RELATIVE AGE EFFECT IN YOUNG COMPETITIVE TENNIS PLAYERS

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Abstract:

The purpose of this study was to examine the presence of the relative age effect (RAE) in young tennis players. Data from a sample of all ranked (n= 3463) and licensed (n= 29150) players in consecutive age groups (10- to 17-year-old) were collected from the official web page of the national federation. They were assigned to four quartiles according to the month of birth: a) Quartile 1 = January-February-March, b) Quartile 2 = April-May-June, c) Quartile 3 = July-August-September, d) Quartile 4 = October-November-December. The players aged between 10 and 17 years affiliated with the national federation were assigned as theoretically expected distribution. The results revealed that 70%, 60.1%, and 56.6% of the top 10, 50, and all ranked players were born in the first half of the year, respectively. However, the results from the chi-square test of goodness-of-fit showed significant RAEs only in the distributions of all ranked and top 50 players at the age of 10 and 11 correspondingly. These results may suggest that RAE exists among young tennis players who are in their early adolescence years.

Key words: *racket sports, talent identification, biological age, physical growth, maturation*

Introduction

Players born within the same calendar year are grouped together in tennis and the majority of the other sports (Ulbricht, Fernandez-Fernandez, Mendez-Villanueva, & Ferrauti, 2015). The term "relative age effects" (RAE) describes the physical and psychological differences among athletes of the same selection year that result from variations in their birthdates (Andronikos, Elumaro, Westbury, & Martindale, 2016). Studies in different sports have shown that, within the same selection year, young athletes born earlier in the year have a higher chance of being selected for elite teams and talent development programs compared to those born later in the year (Augste & Lames, 2011; Cobley, Baker, Wattie, & McKenna, 2009; Delorme & Raspaud, 2009; Fumarco, Gibbs, Jarvis, & Rossi, 2017; Gómez-López, Granero-Gallegos, Molina, & Ríos, 2017; Helsen, et al., 2012; Helsen, Van Winckel & Williams, 2005; Mujika, et al., 2009). This situation results from the inhomogeneous distribution of athletes' birthdates. It is a well-known phenomenon that athletes born at the beginning of the competition year are disproportionately represented, while the athletes born towards the end of the competition year are typically underrepresented (Gerdin, Hedberg, & Hageskog, 2018; Loffing, Schorer, & Cobley, 2010). A child that benefits from an edge in relative age is likely to be viewed as talented in his/her age group; therefore, it is possible for truly talented athletes to be overlooked, which may create discrimination against players who were born later (Delorme, Boiché, & Raspaud, 2010; Koloničný, Agricola, Bozděch, & Zháněl, 2021; Musch & Grondin, 2001). However, studies have also revealed that comparatively younger athletes do better in rotational sports or gymnastics (Maffulli, King, & Helms, 1994). This is known as a "reverse relative age effect," which means an advantage for late-maturing players compared to early and on-time maturers (Andronikos, et al., 2016).

Research has shown that being relatively older or younger in one's age group can have both physical and psychological effects on young athletes

(Edgar & O'Donoghue, 2005). There is a strong link, supported by numerous studies, between birthdate and the selection for teams or competitions in physically demanding sports (Augste & Lames, 2011; Delorme & Raspaud, 2009; Gerdin, et al., 2018; Helsen, et al., 2012; Mujika, et al., 2009). However, the phenomenon known as RAE is also present in sports that require less physical exertion, such as chess (Breznik & Law, 2016), indicating that RAE may be influenced more by experience, psychology, and social factors than previously thought. In sports such as tennis, where factors such as height, strength, speed, and power are key to success (Fernandez-Fernandez, Sanz-Rivas, & Mendez-Villanueva, 2009), older children tend to have an advantage and are often considered more talented, leading to their selection for elite teams (Baxter-Jones, 1995; Edgar & O'Donoghue, 2005). The phenomenon referred to as the Pygmalion effect, where individuals who lack exceptional skills are perceived as talented by coaches, selectors, and even themselves is frequently observed in the world of sports (Rejeski, Darracott, & Hutslar, 1979). This can lead to better opportunities for development and growth, but not necessarily due to actual talent (Edgar & O'Donoghue, 2005). As a result, relatively younger players may have to match the physical capabilities of older players to stay competitive and be selected for higher levels of talent development (Ulbricht, et al., 2015). It is important to note that this phenomenon can lead to discrimination against players who were born later and may be overlooked for development opportunities.

There has been a heightened focus on RAE in the last two decades, especially in youth sports (Cobley, et al., 2009; Helsen, et al., 2005; Musch & Grondin, 2001). In their bibliometric analysis conducted in 2020, Bilgiç and Işın (2022) showed that RAE was a popular topic to be studied in sports sciences, and more than 85% of the studies on RAE were published in the last ten years, whereas more than half of the studies were published in the last five years. Despite the growing interest in RAE, several studies investigated RAE in youth tennis. For example, in their research on Swedish junior tennis players, Gerdin et al. (2018) compared the birthdates of the Swedish population to ranked tennis players. They revealed that the higher a player's rank was, the greater RAE occurred. The top 10 players showed the greatest proportion (64.1%) of being born in the first two quarters of the year when compared to the top 50 and all ranked players. They also presented some gender differences. Compared to the boys, RAEs for girls born in the first half of the year were more prevalent in all comparisons (ranked, top 50, and top 10). In another study, Ulbricht et al. (2015) analyzed young German male tennis players in terms of RAE and physical fitness characteristics. In line with Gerdin et al. (2018), their results showed inhomogeneous birth distributions in young competitive tennis players and greater prevalence of RAE with the progression of competition levels. However, more research is still needed to analyze the RAE in tennis players. Thus, the purpose of the study was to investigate the presence of RAE in young male and female competitive tennis players.

In studies investigating RAEs, the most commonly used methods are the equal distribution of birth quartiles and overall population percentages since they are relatively straightforward and do not require specialized data or knowledge about the specific population being studied. This study is original in the sense that it used the percentages of licensed players as the theoretical expected distribution, which is more accurate and relevant. Additionally, using this method can help to control for external factors that may influence RAEs, such as social and cultural factors, as well as other variables such as training opportunities, access to resources, and coaching quality.

Methods

Data collection

The data of all Turkish tennis players (*N* = 73.369), including their birth date and rankings, were collected through the public website of the Turkish Tennis Federation (www.ttf.org.tr). The inclusion criteria for the subjects were being licensed players and being born between 1 January 2004 and 31 December 2011. Subsequently, a total of 29.150 (14.680 males, 14.470 females) licensed players were included as reference categories to conduct the study. Then, the ranked players (*N* = 3.463) were classified based on their 2021 year-end ranking according to each age group from 10- to 17-years-old. After allocation, the subjects were divided into two groups, boys and girls, and each gender group was assigned to one of the four quartiles according to the month of birth: a) Quartile 1 (Q1) = January-February-March, b) Quartile 2 (Q2) = April-May-June, c) Quartile 3 (Q3) = July-August-September, d) Quartile 4 (Q4) = October-November-December (Zháněl, Válek, Bozděch, & Agricola, 2022). The birth data of the general population was collected from the General Directorate of Civil Registration and Citizenship Affairs. The ethical approval was obtained from the Human Subjects Ethics Committee of the Middle East Technical University (0056-ODTUİAEK-2023).

Data analyses

A chi-square test of goodness-of-fit was performed to test the presence of RAE in Turkish tennis players for each gender separately. The players aged between 10-17 years, affiliated with the Turkish Tennis Federation, were assigned as theoretically expected distribution as previously suggested (Delorme & Raspaud, 2009). Following, the observed frequency of the top 10, top 50, and all ranked players of each age group and gender were evaluated accordingly to determine whether the observed and expected frequency were significantly different. All statistical analyses were performed using SPSS 28.0 (IBM, Chicago, Illinois, USA) and Microsoft Excel (Microsoft, Seattle, Washington, USA) and the level of alpha was set at .05.

Results

The results revealed that nearly 70%, 60%, and 57% of the top 10, 50, and all ranked players, respectively, were born in the first half of the year. The results from the chi-square test of goodness-of-fit when both the boys and girls were pooled are presented in Table 1. The distribution of the observed and expected frequency significantly differed in 10-year-old (all ranked) tennis players

Table 1. All gender

Age group	Rank	Q1 (%)	Q2 (%)	Q3 (%)	Q4 (%)	N	χ2	w	Group comparison
	Top 10	12 (60%)	4 (20%)	2 (10%)	2 (10%)	20			
	Top 50	38 (38%)	23 (23%)	24 (24%)	15 (15%)	100	7.32		
10	Ranked	122 (31.20%)	110 (28.13%)	93 (23.79%)	66 (16.88%)	391	**9.08***	0.15	Q1>Q2>Q3>Q4
	Licensed	653 (26.5%)	628 (25.49%)	662 (26.87%)	521 (21.14%)	2464			
	Population	312023 (24.91%)	293565 (23.43%)	348501 (27.82%)	298723 (23.84%)	1252812			
	Top 10	11 (55%)	7 (35%)	2 (10%)	0 (0%)	20			
	Top 50	41 (41%)	29 (29%)	17 (17%)	13 (13%)	100	**9.26***	0.30	Q1>Q2>Q3>Q4
11	Ranked	195 (32.23%)	168 (27.77%)	128 (21.16%)	114 (18.84%)	605	5.39		
	Licensed	929 (29.67%)	816 (26.06%)	777 (24.82%)	609 (19.45%)	3131			
	Population	318050 (25.22%)	312594 (24.79%)	337045 (26.72%)	293480 (23.27%)	1261169			
	Top 10	8 (40%)	6 (30%)	3 (15%)	3 (15%)	20			
	Top 50	36 (36%)	27 (27%)	22 (22%)	15 (15%)	100	3.80		
12	Ranked	187 (28.86%)	181 (27.93%)	154 (23.77%)	126 (19.44%)	648	0.42		
	Licensed	1031 (28.07%)	1011 (27.53%)	888 (24.18%)	743 (20.23%)	3673			
	Population	314240 (24.81%)	315062 (24.87%)	349213 (27.57%)	288236 (22.75) %	1266751			
	Top 10	4 (20%)	5 (25%)	10 (50%)	1 (5%)	20			
	Top 50	33 (33%)	23 (23%)	26 (26%)	18 (18%)	100	1.04		
13	Ranked	132 (26.61%)	125 (25.20%)	131 (26.41%)	108 (21.77%)	496	2.33		
	Licensed	1107 (28.51%)	985 (25.37%)	1044 (26.89%)	747 (19.24%)	3883			
	Population	331485 (25.59%)	319969 (24.70%)	354495 (27.36%)	289562 (22.35%)	1295511			
	Top 10	8 (40%)	9 (45%)	3 (15%)	0	20			
	Top 50	40 (40%)	24 (24%)	22 (22%)	14 (14%)	100	7.56		
14	Ranked	115 (29.64%)	101 (26.03%)	101 (26.03%)	71 (18.30%)	388	1.05		
	Licensed	1152 (28.19%)	1053 (25.76%)	1054 (25.79%)	828 (20.26%)	4087			
	Population	328010 (25.43%)	318637 (24.70%)	351548 (27.25%)	291797 (22.62%)	1289992			
	Top 10	4 (20%)	10 (50%)	3 (15%)	3 (15%)	20			
	Top 50	31 (31%)	29 (29%)	19 (19%)	21 (21%)	100	3.01		
15	Ranked	110 (30.73%)	95 (26.54%)	73 (20.39%)	80 (22.35%)	358	7.57		
	Licensed	1147 (28.20%)	1042 (25.61%)	1083 (26.62%)	796 (19.57%)	4068			
	Population	327594 (26.09%)	313543 (24.97%)	339553 (27.05%)	274742 (21.88%)	1255432			
	Top 10	3 (15%)	6 (30%)	6 (30%)	5 (25%)	20			
	Top 50	28 (28%)	24 (24%)	21 (21%)	27 (27%)	100	4.11		
16	Ranked	95 (29.32%)	83 (25.62%)	77 (23.77%)	69 (21.30%)	324	2.41		
	Licensed	1072 (26.59%)	1086 (26.93%)	1072 (26.59%)	802 (19.89%)	4032			
	Population	337074 827.10%)	312810 (25.14%)	325769 (26.19%)	268388 (21.57%)	1244041			
	Top 10	10 (50%)	5 (25%)	0	5 (25%)	20			
	Top 50	32 (32%)	23 (23%)	20 (20%)	25 (25%)	100	3.42		
17	Ranked	74 (29.25%)	66 (26.09%)	59 (23.32%)	54 (21.34%)	253	1.30		
	Licensed	1091 (28.62%)	956 (25.08%)	1006 (26.39%)	759 (19.91%)	3812			
	Population	336830 (27.55%)	308743 (25.26%)	320019 (26.18%)	256892 (21.01%)	1222484			

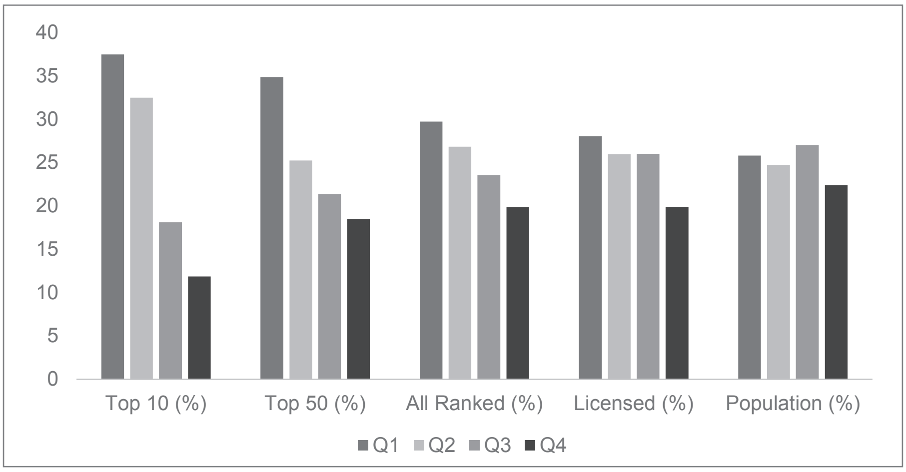

Figure 1. Birth distribution of all players.

Table 2. Comparison of the seasons of birth distribution in girls

Age group	Rank	Q1 (%)	Q2 (%)	Q3 (%)	Q4 (%)	N	χ2	w	Group comparison
10	Top 10	6 (60%)	2 (20%)	0	2 (20%)	10			
	Top 50	18 (36%)	10 (20%)	13 (26%)	9 (18%)	50	2.56		
	Ranked	47 (28.83%)	40 (24.54%)	48 (29.45%)	28 (17.18%)	163	1.08		
	Licensed	303 (26.19%)	287 (24.81%)	336 (29.04%)	231 (19.97%)	1157			
11	Top 10	6 (60%)	3 (30%)	1 (10%)	0	10			
	Top 50	24 (48%)	12 (24%)	10 (20%)	4 (8%)	50	**8.72***	0.4	Q1>Q2>Q3>Q4
	Ranked	100 (35.84%)	71 (25.45%)	63 (22.58%)	45 (16.13%)	279	4.4		
	Licensed	486 (30.62%)	405 (25.52%)	389 (24.51%)	307 (19.34%)	1587			
12	Top 10	6 (60%)	3 (30%)	0	1 (10%)	10			
	Top 50	16 (32%)	17 (34%)	8 (16%)	9 (18%)	50	2.69		
	Ranked	93 (30%)	92 (29.68%)	63 (20.32%)	62 (20%)	310	3.04		
	Licensed	496 (27.79%)	486 (27.23%)	426 (23.87%)	377 (21.12%)	1785			
13	Top 10	1 (10%)	3 (30%)	6 (60%)	0	10 (10%)			
	Top 50	17 (34%)	11 (22%)	15 (30%)	7 (14%)	50	1.96		
	Ranked	62 (29.95%)	50 (24.15%)	52 (25.12%)	43 (20.77%)	207	0.7		
	Licensed	555 (28.19%)	509 (25.85%)	518 (26.31%)	387 (19.65%)	1969			
14	Top 10	5 (50%)	4 (40%)	1 (10%)	0	10			
	Top 50	25 (50%)	12 (24%)	9 (18%)	4 (8%)	50	**12.58***	0.5	Q1>Q2>Q3>Q4
	Ranked	64 (36.57%)	41 (23.43%)	48 (27.43%)	22 (12.57%)	175	**8.33***	0.2	Q1>Q3>Q2>Q4
	Licensed	583 (28.72%)	520 (25.62%)	534 (26.31%)	393 (19.36%)	2030			
15	Top 10	2 (20%)	4 (40%)	3 (30%)	1 (10%)	10			
	Top 50	13 (26%)	12 (24%)	12 (24%)	13 (26%)	50	1.83		
	Ranked	50 (33.11%)	37 (24.50%)	31 (20.53%)	33 (21.85%)	151	4.1		
	Licensed	590 (28.82%)	531 (25.94%)	546 (26.67%)	380 (18.56%)	2047			
16	Top 10	1 (10%)	3 (30%)	5 (50%)	1 (10%)	10			
	Top 50	12 (24%)	14 (28%)	9 (18%)	15 (30%)	50	5.06		
	Ranked	42 (32.06%)	32 (24.43%)	30 (22.90%)	27 (20.61%)	131	2.95		
	Licensed	533 (26.68%)	519 (25.98%)	562 (28.13%)	384 (19.22%)	1998			
17	Top 10	6 (60%)	1 (10%)	0	3 (30%)	10			
	Top 50	19 (38%)	10 (20%)	10 (20%)	11 (22%)	50	2.2		
	Ranked	35 (35.71%)	22 (22.45%)	24 (24.49%)	17 (17.35%)	98	1.59		
	Licensed	571 (30.10%)	437 (23.04%)	509 (26.83%)	380 (20.03%)	1897			

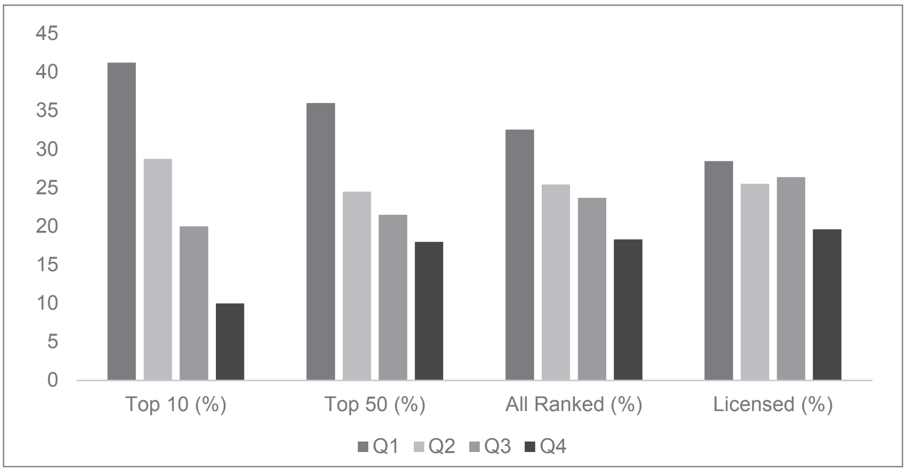

Figure 2. Birth distribution of girls.

Table 3. Comparison of the seasons of birth distribution in boys

Age group	Rank	Q1 (%)	Q2 (%)	Q3 (%)	Q4 (%)	N	χ2	w	Group comparison
10	Top 10	6 (60%)	2 (20%)	2 (20%)	0	10			
	Top 50	20 (40%)	13 (26%)	11 (22%)	6 (12%)	50	5.78		
	Ranked	75 (32.89%)	70 (30.70%)	45 (19.74%)	38 (16.67%)	228	**10.65***	0.22	Q1>Q2>Q3>Q4
	Licensed	350 (26.78%)	341 (26.09%)	326 (24.94%)	290 (22.19%)	1307			
11	Top 10	5 (50%)	4 (40%)	1 (10%)	0	10			
	Top 50	17 (34%)	17 (34%)	7 (14%)	9 (18%)	50	4.04		
	Ranked	95 (29.14%)	97 (29.75%)	65 (19.94%)	69 (21.17%)	326	5.15		
	Licensed	443 (28.69%)	411 (26.62%)	388 (25.13%)	302 (19.56%)	1544			
12	Top 10	2 (20%)	3 (30%)	3 (30%)	2 (20%)	10			
	Top 50	20 (40%)	10 (20%)	14 (28%)	6 (12%)	50	5.16		
	Ranked	94 (27.81%)	89 (26.33%)	91 (26.92%)	64 (18.93%)	338	1.16		
	Licensed	535 (28.34%)	525 (27.81%)	462 (24.47%)	366 (19.39%)	1888			
13	Top 10	3 (30%)	2 (20%)	4 (40%)	1 (10%)	10			
	Top 50	16 (32%)	12 (24%)	11 (22%)	11 (22%)	50	1.01		
	Ranked	70 (24.22%)	75 (25.95%)	79 (27.34%)	65 (22.49%)	289	4.36		
	Licensed	552 (28.84%)	476 (24.87%)	526 (27.48%)	360 (18.81%)	1914			
14	Top 10	3 (30%)	5 (50%)	2 (20%)	0	10			
	Top 50	15 (30%)	12 (24%)	13 (26%)	10 (20%)	50	0.21		
	Ranked	51 (23.94%)	60 (28.17%)	53 (24.88%)	49 (23.01%)	213	1.84		
	Licensed	569 (27.66%)	533 (25.91%)	520 (25.28%)	435 (21.15%)	2057			
15	Top 10	2 (20%)	6 (60%)	0	2 (20%)	10			
	Top 50	18 (36%)	17 (34%)	7 (14%)	8 (16%)	50	6.28		
	Ranked	60 (28.99%)	58 (28.02%)	42 (20.29%)	47 (22.71%)	207	4.29		
	Licensed	557 (27.56%)	511 (25.28%)	537 (26.57%)	416 (20.58%)	2021			
16	Top 10	2 (20%)	3 (30%)	1 (10%)	4 (40%)	10			
	Top 50	16 (32%)	10 (20%)	12 (24%)	12 (24%)	50	2.00		
	Ranked	53 (27.46%)	51 (26.42%)	47 (24.35%)	42 (21.76%)	193	0.39		
	Licensed	539 (26.50%)	567 (27.88%)	510 (25.07%)	418 (20.55%)	2034			
17	Top 10	4 (40%)	4 (40%)	0	2 (20%)	10			
	Top 50	13 (26%)	13 (26%)	10 (20%)	14 (28%)	50	2.43		
	Ranked	39 (25.16%)	44 (28.39%)	35 (22.58%)	37 (23.87%)	155	2.30		
	Licensed	520 (27.15%)	519 (27.10%)	497 (25.95%)	379 (19.79%)	1915			

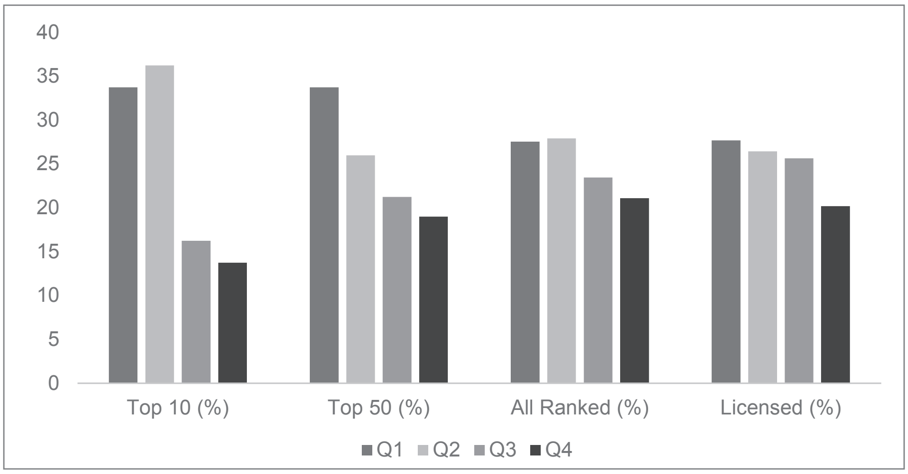

Figure 3. Birth distribution of boys.

(χ2 (3, 391) = 9.08, $p < .05$, $w = .15$). The percentage of the players were 31.2%, 28.1%, 23.8%, and 16.9% for Q1, Q2, Q3, and Q4, respectively. Concerning the 11-year-old age group, the players ranked in the top 50 showed a significant difference according to their birth quartile (χ2 (3, 100) = 9.26, $p < .05$, $w = .30$). The distribution percentage according to the birth quartile was 41%, 29%, 17%, 13% for Q1, Q2, Q3, and Q4, respectively. In terms of all other age groups, the distribution of the observed and expected frequency was constant. Figure 1 illustrates the distribution of all ranked and aged players compared to the distribution of licensed players and the general population.

The results also revealed that the expected and observed frequency significantly varied for 11-year-old girls, ranked in the top 50, (χ2 (3, 50) = 8.72, $p < .05$, $w = .42$). The birth quartiles of these players were clustered in Q1, Q2, Q3, and Q4 with the percentage of 48%, 24%, 20%, and 8%, respectively. Another significant difference was observed among 14-year-old girls ranked in the top 50 and all-ranked (χ2 (3, 175) = 8.33, $p < .05$, $w = .22$). Half (50%) of the top 50 ranked players were born in Q1, while 24% of those were born in Q2, 18% in Q3 and 9% Q4. RAE was not observed in the remaining age groups among girls (Table 2). The observed and expected distribution of girls regardless of their age and rank are shown in Figure 2.

For the boys, the results indicated that all ranked 10-year-old players showed the presence of RAE (χ2 (3, 228) = 10.65, $p < .05$, $w = .22$). Of these players, 32.9% were born in Q1, and 30.7%, 19.7%, and 16.7% were born in Q2, Q3, and Q4, respectively. The remaining age groups showed no significant difference among boys (Table 3). An illustration of all age and ranked boys compared with all licensed boys can be seen in Figure 3.

Discussion and conclusions

The purpose of the study was to evaluate the effect of relative age on young Turkish competitive tennis players. The assessment of RAEs in a population often involves comparing birth quartiles. There are three commonly used methods for this comparison. The first method assumes equal distribution of birth quartiles, where each quartile consists of 25% of the population. Comparisons are then made based on this equal distribution. The second method involves comparing the RAEs of the sample to the overall population percentages if the data is available. The third method involves comparing the RAEs of the sample to the percentages of licensed players if the data is accessible. In the present study, the third method was chosen for RAEs assessment since the sample consisted of competitive tennis players, and comparing the sample to licensed players with similar characteristics and backgrounds could provide more reliable results. The main findings from the present study can be summarized as RAE was limited to two age groups (11- and 14-year-olds) for girls, one age group (10-year olds) for boys, and two age groups (10- and 11-year olds) for genders pooled together. RAE was observed to be more pronounced higher up in the rankings. From all ranked to top 10, the prevalence of RAE was more pronounced in both boys and girls (see Figure 1, Figure 2, and Figure3).

The study revealed that a greater proportion of top-ranked tennis players were born in the first half of the year, particularly among the 10- and 11-year-old age groups, where the gap was most noticeable. It is consistent with prior research that has identified significant RAE in youth sports. The study conducted by Edgar and O'Donoghue (2005) on elite senior junior tennis players discovered that nearly 60% of the senior and junior players participating in the initial rounds of Grand Slam tournaments were born in the first six months of the year. The findings of a study conducted by Baxter-Jones (1995) showed that a high proportion, up to 85%, of elite British junior players were born in the first half of the year, and Dudink (1994) revealed that almost half (50%) of 60 12-16-year-old elite Dutch junior tennis players were born in the first birth quartile.

RAE in tennis has been well documented within a broad age and ranking range (Agricola, Zháněl, & Hubáček, 2013; Giacomini, 1999; Koloničný, Agricola, & Jiri, 2021b). The present study found varying results based on age group and gender, with the RAE being more pronounced in girls. There were significant differences for 11-year-old top 50 ranked girls, 14-year-old top 50 ranked girls, and all-ranked girls, as well as for 10-year-old top 50 ranked boys between the expected and observed frequency of birth quartiles. The findings indicated differences in the mean values between the expected and observed frequencies in favor of Q1 in the majority of all subcategories and age groups; however, it failed to show any significant difference (see Table 1, Table 2, and Table 3). Several studies (Gerdin, et al., 2018; O'Donoghue, 2009; Zhaněl, et al., 2022) have indicated that the RAE has an impact on both male and female tennis players, with some research (Gerdin, et al., 2018) suggesting that it is stronger for female players. However, Edgar and O'Donoghue (2005) found no significant difference between the genders. They revealed that the RAE was found to be more prevalent among players born in the first and fourth quarters of the year. A study by Koloničný et al. (2021a) found that the RAE was present in all male and female sub-categories, including "Ranked", "Top 100," and "Top 10". However, the effect was only statistically significant among the top 10 male players. The authors also identified earlier physical, psychological, and mental maturity as contributing factors to the RAE. Additionally, Zháněl et al. (2022) found that the effect was statistically significant for the top 100 senior female tennis players.

In conclusion, the results of this study indicate the trend of players being born mostly in the first half of the year, potentially giving them an advantage in physical and mental development. Yet, the distribution based on birth quartiles did not significantly differ among the majority of age groups in both genders. Thus, it can be concluded that several factors such as physical development, psychological and physiological differences might play a key role in the success of players other than the relative age factor. These findings shed light on the issue of RAE in youth sports and its impact on the development and selection of young athletes. This study highlights the importance of conducting further research to fully understand the mechanisms behind RAEs and to promote fairness in the selection process. These insights provide valuable information for coaches, trainers, and sports organizations to consider how to develop and when to select young athletes.

This study has several limitations. Firstly, it only focused on competitive tennis players aged between 10 and 17 years, and there is limited research on players older than 17 years. Future studies should consider including adult tennis players. Secondly, the RAEs were only assessed in tennis players, and future studies should examine this issue in other sports as well. Lastly, two important biological factors, the growth and maturity status of the players, were not considered.

References

Agricola, A., Zháněl, J., & Hubáček, O. (2013). Relative age effect in junior tennis (male). *Acta Gymnica*, *43*(1), 27-33. https://doi.org/10.5507/ag.2013.003

Andronikos, G., Elumaro, A.I., Westbury, T., & Martindale, R.J.J. (2016). Relative age effect: implications for effective practice. *Journal of Sports Sciences*, *34*(12), 1124-1131. https://doi.org/10.1080/02640414.2015.1093647

Augste, C., & Lames, M. (2011). The relative age effect and success in German elite U-17 soccer teams. *Journal of Sports Sciences*, *29*(9), 983-987. https://doi.org/10.1080/02640414.2011.574719

Baxter-Jones, A.D.G. (1995). Growth and development of young athletes: Should competition levels be age related? *Sports Medicine*, *20*(2), 59-64. https://doi.org/10.2165/00007256-199520020-00001

Bilgiç, M., & Işın, A. (2022). Embarking on a journey: A bibliometric analysis of the relative age effect in sport science. *German Journal of Exercise and Sport Research*, online ahead of print. https://doi.org/10.1007/s12662-021-00792-w

Breznik, K., & Law, K.M.Y. (2016). Relative age effect in mind games: The evidence from elite chess. *Perceptual and Motor Skills*, *122*(2), 583-594. https://doi.org/10.1177/0031512516640957

Cobley, S., Baker, J., Wattie, N., & McKenna, J. (2009). Annual age-grouping and athlete development. *Sports Medicine*, *39*(3), 235-256. https://doi.org/10.2165/00007256-200939030-00005

Delorme, N., Boiché, J., & Raspaud, M. (2010). Relative age effect in elite sports: Methodological bias or real discrimination? *European Journal of Sport Science*, *10*(2), 91-96. https://doi.org/10.1080/17461390903271584

Delorme, N., & Raspaud, M. (2009). The relative age effect in young French basketball players: A study on the whole population. *Scandinavian Journal of Medicine and Science in Sports*, *19*(2), 235-242. https://doi.org/10.1111/j.1600-0838.2008.00781.x

Dudink, A. (1994). Birth date and sporting success. *Nature*, *368*(6472), 592-592. https://doi.org/10.1038/368592a0

Edgar, S., & O'Donoghue, P. (2005). Season of birth distribution of elite tennis players. *Journal of Sports Sciences*, *23*(10), 1013-1020. https://doi.org/10.1080/02640410400021468

Fernandez-Fernandez, J., Sanz-Rivas, D., & Mendez-Villanueva, A. (2009). A review of the activity profile and physiological demands of tennis match play. *Strength and Conditioning Journal*, *31*(4), 15-26. https://doi.org/10.1519/ssc.0b013e3181ada1cb

Fumarco, L., Gibbs, B.G., Jarvis, J.A., & Rossi, G. (2017). The relative age effect reversal among the National Hockey League elite. *PloS One*, *12*(8), e0182827. https://doi.org/10.1371/journal.pone.0182827

Gerdin, G., Hedberg, M., & Hageskog, C.A. (2018). Relative age effect in Swedish male and female tennis players born in 1998–2001. *Sports*, *6*(2), 38. https://doi.org/10.3390/sports6020038

Giacomini, C.P. (1999). Association of birthdate with success of nationally ranked junior tennis players in the United States. *Perceptual and Motor Skills*, *89*(2), 381-386. https://doi.org/10.2466/pms.1999.89.2.381

Gómez-López, M., Granero-Gallegos, A., Molina, S.F., & Ríos, L.J.C. (2017). Relative age effect during the selection of young handball player. *Journal of Physical Education and Sport*, *17*(1), 418. http://dx.doi.org/10.7752/jpes.2017.01062.

Helsen, W.F., Baker, J., Michiels, S., Schorer, J., Van Winckel, J., & Williams, A.M. (2012). The relative age effect in European professional soccer: Did ten years of research make any difference? *Journal of Sports Sciences*, *30*(15), 1665-1671. https://doi.org/10.1080/02640414.2012.721929

Helsen, W.F., Van Winckel, J., & Williams, A.M. (2005). The relative age effect in youth soccer across Europe. *Journal of Sports Sciences*, *23*(6), 629-636. https://doi.org/10.1080/02640410400021310

Koloničný, R., Agricola, A., Bozděch, M., & Zháněl, J. (2021a). The relative age effect in Czech U14 male and female tennis players in 2007–2016. *Studia Sportiva*, *15*(2), 50-60. https://doi.org/10.5817/sts2021-2-5

Koloničný, R., Agricola, A., & Jiri, Z. (2021b). RAE with Czech tennis players in category U16 in 2003–2017. *Česká Kinantropologie*, *25*(3-4), 47-59.

Loffing, F., Schorer, J., & Cobley, S. (2010). Relative age effects are a developmental problem in tennis: But not necessarily when you're left-handed! *High Ability Studies*, *21*(1), 19-25. https://doi.org/10.1080/13598139.2010.488084

Maffulli, N., King, J.B., & Helms, P. (1994). Training in elite young athletes (the Training of Young Athletes (TOYA) Study): Injuries, flexibility and isometric strength. *British Journal of Sports Medicine*, *28*(2), 123-136. https://doi.org/10.1136/bjsm.28.2.123

Mujika, I., Vaeyens, R., Matthys, S.P., Santisteban, J., Goiriena, J., & Philippaerts, R. (2009). The relative age effect in a professional football club setting. *Journal of Sports Sciences*, *27*(11), 1153-1158. https://doi.org/10.1080/02640410903220328

Musch, J., & Grondin, S. (2001). Unequal competition as an impediment to personal development: A review of the relative age effect in sport. *Developmental Review*, *21*(2), 147-167. https://doi.org/10.1006/drev.2000.0516

O'Donoghue, P. (2009). Relative age in elite tennis. *Studies in Physical Culture and Tourism*, *16*(4), 379-388. http://www.wbc.poznan.pl/Content/127606/5_ODonoghue_REV.pdf

Rejeski, W., Darracott, C., & Hutslar, S. (1979). Pygmalion in youth sport: A field study. *Journal of Sport Psychology*, *1*(4), 311-319. https://doi.org/10.1123/jsp.1.4.311

Ulbricht, A., Fernandez-Fernandez, J., Mendez-Villanueva, A., & Ferrauti, A. (2015). The relative age effect and physical fitness characteristics in German male tennis players. *Journal of Sports Science and Medicine*, *14*(3), 634-642.

Zháněl, J., Válek, T., Bozděch, M., & Agricola, A. (2022). The relative age effect in top 100 elite female tennis players in 2007–2016. *PloS One*, *17*(11), e0276668. https://doi.org/10.1371/journal.pone.0276668

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