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Relative Age Effect in Junior Padel Players: Insights from National Team Selection at the 2024 Junior European Championships

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Abstract: The aim of this study was to investigate the relative age effect (RAE) in junior padel players participating in the 2024 European Junior Championships by Teams. The sample comprised 285 junior athletes (165 boys from 16 boys' teams and 120 girls from 12 girls' teams). Dates of birth were categorized into quartiles. Data analysis included Chi-squared goodness-of-fit tests, Fisher's exact goodness-of-fit tests, Chi-squared tests, Fisher's exact tests with Monte Carlo correction (95% CI), and Spearman correlations. Results indicated no consistent RAE overall. However, in boys, a higher proportion of players were born in Q1 (CSR = 2.2) and in the last year of eligibility (CSR = 2.0) in the highest-ranked teams. Additionally, position correlated directly with both quartile (boys: $p = 0.015$; girls: $p = 0.001$) and category year (boys: $p = 0.032$; girls: $p = 0.038$). Based on these findings, it can be concluded that while the overall analysis did not reveal a consistent RAE among all junior padel players, significant trends emerged within the boys' teams, especially among higher-ranked groups. The findings suggest that early birth quartiles and being in the last year of eligibility may confer advantages in competitive performance. These results highlight the need for further investigation into the implications of the RAE in youth sports, particularly regarding talent development and team selection processes.

Keywords: racquet sports; talent identification; youth

1. Introduction

In recent years, padel has exploded in popularity, becoming one of the fastest-growing sports across the globe since it is easy to play and enjoyable for people of all ages and skill levels [1–3]. From the very first day, beginners can experience the fun and competitive spirit the sport offers [4]. Today, more than 30 million people play padel in cities across five continents [5], an impressive figure that continues to rise each year. But padel's rapid growth is most evident on its biggest competitive stages—and nowhere is this more apparent than at the annual European Junior Padel Championships by Teams.

Each year, the best young athletes from across Europe gather, not just to compete but to earn the honor of representing their country. For young players dreaming of donning their nation's colors, these championships represent the pinnacle of youth competition. Yet, with limited spots available—just four players per age category (U14, U16, U18) and gender—the selection process is fierce. Only the most talented and fortunate athletes are chosen to compete, making the national team a symbol of elite status within the sport.

However, beneath the surface of selection processes in youth sports lies a subtle yet significant factor: the relative age effect (RAE). This phenomenon arises from age differences among individuals within the same nominal age group, often due to their birth in different quartiles of the same year [6]. These differences sharpen disparities in athletes' maturation status, which may not align with their

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chronological age [7]. As a result, athletes born earlier in the year—often with advanced maturational development—are overrepresented in youth sports [8]. This advantage, commonly referred to as the relative age effect, gives relatively older athletes more opportunities for selection and better performance outcomes compared to their younger peers [9].

It is important to note that, in padel, players nearly four years apart in age could be eligible for the same spot. For example, a Spanish boy born on January 1st, 2008, and another born on December 31st, 2012, could both vie for a place on the U16 Spain team if the competition was held in 2024. Moreover, according to the rules, one player could compete in one match within his/her own category and, in another match, be allowed to compete in an older age category.

The RAE has been investigated from various perspectives and for diverse purposes. Research has explored its prevalence in both team and individual sports [10–12], assessed its influence within specific competitions [13,14], and examined the extent to which factors such as gender, age, or competition categories in clubs and federations shape its impact [15,16]. Moreover, some studies have proposed interventions aimed at mitigating its potential consequences [17–19]. Recently, there has been a growing focus on understanding the relationship between the RAE and competition performance, with the aim of gaining deeper insights into how this phenomenon influences athletic outcomes [20–22].

Yet, in the world of padel, the impact of relative age remains largely unexplored territory. Despite padel's rapid rise, it is one of the least studied sports regarding RAE in recent years [23]. To the best of our knowledge, there has been only one study addressing this issue, and it focuses exclusively on professional players [24]. This gap is surprising given the sport's rapid growth and the increasing competition among youth athletes.

Understanding how relative age influences national team selection in padel is crucial not just for fairness, but for unlocking the full potential of young athletes. If selection processes systematically favor older athletes, younger and potentially equally talented players may be overlooked, which could ultimately shape the trajectory of talent development in the sport. This research aims to address this gap, examining the relative age effect within the context of the European Junior Championships by Teams, and shedding light on how this invisible bias may shape the future of youth padel.

2. Materials and Methods

2.1. Sample

The sample consisted of players representing teams from each country participating in the 2024 European Junior Championship, in which each tie is played in the best of three matches (one U14 match, one U16 match and one U18 match). Specifically, 16 countries (Germany, Austria, Belgium, Denmark, Spain, Estonia, Finland, France, Netherlands, Italy, Hungary, Lithuania, Norway, Portugal, Sweden and Switzerland) participated in the men's category, which corresponded to 165 boys, and 12 countries (Germany, Belgium, Czech Republic, Spain, Estonia, Finland, France, Netherlands, Italy, Hungary, Portugal and Sweden) participated in the women's category, which corresponded to 120 girls.

2.2. Study Variables

The following variables were used in this study to analyze the Relative Age Effect (RAE) in junior players taking part in the 2024 European Junior Championships by Teams:

- Sex: The sex of the players, classified into two categories: boys and girls.
- Year category: This variable specifies the player's birth year relative to the eligibility range within each age category. It distinguishes between players born in:
  - Last possible year for the age category (e.g., 2013 for U14, 2011 for U16, and 2009 for U18).
  - Second last possible year (e.g., 2012 for U14, 2010 for U16, and 2008 for U18).
  - Third last possible year (e.g., 2011 for U14, 2009 for U16, and 2007 for U18).
  - Fourth last possible year (e.g., 2010 for U14, 2008 for U16, and 2006 for U18).

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- Quartile: Players' birthdates were divided into quartiles based on their birth month within a calendar year:
  - Q1: January to March.
  - Q2: April to June.
  - Q3: July to September.
  - Q4: October to December.

This variable was used to assess the relative distribution of players born earlier (Q1, Q2) versus later (Q3, Q4) in the year and its impact on selection.

- Position: The final ranking of the team at the conclusion of the championship. This variable was used to investigate the relationship between team performance and player selection based on relative age. Teams were categorized by their final standing, with special focus on the top teams and the bottom teams.

2.3. Procedure

The month of birth of each young player was categorized into quartiles (Q). The annual calendar from January 1st to December 31st was considered. The 1st quartile (Q1) consisted of the months January, February and March; the 2nd quartile (Q2) included the months April, May and June; the 3rd quartile (Q3) comprised the months July, August and September; and the 4th quartile (Q4) consisted of the months October, November and December.

2.4. Statistical Analysis

A descriptive analysis was performed to obtain information on the percentage of boys and girls participating in each quartile. Consistent with previous studies, the expected values were calculated by assuming equal distribution of births in each quartile of the year [25–27]. Inferential tests were performed to make comparisons between data categories including Chi2 goodness-of-fit tests, Fisher's exact goodness-of-fit tests, Chi2 tests, Fisher's exact tests with Monte Carlo correction (95% CI), and Spearman correlations. All data were analyzed using the SPSS statistical package for Macintosh v.25.0 (SPSS Inc, Chicago, IL, United States) and a p value less than 0.05 was considered statistically significant.

3. Results

The birthdate distribution of all young players (n = 285) was not statistically different from the expected distribution for each quartile ($p > 0.05$, Table 1).

Table 1. Evaluation of quartiles of young padel athletes' birth of the European Junior Championships by Teams 2024 by sex using Chi2 test and by country, using the Fisher's exact test.

		Number and (%) of young athletes per quartile					χ^2	p
		Q1	Q2	Q3	Q4	Total		
All athletes		70 (24.6)	79 (27.7)	78 (27.4)	58 (20.4)	285	3.968	0.265
By sex								
Male		35 (21.2)	44 (26.7)	48 (29.1)	38 (23.0)	165	2.491	0.477
Female		35 (29.2)	35 (29.2)	30 (25.0)	20 (16.7)	120	5.000	0.172
Boys								
Position	*Country*							
1	Spain	5 (41.7)	2 (16.7)	0 (0.0)	5 (41.7)	12	1.500	0.622
2	France	3 (30.0)	5 (50.0)	1 (10.0)	1 (10.0)	10	4.400	0.261
3	Sweden	1 (8.3)	4 (33.3)	7 (58.3)	0 (0.0)	12	4.500	0.115
4	Belgium	3 (30.0)	4 (40.0)	2 (20.0)	1 (10.0)	10	2.000	0.720

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5	Italy	3 (25.0)	3 (25.0)	2 (16.7)	4 (33.3)	12	0.667	0.978
6	Portugal	5 (41.7)	0 (0.0)	3 (25.0)	4 (33.3)	12	0.500	0.935
7	Netherlands	4 (33.3)	3 (25.0)	4 (33.3)	1 (8.3)	12	2.000	0.705
8	Estonia	0 (0.0)	2 (33.3)	2 (33.3)	2 (33.3)	6	0.000	1.000
9	Denmark	3 (50.0)	2 (33.3)	0 (0.0)	1 (16.7)	6	1.000	0.877
10	Lithuania	0 (0.0)	5 (62.5)	2 (25.0)	1 (12.5)	8	3.250	0.296
11	Finland	2 (16.7)	2 (16.7)	7 (58.3)	1 (8.3)	12	7.333	0.065
12	Switzerland	1 (11.1)	1 (11.1)	3 (33.3)	4 (44.4)	9	3.000	0.481
13	Austria	1 (9.1)	1 (9.1)	7 (63.6)	2 (18.2)	11	9.000	0.032*
14	Norway	2 (22.2)	3 (33.3)	2 (22.2)	2 (22.2)	9	0.333	1.000
15	Germany	0 (0.0)	2 (16.7)	4 (33.3)	6 (50.0)	12	2.000	0.424
16	Hungary	2 (16.7)	5 (41.7)	2 (16.7)	3 (25.0)	12	2.000	0.705
Girls by country								
Position	*Country*							
1	Spain	7 (58.3)	4 (33.3)	1 (8.3)	0 (0.0)	12	4.500	0.115
2	Italy	6 (50.0)	4 (33.3)	1 (8.3)	1 (8.3)	12	6.000	0.130
3	Portugal	4 (33.3)	2 (16.7)	2 (16.7)	4 (33.3)	12	1.333	0.780
4	France	2 (20.0)	5 (50.0)	2 (20.0)	1 (10.0)	10	3.600	0.431
5	Belgium	1 (16.7)	3 (50.0)	2 (33.3)	0 (0.0)	6	1.000	0.877
6	Sweden	2 (16.7)	2 (16.7)	7 (58.3)	1 (8.3)	12	7.333	0.065
7	Netherlands	4 (40.0)	3 (30.0)	0 (0.0)	3 (30.0)	10	0.200	1.000
8	Estonia	3 (42.9)	2 (28.6)	1 (14.3)	1 (14.3)	7	1.571	0.846
9	Finland	2 (25.0)	3 (37.5)	2 (25.0)	1 (12.5)	8	1.000	0.962
10	Hungary	0 (0.0)	2 (20.0)	6 (60.0)	2 (20.0)	10	3.200	0.242
11	Germany	2 (16.7)	3 (25.0)	5 (41.7)	2 (16.7)	12	2.000	0.705
12	Czech Republic	2 (22.2)	2 (22.2)	1 (11.1)	4 (44.4)	9	2.111	0.654

Note. *p < 0.05

There is not any relationship between the quartile and the ranking in boys ($\chi2 = 5.488$; df = 3; p = 0.139; Vc = 0.182) and in girls ($\chi2 = 5.839$; df = 3; p = 0.120; Vc = 0.221) (Table 2). In boys, there is a higher proportion of players born in Q1 (CSR = 2.2).

Table 2. Birth quartile distribution between top and bottom-ranked boys' and girls' teams.

			Boys			
		Rank 1-8			**Rank 9-16**	
	n	**%**	**CSR**	**n**	**%**	**CSR**
Q1	24	27.9a	2.2	11	13.9b	-2.2
Q2	23	26.7	0.0	21	26.6	0.0
Q3	21	24.4	-1.4	27	34.2	1.4
Q4	18	20.9	-0.7	20	25.3	0.7
			Girls			
		Rank 1-6			**Rank 7-12**	
	n	**%**	**CSR**	**n**	**%**	**CSR**
Q1	25	35.2	1.8	10	20.4	-1.8
Q2	22	31.0	0.5	13	26.5	-0.5

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Q3	16	22.5	-0.8	14	28.6	0.8
Q4	8	11.3	-1.9	12	24.5	1.9

Note. n: number; % percentage; CSR: corrected standard residuals; CSR > 1.96: Bold; a, b = indicate significant differences in the Z tests for comparison of column proportions from p < 0.05 adjusted according to Bonferroni.

There is not any relationship between the quartile and the ranking in boys (F = 6.842; df = 3; contingency coefficient = 0.207; p = 0.056, $IC_{MonteCarlo}$ = [0.052, 0.056]) and in girls (F = 5.060; df = 3; contingency coefficient = 0.205; p = 0.112, $IC_{MonteCarlo}$ = [0.106, 0.118]) (Table 3). However, in boys, there is a higher proportion of players born in the last year possible (CSR = 2.0) and in girls, there is a higher proportion of players born in third last year (CSR = 2.1).

Table 3. Year category distribution between top and bottom-ranked boys' and girls' teams.

	Boys					
	Rank 1-8			**Rank 9-16**		
	n	**%**	**CSR**	**n**	**%**	**CSR**
Last year	62	72.1a	2.0	45	57.0b	-2.0
Second last year	23	26.7	-1.0	27	34.2	1.0
Third last year	1	1.2	-1.8	5	6.3	1.8
Fourth last year	0	0.0	-1.5	2	2.5	1.5
	Girls					
	Rank 1-6			**Rank 7-12**		
	n	**%**	**CSR**	**n**	**%**	**CSR**
Last year	43	60.6	1.3	24	49.0	-1.3
Second last year	27	38.0	-0.5	21	42.9	0.5
Third last year	0	0.0a	-2.1	3	6.1b	2.1
Fourth last year	1	1.4	-0.3	1	2.0	0.3

Note. n: number; % percentage; CSR: corrected standard residuals; CSR > 1.96: Bold; a, b = indicate significant differences in the Z tests for comparison of column proportions from p < 0.05 adjusted according to Bonferroni.

Finally, Table 4 show direct correlations between position and quartile (boys: p = 0.015; girls: p = 0.001) and between position and category year (boys: p = 0.032; girls: p = 0.038).

Table 4. Correlation between the team position and the quartile and category year of the team players.

Boys			
Variable	**Position**	**Quartile**	**Category year**
Position	1	0.188*	0.167*
Quartile		1	-0.071
Category year			1
Girls			
Variable	**Position**	**Quartile**	**Category year**
Position	1	0.304**	0.190*
Quartile		1	0.043
Category year			1
Note. *p < 0.05; **p < 0.01			

4. Discussion

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The aim of this study was to examine the prevalence of the relative age effect and its influence on the performance of elite youth padel teams, with a focus on birth quartile distributions, year categories, and their correlation with team rankings in the European Junior Championships 2024. The results did not show evidence of this effect in the sample of padel players analyzed. As found by [24] when they analyzed the birth quartile of professional padel, our study shows that there is no relative effect of age in junior players at the 2024 European Championships, neither in the total number of players nor differentiating them by gender, country or position in the ranking. These results could be related to the level of professionalization in padel. Padel, although it has not been considered a popular sport in the past, is acquiring an international relevance in the recent years. This fact may mean that there is not a talent acquisition process as developed as there is, for example, in soccer [28]. So, if padel continues to grow in popularity and significance within the sporting world, leading to more practitioners in various countries, we can expect that selection processes will be refined and players will be recruited at younger ages. This trend may facilitate the emergence of the relative age effect in this sport in the coming years.

However, and in contrast to the results obtained, the literature in other sports such as basketball [29], handball [30], athletics [31], triathlon [32], volleyball [33] or tennis [34] has shown a positive effect when it comes to junior athletes. Likewise, this effect is also found in professional categories in sports such as soccer [35,36], basketball [37] or handball [38].

A possible explanation for the non-existence of the relative effect of age in the present study could be found in the physical and anthropometric characteristics required for these sports. For example, in the talent recruitment process for basketball players, height, speed or agility have been considered critical variables [39]. In the case of soccer, skeletal age or body composition have been relevant [40]. However, in padel, anthropometric variables such as height, weight or body mass index do not seem to be as relevant as they are for other racquet sports such as tennis or badminton in junior categories [41,42].

The best eight male teams (out of sixteen) were composed of a significantly higher proportion of players born in the first quartile compared to the worst eight teams. A similar trend was observed in girls, although the difference was not statistically significant. Furthermore, for both boys and girls, the final position of the team was directly correlated with the quartile or category year. In other words, teams with a higher proportion of players born in the earlier quartiles or in the final year of eligibility tend to perform better in competitions, indicating that the relative age effect may play a role in shaping team success in junior padel. To the best of our knowledge, no prior study in racket sports has investigated this relationship between team performance and RAE. In line with our results, previous research in football has shown that older teams tend to achieve better final rankings [43,44].

Strengths, limitations and future studies

This study is the first to analyze the relative age effect (RAE) in junior padel players, making it a pioneering study in this sport. However, there are several limitations to consider. The sample size could be larger and more representative, as it included only 17 countries and 285 players from just one event. Expanding the sample to include a higher number of players would be beneficial. Other studies with junior tennis players have shown different results regarding RAE, likely due to the size of the examined groups [45]. Additionally, since padel is a relatively new sport in most of the countries participating in the tournament, some players may have competed in a higher age category. Future research should focus on longitudinal studies to assess the long-term impact of the RAE, comparative studies across different racket sports, and a deeper exploration of gender differences within junior padel. Investigating the effects of early recruitment on athlete development and retention will also be critical in shaping future talent development strategies.

Practical Applications

The findings of this study have important practical applications for talent identification and development in junior padel. Coaches and selectors should be aware of the potential advantages conferred by early birth quartiles, ensuring that selection processes are equitable and inclusive. Implementing age-adjusted categories could foster a more balanced competitive environment and

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support the development of all athletes. Additionally, tailored coaching strategies may help younger players overcome the challenges posed by the relative age effect.

5. Conclusions

There is no relative effect of age in junior players at the 2024 European Championships, neither in the total number of players nor differentiating them by gender, country or position in the ranking. However, there are direct correlations between the position and the quartile and between the position and the year of the category for male and female players. These findings provide new insights into how RAE and multi-year age categories influence talent identification in junior padel, highlighting the need for equitable selection strategies such as adjusted age classifications.

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