Relative Age Effect (RAE) Among Malaysia University Athletes
Efecto de la edad relativa (RAE) entre los atletas universitarios de Malasia

Authors

Nor Ashikin Hassan [1,2]
Zamri Abd. Kahar [1,3]
Ali Md Nadzalan [1]
Jeffrey Low Fook Lee [4]
Abd Muiz Nor Azmi [1]
Rivan Saghita Pratama [5]
Septyaningrum Putri Purwoto [10]

[1] Universiti Pendidikan Sultan Idris (Malaysia)
[2] Universiti Teknologi MARA (Malaysia)
[3] Universiti Teknologi MARA Shah Alam (Malaysia)
[4] Tunku Abdul Rahman University of Management and Technology (Malaysia)
[5] Universitas Negeri Semarang (Indonesia)
[6] STKIP PGRI Bangkalan (Indonesia)
(Indonesia)

Corresponding author:
Ali Md Nadzalan
ali.nadzalan@fsskj.upsi.edu.my

Abstract

Introduction: Currently, most research on RAE in sports is focused on youth and top levels, leaving university athletes, especially in Malaysia, with very little information to work
Objective: This study aims to investigate the RAE in more depth by adding variables such as gender, sports category, and the type of higher education school (IPTS/IPTA).
Methodology: A quantitative research strategy was used with 4,683 athlete birth dates. The chi-square test showed that SUKIPT 2022 athletes had a high rate of RAE.
Results: The distribution of athletes' birth dates over the four quarters of the year exhibited a substantial imbalance, as seen by the chi-square statistic ($\chi2$ (3, N = 4683) = 59.618, p =< .001; V = 0.080). The data shows a strong RAE among players born in the fourth quarter, which could mean an RAE bias. The study also found that RAE was common among all genders and in various sports, including IPTA players. However, there was interesting RAE seen in athletes from private universities (IPTS) ($\chi2$ (3, N = 1372) = 5.429, p =.143).
Discussion: The results validate the presence of the RAE within the population of university athletes, indicating that variances in development could potentially impact the selection and performance of athletes. This study enhances the comprehension of the RAE within the university sports domain. It establishes a basis for forthcoming research endeavours to investigate approaches to alleviate RAE and foster equitable athlete growth and selection.
Conclusions: The frequency of RAE in athletes competing for the university at the 2022 Higher Education Institution Games (SUKIPT).

Keywords

Relative Age Effect; talent identification; athlete development; selection bias.

Resumen

Introducción: Actualmente, la mayoría de las investigaciones sobre RAE en deportes se centran en los jóvenes y los niveles superiores, lo que deja a los atletas universitarios, especialmente en Malasia, con muy poca información para trabajar.
Objetivo: Este estudio tiene como objetivo investigar el RAE con más profundidad agregando variables como el género, la categoría deportiva y el tipo de escuela de educación superior (IPTS/IPTA).
Metodología: Se utilizó una estrategia de investigación cuantitativa con 4.683 fechas de nacimiento de atletas. La prueba de chi-cuadrado mostró que los atletas de SUKIPT 2022 tenían una alta tasa de RAE.
Resultados: La distribución de las fechas de nacimiento de los atletas durante los cuatro trimestres del año exhibió un desequilibrio sustancial, como lo muestra la estadística de chi-cuadrado ($\chi2$ (3, N = 4683) = 59.618, p = < .001; V = 0.080). Los datos muestran un fuerte RAE entre los jugadores nacidos en el cuarto trimestre, lo que podría significar un sesgo de RAE. El estudio también encontró que el RAE era común entre todos los géneros y en varios deportes, incluidos los jugadores de IPTA. Sin embargo, se observó una RAE interesante en atletas de universidades privadas (IPTS) ($\chi2$ (3, N = 1372) = 5,429, p = 0,143).
Discusión: Los resultados validan la presencia de la RAE dentro de la población de atletas universitarios, lo que indica que las variaciones en el desarrollo podrían afectar potencialmente la selección y el rendimiento de los atletas. Este estudio mejora la comprensión de la RAE dentro del ámbito del deporte universitario. Establece una base para los próximos esfuerzos de investigación para investigar enfoques para aliviar la RAE y fomentar el crecimiento y la selección equitativos de los atletas.
Conclusiones: La frecuencia de la RAE en los atletas que compiten por la universidad en los Juegos de Instituciones de Educación Superior de 2022 (SUKIPT).

Palabras clave

Efecto de la edad relativa; identificación de talentos; desarrollo de atletas; sesgo de selección.

Introduction

The Relative Age Effect (RAE) phenomenon refers to the disparity in age within a particular group (Agricola et al., 2024; Silva et al., 2022), focusing on the advantages of older individuals for specific cut-offs in academic or sports years (Mat-Rasid, Abdullah, Juahir, Rusdiana, Bisyri, Maliki, Musa, Kosni & Azmi, 2022). According to Dube and Grobbelaar (2022), the RAE is when a disproportionate number of athletes born earlier in the calendar year participate in a specific sport. This is determined by birth date and age-group classification cut-off dates. Researchers have examined the study of grouping individuals into cohorts based on chronological age in the fields of sport and education (Hamizi & Low, 2022; Brustio, Kelly, Lupo, & Ungureanu, 2022; Difernand et al., 2023; Dube & Grobbelaar, 2022). Silva, Leonardo, Rodrigues, and Krahenbühl (2022) argue that RAE, as the difference in birth dates between athletes of the same age, can result in an advantage for the relatively older one. The Relative Age Effect (RAE) highlights how differences in birth dates within age-group classifications give relatively older individuals in academic and sports settings a significant advantage (Bartolomei et al., 2021; Fernanda et al., 2021).

The practice of grouping children and teenagers according to their chronological ages is widespread in the realms of sports and education, facilitating fair competition, age-appropriate instruction, and participant safety. Athletes' physical, mental, technical and spiritual growth are all part of sports training (Pratama et al., 2025; Sofyan et al., 2024). The importance of adequate facilities for athlete performance(Marsudi et al., 2024).Competence of young athletes generally comes from coaching that is structured and directed (Susanto et al., 2023). Selecting talented athletes is crucial for achieving peak performance (Susanto et al., 2024). In sports, it is common practice for persons who have yet to reach their full age to take part in tournaments alongside other athletes whose ages are within one to three years of their own. Learning through sport can enhance cognitive, social and emotional development (Pranoto et al., 2023). The RAE phenomenon, a significant factor in talent identification and athlete selection within sports teams, can impact the selection process (Suppiah et al., 2020). Individuals born in January and December, with a disparity of 11 months in age at 10, are more likely to be selected for top teams if they accumulate advantages over time. This is because these individuals are often linked to highly skilled coaching staff, enhanced prospects for training and competition engagement, and elevated levels of competitive engagement. According to Joyner et al. (2020), the belief that older and biologically mature athletes are overrepresented stems from the notion that their more substantial physical condition gives them an extra advantage. Good physical condition is essential for optimal performance (Bahtra et al., 2023, 2024; Karyono et al., 2024; Ningrum et al., 2024; Zanada et al., 2023).This advantage is attributed to substantial consequences in sports regarding identifying talent, giving rise to issues over potential discrimination and disparities in opportunities.

RAE can ascertain variations in the rates of growth and development observed among athletes, leading to the prioritization of exceptional athletes over more experienced ones (Ariffin, Hashim, & Lee, 2019; Marapen, Lee, 2015). The Institute of Higher Education (IPT) plays a crucial role in promoting active engagement of students in sports activities and offering educational opportunities for university-level athletes. Other than that, another research by Jakiwa et al. (2022) showed that even though student-athletes were required to spend most of their time and energy in sports training, there were positive effects of sports participation on students' academic achievement. The main sports carnival for higher education in Malaysia, known as Sukan IPT or SUKIPT, holds significant importance as the largest sporting event in Malaysia. The 2022 SUKIPT, hosted by Universiti Pendidikan Sultan Idris (UPSI), serves as a strategic initiative for the Ministry of Higher Education (MoHE) for the comprehensive growth and development of sports at university, national, and international levels. The cut-off age requirement exhibits variation between nations and is often contingent upon the academic year in conjunction with their chronological age.

Studies on the prevalence of the Relative Age Effect (RAE) in Malaysia have focused heavily on school-level athletes, particularly in junior age categories and among elite performers. At the school level, the distribution of student-athletes' birth quartiles becomes more dispersed with age, reducing the frequency of RAE occurrences. Physical and psychomotor characteristics have been identified as key contributors to academic performance and RAE, as supported by various studies (Navarro-Paton, Mecias-Calvo, Rodriguez, & Arufe-Giraldez, 2021; Oterhals, Bachmann, Bjerke, & Pedersen, 2023;

Urruticoechea et al., 2021). To address this issue, researchers have proposed strategies and interventions for practitioners (Navarro-Patón, (2021).

However, recent evidence suggests that factors beyond physical attributes also contribute to RAE, particularly in technical sports. Despite extensive research on team sports and gender comparisons among youth athletes, limited investigation has been conducted on RAE within the context of university athletes, especially in Malaysia. This gap in research has prompted a growing interest in examining the prevalence of RAE among university athletes, leading to further inquiry into the underlying causes and implications of the effect in this demographic.

Method

Participants

The study investigates the Relative Age Effect (RAE) among university athletes in Malaysia, using a quantitative methodology and descriptive analytic approach. The data was collected from SUKIPT 2022, a competition involving 21 sports, and analysed using the chi-square goodness-of-fit test. The target population included student-athletes from various institutions, including IPTA (22 institutions), IPTS (39 institutions), and IPG. The data was categorized by gender, sports type, and educational institution. Analyzing gender, sports type, IPTA (public), and IPTS (private) is needed to identify disparities, tailor programs, allocate resources effectively, and promote inclusivity and equity in sports and education. This ensures targeted support and balanced opportunities for all participants. The study comprehensively describes the phenomenon and its relationship with university athletes.

The study included 4,683 participants (male = 2806, female =1877) ranging in age from 17.9 to 25.9 years as in table 1. The study's participants had a mean age of 21.5 years (M=21.5, SD=1.65), suggesting that the overall sample consisted of relatively young individuals.

Table 1. List SUKIPT 2022 sporting events and athletes

Bil	Sports	Total Athletes	Male	Female	IPTA	IPTS	IPG
1.	Archery	149	81	68	123	25	1
2.	Athletics	408	260	148	264	142	2
3.	Badminton	383	241	142	148	222	14
4.	Chess	256	149	107	126	108	22
5.	Football	226	226	0	226	0	0
6.	Futsal	283	179	104	199	84	0
7.	Golf	57	40	17	38	19	0
8.	Hockey	316	189	127	222	69	25
9.	Karate	163	92	71	124	38	1
10.	Kayak	88	49	39	85	3	0
11.	Lawn Bowls	116	61	55	115	0	1
12.	Netball	286	0	286	144	130	12
13	Petanque	167	88	79	134	22	11
14.	Rugby	371	298	73	263	96	12
15	Sepak Takraw	94	84	10	64	25	5
16.	Silat	317	186	131	243	67	7
17.	Softball	302	179	123	271	31	0
18.	Squash	52	30	22	34	18	0
19.	Swimming	109	63	46	45	63	1
20.	Table Tennis	228	130	98	124	104	0
21.	Taekwondo	312	181	131	205	106	1
	TOTAL	4683	2806	1877	3197	1372	115

Instruments and procedure

The data for this research was sourced from the SUKIPT 2022 website and MoHE (https://www.mohe.gov.my/). The birth year was defined as starting on 1 January, with the cut-off age in Malaysia being from 1st January to 31st December. The study used quartiles to evaluate the birthdates of athletes, with the first quartile consisting of those born between 1st January and 31st March, the second quartile between 1st April and 30th June, the third quartile between 1st July and 30th September, and the fourth quartile between 1st October and 31st December (see Table 2). After the data on birthdate and type of sport was gathered, the data were transferred to Microsoft Excel. The date of

birth, type of sport, gender, type of higher education, and birth quartile are identified and put into the column accordingly.

Table 2. Birthdate quartile cut-off in Malaysia

| Months	Quartiles
January, February, March	Quartile 1 (Q1)
April, May, June	Quartile 2 (Q2)
July, August, September	Quartile 3 (Q3)
October, November, December	Quartile 4 (Q4)

Statistical analysis

The study employs the Chi-Square goodness-of-fit test to analyze the distribution of birth dates among university athletes participating in various sports. The Chi-Square (χ^2) test compares observed and expected birth date distributions. It also examines the prevalence of different sports, including team and individual sports, and assesses the distribution differences between male and female athletes. Post-hoc tests using standardized residuals (SR) determine statistical significance. The Chi-Square analysis is frequently utilized in relative age effect (RAE) research, as noted by Hamizi & Low (2022) and Fonseca et al. (2019). Additionally, effect sizes such as Cramer's V are used to measure the strength of relationships between variables in a contingency table. Cramer's V for df 1 with interpretations as follows: Cramer's V 0 < 0.10 indicates a negligible, 0.10 ≤ Cramer's V < 0.30 represents a small; 0.30 ≤ Cramer's V < 0.50 indicates a moderate; howing a reasonably strong relationship with practical relevance; and Cramer's V ≥ 0.50 signifies a large. All statistical analyses were conducted using SPSS version 28.

Results

The statistical analysis for RAE was observed one by one, which is compared to several sub-categories to be studied. Firstly, we are looking at results for overall Malaysian university athletes; secondly, exploration among female and male athletes; thirdly, observation extended to types of sports; and finally, observation of RAE among IPTA and IPTS athletes. Figure 1 shows the birthdate distribution among Malaysian university athletes and subsequently. As we can see, the graph shows a decreasing trend from Q1 to Q4 except for IPTS and individual sports birthdate distribution. This is the first general result that we can see there was a prevalence of RAE among university athletes in Malaysia.

Figure 1. *Birthdate quartile* distribution for Malaysian university athletes for overall athletes, gender, type of sports and education institution category
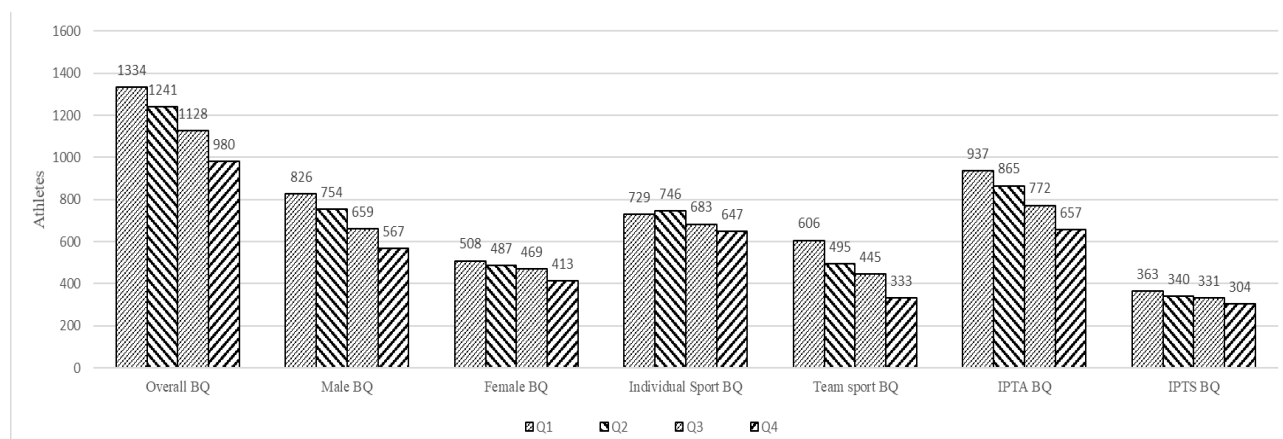
Looking deeper into chi-square statistical analysis, as shown in table 2, the result for overall athletes shows us that the RAE among university athletes in Malaysia exists in high correlation. The result indicated a statistically significant relationship, as evidenced by the chi-square value of χ2 (3, N = 4683) =59.619, p =< .001; *V* = 0.14 showed the prevalence of RAE is present among the athletes in SUKIPT 2022. The chi-square goodness-of-fit test at the p = .001 level indicates a statistically significant

relationship between the variables being studied. The analysis of Cramer's *V* reveals an effect size of approximately 0.14, suggesting a small to medium effect size according to the interpretation guidelines in the search results.

There were 2806 male athletes in total. The distribution by quartiles is Q1=826 (29.44%), Q2=754 (26.87%), Q3=659 (23.49%), and Q4=567 (20.21%). The quartile distribution for female athletes representing their respective universities in SUKIPT 2022 is as follows: Q1=508 (27.06%), Q2=487 (25.95%), Q3=469 (24.99%), and Q4=413 (22.00%). This distribution accounts for a total of 1877 female athletes.

The data analysis was extended to look into the prevalence of RAE among SUKIPT 2022 athletes by gender population. Statistical analysis Chi square goodness-of-fit test showed a significant relative on male $\chi2$ (3, N = 2806) =54.388 p =< .001, *V* = 0.14 whereas for female, $\chi2$ (3, N = 1877) =10.614 p = 0.014, *V* = 0.04. The significance of the chi-square goodness-of-fit test at the p = .001 level suggests a relationship between the variables under examination. Therefore, the significant relationship between gender and the observed frequencies suggests that the observed frequencies do not match the expected frequencies for both genders, showing that RAE is present.

Table 3. Post-hoc analysis using Standardized Residuals of the distribution of players born

Sub-category		Observed	Expected	SR	$\chi2$	P Value	Cramer's *V*
Overall Athletes	Q1	1334	1170.8	163.3	59.619	<.001	0.14
	Q2	1241	1170.8	70.3			
	Q3	1128	1170.8	-42.7			
	Q4	980	1170.8	-190.7			
Male Athletes	Q1	826	701.5	124.5	54.3888	<.001	0.14
	Q2	754	701.5	52.5			
	Q3	659	701.5	-42.5			
	Q4	567	701.5	-134.5			
Female Athletes	Q1	508	469.3	38.8	10.614	.014	0.04
	Q2	487	469.3	17.8			
	Q3	469	469.3	-.2			
	Q4	413	469.3	-56.2			
Individual Sports Athlete	Q1	729	701.3	27.8	8.626	.035	0.035
	Q2	746	701.3	44.8			
	Q3	683	701.3	-18.2			
	Q4	647	701.3	-54.2			
Team Sports Athlete	Q1	605	469.5	135.5	81.455,	<.001	0.16
	Q2	495	469.5	25.5			
	Q3	445	469.5	-24.5			
	Q4	333	469.5	-136.5			
IPTA Athletes	Q1	929	799.3	129.8	54.307	<.001	0.09
	Q2	853	799.3	57.8			
	Q3	766	799.3	-33.2			
	Q4	649	799.3	-150.2			
IPTS Athletes	Q1	371	343.0	28.0	5.429	.143	0.02
	Q2	352	343.0	9.0			
	Q3	337	343.0	-6.0			
	Q4	312	343.0	-31.0			

Notes: *Significant effect at an alpha level of P < 0.05. Q1 = Jan–Mar, Q2 = Apr–Jun, Q3 = Jul–Sept, and Q4 = Oct-Dec

There are 2805 athletes in the individual sports category, with 729 (25.99%) in Q1, 746 (26.60%) in Q2, 683 (24.35%) in Q3, and 647 (23.07%) in Q4. The chi-squared test revealed a significant relationship between the athletes' birthdates and their distribution across the quartiles for team sports $\chi2$ (3, N = 1878) = 81.455, p < .001, *V* = 0.16) and for individual sports $\chi2$ (3, N = 2805) = 8.626, p = .035, *V* = 0.035). These findings indicate a high prevalence of the Relative Age Effect among athletes in team sports, but a lower incidence among players in individual sports.

When looking at the statistics numerically, more IPTA athletes were born in the first quartile (929), second (853), and third (766). Only 649 people were born in the fourth quartile, a significant difference. The statistical investigation found a significant chi-square goodness fit test in a sample of athletes from IPTA ($\chi2$ (3, N = 3197) = 54.307, p <.001). Cramer's V was 0.09, indicating a small impact size according to interpretation norms (Delorme and Champely, 2013). This showed that IPTA athletes at SUKIPT 2022 had a high rate of RAE.

This study will also assess RAE recognition in 1372 private university athletes (IPTS). The athlete breakdown by quartile is: 27.13% (371 people) were born in Q1, 25.41% (352 people) in Q2, 24.74% (337 people) in Q3, and 22.72% (312 people) in Q4. The difference between the fourth and first quartiles is 4.41%. The chi-square test was used to analyze data from private university athletes (χ2 (3, N = 1372) = 5.429, p =.143). Cramer's *V* was about 0.02, indicating a small influence. A chi-squared test p-value of.149 suggests private university athletes rarely have RAE.

Discussion

The primary aim of this study was to ascertain the prevalence of the Relative Age Effect (RAE) within the population of Malaysia University athletes. Furthermore, the study sought to delve deeper into the subject by analysing the collected data comprehensively. Therefore, this study explored whether the RAE still influences the selected athletes when representing their respective institutes, considering factors such as gender, sports category, and university categories.

The study's conclusions revealed the frequency of RAE in athletes competing for the university at the 2022 Higher Education Institution Games (SUKIPT). The study provides further evidence supporting previous research, indicating that the phenomenon of RAE continues to exert its influence in tournaments encompassing individuals aged 18 and above. The present study focuses on data analysis on the date of birth for individuals aged 17 to 25 years. The study further corroborates previous research by demonstrating that the Relative Age Effect (RAE) remains influential in tournaments for individuals aged 17 and above. This analysis specifically examines birthdate data for individuals in the university setting, from age 17 onwards, highlighting the continued relevance of RAE in this demographic.

The present discovery aligns with the perspectives put forth by various researchers, who assert that selecting individuals to participate in sports is significantly impacted by the experiences and abilities they have acquired during their time in school. This finding aligns with the theoretical paradigm given by Hancock, Adler, and Côté (2013), which posits that parents influence RAEs through Matthew effects, coaches impact RAEs through Pygmalion effects, and athletes affect RAEs through Galatea effect. The influence of the RAE was found to be higher in men, in adulthood (senior category), in invasion games, and in national contexts. As athletes progress to higher performance levels, it does not seem clear that relatively older athletes enjoy certain sports and competitive advantages over their younger peers. The impact of the RAE tends to decrease but not disappear as the sports transition process progresses, especially in team sports such as football (de la Rubia et al., 2020). The findings shown in this study oppose the reverse RAE or Underdog Hypothesis proposed by Cobley et al. (2009), which suggests that the RAE may diminish as individuals' transition from youth to senior levels.

Numerous empirical investigations have explained the prevalence of RAE within the subcategory of female athletes, revealing that it does not exhibit a significant presence. Conversely, it has been observed that male athletes tend to show a more pronounced display of RAE than their female counterparts. The observed phenomenon can be ascribed to the broader variability in male maturation during adolescence. In contradistinction to the outcomes elucidated within the confines of the present investigation, it becomes evident that a preponderance of the RAE manifests itself among the cohort of female athletes engaging in the 2022 IPT Games held in Malaysia. The present study corroborates the conclusions drawn by multiple scholars (Gines et al., 2023; Gil et al., 2021; Götze & Hoppe, 2021; Jakobsson et al., 2021) regarding the RAE among female athletes. Extensive discourse has revealed many factors contributing to the persistent prevalence of this phenomenon within the realm of sports engagement among individuals aged 18 and above. One pertains to the influence of early engagement at the minor level, which confers an advantageous edge upon those born earlier regarding physical attributes. The Relative Age Effect (RAE) does not guarantee that older athletes will be taller or more physically developed, as RAE primarily addresses age-related advantages rather than specific physical attributes (Agricola et al., 2024; Bartolomei et al., 2021). The present findings indicate that female athletes exhibited a marginally higher p-value than their male counterparts. However, it is noteworthy that the relationship between birthdates and quartile distribution remains statistically significant. In a recent empirical investigation conducted by Andrew et al. (2022), RAE was examined within the context of female soccer players. The researchers observed a notable absence of RAE among the female cohort,

in stark contrast to their male counterparts, who exhibited a discernible presence of RAE. The observed disparity in sports participation between genders, as evidenced by the findings of this investigation, may be attributed to a lower level of engagement among women.

Numerous studies have demonstrated that the quality of training and the opportunities available in schools significantly affect students' involvement in sports. For instance, Smith et al. (2019) discovered that well-structured sports programs within schools can boost students' engagement in extracurricular sports through targeted training and teacher support. Additionally, social support from peers and educators is crucial in influencing sports participation. Lee et al. (2020) found that students who receive substantial emotional and social backing from their school environment are more likely to be actively involved in sports. Positive experiences in physical education classes are linked to increased participation in sports outside of school, indicating that effective physical education can lead to greater involvement in after-school sports (Brazendale et al., 2015).

The result prevalence of RAE among SUKIPT 2022 athletes for team sports games obviously shows that RAE is a strong display with significant numbers of $p =< .001$. The result is consistent with many past studies, and in other words, this study is more evidence that the prevalence of RAE was substantial in team sports. The RAE has been repeatedly seen in several team sports, such as soccer, ice hockey, basketball, rugby, and Australian football. According to Romann et al. (2020), the impact tends to be more significant in sports prioritizing physical traits such as size, strength, and power. De la Rubia et al. (2021) have reported similar findings and perspectives, indicating that the RAE is observable in team sports. RAE holds considerable importance within team sports, exerting influence over player selection, performance outcomes, and career advancement. Nonetheless, the influence of sports can be contingent upon other circumstances, including but not limited to gender, the level of competition, and the particular sport in question.

The Relative Age Effect (RAE) refers to the advantage that individuals born earlier in the selection year can experience due to age-based cutoff dates in sports and education. This effect often differs between genders, with distinct impacts on male and female athletes. Recent research confirms that RAE is generally more significant among male athletes, primarily because of greater physical variability during adolescence among males, which benefits those born earlier in the selection year (Fernanda et al., 2021). For instance, Vaeyens et al. (2018) demonstrate that RAE is notably pronounced in sports that demand high physical intensity, where age-related physical differences can greatly influence performance. Conversely, studies focusing on female athletes indicate a less pronounced RAE. This reduced impact may be attributed to variations in competition structures and selection processes. McCarthy and Collins (2021) found that in female sports, RAE is often lessened by lower selection pressures and a more inclusive talent identification approach. Additionally, Mladenović and Maksimović (2022) review suggests that although RAE affects both genders, its impact varies based on factors like sport type, competition level, and maturation rates. Their research indicates that while RAE is still relevant, its influence is diminished in female sports due to less pronounced differences in physical maturation.

The study was expanded to assess whether RAE affects athletes from both IPTA and IPTS categories. Results revealed a notable difference in birth rates between Q1 and Q3, especially among IPTA athletes, with 80.51% being born within these quarters. This aligns with earlier studies linking early birth within the academic year to enhanced athletic and academic success. However, no significant RAE impact was detected on IPTS athletes' performance during SUKIPT 2022. This may be due to the high competition for IPTA admissions, where students with stronger academic distinctions gain an edge. The intense competition for IPTA spots, coupled with merit-based advantages, likely plays a role. Additionally, government-driven educational and career programs, such as the MACE initiative by Malaysia's National Sports Council, may influence these outcomes by offering athletes more opportunities to pursue higher education at IPTA institutions.

RAE describes the advantage that individuals born earlier within a given selection year may gain due to age-based cut-off dates in sports. This phenomenon is observed in numerous sports settings, including university competitions like SUKIPT 2022. RAE has a significant influence on sports, particularly in team sports and within higher education institutions. RAE refers to the advantage that athletes born earlier in a selection year may have due to age-based cut-off dates, which can affect their chances of being selected and succeeding in sports teams or competitions. This advantage often results in better athletic opportunities and higher representation in elite categories for those born in the earlier months of the

selection period. This effect is particularly evident in team sports and in higher education settings, including Malaysian institutions such as IPTA (Institut Pengajian Tinggi Awam) and IPTS (Institut Pengajian Tinggi Swasta). In team sports, RAE can greatly influence player selection and team composition (Cabezon et al., 2024). Musch and Grondin (2022) found that players born earlier in the year often gain physical and psychological advantages, which can increase their chances of being chosen for elite teams. RAE is especially pronounced in sports with high physical contact and competition (Cabezon et al., 2024).

For higher education institutions (IPTA and IPTS), understanding RAE is essential for fair and equitable development of student-athletes. RAE affects opportunities and development within university sports programs, with earlier-born students often receiving more attention and resources, which can distort talent identification and development (De La Rubia et al., 2020). The need to address RAE in educational settings to improve both academic and athletic outcomes (Aku & Yang, 2024). Their research suggests implementing strategies to counteract RAE, such as adjusting selection criteria and providing support to ensure fair opportunities for all students, regardless of their birthdate.

Conclusions

As a conclusion, educational institutions should implement interventions that enhance motor competence, regardless of a child's chronological age. Long-term training strategies should be implemented to foster steady development, recognizing younger team members as potential "developmental players" and allowing them to participate in less consequential events and friendly matches. The impact of RAE may vary depending on factors such as the specific sport, competition level, and geographical region. Previous research has highlighted maturity, physical size, and depth of competition as factors that precede RAEs. The present discourse aims to address the predicament faced by individuals who often find themselves overlooked in their chosen athletic pursuits.

The present inquiry proposes implementing a prospective investigation, specifically a longitudinal study, to scrutinize the efficacy of universities as facilitators for the discovery of nascent athletic aptitude, in addition to the cultivation of preexisting talent within the realm of sports. This comparative analysis can be further expanded by examining the distribution of births within the observed year to determine if they exhibit a parallel pattern.

Acknowledgements

References

Andrew, M., Finnegan, L., Datson, N., & Dugdale, J. H. (2022). Men Are from quartile one, women are from? relative age effect in european soccer and the influence of age, success, and playing status. *Children*, *9*(11), 1747. https://doi.org/10.3390/children9111747

Agricola, A., Polách, M., Válek, T., Nykodým, J., & Zháněl, J. (2024). El efecto de la edad relativa de los participantes en las finales mundiales de tenis júnior en 2012–2016 (The Relative Age Effect of Participants in the World Junior Tennis Finals in 2012–2016). *Retos*, *51*, 955–961. https://doi.org/10.47197/retos.v51.99664

Ariffin, N. M., Hashim, M., & Lee, J. L. F. (2019). Relative age effects on MSSM, SUKMA and National netball players in Malaysia. *Jurnal Sains Sukan & Pendidikan Jasmani, 8*(1), 22-30. https://doi.org/10.37134/jsspj.vol8.1.3.2019

Aku, Y., & Yang, C. (2024). The relative age effect and its influence on athletic performance in Chinese junior female' tennis players. *PLoS ONE*, *19*(3), 1–15. https://doi.org/10.1371/journal.pone.0298975

Bahtra, R., Putra, A. N., Septri, Dinata, W. W., Andria, Y., & Susanto, N. (2023). Improving Endurance Ability through Endurance Training Model-Based Drill Technique. *International Journal of*

Human Movement and Sports Sciences, *11*(2), 335–341. https://doi.org/10.13189/saj.2023.110210

Bahtra, R., Zelino, R., Bafirman, Fajri, H. P., Valencia, W. G., Susanto, N., García-Jiménez, J. V., & Pavlovic, R. (2024). Enhancing VO2Max: contrasting effects of fartlek training and small-sided games. *Journal of Physical Education and Sport*, *24*(2), 441–448. https://doi.org/10.7752/jpes.2024.02054

Bartolomei, S., Grillone, G., Di Michele, R., & Cortesi, M. (2021). A comparison between male and female athletes in relative strength and power performances. *Journal of Functional Morphology and Kinesiology*, *6*(1). https://doi.org/10.3390/jfmk6010017

Brazendale, K., Graves, B. S., Penhollow, T., Whitehurst, M., Pittinger, E., & Randel, A. B. (2015). Children's Enjoyment and Perceived Competence in Physical Education and Physical Activity Participation Outside of School. *Civic Research Institute*, 65–69. https://www.researchgate.net/publication/280206297

Brustio, P. R., Kelly, A. L., Lupo, C., & Ungureanu, A. N. (2022). The influence of contextual factors on the relative age effect in male international rugby union: the impact of sociocultural influences and playing position. *Children*, *9*(12), 1941. https://doi.org/10.3390/children9121941

Yagüe Cabezón, J. M., Fernández García, B., Redondo Castán, J. C., & Izquierdo Velasco, J. M. . (2024). El Efecto de la Edad Relativa en las siete mejores ligas profesionales de fútbol femenino de la Unión de Federaciones Europeas de Fútbol (UEFA) (The Effect of Relative Age in the top seven professional women's soccer leagues of the Union of Euro-pean Football Associations (UEFA)). *Retos*, *54*, 518–528. https://doi.org/10.47197/retos.v54.103292

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

De La Rubia, A., Lorenzo-Calvo, J., & Lorenzo, A. (2020). Does the Relative Age Effect Influence Short-Term Performance and Sport Career in Team Sports? A Qualitative Systematic Review. *Frontiers in Psychology*, *11*, 1–27. https://doi.org/10.3389/fpsyg.2020.01947

Difernand, A., Quentin De Larochelambert, Sébastien Homo, Rousseau, F., Antero, J., Toussaint, J.-F., & Sedeaud, A. (2023). *Relative age effects in track-and-field: Identification and performance rebalancing*. *13*. https://doi.org/10.3389/fphys.2022.1082174

Dube, S. R., & Grobbelaar, H. W. (2022). Prevalence of the relative age effect among high-performance, university student-athletes, versus an age-matched student cohort. *South African Journal of Sports Medicine*, *34*(1). https://doi.org/10.17159/2078-516x/2022/v34i1a13310

Maciel, L. F. P., Flach, M. C., Nascimento, R. K. do, Dallegrave, E. J., Nascimento, J. V. do, & Folle, A. (2021). Efecto de la edad relativa en el baloncesto: implicaciones para la selección de jugadores exitosos (Relative Age Effect on basketball: implications for the selection of successful players). *Retos*, *42*, 266–275. https://doi.org/10.47197/retos.v42i0.83847

Fonseca, F. S., Figueiredo, L. S., Gantois, P., de Lima-Junior, D., & Fortes, L. S. (2019). Relative age effect is modulated by playing position but is not related to competitive success in elite under-19 handball athletes. *Sports*, *7*(4), 91. https://doi.org/10.3390/sports7040091

Gil, S. M., Bidaurrazaga-Letona, I., Larruskain, J., Esain, I., & Irazusta, J. (2021). The relative age effect in young athletes: A countywide analysis of 9–14-year-old participants in all competitive sports. *PLOS ONE*, *16*(7), e0254687. https://doi.org/10.1371/journal.pone.0254687

Gines, H. J., Huertas, F., Calvo, T. G., Ponce-Bordón, J. C., Figueiredo, A. J., & Ballester, R. (2023). Age and maturation matter in youth elite soccer, but depending on competitive level and gender. *International Journal of Environmental Research and Public Health, 20*(3). https://doi.org/10.3390/ijerph20032015

Götze, M., & Hoppe, M. W. (2021). Relative age effect in elite german soccer: influence of gender and competition level. *Frontiers in Psychology*, *11*. https://doi.org/10.3389/fpsyg.2020.587023

Hamizi, M. I. F. M., & Low, J. F. L. (2022). Relative age effects among malaysian elite adult field hockey players. *International Journal of Human Movement and Sports Sciences*, *10*(4A), 29–35. https://doi.org/10.13189/saj.2022.101305

Hancock, D. J., Adler, A. L., & Côté, J. (2013). A proposed theoretical model to explain relative age effects in sport. *European Journal of Sport Science*, *13*(6), 630–637. https://doi.org/10.1080/17461391.2013.775352

Jakiwa, J., Atan, S. A., Azli, M. S., Rustam, S., Hamzah, N., & Zainuddin, A. A. (2022). The level of sports participation and academic success among Malaysian student-athletes. *International Journal of*

Learning, Teaching and Educational Research, *21*(6), 122–137. https://doi.org/10.26803/ijlter.21.6.8

Jakobsson, J., Julin, A. L., Persson, G., & Malm, C. (2021). Darwinian selection discriminates young athletes: the relative age effect in relation to sporting performance. *Sports Medicine - Open*, *7*(1). https://doi.org/10.1186/s40798-021-00300-2

Joyner, P. W., Lewis, J., Mallon, W. J., Kirkendall, D., Dawood, R., Fagerberg, A., … Garrett, W. (2020). Relative age effect: beyond the youth phenomenon. *BMJ Open Sport & Exercise Medicine*, *6*(1), e000857. https://doi.org/10.1136/bmjsem-2020-000857

Karyono, T. H., Hidayat, R. A., Ihsan, F., Susanto, N., Wijanarko, T., García-Jiménez, J. V., Eken, Ö., Latino, F., & Tafuri, F. (2024). Performance Enhancement Strategies For Badminton Athletes: A Systematic Review. *Retos*, *57*, 379–389. https://doi.org/10.47197/retos.v57.107124

Marsudi, I., Fajar, M. K., Rusdiawan, A., Kurniawan, R., Ar Rasyid, M. L. S., Susanto, N., García-Jiménez, J. V., & Pavlovic, R. (2024). Managing East Java's Sports Facilities and Infrastructure for Achievement. *International Journal of Human Movement and Sports Sciences*, *12*(2), 363–370. https://doi.org/10.13189/saj.2024.120211

McCarthy, P. J., & Collins, D. (2021). Gender Differences in the Relative Age Effect in Sport: An Exploration of the Impact of Selection Pressure and Competition Structure. *International Journal of Sport Psychology, 52*(3), 245-263. https://doi.org/10.7352/IJSP.2021.52.003

Mat-Rasid, S. M., Abdullah, M. R., Juahir, H., Rusdiana, A., Bisyri, A., Maliki, H. M., Musa, R. M., Kosni, N. A., & Azmi, A. M. N. (2022). The relative age effect on physical fitness of school children. *International Journal of Human Movement and Sports Sciences, 10*(5): 1098-1106. https://doi.org/10.13189/saj.2022.100528

Mladenović, R., & Maksimović, Z. (2022). Relative Age Effect and Gender Differences: A Comprehensive Review of Recent Findings. *Journal of Sports Sciences, 40*(4), 456-465. https://doi.org/10.1080/02640414.2021.2030405

Navarro-Patón, R., Mecías-Calvo, M., Rodríguez Fernández, J. E., & Arufe-Giráldez, V. (2021a). Relative Age Effect on Motor Competence in Children Aged 4–5 Years. *Children*, *8*(2), 115. https://doi.org/10.3390/children8020115

Ningrum, N. R., Sukamti, E. R., & Kurniawan, F. (2024). *ORIGINAL ARTICLES . PHYSICAL THERAPY Analysis of fencers ' post-injury adjustment : confirmatory factor analysis*. *10*(3), 39–52.

Oterhals, G., Bachmann, K. E., Bjerke, A. H., & Pedersen, A. V. (2023). The relative age effect shifts students' choice of educational track even within a school system promoting equal opportunities. *Frontiers in Psychology*, *13*. https://doi.org/10.3389/fpsyg.2022.1066264

Pranoto, N. W., Sibomana, A., Ndayisenga, J., Chaeroni, A., Fauziah, V., Susanto, N., Pavlovic, R., & Rayendra, R. (2023). Development of a disaster mitigation learning program for kindergarten students through physical fun games. *Journal of Physical Education and Sport*, *23*(12), 3228–3234. https://doi.org/10.7752/jpes.2023.12369

Pratama, R. S., Wahadi, Romadhoni, S., Haryono, S., & Irawan, Y. (2025). Peningkatan Prestasi Atlet Menggunakan Sports Training Program Monitor Pada Klub Petanque di Jawa Tengah. *PROFICIO: Jurnal Pengabdian Kepada Masyarakat*, *6*(1), 152–160.

Romann, M., Rüeger, E., Hintermann, M., Kern, R., & Faude, O. (2020). Origins of relative age effects in youth football—a nationwide analysis. *Frontiers in Sports and Active Living*, *2*. https://doi.org/10.3389/fspor.2020.591072

Silva, L. A., Leonardo, L., Rodrigues, H. de A., & Krahenbühl, T. (2022). El efecto relativo de la edad en los deportes de equipo de invasión: una revisión sistemática en los deportes juveniles (The Relative Age Effect in invasion team sports: A systematic review in youth sports). *Retos*, *46*, 641–652. https://doi.org/10.47197/retos.v46.94211

Smith, J., Brown, A., & Johnson, R. (2019). The Impact of School-Based Sports Programs on Student Participation and Performance. *Journal of Educational Research, 112*(3), 245-258. https://doi.org/10.1080/00220671.2018.1496069

Sofyan, D., Abdullah, K. H., Melendres Tanucan, J. C., Susanto, N., & Hidayat, Y. (2024). Unlocking the Secrets of Successful Sports Training: A Bibliometric Analysis. *Journal of Scientometric Research*, *13*(2), 575–588. https://doi.org/10.5530/jscires.13.2.45

Sukipt 2022. (2022, August). RESULT SYSTEM. Retrieved July 28, 2023, from medal.sukipt.com.my website: https://medal.sukipt.com.my/statistik_penyertaan_detailrpt.asp

Suppiah, P. K., Lee, J. L. F., Azmi, A. M. N., Noordin, H., & Musa, R. M. (2020). Relative age effect in U-16 Asian championship soccer tournament. *Malaysian Journal of Movement, Health & Exercise*, 9(1), 1-8. https://doi.org/10.15282/mohe.v9i1.362

Susanto, N., Dinata, W. W., Ihsan, N., Bahtra, R., Andria, Y., Pranoto, N. W., Anam, K., Sofyan, D., Lourenço, C. C. V., Burhaein, E., García-Jiménez, J. V., & Setyawan, H. (2023). Instrument for Assessing Basketball Skills in Junior High School Students in Indonesia. *Journal of Physical Education and Sport*, *23*(12), 3220–3227. https://doi.org/10.7752/jpes.2023.12368

Susanto, N., García-Jiménez, J. V., Nowak, A. M., Setyawan, H., Pavlovic, R., Rusdiawan, A., & Syaukani, A. A. (2024). Development Assessment Model for Talent Identification of Young Indonesian Basketball Players: Anthropometrics, Biomotor, Technical, and Tactical Skills. *International Journal of Human Movement and Sports Sciences*, *12*(4), 625–635. https://doi.org/10.13189/saj.2024.120403

Turner, M., & Fox, J. (2021). The Role of Physical Education Experiences in Promoting Extracurricular Sports Participation. *Journal of Sport and Health Science,* *14*(1), 65-78. https://doi.org/10.1016/j.jshs.2020.10.001

Urruticoechea, A., Oliveri, A., Vernazza, E., Giménez-Dasí, M., Martínez-Arias, R., & Martín-Babarro, J. (2021). The relative age effects in educational development: a systematic review. *International Journal of Environmental Research and Public Health*, *18*(17), 8966. https://doi.org/10.3390/ijerph18178966

Zanada, J. F., Nasrulloh, A., Nugroho, S., & Susanto, N. (2023). The effect of circuit training program on physical fitness level in volleyball club athletes IPK Kuamang. *Fizjoterapia Polska*, *23*(3), 120–124. https://doi.org/https://doi.org/10.56984/8ZG143IT9

Authors' and translators' details:

Nor Ashikin Hassan	ashikin665@uitm.edu.my	Author/a
Zamri Abd. Kahar	zamri882@uitm.edu.my	Author/a
Ali Md Nadzalan	ali.nadzalan@fsskj.upsi.edu.my	Author/a
Jeffrey Fook Lee Low	lowfl@tarc.edu.my	Author/a
Abd Muiz Nor Azmi	abdulmuiz@fsskj.upsi.edu.my	Author/a
Rivan Saghita Pratama	rivan.saghita.pratama@mail.unnes.ac.id	Author/a
Sunanto	alif30@unusa.ac.id	Author/a
Rita Arni	ritaarni@fbs.unp.ac.id	Translator/a
Özgür Eken	ozgureken86@gmail.com	Author/a
Mert Kurnaz	mertkurnaz@halic.edu.tr	Author/a
Septyaningrum Putri Purwoto	septyaningrum@stkippgri-bkl.ac.id	Author/a