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El Efecto de la Edad Relativa en los Atletas Jóvenes de Paratlético: Análisis de cuartil de nacimiento y desempeño en eventos atléticos individuales

The Relative Age Effect on Young Athletes of Para-Athletics: Birth quartile analysis and performance in individual athletic events

O Efeito da Idade Relativa em Jovens Atletas de Paraatletismo: Análise do quartil de nascimento e do desempenho em eventos individuais de atletismo

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RESUMEN

El Efecto de la Edad Relativa (EER) es un fenómeno caracterizado por una sobrerrepresentación significativa de atletas nacidos en los primeros meses del año competitivo en la misma categoría de edad que se ha observado en categorías juveniles de atletismo. Sin embargo, hay una falta de investigación para investigar este fenómeno y su relación con el deporte para, y no está claro si este efecto está presente en los jóvenes atletas. Por lo tanto, nuestro estudio examinó la existencia de EER en jóvenes atletas para-atléticos (categorías U16, U18 y U20) y el rendimiento en eventos deportivos individuales según el cuartil de nacimiento (Q1, Q2, Q3 y Q4). Las fechas de nacimiento se recogieron de 700 jóvenes atletas masculinos de deportes para que participaran en eventos deportivos individuales entre 2018 y 2019 en las categorías U16, U18 y U20. En resumen, se observó una distribución desigual de las fechas de nacimiento por cuartil cuando un mayor número de jóvenes para-atletas nació en el primer trimestre del año para U16 (χ^2_3 = 18.785; p = .0003; Phi efecto = 0.45), U18 (χ^2_3 = 6.846; p = .05; Phi efecto = 0.17), y U20 (χ^2_3 = 10.156; p = .017; Phi efecto = 0.17). Sin embargo, cuando comparamos el desempeño de los atletas por evento (eventos de atletismo) y por separado por cuartil, no se encontró diferencia significativa (p > .05). En conclusión, nuestro estudio evidenció el papel influyente de la edad relativa en atletismo, pero parece que este fenómeno no está relacionado con el rendimiento en atletismo.

Palabras clave: grupo de edad, inclusión, para-deporte, atletismo, fecha de nacimiento.

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ABSTRACT

The Relative Age Effect (RAE) is a phenomenon characterized by a significant over-representation of athletes born in the first months of the competitive year in the same age category that has been observed in athletics juvenile categories. However, there is a lack of research to investigate this phenomenon and its relationship with para-sport, and it is not clear whether this effect is present in young para-athletes. Thus, the present study aims to examine the existence of RAE in young para-athletics athletes (U16, U18, and U20 categories) and the performance in individual athletic events according to the birth quartile (Q1, Q2, Q3, and Q4). Birth dates were collected from 700 young male athletes from para-sport who participated in individual athletic events between 2018 and 2019 in the U16, U18, and U20 categories. In summary, unequal distribution of birth dates per quartile was observed where a greater number of young para-athletes was born in the Q1 of the year for U16 (χ^2_3 = 18.785; p = .0003; Phi effect = .45), U18 (χ^2_3 = 6.846; p = .05; Phi effect = .17), and U20 (χ^2_3 = 10.156; p = .017; Phi effect = .17). However, when we compared the performance of the athletes by event (track and field events) and separately by quartile, no significant difference was found (p > .05). In conclusion, our study evidenced the influential role of relative age in track and field para-athletes, but it seems that this phenomenon is not related to performance in track and field events.

Keywords: age group, inclusion, para-sport, athletics, birth date.

RESUMO

O Efeito da Idade Relativa (EIR) é um fenômeno caracterizado por uma significativa representação de atletas nascidos nos primeiros meses do ano competitivo na mesma faixa etária que tem sido observada em categorias juvenis de atletismo. No entanto, há ainda uma lacuna em termos de investigação para analisar esse fenômeno e sua relação com o para-desporto. Assim, o obejtivo do presente estudo foi analisar a existência de EIR em atletas jovens de para-atletismo (categorias Sub-16, Sub-18 e Sub-20) e sua relação com o desempenho em eventos atléticos individuais de acordo com o quartil de nascimento (Q1, Q2, Q3 e Q4). As datas de nascimento foram recolhidas de 700 jovens atletas do sexo masculino de paradesporto que participaram de eventos de atletismo individuais entre 2018 e 2019 nas categorias Sub-16, Sub-18 e Sub-20. No geral, observou-se uma distribuição desigual das datas de nascimento por quartil, onde um maior número de jovens para-atletas nasceu no Q1 do ano para Sub-16 (χ^2_3 = 18.785; p = .0003; Phi effect = .45), Sub-18 (χ^2_3 = 6.846; p = .05; Phi effect = .17), e Sub-20 (χ^2_3 = 10.156; p = .017; Phi effect = .17). Entretanto, quando comparamos o desempenho dos atletas por evento (provas de atletismo) e separadamente por quartil, não houve diferenças significativas (p > .05). Em conclusão, nosso estudo evidenciou o papel influente da idade relativa em paraatletas de atletismo, mas parece que esse fenômeno não está relacionado ao desempenho em eventos desta modalidade.

Palavras chave: faixa etária, inclusão, paradesporto, atletismo, data de nascimento.

INTRODUCTION

The relative age effect (RAE) is characterized by a significant over-representation of athletes born close to the date of selection; that is, it refers to the over-representation of athletes born earlier in the selection year compared to late-born athletes within the same age category (Brustio et al., 2019; Folgar et al., 2023). This phenomenon has been commonly observed in young people inserted in school (Figueiredo et al., 2023; Morrison et al., 1995) and in the sports environment, as in track and field athletes (Caregnato et al., 2023; Difernand et al., 2023; Kearney et al., 2018).

The RAE has been a common phenomenon among youth athletes in sports environments. Children born early in the selection year are more likely to experience success and sustain participation, especially in the youngest age category (Ortigosa-Márquez et al., 2018; Kearney et al., 2018). For example, Brazo-Sayavera et al. (2018) observed an effect of the strongest relative-age in the track and field U18 athletes category compared to those U20. On the other hand, Kearney et al. (2018) revealed that

the RAE was most pronounced during U13 competitions, throughout athletes' first exposure to formal track and field competitions. Specifically, in track and field events, Kearney et al. (2018) also showed that the RAE was present in several events (i.e., 100 m, obstacles, 800 m, 1.500 m, high jump, weight throw, discus throw, and dart). Difernand et al. (2023) presented similar results when investigating the RAE among French athletes in different athletics events, showing that the phenomenon was present in all events.

Previous studies explained that this phenomenon in youth athletes from various sports is associated with the "maturation selection hypothesis" (Cobley et al., 2008; 2018); that is, young athletes born in the first months would be selected because they were chronologically older than other athletes and have improved physical fitness and anthropometric characteristics (Malina, 1994). However, it is unclear how the RAE could influence sports participation and the performance of young athletes with impaired physical or intellectual performance.

Researchers suggested that young people with intellectual disabilities have less opportunity to exercise when compared to those without disabilities (Modesto et al., 2020). On the other hand, the authors suggested that young people with intellectual disabilities tend to achieve skeletal maturation prematurely (Modesto et al., 2020). In this sense, although biological maturation is associated with RAE (Costa et al., 2013), no study has investigated this phenomenon and its relationship with para-sport.

In para-sport, the body of scientific literature has proposed to examine some factors associated with sports participation, which involve both physical (Wu & Williams, 2001) and psychological (Rodríguez Macías et al., 2022) aspects. For example, a recent study showed that some barriers hindering the training and performance of athletes are related to the lack of financial support and visibility in the media and dependence on other people (Rodríguez Macías et al., 2022). On the other hand, the coach, and families in the sporting and social contexts, respectively, seem to influence the training process of para-athletes (Rodríguez Macías et al., 2022). To the best of our knowledge, only one study analyzed the RAE in paralympic sport, performed specific with Brazilian para-swimmers (de Oliveira et al., 2023). However, there are no RAE studies with para-athletics (Bilgiç & Isın, 2022; de Oliveira et al., 2023). Thus, it becomes necessary to understand other factors that may be associated with the participation of para-athletes of athletics, specifically the RAE.

Para-athletics (track and field events) is a sport based on the athlete's functional impairment that proposes a classification system designed to make competitions between athletes with disabilities fair and equitable (https://www.paralympic.org/). In this context, the competitors are typically organized into three broad categories (deaf sports, athletes with a physical disability, and athletes with an intellectual disability) to guarantee equal opportunities for competition (World Para Athletics). Specifically in Brazil, the competitions organized by the Brazilian Paralympic Committee are also played in a single age category to avoid disparity relative to chronological age (Costa et al., 2013). Para-athletes of athletics have a 2-year competitive cycle at youth and junior levels. Thus, a chronological age difference between individuals born in the same age group can still happen and could make it particularly susceptible to RAE. However, no study has yet proposed to investigate age-related disparities in para-athletes of athletics.

Therefore, the purposes of this study were (1) to analyze the existence of RAE in young para-athletes of athletics, considering all age groups between U16, U18, and U20 years of age, and (2) to analyze competition performance data according to birth quartile.

METHODS

Study design

Similar to other empirical studies that have investigated the effect of relative age on sport, (Apollaro et al., 2022; Ferriz-Valero et al., 2020; Folgar et al., 2023; Leonardi et al., 2022), the present study consists of a descriptive, cross-sectional, and observational approach (Anguera & Hernández-Mendo, 2016; Ato et al., 2013).

Participants

The sample size was estimated using G*Power software version 3.1.9.2 (Universität Kiel, Kiel, Germany) utilizing "Goodness-of-fit tests:

contingency tables" with power = 0.90, *df* = 3; medium effect size *w* = 0.3, considering previous findings about RAE and Athletics (Brazo-Sayavera et al., 2016). Results indicated that 191 subjects would be necessary for the total sample in the present study. Thus, 700 para-athletes with rankings in the 2018 and 2019 seasons were included in the study. We included all male participants from several Brazilian states who participated in individual para-athletics events (i.e., regularly competed at the national level). It is noteworthy that the female participants were not included in the study due to the small number of athletes inserted in the database. Only para-athletes of the U16, U18, and U20 categories were included in the present study.

Similar to previous studies that investigated RAE (de Oliveira et al., 2023; Solon Junior & Silva Neto, 2021; Solon Junior & Silva Neto, 2020) and by following the National Council of Ethics guidelines in Research of Brazil (resolution 510/16), the present cross-sectional and retrospective study did not need ethical approval because the data were collected on an open website (https://www.cpb.org.br/rankingserecordes).

Data collection and procedures

The dates of birth and the data of the performance in track and field events were extracted from the official website of the Brazilian Paralympic Committee (CPB), the most important institution of Paralympic in Brazil and the organizer of the competition, which guarantees the reliability of data. https://cpb.org.br/modalidades/atletismo/ranking/ (https://cpb.org.br/modalidades/atletismo/ranking/). Also, it is noteworthy that an electronic timing system records test results in national and regional competitions; subsequently, these results are collected by CPB so that the athlete can enter the national ranking.

Similar to studies that divided athletes on cut-off dates (Castro et al., 2023; Figueiredo et al., 2023; Leonardi et al., 2022; de Oliveira et al., 2023; de la Rubia et al., 2021); that is, according to the quartile referring to the month of birth of the athlete in the year in which it was registered; the para-athletes were divided into U16 (*n* = 93), U18 (*n* = 247), and U20 (*n* = 360) age categories based on the date of birth. This grouping refers to the rules of the World for Athletics and the guidelines of the Paralympic athletics competitions of the Brazilian School Games. It is noteworthy that, although only categories U16 and U18 are considered for school games, the present study also analyzed category U20 to verify whether the RAE could influence an older age category. All subjects participated and ranked in events: Sprints: 100m (*n* = 129), 200m (*n* = 93), and 400m (*n* = 119); Middle distance: 800m (*n* = 54) and 1500m (*n* = 42); Jumps: long jump (*n* = 97); Weight throwing (*n* = 75); Throws: discus (*n* =35), and javelin (*n* =56).

The performance was evaluated by the results of each test and grouped by quartile in each age category. Sprints tests (100m, 200m, and 400m), middle distance (800m), and 1500m had their results expressed in time (seconds). Also, the tests of weight throwing, javelin throw, discus throw, and long jump were expressed in the distance of the path travelled (meters).

Para-athletics is practiced by athletes with physical, visual, or intellectual disabilities, which aims to make the sport fairer and more competitive. The competitors are divided into groups according to the degree of disability observed by the functional classification. For athletes with visual impairment, using a guide and support athletes vary according to functional class. It is noteworthy that the higher the degree of impairment, the lower the number of the class; thus, the athletes were divided according to functional deficiencies (i.e., physical-motor, visual, and intellectual) and the degree of impairment of the disability, as performed in the study of de Oliveira et al. (2023). Due to the small number of participants, the type (i.e., physical-motor, visual, and intellectual) and classification of disability impairment were used as covariable during the analyses; therefore, the athletes were analyzed together.

Regarding the seasonality of births in Brazil, births of disabled people in Brazil are unavailable, so a birth distribution was considered at 25% for each (Q) of the year, i.e., Q1 corresponds to January 1st to March 31st; the Q2 from April 1st to June 30th; the Q3 from July 1st to September 30th; and the Q4 covers from October 1st to December 31st. Accordingly, each quartile corresponds to a year's trimester or quartile.

Statistical analysis

The study's participants were organized by the year of birth quarterly intervals (Q1, Q2, Q3, and Q4), and

25% was assumed as the expected frequency for each quarter. We used the chi-square goodness-of-fit tests (χ^2) to verify differences between the observed and expected frequency separately by birth quartile. Thus, all the data described in Table 1 were inserted and analyzed in www.statskingdom.com. The magnitude of effect size (Phi effect - Φ) for the chi-square goodness-of-fit tests (χ^2) was based on the degree of freedom 3 (*df* = 3), being small effect = 0.06, medium effect = 0.17, and large effect = 0.29 (Kim, 2017). Additionally, the Odds Ratio (ORs) were calculated for Q1 versus Q4.

Regarding performance, the Shapiro-Wilk and Levene tests were used to evaluate the normality and homogeneity of variances, respectively. The data were not analyzed separately by functional ability or type of test because the sample size was insufficient to obtain statistical power. A univariate covariance analysis (ANCOVA) was used to test the differences between the performance of the individuals per quartile. Therefore, the deficiency's type (i.e., physical-motor, visual and intellectual) and classification (numbered according to CPB site rules) were used as covariates. All prerequisites for using ANCOVA were accepted; the independent variable (quartile) did not affect the covariate, and the homogeneity of the regression parameters was assumed, but Greenhouse-Geisser correction to the degrees of freedom was applied when violations to sphericity were present. It is noteworthy that the media presented in table 2 were adjusted by the covariate. In some tests of the U16 category, no performance-related variations were made between the quartiles due to the small sample number. In addition, the Bonferroni test was used for post-hoc analysis when the F-ratio was significant. It is noteworthy that the homogeneity of the regression parameters was performed to verify the difference in the effect of the covariable on the dependent variable. All data were obtained using SPSS 26.0 program. A value of $p < 0.05$ was assumed to show statistical significance.

Participation

Table 1 shows the distribution of expected and observed frequencies in para-athletes of athletics by age categories. In U16 category, an unequal distribution was observed between quartiles with a large effect magnitude ($\chi^2_3 = 18.785$; $p = 0.0003$; Phi effect = 0.45, large effect magnitude). After comparing the difference between the observed data and the expected data (25%) with the chi-square goodness-of-fit tests, this effect was significantly observed in Q1 ($\chi^2_1 = 6.00$; $p = 0.01$) and Q4 ($\chi^2_1 = 11.40$; $p = 0.0007$). The odds ratio of Q1 vs Q4 was 7.41, that is, subjects who are born in the first quartile of the year are seven times more likely to be included in para-sport when compared to those born in the fourth quartile.

Table 1

Frequency of birth dates for trimester and age categories for male para-athletics athletes.

Category	Quartile	OF (% distribution)	EF (% distribution)	Difference	*df*	χ^2	*p*
U16	Q1	35 (37.63%)	23.25 (25%)	11.75	1	5.94	0.01*
	Q2	29 (31.18%)	23.25 (25%)	5.75	1	1.42	0.76
	Q3	22 (23.66%)	23.25 (25%)	-1.25	1	0.07	0.79
	Q4	7 (7.53%)	23.25 (25%)	-16.25	1	11.36	0.0007*
U18	Q1	79 (31.98%)	61.75 (25%)	17.25	1	4.82	0.02*
	Q2	52 (21.06%)	61.75 (25%)	-9.75	1	1.54	0.21
	Q3	59 (23.89%)	61.75 (25%)	-2.75	1	0.12	0.73
	Q4	57 (23.07%)	61.75 (25%)	-4.75	1	0.37	0.45
U20	Q1	112 (31.11%)	90 (25%)	22.00	1	5.38	0.02*
	Q2	81 (22.50%)	90 (25%)	-9.00	1	0.90	0.66
	Q3	95 (26.38%)	90 (25%)	5.00	1	0.28	0.40
	Q4	72 (20.00%)	90 (25%)	-18.00	1	3.60	0.06

Note. OF = Observed frequency; EF = Expected frequency; DF = Degree of freedom; χ^2 = chi-square goodness-of-fit tests; *p* = *p* valor; * = significant difference between the observed frequency and the expected frequency.

Table 2

Performance of para-athletes by event and birth quartile of the U16 category

	Performance per event			
Quartile	100m (*n* = 21)	200m (*n* = 17)	400m (*n* = 16)	Javelin throw (*n* = 8)
1	16.38 s (±0.93) (n=8)	29.82 s (±3.57) (n=5)	76.33 s (±6.06) (n=7)	16.75 m (±3.12) (n=2)
2	15.52 s (±1.19) (n=5)	33.02 s (±3.53) (n=4)	60.51 s (±11.61) (n=2)	13.51 m (±3.30) (n=2)
3	14.90 s (±1.50) (n=3)	37.22 s (±5.18) (n=2)	74.01 s (±9.19) (n=3)	12.00 m (±2.63) (n=2)
4	17.93 s (±1.16) (n=5)	36.73 s (±2.97) (n=6)	84.05 s (±8.05) (n=4)	19.74 m (±2.71) (n=2)
F	1.146	0.759	1.020	1.317
p value	0.361	0.538	0.421	0.413
Effect size (η2p)	0.177	0.159	0.218	0.568

Table 3

Performance of para-athletes by track events and birth quartile of the U18 and U20 categories

	U18		U20	
Track events	Quartile	Performance	Quartile	Performance
100m	1 (*n* = 11)	16.63 s (±1.20)	1 (*n* = 23)	16.18 s (±0.75)
	2 (*n* = 12)	17.21 s (±1.21)	2 (*n* = 15)	15.81 s (±0.93)
	3 (*n* = 10)	16.89 s (±1.25)	3 (*n* = 16)	17.00 s (±0.90)
	4 (*n* = 11)	15.98 s (±1.29)	4 (*n* = 10)	14.79 s (±1.14)
F		0.156		0.807
p value		0.925		0.495
Effect size (η2p)		0.012		0.039
200m	1 (*n* = 6)	32.74 s (±3.94)	1 (*n* = 17)	37.03 s (±4.41)
	2 (*n* = 9)	24.01 s (±3.46)	2 (*n* = 7)	35.86 s (±6.89)
	3 (*n* = 9)	33.05 s (±3.21)	3 (*n* = 12)	35.80 s (±5.26)
	4 (*n* = 8)	33.54 s (±3.73)	4 (*n* = 8)	41.48 s (±6.47)
F		0.025		0.180
p value		0.995		0.909
Effect size (η2p)		0.003		0.014
400m	1 (*n* = 12)	68.71 s (±5.61)	1 (*n* = 16)	74.66 s (±5.22)
	2 (*n* = 12)	69.14 s (±5.86)	2 (*n* = 16)	64.78 s (±5.16)
	3 (*n* = 13)	80.07 s (±6.39)	3 (*n* = 15)	64.35 s (±5.29)
	4 (*n* = 11)	72.88 s (±5.09)	4 (*n* = 8)	62.97 s (±7.23)
F		0.917		0.946
p value		0.440		0.425
Effect size (η2p)		0.060		0.054
800m	1 (*n* = 3)	139.56 s (±16.07)	1 (*n* = 9)	135.08 s (±6.43)
	2 (*n* = 5)	154.38 s (±14.13)	2 (*n* = 7)	153.08 s (±7.06)
	3 (*n* = 4)	180.14 s (±14.39)	3 (*n* = 6)	155.09 s (±7.62)
	4 (*n* = 5)	143.48 s (±12.53)	4 (*n* = 8)	142.79 s (±6.75)
F		1.697		1.847
p value		0.221		0.164
Effect size (η2p)		0.298		0.181
1500m	1 (*n* = 4)	292.00 s (±31.95)	1 (*n* = 6)	287.13 s (±19.59)
	2 (*n* = 5)	353.63 s (±27.69)	2 (*n* =4)	308.40 s (±22.35)
	3 (*n* = 4)	328.12 s (±32.33)	3 (*n* = 5)	305.37 s (±20.18)
	4 (*n* = 4)	317.21 s (±34.77)	4 (*n* = 5)	299.39 s (±20.58)
F		0.754		0.206
p value		0.541		0.891
Effect size (η2p)		0.159		0.040

Although a lower RAE was observed (i.e. with a small effect magnitude), there was also an unequal distribution on the birth date from para-athletes of U18 ($\chi^2 3 = 6.846$; p = 0.05; Phi effect = 0.17, medium effect magnitude) and U20 ($\chi^2 3 = 10.156$; p = 0.017; Phi effect = 0.17, medium effect magnitude)

categories, statistically in the first quartile ($\chi^2 1$ = 4.82; p = 0.03 and $\chi^2 1$ = 5.38; p = 0.02, respectively). The odds ratio of Q1 vs Q4 for the U18 and U20 categories were 1.58 and 1.81, respectively.

Performance

Tables 2, 3, and 4 show the performance of para-athletics athletes by age categories separately per event. In all categories, the results of the present study showed no difference in the performance of the tests among the athletes per birth quartile (p > 0.05).

Table 4

Performance of para-athletes by field events and birth quartile of the U18 and U20 categories

	U18		U20	
Field events	Quartile	Performance	Quartile	Performance
Weight throwing	1 (*n* = 11)	6.13 m (± 0.48)	1 (*n* = 12)	7.06 m (± 0.61)
	2 (*n* = 5)	6.13 m (± 0.68)	2 (*n* = 16)	7.92 m (± 0.53)
	3 (*n* = 5)	4.89 m (± 0.68)	3 (*n* = 11)	6.65 m (± 0.64)
	4 (*n* = 2)	7.51 m (± 1.35)	4 (*n* = 5)	5.58 m (± 0.95)
F		1.341		1.802
p value		0.292		0.163
Effect size (η2p)		0.183		0.122
Javelin throw	1 (*n* = 7)	18.77 m (± 2.70)	1 (*n* = 10)	17.19 m (± 2.99)
	2 (*n* = 6)	17.08 m (± 5.58)	2 (*n* = 10)	26.42 m (± 3.03)
	3 (*n* = 2)	19.46 m (± 3.26)	3 (*n* = 7)	20.23 m (± 3.53)
	4 (*n* = 2)	18.36 m (± 5.16)	4 (*n* = 3)	15.46 m (± 5.49)
F		0.083		1.852
p value		0.968		0.164
Effect size (η2p)		0.020		0.182
Discus throw	1 (*n* = 5)	11.88 m (± 1.28)	1 (*n* = 5)	14.79 m (± 3.78)
	2 (*n* = 4)	12.39 m (± 1.40)	2 (*n* =7)	17.84 m (± 3.24)
	3 (*n* = 2)	13.26 m (± 1.96)	3 (*n* = 4)	14.11 m (± 4.10)
	4 (*n* = 1)	25.61 m (± 3.78)	4 (*n* = 2)	19.57 m (± 6.00)
F		3.641		0.339
p value		0.072		0.798
Effect size (η2p)		0.609		0.073
Long Jump	1 (*n* = 10)	4.22 m (± 0.35)	1 (*n* = 14)	4.15 m (± 0.26)
	2 (*n* = 11)	3.93 m (± 0.32)	2 (*n* = 13)	5.05 m (± 0.27)
	3 (*n* = 8)	4.33 m (± 0.38)	3 (*n* = 19)	4.95 m (± 0.22)
	4 (*n* = 8)	4.81 m (± 0.40)	4 (*n* = 8)	5.01 m (± 0.34)
F		0.935		2.478
p value		0.435		0.072
Effect size (η2p)		0.081		0.132

DISCUSSION

The study aimed to analyze how the RAE could influence young para-athletics athletes (U16, U18, and U20). The para-athletics competitions and events are also organized according to age categories of the athletes, based on participant's chronological age. In summary, our key findings show an inequitable distribution ($p < 0.05$) of birth dates by a quartile in all age categories, which were mainly indicated by the over-representativeness of athletes born in the first quartile of the year (see table 1).

These results with young athletes of para-athletics are consistent with other studies conducted on young track and field athletes, but without disability (Brazo-Sayavera et al., 2017, 2018; Difernand et al., 2023; Hollings et al., 2014; Kearney et al., 2018). These studies showed an over-representation of young (U13, U15, U17, and U18) track and field athletes born early in the selected year, especially in the

youngest category (Brazo-Sayavera et al., 2017, 2018; Difernand et al., 2023; Kearney et al., 2018). Therefore, our results support the "maturation-selection" hypothesis as a mechanism for RAE in athletes with disabilities.

Previous investigations suggest that this effect is explained by the maturational profile associated with a late maturation of athletes born in the last quartile of the year (Costa et al., 2013). Thus, it is suggested that this phenomenon would also influence the maturational process of children in para-sport and, consequently, in the participation of young para-athletes in athletics. Such information is vital to guide policies about competition structure in para-sport (Paralympic committees, federations, etc.), youth para-athletes development squads, and help coaches facilitate access to sports for people with disabilities to minimize the effects of RAE on young athletes' early experiences of competition.

Indeed, numerous factors influence the participation of athletes with disabilities in the sports environment, among which the coach figure stands out (Rodríguez Macías et al., 2022). In this regard, Banack et al. (2011) reported that para-athletes who perceive the coach's support are more motivated, which generates greater persistence, enjoyment, and effort. Consequently, due to the early introduction of athletes in competitions and the maturational differences (Kearney et al., 2018), it is necessary that coaches critically reflect on early exclusion of athletic para-athletes in this age group. Also, persons with disabilities report lack of institutional support, personal and family barriers, as well as lack of training or lack of adapted sports equipment and facilities (Úbeda-Colomer et al., 2016), in addition to little offer of adapted activities (Messent et al., 1998). Thus, it is important to create public policies that provide and support athletes with disabilities so that they remain engaged in sports.

In contrast with Kearney et al. (2018), we found no influence of RAE on the performance of para-athletes. Also, Hollings et al. (2014) showed that RAE was higher in events with a greater emphasis on speed and/or strength. The authors (Kearney et al., 2018) explained that high-performing athletes in the youngest age category are more likely to be relatively older. Therefore, there is a higher probability that they are biologically more developed. However, in the present study, no REA on performance in all events analyzed was observed.

Although RAE's influence is multifactorial (Cobley et al., 2008), the causes that could explain the absence of this phenomenon in the performance of para-sport seem to be related to social aspects (Musch & Grondin, 2001). For example, Imms (2008) stated that for these athletes, support from friends, teammates, or national teammates is a crucial issue to continue participating in sports. Thus, these social factors would increase engagement in para-athletics and, consequently, a positive effect on competitive performance (Macias, 2022).

This study has some limitations that must be considered. Like other studies that investigated RAE (Sherar et al., 2007; Solon Junior & Silva Neto, 2020), this is an observational and retrospective study; thus, a longitudinal investigation with para-athletics is recommended. In addition, the small number of participants is also a limitation of the study; however, these data refer to all Brazilian para-athletes who made up the ranking. Therefore, it is suggested that future studies can evaluate this phenomenon in a more significant number of para-athletics so that it is possible to verify the influence of this effect within each functional category or athlete's disability (i.e., congenital or acquired), as suggested elsewhere (de Oliveira et al., 2023). Our other limitation consisted of demographic data absent from para-athletes, since information on social, structural, and financial support can modulate the RAE phenomenon (Wattie et al., 2015).

CONCLUSION

In conclusion, our results suggest an uneven distribution of birth dates by quartile and that, specifically, a greater number of young para-athletics are born in the first quartile of the year in all age categories analyzed (U16, U18, and U20), with greater effect in category U16. Thus, RAE might influence the selection, inclusion, and progression of para-athletics in events such as the Paralympic games. On the other hand, no difference in performance competitive between birth quartiles was found in all events of athletics analyzed.

PRACTICAL IMPLICATIONS

Literature suggests some measures to mitigate the relative age effect in sports which can be considered in the parasport. Coaches should know this phenomenon to make conscious decisions in the process of selection, detection, and development of talents on young athletes of para-athletics. Also, these results highlight the need to carefully consider the role and need for competitive opportunities at different age groups in in para-athletes of athletics, including correction adjustments techniques and competition structure within track and field.

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