Jurnal Sains Sukan dan Pendidikan Jasmani Vol 13, No 1, 2024 (1-8)
ISSN: 2232-1918 / eISSN: 2600-9323
https://ejournal.upsi.edu.my/journal/JSSPJ

RELATIVE AGE EFFECT IN TOP EUROPEAN FOOTBALL LEAGUES

Nurul Nabilah Arbain, Mohd Zulkhairi Mohd Azam*, Maisarah Mohd Saleh, Nurul Diyana Sanuddin, Norlaila Azura Kosni & Nur Atikah Mohamed Kassim

Faculty of Sports Science and Recreation, Universiti Teknologi MARA, Jengka Campus, Pahang Branch, Malaysia

Corresponding: zulkhairiazam@uitm.edu.my

Published online: 25 April 2024

To cite this article (APA): Arbain, N. N., Mohd Azam, M. Z., Mohd Saleh, M., Sanuddin, N. D., Kosni, N. A., & Mohamed Kassim, N. A. (2024). Relative Age Effect in Top European Football Leagues. *Jurnal Sains Sukan & Pendidikan Jasmani, 13*(1), 1–8. https://doi.org/10.37134/jsspj.vol13.1.1.2024

To link to this article: https://doi.org/10.37134/jsspj.vol13.1.1.2024

ABSTRACT

Relative age effect (RAE) known as the birth date effect phenomena that widely used in identifying the individual talents and skills which early born have greater advantages compare to later born individuals. The main objective of this study is to investigate the relationship of RAE between European football leagues team rankings. For this study it involved a total of 946 football players (n=946) from every top four European football league which included the English Premier League (EPL) (United Kingdom), Serie A (Italy), La Liga (Spain) and Bundesliga (Germany). The secondary data were collected from every football league official website and categorized into four different quartiles (Q1, Q2, Q3, and Q4). The cut-off date started at 1st of January for Italy, Spain, Germany and England according to the equality principles that was established by FIFA. Then, the Chi-square ($\chi 2$) test assisted for birth month distribution into four different quartiles in order to gain frequencies in each quartile. Result showed the presence of RAE in all top four European football leagues. Moreover, there were overrepresented players in Q1 in every league ranking team especially among top four teams. To conclude, the top four European football leagues had prevalence in RAE which the early born mostly overrepresented in every top four European Leagues, and suggests that early born footballers are also associated with high ranking in those leagues. Thus, it is possible to associate high team ranking and success with RAE in elite professional football.

Keywords: RAE, Early Born, Elite Professional Football, Europe

INTRODUCTION

The relative age effect, or RAE, is a part of talent identification concept that's been extensively explored in the world of sports, and football in particular. Simply put, it's the idea that athletes born earlier in the year, or close to the cut-off date for age-group classification in sports, tend to have an advantage (Gyimesi & Kehl, 2021). This advantage isn't just limited to sports, but extends to education and business as well, playing a key role in the journey towards excellence.

When zoom in on football, past studies find that the RAE has been mainly studied in male athletes, especially those involved in popular sports and high-level competitions. For example, a study conducted in Bizkaia, Spain, discovered that the RAE was clearly present in football, but interestingly, only in leagues with a higher level of competition. In fact, males born in January were 3.23 times more likely to play in the top leagues than those born in December (Gil et al., 2014). In another study that took a longitudinal and cross-sectional look at the RAE in competitive youth football, it was found that both academy and grassroots players showed a birthdate asymmetry, with the RAE being much larger in the academy. In other words, players born earlier in the year had a higher chance of staying in the

academy than those born later (Sierra-Díaz et al., 2017 & Lupo et al., 2019).

Previous researches have predominantly aimed to establish the existence of the RAE across various sports. For instance, a study by Delorme and colleagues in 2009 compared the manifestation of RAE in multiple elite championship sports, including handball, volleyball, ice hockey, basketball, football, and rugby. This comparative analysis aimed to understand how RAE varies across different sporting disciplines, shedding light on whether some sports are more prone to RAE than others. Furthermore, research has suggested that athletes born earlier in the selection period are more likely to be chosen for sports teams competing at higher levels. According to a 2017 study by Práxedes et al., these early-born athletes often benefit from more extensive experience and receive larger amounts of incentives. This potentially fuels a self-perpetuating cycle, where these athletes continue to receive more opportunities and resources, reinforcing the impacts of RAE.

Furthermore, the team sports at international and national level including football (Işın, 2021 & Yagüe, 2020), basketball (Maciel et al., 2021 & Torres-Unda et al., 2012), skiing (Bjerke et al., 2020), hockey (Nolan & Howell, 2010) and futsal (Lago-Fuentes et al., 2020) had shown greater result in RAE rather than individual games as well. RAE studies are related with bias phenomena towards the later born which the fact that the older athletes more likely to perform better, give advantages in competition and also had long term effect in athletes' career for instance the ice hockey (Steingröver et al., 2016). Same goes in with academic performance, which individuals who were early born score higher compare to the later born even though they did learn in similar way (Foureaux Koppensteiner, 2017). Besides that, younger athletes with significant result on RAE are more prone to be selected in advance into the sports academy for further learning, training and involvement in their specific sports (De la Rubia et al., 2020 & Ek et al., 2020).

However, it's important to note that the RAE isn't without its critics. Some argue that the effect isn't as significant as it seems, or that it may not play a major role in the long-term success of athletes. Others suggest that the RAE might be a result of other factors, like the level of competition or the popularity of a sport. Usually, previous finding mentioned that the athletes who were born in first two quartiles were greater in team performance but in this study by Fonseca et al., (2019) showed average age distribution for all teams and no significant result on RAE with the teams who are in the highest ranking in the handball competition, but somehow RAE was related with defensive positions that required larger frame of physical, same as shown in football by Peña-González et al., (2020) with central defenders posing bigger physique and overrepresentation in early quartile. Whilst in another study on elite European football teams, they presented different findings which the early born players are not talented or an expert than later- born players. Although the famous club in Europe recruit earlier born player, it resulted in no advantages from observation based on their match played and market value (Doyle & Bottomley, 2018).

Furthermore, from their research it seems to be no countries or clubs that have completely eliminated or substantially reduced the RAE, serving as a benchmark in this regard. This implies that the challenge of RAE is pervasive across various sporting environments and systems, and finding effective ways to counter it remains a widespread issue. Relating to the issue, the outcomes of the RAE can differ significantly based on a number of factors. In a review article by Jasni et al., (2022), they suggest that the size of the sample taken into consideration can greatly influence the results. Larger sample sizes may provide a more accurate reflection of the prevalence and impact of RAE, whereas smaller sample sizes may lead to skewed or incomplete perspectives. They further discussed that the level at which an athlete competes is also another important contributing factor for RAE with higher levels of competition might show a stronger relative age effect, as these environments often foster more competition and thus amplify the advantages or disadvantages associated with RAE. Despite these counter-arguments, the majority of evidence suggests that the RAE does indeed have a significant impact on player selection and retention in football. In instance, to determine the possibility in developing the players' talents and skills, evaluation on RAE should be performed as the past findings mentioned the players who closed to cut-off date likely to be overrepresented (Lago-Fuentes et al., 2020).

Looking into a study by Rong and Low, (2020) highlighted the influence of RAE in the selection of athletes for international competitions. They found a significant trend where male medal-winning athletes were predominantly born earlier in the selection period. This suggests that RAE may

also have an impact on athlete performance and success at the highest levels of competition, which may give the idea of top performing clubs in European football leagues. However, despite the extensive research conducted on RAE, there is a noticeable gap in studies focusing on European football league teams that have qualified for prestigious championships. The patterns of RAE among elite professional football players competing in top-tier European leagues remain relatively unexplored. Therefore, this study aims to look into the relationship of RAE on top European football leagues, and delve deeper into each league with the achievement of top four teams that qualified to the European Champions League and bottom three teams that relegated to lower division. Conducting more research in this area is crucial to gaining a comprehensive understanding of the prevalence and implications of RAE in these high-stakes environments.

METHODOLOGY

Sampling

The sampling method that being used was purposive sampling method. There were 946 football players (n = 946) from 28 different teams in European football leagues in this research. The subjects have been selected from every top four European football leagues which are English Premier League, Bundesliga, La Liga and Serie A in their season 2020/2021. Inclusion of those four leagues is due to their publicity, high performance-wise, most generated television income distributed compared to other leagues, success at European club competition levels and high fans database. In addition, for the top four teams in each league's rankings included Manchester City, Manchester United, Liverpool FC, Chelsea FC, Bayern Munchen, RB Leipzig, Borussia Dortmund, Vfl Wolfsburg, Inter Milan, AC Milan, Atalanta, Juventus, Atletico Madrid, Real Madrid, FC Barcelona and Sevilla FC. Then, the football teams who were in bottom three in each league rankings consist of Fulham FC, West Bromwich Albion, Sheffield United, FC Koln, Werder Bremen, FC Schalke 04, Benevento Calcio, FC Crotone, Parma Calcio 1913, SD Huesca, Real Valladolid, and SD Eibar as shown in Table 1. The reason for including top four clubs from each league is because those top four clubs will compete at the highest level of club competition in Europe which is the European Champions League next season and it is also considered the most prestigious competition at club level. Meanwhile, the inclusion of bottom three clubs is due to their overall low performances for that particular season and shall be relegated to lower league division. For those reasons, this study tried to look into the role of RAE in top and poor performing clubs in those leagues.

Table 1. Top Four & Bottom Three Standing in Leagues

Leagues	Top four (n=12)	Bottom three (n=9)
English Premier League	Manchester City, Manchester United. Liverpool FC, Chelsea FC	Fulham FC, West Bromwich Albion, Sheffield United
La Liga	Atletico Madrid, Real Madrid, FC Barcelona, Sevilla FC	SD Huesca, Real Valladolid, SD Eibar
Bundesliga	Bayern Munchen, RB Leipzig, Borussia Dortmund, Vfl Wolfsburg	FC Koln, Werder Bremen, FC Schalke 04
Seria A	Inter Milan, AC Milan, Atalanta, Juventus	Benevento Calcio, FC Crotone, Parma Calcio 1913

Procedure and Instrumentation

The information details of every football teams and players were obtained as secondary data from official website each leagues were; EPL (https://www.premierleague.com/), Bundesliga (https://www.bundesliga.com/en/bundesliga), Serie A (https://www.legaseriea.it/en), and La Liga (https://www.laliga.com/en-GB).The players' birth date were categorized under four different quartiles groups which were: Q1 (January, February and March), Q2 (April, May and June), Q3 (July, August and September), and Q4 (October, November and December). After that, they will divide into two category which top four and bottom three team leagues rankings. The top four team which were the highest football teams in league rankings being known as the group that being qualified into the Champions League competition. Then, the bottom three teams which were ranked three lowest teams in each league rankings and relegated to lower league division.

Table 2. Birth Quartile Group

Quartiles	Months in each quartile
Q1	January, February, March
Q2	April, May, June
Q3	July, August, September
Q4	October, November, December

Statistical Analysis

The process of analysis data collection was conducted by using IBM Statistical Package for the Social Science (SPSS) version 26. The Chi-square (x2) test assisted in birth month distribution divided into four different quartiles. Plus, the data included birth of date, type of leagues, name of clubs, and the team position ranking. Then, the frequencies were gained for each quartile. This test was used look over into the dissimilarity between the observation and expectation in date of birth frequencies. Next, the post hoc test was used to determine the significant result on every quartile groups. The Standard Residual (SR) value performed at ≥1.96 that represent as overrepresentation and ≤ -1.96 as underrepresentation of the quartile group distribution (Rong & Low, 2020).

RESULTS

Table 3. Birth Quartile Distribution in Top Four European Leagues

Quartiles	Observed N	Expected N	Residual
Q1	317	236.5	5.23*
Q2	258	236.5	1.39
Q3	190	236.5	-3.02
Q4	181	236.5	-3.61
N	946		
P		.001	

Based on the Table 3, the prevalence of RAE was found in top four European Football Leagues which $\chi 2$ (3, n= 946), 51.522, p = .001. An overrepresentation of players with highest SR value were belong to Q1 with value (SR= 5.23). But then, there were underrepresentation players in Q3 with negative SR value (SR= -3.02), whileQ4 with (SR= -3.61).

Table 4. Birth Quartile Distribution among Top Four Team League Rankings

	EPL			Serie A			La Liga			Bundesliga		
	Ob	**Ex**	**SR**	**Ob**	**Ex**	**SR**	**Ob**	**Ex**	**SR**	**Ob**	**Ex**	**SR**
Q1	38	34.8	0.54	50	35.0	2.53*	46	32.3	2.41*	42	30.8	2.02*
Q2	33	34.8	-0.30	43	35.0	1.35	33	32.3	0.12	35	30.8	0.76
Q3	28	34.8	-1.15	21	35.0	-2.36	28	32.3	-0.75	22	30.8	-1.59
Q4	40	34.8	0.88	26	35.0	-1.52	22	32.3	-1.81	24	30.8	-1.22
n	139			140			129			123		
P		.476			.001			.021			.034	

Table 4 showed the significant result in RAE three out of four leagues which Serie A, La Liga and Bundesliga were included. For the EPL had shown no significant value with $\chi 2$ (3, n = 139), 2.496, p = .476. Besides that,for the SR value, overrepresentation players were found in Serie A (SR= 2.53), La Liga (SR= 2.41) and Bundesliga (SR= 2.02) for all players who in Q1.

Table 5: Birth Quartile Distribution among Bottom Three in League Rankings

	EPL			Serie A			La Liga			Bundesliga		
	Ob	**Ex**	**SR**	**Ob**	**Ex**	**SR**	**Ob**	**Ex**	**SR**	**Ob**	**Ex**	**SR**
Q1	34	26.5	1.46	35	27.5	1.43	39	25.3	2.72*	33	24.5	1.72
Q2	20	26.5	-1.26	36	27.5	1.62	31	25.3	1.13	27	24.5	0.51
Q3	25	26.5	-0.29	23	27.5	-0.85	21	25.3	-0.85	22	24.5	-0.51
Q4	27	26.5	0.10	16	27.5	-2.19	10	25.3	-3.04	16	24.5	-1.66
Total	139			110			101			98		
	P		.283			.017			.001			.093

Table 5 proved there were only two leagues resulted on significant of RAE for Serie A, $\chi 2$ (3, n= 110), 10.218,p = .017 and La Liga $\chi 2$ (3, n= 101), 18.723, p = .001. In addition, La Liga was the only leagues which had anoverrepresentation player with (SR= 2.72) who were in Q1.

DISCUSSIONS

The primary aim of this study was to investigate the existence of the RAE in the top four European professional football leagues. The results significantly confirmed the presence of RAE, aligning with previous research conducted on top division professional football leagues (Yagüe et al., 2018). The study revealed that players born earlier in the year were overrepresented compared to those born later, a finding that resonates with the conclusions of Yagüe et al., (2020).

In this study, players born in the first quarter (Q1) were overrepresented with a SR of 5.23 across all four leagues. Conversely, players born in the third (Q3) and fourth (Q4) quarters were underrepresented, with SR values of -3.02 and -3.61, respectively. This pattern mirrors findings from previous studies on professional Spanish (Yagüe et al., 2020) and Turkish (Arslan, 2020) league, which reported an overrepresentation of players born in Q1 and Q2 compared to those born in Q3 and Q4, and the same pattern can also be seen in most elite sports (Delorme et al., 2009). This study also found parallels with research by Lupo et al., (2019), which posited that individuals born earlier in the year often have a competitive edge in high-performance sports. In a recent article focusing on senior professional footballers by Bezuglov et al., (2023) reflecting that RAE was evident on all top league divisions from 54 European countries. This advantage was evident in the prevalence of RAE among the most popular leagues in Europe that qualified for the next season of Champions League competition. The underrepresentation of Q3 and Q4 players in these top leagues aligns with the underdog theory, which suggests that later-born individuals often excel in self-control, a trait that can benefit early-born players during matches (Cumming et al., 2018).

The overrepresentation of players born in the first quarter (Q1) of the year, as revealed in this study, may have significant implications for the opportunities available to later-born players in lower divisions to advance to higher divisions, which also interpreted in study by Sierra-Díaz et al., (2017) on elite and young footballers. This overrepresentation suggests that the RAE could be limiting the upward mobility of these players, potentially leading to a loss of talent for the clubs and the sport as a whole. This notion is supported by the work of Gyimesi and Kehl (2021), who noted that the market value of European football club players increases with their performance, which in turn correlates with being born earlier in the year. This correlation suggests that the RAE could be influencing not only player selection and development but also the economic dynamics of the sport. The overrepresentation of Q1 players in the top four European football leagues further underscores this point, indicating that the RAE could be shaping the composition of these leagues.

The existence of RAE among the top four clubs in the league rankings of each of the top four European football leagues was also investigated. Significant results were found in three of the four leagues - Serie A, La Liga, and Bundesliga - with the exception of the English Premier League. This finding aligns with research by Rong and Low, (2020) and Yagüe et al., (2020), which found that RAE significantly affected medal winners and top performing teams, particularly those born in Q1. The high SR values for Q1 players in Serie A, La Liga, and Bundesliga suggest that earlier-born players may have a maturity advantage, which can provide significant benefits in sports practice (Lupo et al., 2019 & Práxedes et al., 2017). This maturity advantage, stemming from the additional months of physical, cognitive, and emotional development that earlier-born players have over their later-born peers, can give them an edge in both training and competitive matches as reported by Altimari et al., (2021). Meanwhile, as for the English Premier League, the non-significant result for the top four clubs may be influenced by various factors such as the high level of competitiveness, high quality and well-known coaches which shown that five to seven teams competing fiercely for the top four slots compared to other leagues. However, it's important to note that this maturity advantage is temporary, as later-born players will eventually catch up as they mature. Despite this, the initial advantage can have long-lasting effects, as the increased opportunities and resources received by earlier-born players can lead to better skill development and performance in the long run.

Previous studies have emphasized the role of psychological and physiological development in athletes' performance, suggesting that these factors may influence why early-born individuals often dominate the competitive football scene (Sierra-Díaz et al., 2017). Furthermore, elite sports like football often exhibit a greater RAE in lower-tier leagues, with the effect increasing as the league tier rises, particularly for early-born players (Lupo et al., 2019 & Bezuglov et al., 2023). In a retrospective cross-sectional study by Peña-González et al., (2020), RAE were significant with overrepresentation of Q1 and Q2 among youth footballers participating in international competition. Despite similar competitive levels and playing positions, athletes differ in their anthropometric assessments and physical performance based on whether they are classified as early or late-born (Peña-González et al., 2021).

The study also sought to determine the presence of RAE among the bottom three teams in the league rankings of each of the top four European football leagues. No significant RAE was found in three of the leagues, with the exception of La Liga, which showed a significant result. This finding aligns with previous studies that reported a prevalence of RAE among all Russian football players, albeit less so in the middle divisions of the football leagues (Bezuglov et al., 2019). The overrepresentation of Q1 players in La Liga, even among the bottom three teams, supports the notion that early-born players dominate the highest football tiers (Bezuglov et al., 2019). Despite previous studies asserting that early-born athletes show a high prevalence of RAE in team sports performance (de la Rubia et al., 2020), this study demonstrated that even teams facing relegation in La Liga exhibited significant RAE.

Moreover, the prevalence of RAE in three of the four top-ranked teams in Serie A, La Liga, and Bundesliga leagues, as well as its presence even among teams facing relegation in La Liga, further attests to the widespread impact of RAE. These findings indicate that birth timing can significantly influence an individual's career trajectory in professional football, from lower divisions to elite leagues. However, the implications of RAE extend beyond individual players. The overrepresentation of early-born players could potentially limit opportunities for later-born players, thereby affecting the diversity and breadth of talent within the leagues. Furthermore, the pervasive presence of RAE could significantly

impact team performance and consistency, potentially influencing the success and achievements earned by each football team.

In conclusion, the data and findings from this research strongly suggest a widespread prevalence of RAE among the top four European Leagues. This prevalence could significantly impact the consistency of team performance, potentially influencing the historic titles earned by each football team. The greater RAE results may be attributed to the superior physiological and psychological appearances of the football players. The interplay of internal and external factors within the players or teams provides compelling evidence of RAE among football players.

CONCLUSIONS

This study sheds light on the RAE in European football leagues, revealing a notable trend of early-born players being overrepresented in the top four leagues. This pattern, consistent across various research, suggests these players may have developmental advantages that influence their career paths and the overall efficacy of their teams. Notably, this effect is evident in teams across different standings, from top performers in leagues like Serie A, La Liga, and Bundesliga, to those facing challenges in La Liga. This finding points to a deeper, systemic impact of RAE on the sport, affecting not just individual careers but also the strategic dynamics of teams. Looking forward, it is crucial for future research to delve deeper into the long-term effects of RAE on player development and team performance. Investigating how various internal and external factors contribute to this phenomenon will be key to developing strategies that mitigate its impact, and generate greater competitive landscape in European football leagues.

REFERENCES

Altimari, J., Altimari, L., Bortolotti, H., Junior, A., Gabardo, J., Buzzachera, C., Frisselli, A., & Moraes, A. (2021). The relative age effect on anthropometry, body composition, biological maturation and motor performance in young Brazilian soccer players. Journal of Human Kinetics, 77, 147-157. https://doi.org/10.2478/hukin-2021-0017

Arslan, Y. (2020). The relative age effect in Turkish professional soccer. European Journal of Human Movement, 44. https://doi.org/10.21134/eurjhm.2020.44.560

Bezuglov, E., Morgans, R., Butovskiy, M., Emanov, A., Shagiakhmetova, L., Pirmakhanov, B., Waśkiewicz, Z., & Lazarev, A. (2023). The relative age effect is widespread among European adult professional soccer players but does not affect their market value. PLOS ONE, 18(3), e0283390. https://doi.org/10.1371/journal.pone.0283390

Bjerke, Ø., Lorås, H., & Vorland Pedersen, A. (2020). Variations in the constituent year effect in junior world championships in Alpine skiing: A window into relative development effects? PLOS ONE, 15(4), e0231384. https://doi.org/10.1371/journal.pone.0231384

Cumming, S. P., Searle, C., Hemsley, J. K., Haswell, F., Edwards, H., Scott, S., Gross, A., Ryan, D., Lewis, J., White, P., Cain, A., Mitchell, S. B., & Malina, R. M. (2018). Biological maturation, relative age and self-regulation in male professional Academy soccer players: A test of the underdog hypothesis. Psychology of Sport and Exercise, 39, 147-153. https://doi.org/10.1016/j.psychsport.2018.08.007

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. https://doi.org/10.3389/fpsyg.2020.01947

Delorme, N., Boiché, J., & Raspaud, M. (2009). The relative age effect in elite sport. Research Quarterly for Exercise and Sport, 80(2), 336-344. https://doi.org/10.1080/02701367.2009.10599568

Doyle, J. R., & Bottomley, P. A. (2018). Relative age effect in elite soccer: More early-born players, but no better valued, and no paragon clubs or countries. PLOS ONE, 13(2), e0192209. https://doi.org/10.1371/journal.pone.0192209

Ek, S., Wollmer, P., Karlsson, M. K., Peterson, T., Thorsson, O., Olsson, M. C., S. Malmborg, J., & Dencker, M. (2020). Relative age effect of sport Academy adolescents, a physiological evaluation. Sports, 8(1), 5. https://doi.org/10.3390/sports8010005

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

Foureaux Koppensteiner, M. (2017). Relative age, class assignment, and academic performance: Evidence from Brazilian primary schools. The Scandinavian Journal of Economics, 120(1), 296-325. https://doi.org/10.1111/sjoe.12215

Gil, S. M., Badiola, A., Bidaurrazaga-Letona, I., Zabala-Lili, J., Gravina, L., Santos-Concejero, J., Lekue, J. A., & Granados, C. (2014). Relationship between the relative age effect and anthropometry, maturity and performance in young soccer players. Journal of Sports Sciences, 32(5), 479-486. https://doi.org/10.1080/02640414.2013.832355

Gyimesi, A., & Kehl, D. (2021). Relative age effect on the market value of elite European football players: A balanced sample approach. European Sport Management Quarterly, 23(2), 544-560. https://doi.org/10.1080/16184742.2021.1894206

Işın, A. I. (2021). The relative age effect in successful national football teams. Kinesiologia Slovenica, 27(2). https://doi.org/10.52165/kinsi.27.2.40-51

Jasni, N. R. S., Tengku Kamalden, T. F., Jakiwa, J., & Wazir, M. R. W. N. (2022). Systematic Review: Mechanism of Relative Age Effect in Sport. SPED, 37, 1032-1039.

Lago-Fuentes, C., Rey, E., Padrón-Cabo, A., Prieto-Troncoso, J., & Garcia-Núñez, J. (2020). The relative age effect in professional Futsal players. Journal of Human Kinetics, 72(1), 173-183. https://doi.org/10.2478/hukin-2019-0105

Lupo, C., Boccia, G., Ungureanu, A. N., Frati, R., Marocco, R., & Brustio, P. R. (2019). The beginning of senior career in team sport is affected by relative age effect. Frontiers in Psychology, 10. https://doi.org/10.3389/fpsyg.2019.01465

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

Nolan, J. E., & Howell, G. (2010). Hockey success and birth date: The relative age effect revisited. International Review for the Sociology of Sport, 45(4), 507-512. https://doi.org/10.1177/1012690210371560

Peña-González, I., Javaloyes, A., Sarabia, J. M., & Moya-Ramón, M. (2020). Relative age-related differences between different competitive levels and field positions in young soccer players. Research in Sports Medicine, 29(3), 254-264. https://doi.org/10.1080/15438627.2020.1853540

Rong, L., & L Low, J. (2020). Relative age effects among Malaysian athletes in 29th Sea Games Kuala Lumpur 2017. Malaysian Journal of Movement, Health & Exercise, 9(1). https://doi.org/10.15282/mohe.v9i1.410

Práxedes, A., Moreno, A., García-González, L., Pizarro, D., & Del Villar, F. (2017). The relative age effect on soccer players in formative stages with different sport expertise levels. Journal of Human Kinetics, 60(1), 167-173. https://doi.org/10.1515/hukin-2017-0100

Sierra-Díaz, M., González-Víllora, S., Pastor-Vicedo, J., & Serra-Olivares, J. (2017). Soccer and relative age effect: A walk among elite players and young players. Sports, 5(1), 5. https://doi.org/10.3390/sports5010005

Steingröver, C., Wattie, N., Baker, J., & Schorer, J. (2016). Does relative age affect career length in North American professional sports? Sports Medicine - Open, 2(1). https://doi.org/10.1186/s40798-016-0042-3

Torres-Unda, J., Zarrazquin, I., Gil, J., Ruiz, F., Irazusta, A., Kortajarena, M., Seco, J., & Irazusta, J. (2012). Anthropometric, physiological and maturational characteristics in selected elite and non-elite male adolescent basketball players. Journal of Sports Sciences, 31(2), 196-203. https://doi.org/10.1080/02640414.2012.725133

Yagüe, J. M., de la Rubia, A., Sánchez-Molina, J., Maroto-Izquierdo, S., & Molinero, O. (2018). The Relative Age Effect in the 10 Best Leagues of Male Professional Football of the Union of European Football Associations (UEFA). Journal of Sports Science and Medicine, 17(3), 409. https://doi.org/10.21134/eurjhm.2020.44.539

Yagüe, J. M., Molinero, O., Alba, J. Á., & Redondo, J. C. (2020). Evidence for the relative age effect in the Spanish professional soccer league. Journal of Human Kinetics, 73(1), 209-218. https://doi.org/10.2478/hukeauxkin-2019-0145