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ORIGINAL RESEARCH

The study of relative age effects on weightlifting athletes in U15 and youth age groups

Kenan Erdağı[1], Bülent Işık[2]

[1] *Physical Education and Sports Department, Faculty of Education, Necmettin Erbakan University, Konya, Türkiye.*
[2] *Department of Physiology, Medical School, University of Karamanoğlu Mehmetbey, Karaman, Türkiye.*

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Abstract

Within the sporting scope, the relative age effects refer to the possible advantages of participation and performance of athletes born in the first months of the year of selection in relation to others within the same age groups. The aim of this study was to investigate the relative age effects by comparing athletes in different body weight categories in the Under 15 (U-15) and youth age group athletes (males and females) in weightlifting. By using retrospective competition data from the Turkish Weightlifting Federation database, a total of 954 Olympic-style weightlifters (U15 and Youth age groups), 605 males and 349 females), who competed in the Turkish Weightlifting Championships between 2018 and 2019, were included in this study. The data on the birthdates of the athletes were divided into four quarters. The athletes were divided into three subset weight classes. The data were analyzed using the chi-square test. In males, the relative age effects were determined in lightweight athletes in the under 15 age group ($\chi^2(3)= 10.00$, $p< .05$), in lightweight athletes in the youth age group ($\chi^2(3)= 10.83$, $p< .05$), in middleweight category ($\chi^2(3)= 14.09$, $p< .01$) and heavyweight category ($\chi^2(3)= 12.96$, $p< .01$). However, relative age effects were not present in the female under 15 age group ($p>.05$). It can be stated that weightlifting athletes, under 15 age and youth age groups (except youth females), born in the first quarter of the year have a higher chance of success in athletic performance.

Keywords: Olympic style weightlifting, relative age effects, weight categories.

Introduction

The relative age effects (RAEs) refer to the uneven distribution of birthdates among elite athletes in many competitive sports. Athletes born at the beginning of the competitive year show a higher representation whereas the ones born at the end of the year show less. This unequal distribution has been attributed to the greater advantage in size, strength, and coordination for older children and adolescents within each age group. This can amount to as much as a 12-month age advantage for some competitors (Musch & Hay, 1999). The term "age effect", or the RAE, has been shown in sports sciences since the 1980s. However, as later proven by evidence, a considerable research boom in this area has been shown only in the last few years (Delormé et al., 2010; Wattie et al., 2014; Agricola et al., 2020).

RAEs have been noticed in baseball (Grondin & Koren, 2000), hockey players (Agricola et al., 2020; Grondin & Koren, 2000; Baker & Logan, 2007), soccer players (Augste & Lames, 2011; Helsen et al., 2005), track and field athletes (Brazo-Sayavera et al., 2016), rugby (Till et al., 2010) and tennis (Agricola et al., 2013; Ulbricht et al., 2015). For sports such as taekwondo (Albuquerque et al., 2012), basketball (Daniel & Janssen, 1987), dancers (Van Rossum, 2006), and gymnastics (Baxter-Jones, 1995), no significant RAEs were reported.

For weightlifting, the selection date called as "cut-off date" in literature is accepted as the January 1st in

✉ B. Işık, e-mail: drbulent42@gmail.com

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Turkey as it is in many European countries (Işık & Erdağı, 2022; https://www.ewfed.com/regulations.html). For some types of sports such as ice hockey and baseball, this date is the last day of a calendar year, whereas September 1st represents the same for some other sports (Edgar & O'Donoghue, 2005; Simmons & Paull, 2001). The athletes born at the beginning of a calendar year have a certain advantage compared to those born at the end of the same year because they are older by the number of months separating their birth dates. The age difference can be practically up to 12 months, for example, 10% of ten-year-old children's lives. In the prepubertal period, this shows in the advantage of conditioning, morphological, and mental prerequisites, but also in greater experience in sports and life as well which can bring performance advantages too (Helsen et al., 2005; Edgar & O'Donoghue, 2005; Simmons & Paull, 2001; Lames et al., 2009)

RAEs might be associated with many different characteristics like durability and technical skills (Delorme et al., 2009; Sierra-Diaz et al., 2017). It gains higher importance in sports that require body size and strength (Wattie et al., 2008). In studies on RAEs and performance, a positive correlation between RAEs and success is reported (Augste & Lames, 2011; Vaeyens et al., 2005) and a strong relationship between the age and success of players who participated in the World Cup is declared (Barnsley et al., 1992). The studies show that when athletes are grouped chronologically, older ones have a higher chance to be selected for national or elite teams, unlike their counterparts in the same age group (Helsen et al., 1998).

Since the day weightlifting was accepted into Olympic Games, it's been called Olympic weightlifting. Olympic weightlifting includes two different categories: snatch and clean and jerk. In Olympic weightlifting, depending on their ages, male and female athletes are classified in the under 15 (U15), youth, junior, senior, and masters male and female athletes in U15 and Youth age groups participate in competitions in different body weight categories (Erdağı, 2019). There are a limited number of studies on RAEs on male and female athletes who participate in weightlifting competitions according to their age and body weight.

This study aims to examine relative age effects on U15 and youth-age male-female athletes that participate in Olympic-style weightlifting competitions in different body weights. This study also aims to find out in which quarter of the year the athletes, who rank in the first five in the competitions, were born.

Methods

Participants, Data Collection and Ethics Statement

The study included male and female weightlifting athletes in U15 and youth age who participated in Turkey Weightlifting Competitions held in Turkey in 2018 and 2019. As described previously in other studies (Côté et al., 2006; Medic et al., 2009), the names, ranking, and birthdates of the athletes in Olympic-style weightlifting were collected from an online source of Turkish Weightlifting Federation (https://halter.gov.tr/sonuclar/). The data regarding a total of 954 athletes in Olympic style weightlifting (male U15 [M-U15 n=323]; male youth [M-Youth n= 282]; female U15 [F-U15 n= 208]; female youth [F-Youth n=141]) were collected. Olympic-style weightlifting athletes were divided into age U15 and Youth age groups according to European Weightlifting Federation Rules (https://www.ewfed.com/regulations.html). The athletes in both groups, who had invalid lifts in snatch and clean-and-jerk in the competitions, were excluded. Moreover, the weightlifting athletes who participated in more than one competition were counted once only in our study and the duplicates were also excluded from the groups. The study complies with the Declaration of Helsinki and the ethical approval of the study was obtained from the University of Necmettin Erbakan, Social and Humanities Scientific Research Ethics Committee (dated 2021 and numbered 94).

Procedures

To determine the existence of RAEs, the birthdates of the athletes were firstly recorded to reflect their birth quarter (Q), according to the dates used for creating annual age groups. The cut-off date for the selection in weightlifting sport is January 1st and the participants were included into one of four groups: Q1= athletes born in January, February and March; Q2= athletes born in April, May and June; Q3= athletes born in July, August and September; and Q4 = athletes born in October, November and December (Agricola et al., 2020; Baker & Logan, 2007; Brazo-Sayavera et al., 2016).

Apart from Olympic Games, Olympic-style weightlifting competitions are held in 10 different bodyweight categories for different age groups of both male and female athletes. In our study, the weightlifting athletes were divided into subset weight classes; male lightweight (LW) (49 kg, 55 kg, and 61 kg), male middleweight (MW) (67 kg, 73 kg, 81 kg, and 89 kg), male heavyweight (HW) (96 kg, 102 kg, and +102 kg), female lightweight (LW) (40

kg, 45 kg, and 49 kg), female middleweight (MW) (55 kg, 59 kg, 64 kg, and 71 kg) and female heavyweight (HW) (76 kg, 81 kg and +81 kg). Ranking in the first five in weightlifting championships is so important for the athletes according to the athlete selection criteria declared by Turkey Olympic Preparation Center, so the first five athletes in all groups, who were born from Q1 to Q4, were determined and their birthdate quarter was noted.

Statistical Analyses

For statistical analyses, Chi-squared tests were conducted on the birthdates of each athlete within four quarters to assess the significance of deviations from the expected number of births in each quarter. Chi-squared analyses were carried out for each weight and overall data. Additionally, differences for each subgroup were reported. Chi-squared analyses were also endorsed to find out whether a significant difference exists between the rate of ranking of the athletes in the first five in the competitions and the quarter in which the athletes were born. Overall subgroup differences were also studied. All calculations were performed using software SPSS 25 (IBM Corp. Released 2017. IBM SPSS Statistics for Windows, Version 25.0. Armonk, NY: IBM Corp) and the level of significance was set at $p< 0.05$.

Results

Table 1 shows the distribution of the quarter in which male and female athletes in U15 and youth age groups were born. According to the results obtained from the analyses, we found significant relative age effects for M-U15 in overall ($\chi^2(3)=40.80$, $p< .001$)and LW ($\chi^2(3)= 10.00$, $p< .05$). According to the further analyses to find out from which group the difference arises, it was found that the rate of the individuals in overall the Q1was more than the individuals born in the Q2, Q3, and Q4 ($\chi^2(1)= 5.51$, $p< .05$, $\chi^2(1)= 14.83$, $p< .001$, $\chi^2(1)= 37.82$, $p< .001$; respectively) and the rate of Q2 and Q3were higher than Q4 ($\chi^2(1)= 15.46$, $p< .001$, $\chi^2(1)= 6.45$, $p< .05$.; respectively). In LW, the rate of Q1was more than that of Q2, Q3 and Q4($\chi^2(1)= 7.81$, $p< .01$, $\chi^2(1)= 10.29$, $p< .001$, $\chi^2(1)= 27.81$, $p< .001$; respectively) and the rate of Q2 and Q3 was found to be higher than Q4($\chi^2(1)= 6.91$, $p< .01$, $\chi^2(1)= 4.00$, $p< .05$; respectively) (Table 1).

We also observed significant relative age effects for M-Youth age in overall ($\chi^2(3)= 34.00$, $p< .001$), LW ($\chi^2(3)= 10.83$, $p< .05$) and HW ($\chi^2(3)= 12.96$, $p< .01$). According to the further analyses to find out the reason for the difference, it was found that the rate of the individuals in overall Q1 was more than that of the individuals born in the Q2, Q3 and Q4 ($\chi^2(1)= 13.72$, $p< .001$, $\chi^2(1)= 17.15$, $p< .001$, $\chi^2(1)= 24.65$, $p< .001$; respectively) and the rate of LW individuals in the Q1was higher than the individuals born in theQ3 and Q4($\chi^2(1)= 6.15$, $p < .05$, $\chi^2(1)= 8.22$, $p< .01$; respectively) and the rate of MW Q1was higher than Q2, Q3 and Q4($\chi^2(1)= 8.19$, $p < .05$, $\chi^2(1)= 5.69$, $p< .05$, $\chi^2(1)= 9.67$, $p< .01$; respectively) and the rate of HW individuals born in the Q1was more than that of individuals that were born in the Q2, Q3 and Q4($\chi^2(1)= 5.45$, $p< .05$, $\chi^2(1)= 6.53$, $p< .05$, $\chi^2(1)= 7.76$, $p< .01$; respectively; Table 1).

Significant relative age effects for female F-Youth age groups were also observed in overall ($\chi^2(3)=11.99$, $p< .01$) and LW ($\chi^2(3)= 10.00$, $p<.05$). From the results of further analyses to find out the reason for the difference, it was observed that the rate of individuals in overall Q1was more than the individuals who were born in the Q2, Q3 and Q4($\chi^2(1)= 6.37$, $p< .05$, $\chi^2(1)= 7.72$, $p< .01$, $\chi^2(1)= 6.37$, $p< .05$; respectively). The rate of LW individuals born in the Q1was higher than that of the individuals born in the Q2 andQ4 ($\chi^2(1)= 4.57$, $p < .05$, $\chi^2(1)= 6.23$, $p < .05$; respectively) and the rate of Q3 was observed to be more than that of Q4 ($\chi^2(1)= 5.33$, $p< .05$) (Table 1). No significant relative age effects for F-U15 were observed in overall, LW, MW, and HW categories ($p> .05$; Table 1).

Table 2 shows the distribution of competitional ranking and birthdate quarter of the athletes. Depending on the analyses, a significant difference was observed in competitional ranking and birthdate quarter of M-U15 in overall ($\chi^2(3)= 14.00$, $p< .01$).To find out the reason from which the difference stems, we conducted further analyses and found that the rate of the individuals ranking in the first five and born in the Q4 was lower than the ranking rate of the individuals in Q1, Q2 and Q3($\chi^2(1)= 14.54$, $p< .001$, $\chi^2(1)= 8.26$, $p< .01$, $\chi^2(1)= 7.53$, $p< .01$; respectively). Moreover, no significant difference was observed in the rate of distributional difference of Q1, Q2, and Q3 ($p>.05$; Table 2).

We found a significant difference in the rate of overall M-Youth Q1, Q2, Q3, and Q4 of the athletes ranking in the first five in the competitions ($\chi^2(3)= 18.01$, $p< .001$). From the results of further analyses, it was obtained that the ranking in the first five rate of individuals born in Q1 was higher than that of individuals that were born in Q3, and Q4and the ranking rate of Q2 was higher than that of Q4 ($\chi^2(1)= 6.33$, $p< .05$, $\chi^2(1)= 16.33$, $p< .001$, $\chi^2(1)= 7.11$, $p< .01$; respectively; Table 2).

In our study, no significant difference was observed in the rate of ranking in the first five in competitions of F-U15 in overall quarters (p> .05; Table 2). However, a significant difference was present in the rate of ranking in the first five in competitions of F-Youth in overall ($\chi^2(3)= 13.55$, p< .01). From the extra analyses to figure out the reason which the difference occurs, it was found that the rate of the individuals ranking in the first five in competitions and born in the Q1 was higher than that of individuals in the Q2, Q3, and Q4 ($\chi^2(1)= 8.70$, p< .01, $\chi^2(1)= 5.12$, p< .05, $\chi^2(1)= 7.68$, p< .01; respectively; Table 2).

Table 1
Quarter birth rate distribution of the U15 and youth male-female athletes

Groups	Weight Category (kg)		Q1	Q2	Q3	Q4	Total	χ^2	p	Pairwise Comparisons
M-U15	LW	n	77	46	40	24	187	10.00*	.019	Q1>Q2, Q3, Q4
		%	41.2	24.6	21.4	12.8	100			Q2, Q3 >Q4
	MW	n	35	33	25	16	109	5.88	.118	-
		%	32.1	30.3	22.9	14.7	100			
	HW	n	10	9	5	3	27	5.39	.146	-
		%	37.0	33.3	18.5	11.1	100			
	Overall	n	122	88	70	43	323	40.80***	.000	Q1 > Q2, Q3, Q4
		%	37.8	27.2	21.7	13.3	100			Q2, Q3 > Q4
M- Youth	LW	n	32	23	15	13	83	10.83*	.013	Q1 > Q3, Q4
		%	38.6	27.7	18.1	15.7	100			
	MW	n	58	31	35	29	153	14.09**	.003	Q1 > Q2, Q3, Q4
		%	37.9	20.3	22.9	19.0	100			
	HW	n	22	9	8	7	46	12.96**	.005	Q1 > Q2, Q3, Q4
		%	47.8	19.6	17.4	15.2	100			
	Overall	n	112	63	58	49	282	34.00***	.000	Q1 > Q2, Q3, Q4
		%	39.7	22.3	20.6	17.4	100			
F-U15	LW	n	19	20	23	17	79	.95	.814	-
		%	24.1	25.3	29.1	21.5	100			
	MW	n	32	20	26	15	93	7.00	.072	-
		%	34.4	21.5	28.0	16.1	100			
	HW	n	9	13	9	5	36	3.56	.314	-
		%	25.0	36.1	25.0	13.9	100			
	Overall	n	60	53	58	37	208	6.27	.10	-
		%	28.8	25.5	27.9	17.8	100			
F-Youth	LW	n	11	3	10	2	26	10.00*	.019	Q1> Q2, Q4
		%	42.3	11.5	38.5	7.7	100			Q3> Q4
	MW	n	31	22	15	21	89	5.88	.118	-
		%	34.8	24.7	16.9	23.6	100			
	HW	n	11	5	3	7	26	5.39	.146	-
		%	42.3	19.2	11.5	26.9	100			
	Overall	n	53	30	28	30	141	11.99**	.007	Q1 > Q2, Q3, Q4
		%	37.6	21.3	19.9	21.3	100			

LW: Lightweight, MW: Middleweight, HW: Heavyweight, M: Male, F: Female, Q: Quarter
*p<.05, ** p<.01, ***p<.001

Table 2
The birthdate quarter of the athletes ranking in the first five in weightlifting competitions.

Groups	Weight Category (kg)		Q1	Q2	Q3	Q4	Total	χ^2	p	Pairwise Comparisons
M-U15	LW	n	10	6	10	4	30	14.00**	.003	Q1, Q2, Q3 > Q4
		%	33.3	20.0	33.3	13.3	100			
	MW	n	16	12	9	3	40			
		%	40.0	30.0	22.5	7.5	100			
	HW	n	8	8	6	2	24			
		%	33.3	33.3	25.0	8.3	100			
	Overall	n	34	26	25	9	94			
		%	36.2	27.7	26.6	9.6	100			
M-Youth	LW	n	7	10	6	3	26	18.01***	.000	Q1 > Q3, Q4
		%	26.9	38.5	23.1	11.5	100			Q2 > Q4
	MW	n	19	8	10	3	40			
		%	47.5	20.0	25.0	7.5	100			
	HW	n	12	8	3	4	27			
		%	44.4	29.6	11.1	14.8	100			
	Overall	n	38	26	19	10	93			
		%	40.9	28.0	20.4	10.8	100			
F-U15	LW	n	6	5	10	7	28	7.70	0.53	-
		%	21.4	17.9	35.7	25.0	100			
	MW	n	16	10	10	4	40			
		%	40.0	25.0	25.0	10.0	100			
	HW	n	7	6	11	3	27			
		%	25.9	22.2	40.7	11.1	100			
	Overall	n	29	21	31	14	95			
		%	30.5	22.1	32.6	14.7	100			
F-Youth	LW	n	8	1	8	1	18	13.55**	.004	Q1 > Q2, Q3, Q4
		%	44.4	5.6	44.4	5.6	100			
	MW	n	16	8	6	10	40			
		%	40.0	20.0	15.0	25.0	100			
	HW	n	9	4	3	3	19			
		%	47.4	21.1	15.8	15.8	100			
	Overall	n	33	13	17	14	77			
		%	42.9	16.9	22.1	18.2	100			

LW: Lightweight, MW: Middleweight, HW: Heavyweight, M: Male, F: Female, Q: Quarter
*p <.05, ** p <.01, ***p <.001

Discussion

The relative age effect in sport has been studied in many articles in literature (Baker and Logan, 2007; Agricola et al., 2013; Vaeyens et al., 2005; Musch & Grondin, 2001; Abel et al., 2011; Nakata and Sakamoto, 2012). In a study on the relative age and birthplace effects the professional athletes in the national hockey league, it was reported that most of the athletes were born in the first quarter of the year. Besides, the authors stated that their study findings support the existence of birthplace and birthdate effects in professional ice hockey athletes (Baker and Logan, 2007).

In another study, Agricola et al. (2020) reported that ice hockey players were born in Q1 the most

and in Q4 the least. The authors also mentioned that the absolute frequencies of the number of hockey players born in different quarters have a lowering tendency (from Q1 to Q4) and this might mean a possible influence of the RAEs in all groups on their research. The studies of Ulbricht et al. (2015) showed that in the selection of youth tennis players in Germany, the RAEs exist. Compared to all licensed tennis players in the country, most of the athletes analyzed in their study were born in Q1 and they had a higher competition level in youth age players. In their study, Agricola et al. (2013) studied all young male tennis players who participated in world championships, and they reported that 38.9% were born in Q1, 34.3% were born in Q2, 15.9% were born in Q3 and only 10.9% was born in the last quarter of the year. Furthermore, 73.2% of the tennis players who participated in the championship were born in Q1 and Q2 and this percentage accounts for almost three-fourth of all participants. Depending on the findings of their study, the researchers expressed that age the effect has a critical role for elite young male tennis players (Agricola et al., 2013).

In a study evaluating the RAEs of male and female track-and-field athletes in U15 and U17, it was declared that a higher number of athletes were born in Q1 or Q2 whereas very few were born in Q4. They also stated that for both gender and all age groups, significant differences were observed between the number of entries by quarter. As well as these findings, the authors of the study also reported the data from athletics in which female athletes were not affected by RAEs (U17), though their male counterparts of the same age were (Brazo-Sayavera et al., 2016). When the overall RAEs of the athlete groups in our study were examined, it was found that the rate of M-U15, M-Youth, and F-Youth athletes born in Q1 was significantly higher than the athletes born in Q2, Q3, and Q4. When the groups were studied for the RAEs and the body weight categories, it was observed that the rate of the athletes born in the Q1 in M-U15group in LW, M-Youth group in LW, MW, and HW and F-Youth group in LW was significantly higher than that of those born in the Q2, Q3, and Q4.

In most studies in the literature, it is expressed that relative age has very little or no effects on females, compared to males (Brazo-Sayavera et al., 2016; Baxter-Jones, 1995; Delorme et al., 2009). In a study on the RAEs on female and male youth soccer players (U19), it was reported that only a small, non-significant RAEs was found for female Olympic regional and national players, and no effect was found on for female state team level players, whereas there was a strong relative age effect for males at all of these levels (Vicent & Glamser, 2006). In another study on the RAEs of male and female baseball players, Abel et al. (2011) declared that the quarter of the birthdate was not statistically significant for females, but significant for males. No RAEs was reported for male and female taekwondo athletes who attended in many Olympic games (Albuquerque et al., 2012). In a study on elite athletes who participated in Olympic Games in Pekin in 2008, the researchers studied the existence of the RAEs and they mentioned that the effects of relative age are more present in the male gender than in the female gender (Romaneiro et. al., 2009). Kollars et al. (2021) focused on the RAEs of male and female athletes who participated in the Olympic Games from 2000 to 2016 and stated that the RAEs exist in 3 bodyweight categories (LW, MW, HW) of males, whereas it is present only in LW category females. They also mentioned that RAEs does not exist in MW and HW categories of female groups. In our study, we included weightlifting athletes and we found RAEs was present in M-U15, M-Youth and only in F-Youth, whereas it was not significant in F-U15 group.

According to the current study and literature findings, the presence or absence of RAEs in female may be due to the metabolic and physical changes of the female gender during puberty being different from the males. The anabolic effects of hormones such as estrogen are strongly manifested in the puberty period, which covers the ages of 11 to 16 in female. Therefore, physiological developmental stages such as height growth and skeletal maturation can be seen more in females compared to males in the same age group. Being a female during puberty can be considered as a more advantageous situation in terms of early development compared to being a male (Canbolat, 2021). In the study carried out by Helsen et al. (2005), it was found that when the birthdates of the infants were divided into groups of six-month intervals, the distribution of the infants born in the first six months was 79.2%, whereas the rate for the infants born in the second half of the year was 20.8%. They also emphasized that depending on the birthdate of an infant, RAEs are present, and it is one of those factors affecting performance. In our study, the rate of athletes born in the Q1 was higher than the rate of athletes born in the Q4, M-U15 (Q1 37.8%; Q4 13.3%); M-Youth (Q1 39.7%; Q4 17.4%) and F-Youth (Q1 37.6%; Q4 21.3%), and it might be told that this was one of the factors affecting their ranking in the first five in competitions.

In a study on the relationship between RAEs and the success of U17 soccer players, the authors found significant relationships for the teams in each of the leagues analyzed and they reported that there were positive correlations between the RAEs and rank, points scored, and goals against (Augste & Lames, 2011). Barnsley et al. (1992) analyzed the RAEs on a group of football players of the 1990 World Cup and they announced there was a strong relationship between age and international success. In their study, Vaeyens et al. (2005) mentioned that their study findings proved the existence of RAEs in semi-professional and amateur senior soccer players and supported the view that RAEs affected success in soccer. In our study, it was found that the rate of athletes born in Q1, who ranked in the first five in competitions, was higher than the rate of athletes born in Q4 (M-U15 (Q1 36.2%; Q4 9.6%), M-Youth (Q1 40.9%; Q4 10.8%) and F-Youth (Q1 42.9%, Q4 18.2%, apart from F-U15). The biggest goal of athletes and coaches in weightlifting and all other sports branches is to achieve high-level performance and to win medals in competitions. Achieving a high level of athletic performance is closely related to having balanced physiological processes, a mature physical structure, and an advanced training level. In athletes competing in the same age category and born earlier in the same year compared to their competitors' many anthropometric characteristics, such as improved body structure and weight, may provide a performance advantage. In a 2021 study of Olympic-style senior male and female weightlifters, the authors showed that RAEs differed by body weight categories and gender, and affected performance in senior weightlifters (Tufekci et al., 2021). In another study, the presence of RAEs was investigated in young elite male athletes who were born in 1995 and 2005 in Italy and played for under-16 football teams. The authors declared that RAEs are the selection criteria for the selection of high-performing athletes. Moreover, the authors stated that coaches' emphasis on RAEs has not changed over the past decade, which undermines the right to equal opportunity (Ruscello et al., 2023).

The findings of the study carried out by Helsen et al. (1998) show that the athletes born in Q4 might quite possibly stop doing sports if they are not selected by sports teams. From the findings of our study, we might mention that athletes born in Q1 or Q1 and Q2 have a higher chance to be selected by Olympic preparation centers or ranking in the first five in the competitions than athletes born in Q3 or Q4. That's why, from our study findings, it also might be considered that athletes born in the last months of the year might not be selected for Olympic preparation centers or national teams and this might make these athletes delay or totally abort their athletic purposes.

Study Limited

The main limitation of our current study is the reason for not being able to reach the RAEs data of the athletes in the youth and U15 age categories, who took part in Olympic-style weightlifting in the previous years. We think that our study with Turkish weightlifters can shed light on future research in this field.

Conclusions

Our study proves that relative age effects are present in U15 and Youth age males and only in Youth age females. Also, a higher level of success was observed for M-U15 born in the first quarter of the year, for M-Youth born in Q1, Q2, and for F-Youth born in Q1.

Consequently, from the findings of our study and other studies in the literature, we suggest weightlifting trainers and related sports federations consider relative age effects during the selection of U15 and Youth age groups. Moreover, the Turkish Weightlifting Federation can plan the determination of age category for athletes every quarter or half of the year to minimize the effects of relative age. Further studies might focus on the existence of RAEs in elite junior and senior athletes in the Turkish National team and, if any, whether this has changed over the years.

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Authors' Contribution

Study Design: KE; Data Collection: BI, KE; Statistical Analysis: KE, BI; Manuscript Preparation: KE, BI; Funds Collection: BI, KE.

Ethical Approval

The study was approved by the Necmettin Erbakan University of Social and Humanities Scientific Research Ethical Committee (2021/94) and it was carried out in accordance with the Code of Ethics of the World Medical Association also known as a declaration of Helsinki.

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Conflict of Interest

The authors hereby declare that there was no conflict of interest in conducting this study.

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