending on their sex: male (n = 220) and female (n = 220); age category: A – 15–17 years old (n = 125) and B – 12–14 years old (n = 315); and sport type: team sports (n = 206) and individual sports (n = 234). Participation in each of the age categories was determined by the athlete's year of birth, with January 1st as a cut-off date. Team sports involved basketball, volleyball, handball, and futsal. Individual sports included track and field, badminton, cycling, rhythmic gymnastics, judo, karate, taekwondo, wrestling, swimming, table tennis, beach volleyball, and chess. For this study, we defined the birth year as beginning on January 1st [13], and the quarters of birth were defined as: first quarter, Q1 (January 1st to March 31st); second quarter, Q2 (April 1st to June 30th); third quarter, Q3 (July 1st to September 30th); and fourth quarter, Q4 (October 1st to December 31st), similarly to Castro et al. [7]. All the data were tabulated in a spreadsheet for analysis.

Statistical analysis

Athletes' frequencies were presented in relative values. A chi-square goodness-of-fit test (χ^2) was performed to compare the observed and the expected birthdates distribution of athletes in accordance with sex, age category, and sport type. The observed distributions of athletes' birthdates in each quarter (Q1, Q2, Q3, and Q4) were compared with the expected frequencies, on the basis of Brazilian reports from years 2002–2009 (Brazilian Ministry of Health – DATASUS), as previously reported by Figueiredo et al. [20]. For all analyses, the effect size (ω) of the chi-square tests was calculated. Additionally, odds ratio (OR) for Q1 vs. Q4 and first semester vs. second semester (1st:2nd) was calculated. The analyses were performed in the Statistical Package for the Social Sciences (SPSS), version 21.0 (Chicago, USA). The level of significance was 0.05. Whenever multiple comparisons between quarters were necessary, Bonferroni's corrections were applied. In these cases, the significance level was adjusted to 0.008, as suggested by Sharpe [21]. All procedures were carried out with the GraphPad Prism (version 6.0), G*Power (version 3.1), and SPSS (version 21.0) software.

Ethical approval

The conducted research is not related to either human or animal use. Were used public data, with open access.

Results

Sex

The results of the analysis of all athletes' birthdates revealed that the overall observed distribution was different from expected (χ^2 = 9.183; p = 0.027; ω = 0.02; OR for Q1:Q4 = 1.515; OR for 1st:2nd = 1.229), with athletes born in the first quarters of the year (Q1 and Q2) being more frequent than athletes born in the last quarter (Q1 = 127; Q2 = 126; Q3 = 111; Q4 = 76). For male athletes, our analysis indicated an uneven distribution of birthdates (χ^2 = 10.708; p = 0.013; ω = 0.04; OR for Q1:Q4 = 1.793; OR for 1st:2nd = 1.539), with an overrepresentation of athletes born in Q1 compared with Q4 (Q1 = 71; Q2 = 67; Q3 = 46; Q4 = 36). On the other hand, there were no differences between female athletes (χ^2 = 64.761; p = 0.190; ω = 0.02; OR for Q1:Q4 = 1.265; OR for 1st:2nd = 0.989) (Q1 = 56; Q2 = 59; Q3 = 65; Q4 = 40) (Figure 1A).

Age category

The results of the analysis of the athletes' dates of birth by age category revealed uneven distributions of birthdates for category B (χ^2 = 10.267; p = 0.016; ω = 0.03; OR for Q1:Q4 = 1.719; OR for 1st:2nd = 1.312), with athletes born in the first quarters of the year

(Q1 and Q2) being more frequent than athletes born in the last quarter (Q4) (Q1 = 99; Q2 = 87; Q3 = 77; Q4 = 52). There were no differences between athletes from category A (χ^2 = 2.880; p = 0.411; ω = 0.02; OR for Q1:Q4 = 1.062; OR for 1st:2nd = 1.049) (Q1 = 28; Q2 = 39; Q3 = 34; Q4 = 24) (Figure 1B).

Sport type

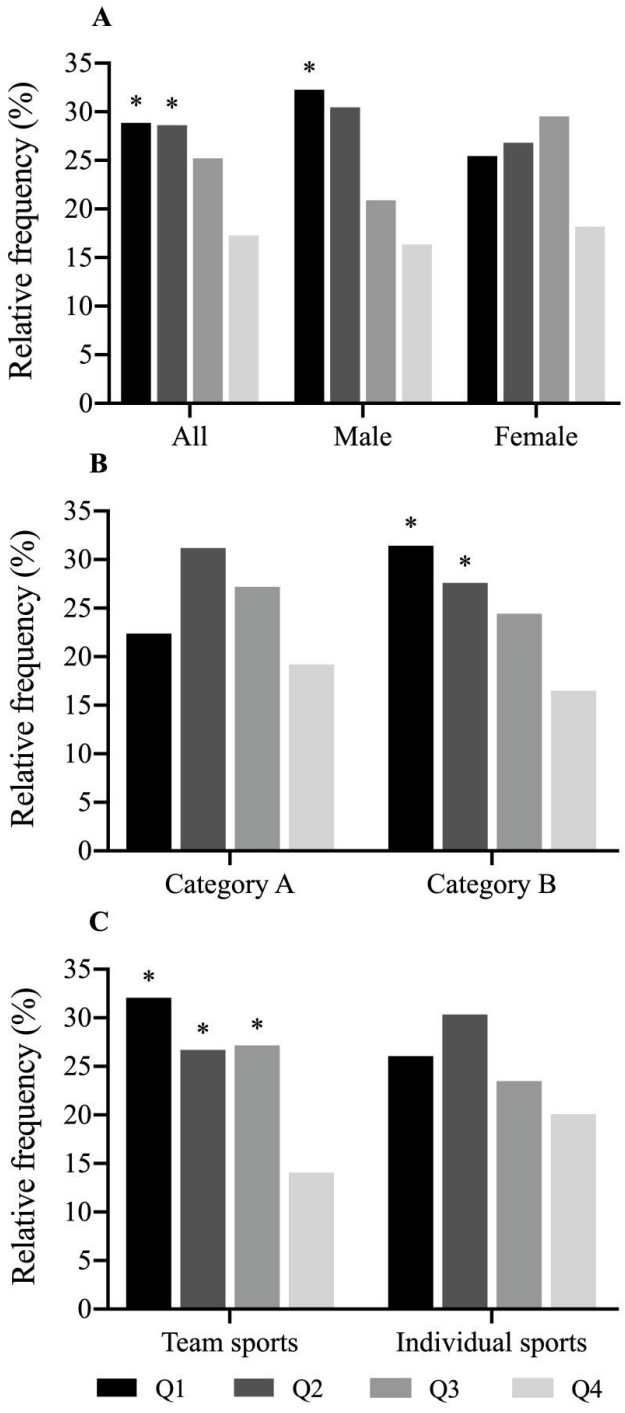
For the athletes of the team sports, the chi-square analysis indicated an uneven distribution of birthdates (χ^2 = 11.400; p = 0.010; ω = 0.05; OR for Q1:Q4 = 2.063; OR for 1st:2nd = 1.293). Athletes born in the first 3 quarters of the year were more frequent than athletes born in the fourth quarter (Q1 = 66; Q2 = 55; Q3 = 56; Q4 = 29). Finally, there were no differences between athletes from individual sports (χ^2 = 2.142; p = 0.544; ω = 0.01; OR for Q1:Q4 = 1.176; OR for 1st:2nd = 1.176) (Q1 = 61; Q2 = 71; Q3 = 55; Q4 = 47) (Figure 1C).

Discussion

This study aimed to analyse the presence of RAE in student-athletes of Mato Grosso state (Brazil) participating in 2 Brazilian school competitions depending on sex, age category, and sport type. The results indicated a higher frequency of student-athletes born in the first quarters of the year in the overall analysis, in male players, in age category B (12–14 years), and in team sports, which confirms our hypotheses.

We identified the prevalence of RAE in the overall analysis and in males, which is in line with previous results, both at high competitive levels [22] and in school sports [14]. It is suggested that male players are culturally more engaged than female players in elite sports in Brazil [23], which may also concern the school context. This would stimulate a greater number of male players, greater competition for spots in teams, and, consequently, a greater chance of RAE occurrence [24]. In this sense, coaches would select apparently taller and stronger student-athletes in order to achieve short-term results in school competitions. In addition, studies have already suggested that RAE is more likely to be observed in the pre-maturation period, which would occur at approximately 11 years of age in female student-athletes [5]. This provides a rationale for the absence of RAE in female student-athletes since all participants in this study were above this age group.

When we divided the participants by age category, there was an overrepresentation of student-athletes born in the first semester of the year, but only in category B. Cobley et al. [13] suggest that RAE is more likely to occur in males at approximately 12 years of age, depending on the period of pubertal maturation [25], which may help to justify our findings and is in line with other studies [24]. Grouping players on the basis of chronological age without considering maturation status can lead to performance differences, which indicates that biological maturation impacts player selection procedures [26]. Thus, it is likely that coaches,



* means different from Q4 (p < 0.008)

Figure 1. Distribution of quarters of birth in accordance with (A) sex, (B) age category, and (C) sport type

when selecting players in the 12–14 age group, choose apparently more skilled players, who possibly differ from their younger peers because they are just more mature [15]. This factor may contribute to reducing the opportunities for relatively younger players to practise [27], as well as to increasing the likelihood that they abandon the sport [28].

On the other hand, RAE was not identified in age category A (15–17 years). We speculate that, in the scholarly context, sports participation reduces after 14 years of age, owing to changes in personal interests and social pressures experienced by student-athletes [29]. This may occur because of family pressure for student-athletes to increase the time dedicated to their studies since as their age increases, they are closer to taking college tests and, consequently, they would have to reduce the time spent on sports and focus on their academic life. In fact, the number of participants in category A was less than half of the number of participants in category B, which highlights this hypothesis. In addition, it is really difficult to become a professional athlete in these modalities in Brazil, which can contribute to the decision to practise sports for recreational purposes rather than increasing the amount of practice to seek professionalization. This reduction in sports participation would cause less competition for spots in teams and potentially reduce RAE [13]. Despite this, the hypothesis was not tested and must be considered with caution.

We also analysed the participants in accordance with the type of sport practised. Our results indicated an overrepresentation of student-athletes born in the first 3 quarters of the year compared with those born in the last quarter only in team sports. These findings are in line with those obtained by Reed et al. [14] in an investigation that was also carried out in the scholarly context. Nonetheless, previous evidence indicates that RAE is affected by sport-specific contextual factors [15]. Therefore, the specific characteristics of the individual sports analysed in this study may have influenced the results. Another factor that influences RAE prevalence is the level of competition [15]. Since RAE tends to have a greater magnitude at higher competitive levels, one could argue that the dispute for places in individual sports in the context of student-athletes in the Mato Grosso state may not be high enough to foster RAE.

This study has some limitations, such as grouping players from different sports modalities together, which can cover the effects of each specific sport. However, this methodological choice allowed us to perform analyses on a larger sample. Additionally, we analysed the sample only in the context of one Brazilian state, which provides local conclusions. Given the limitations of the present study, future research is warranted to employ larger datasets, allowing to investigate RAE on specific sport modalities and even the interaction between multiple aspects, such as sex, age categories, and sport modalities. Additionally, it is important to verify whether these effects are extensive to other Brazilian states, as well as at the national level in this and other countries around the world.

Conclusions

In conclusion, our results demonstrate that RAE is pervasive in the student-athletes of Mato Grosso state (Brazil), specifically in male athletes in early categories of team sports. Such findings confirm the notion that in some cases, RAE is not restricted to the high competitive level. In practical terms, sport organizers, policy makers, and coaches should consider specific counter-RAE interventions to minimize inequalities generated in these sports contexts. In the first place, making school coaches/teachers aware of RAE is crucial to reduce its prevalence in this context. Implementing a paradigm shift in the younger categories is also necessary, so that there is less pressure in the search for results in the short term [30]. At the level of sports policies, specific interventions such as imposing a minimal player quota in competitions and reducing the age range within categories [13] are some viable ways to try to diminish the injustices created by RAE in the context of school sports in the state of Mato Grosso.

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Conflict of interest

The authors state no conflict of interest.

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