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Originales

ARE RELATIVELY OLDER SOCCER PLAYERS MORE FREQUENT AND VALUABLE THAN THEIR RELATIVELY YOUNGER PEERS? A STUDY OF THE MAJOR AMERICAN LEAGUES



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ABSTRACT

Aim: The purpose was to analyze the Relative Age Effect (RAE) on players' representativeness in Top American soccer leagues, and analyze the RAE on players' market value in the above-mentioned leagues.

Methods: The date of birth and perceived market value from 3494 male elite soccer athletes who participated in the 2022 season of the Argentinian (Superliga), Brazilian (Série A), Colombian (Liga Dimayor I), Mexican (Liga MX), and US American (MLS) soccer leagues were collected. The occurrence of the RAE among players was assessed in each of the leagues through a comparison of the incidence of athletes born in each quarter and the frequency expected for each quarter.

Results: The examinations of the players' birth quarters revealed a disparity in birth distribution across all leagues when compared to the expected values.

Conclusion: Results also indicated that market values did not differ based on the players' quarter of birth in Argentina, Brazil, Colombia, Mexico and USA.

Keywords: Relative age effect; Sports performance; Sports management; Sports development.

¿SON LOS FUTBOLISTAS RELATIVAMENTE MAYORES MÁS FRECUENTES Y VALIOSOS QUE SUS PARES RELATIVAMENTE MÁS JÓVENES? UN ESTUDIO DE LAS PRINCIPALES LIGAS AMERICANAS

RESUMEN

Objetivo: El objetivo fue analizar el Efecto de la Edad Relativa (EER) sobre la representatividad de los jugadores en las principales ligas americanas de fútbol, y analizar el EER sobre el valor de mercado de los jugadores en estas ligas.

Métodos: La fecha de nacimiento y el valor de mercado percibido de 3494 deportistas masculinos de fútbol de élite que participaron en la temporada 2022 de las ligas Argentina (Superliga), Brasileña (Série A), Colombiana (Liga Dimayor I), Mexicana (Liga MX) y estadounidense

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(MLS) de fútbol. Se evaluó la aparición del EER entre los jugadores de cada una de las ligas mediante la comparación de la incidencia de deportistas nacidos en cada trimestre y la frecuencia esperada para cada trimestre.

Resultados: La evaluación de los cuartos de nacimiento de los jugadores revelaron una disparidad en la distribución de los nacimientos en todas las ligas en comparación con los valores esperados.

Conclusión: Los resultados también indicaron que los valores de Mercado no diferían según el trimestre de nacimiento de los jugadores en Argentina, Brasil, Colombia, México y Estados Unidos.

Palabras clave: Efecto de la Edad Relativa; Rendimiento Deportivo; Gestión deportiva; Desarrollo deportivo.

JOGADORES DE FUTEBOL RELATIVAMENTE MAIS VELHOS SÃO MAIS FREQUENTES E VALIOSOS DO QUE SEUS COLEGAS RELATIVAMENTE MAIS JOVENS? UM ESTUDO DAS PRINCIPAIS LIGAS AMERICANAS

RESUMO

Objetivo: O objetivo foi analisar o Efeito da Idade Relativa (EIR) na representatividade dos jogadores nas principais ligas de futebol dos Estados Unidos e analisar o EIR no valor de mercado dos jogadores nessas ligas.

Métodos: Foram coletadas a data de nascimento e o valor de mercado percebido de 3.494 atletas de futebol masculino de elite que participaram da temporada de 2022 das ligas de futebol da Argentina (Superliga), Brasil (Série A), Colômbia (Liga Dimayor I), México (Liga MX) e Estados Unidos (MLS). A ocorrência do EIR entre os jogadores foi avaliada em cada uma das ligas por meio de uma comparação da incidência de atletas nascidos em cada trimestre e a frequência esperada para cada trimestre.

Resultados: As análises dos trimestres de nascimento dos jogadores revelaram uma disparidade na distribuição dos nascimentos em todas as ligas quando comparadas aos valores esperados.

Conclusão: Os resultados também indicaram que os valores de mercado não diferiram com base no trimestre de nascimento dos jogadores na Argentina, Brasil, Colômbia, México e EUA.

Palavras-chave: Efeito da idade relativa; Desempenho esportivo; Gestão esportiva; Desenvolvimento esportivo.

INTRODUCTION

Youth athletes are usually organized into annual age groups using specific cut-off dates¹. Grouping by age could lead to a bias in the selection of athletes since being relatively older is more likely to provide a performance and selection advantage when assessed or evaluated (by coaches) against annual age-group peers¹. In other words, those born earlier in the year are more likely to be bigger, stronger, and more physically mature than those born later in the same year^{2,3}. As a result, they are often identified as better athletes and receive more attention and opportunities to develop their skills. This phenomenon is called the relative age effect (RAE) and refers to the tendency for individuals who are born early in a selection year (usually the first few months) to have an advantage over those born later in the same year, in certain areas such as sports. This effect has been observed in many different sports, including soccer⁴⁻⁶, ice hockey⁷, basketball⁸, tennis^{9,10}, and athletics¹¹.

The RAE is closely related to biological maturation, as children who are born earlier in the selection year are often more physically mature than those born later in the same year. This can give them a performance advantage in sports and other competitive activities, as they are stronger, faster, and more coordinated than their less-mature peers¹. They may also be more likely to be identified as talented athletes and receive opportunities for training and development¹². Studies have found that RAE is present in soccer at both the amateur and professional levels^{13,14}. For instance, a study revealed that amongst the 100 most valuable soccer players 60% were born in the first half of the year¹⁵. Also, a big sample comprising 202.951 players competing in Brazilian soccer showed that RAE is present and influenced the players' selection⁴. In fact, this has been found to be true across many different soccer leagues and countries, including the English Premier League, Spanish La Liga, and Italian Serie A.

With a particular emphasis on the Americas, a study testing 1.344 male and female youth soccer players found that while male

players showed a strong relative age effect, there was only a marginal effect for female players, suggesting gender differences in the effect may be due to a complex interaction of biological, maturational, and socialization factors¹⁶. In a South American country (Argentina) it was found a significant correlation between the player's relative age and their likelihood of becoming a professional player, but this effect disappears when professional players are compared with one another, highlighting the potential biases in institutional policies¹⁷. In a competition that implies different American countries (under-10 Libertadores CUP), it was found significant differences in birth quartiles and playing positions, indicating a tendency towards selecting players born in the early months of the year¹⁸.

Some studies have been trying to include different countries aiming to analyze the RAE effect on soccer across different cultures. One of the examples was performed in ten European countries¹³. The results showed that the RAE has remained consistent, with no change observed over the 10-year period in the ten countries¹³. However, as far as we may know, no study included different American competitions in an RAE study, which may offer an opportunity to confirm if RAE effects are present among different contexts and may also help to provide some information to identify possible strategies to adjust to these contexts. Moreover, the prevalence of studies focusing on the influence on market values is reduced, and, as far as we know, absent in the Americas, thus research focusing on that can also bring some value to the overall discussion on the topic.

Thus, the purpose of this study was to: (i) analyze the RAE effect on players' representativeness in Argentinian (Superliga), Brazilian (Série A), Colombian (Liga Dimayor I), Mexican (Liga MX), and US American (MLS) soccer leagues; and (ii) analyze the RAE effect on players' market value on the above-mentioned leagues.

Table 1. Number of teams, players, players' average age, and total estimated market values for selected soccer leagues.

	Argentina	Brazil	Colombia	Mexico	USA
Nº of teams	28	20	20	18	29
Nº of players	703	838	593	472	888
Market value (T€)	512.039	584.979	216.734	446.074	523.450

Note T€ – thousands of euros.

METHODS

Participants

Data from 3494 male elite soccer athletes who participated in the 2022 season of the Argentinian (Superliga), Brazilian (Série A), Colombian (Liga Dimayor I), Mexican (Liga MX), and US American (MLS) soccer leagues were collected. These leagues represent the five most valuable soccer leagues in the American continent in terms of players' market values. General information on the selected leagues is available in Table 1.

Data collection and procedures

The complete names of players, along with their dates of birth and assessed market values, were acquired as publicly available information from the "Transfermarkt" database (www.transfermarkt.com.br), similar to previous studies^{19,20}. Data was collected on January 10th 2023, which was one day before the transfer window opened. The selection of this particular date aimed to mitigate fluctuations in market values, as it was presumed that values had stabilized by this juncture. Athletes with incomplete information were excluded from the research. Whenever an athlete appeared in more than one roster in the same country, duplicate data was removed and only the higher market value was considered for analyses. All data used in this study were reported anonymously.

The examined variables comprised the estimated market values of players (in thousands of euros) and the birth quarters of the players: Q1 (from January to March); Q2 (from April to June); Q3 (from July to September); and Q4 (from October to December).

All data was collected from public documents available online, so this research does not require an ethics committee's approval.

Statistical analysis

The absolute values were used to display the occurrences of players' birth quarters. To evaluate the RAE among players in each league, an analysis was conducted by contrasting the incidence of athletes born in each quarter with the expected frequency for each respective quarter. The frequencies of players' quarters of birth were presented in absolute values. Given the relevant presence of foreign players in each league (over 10% in all cases), it was not recommendable to base our analyses on specific population births databases. Therefore, we followed the indications by Edgar and O'Donoghue¹⁰, considering the days encompassed within each quarter, we adopted the subsequent anticipated birth distribution for each quarter: Q1 = 24.71%, Q2 = 24.91%, Q3 = 25.19% and Q4 = 25.19%.

Chi-square tests (χ^2) were employed to compare the distribution of athletes' birthdates within each of the scrutinized leagues. The effect size (w) for the chi-square tests was computed for all analyses, adhering to Cohen's²¹ guidelines. According to this author's framework, 0.1 denoted a small effect, 0.3 a medium effect, and 0.5 a large effect. The significance level was established at 0.05, except in instances where multiple comparisons between quarters were requisite, leading to the implementation of Bonferroni's

corrections. In such cases, the significance level was adjusted to 0.0083.

The data concerning estimated market values underwent scrutiny for normality, and both the Kolmogorov-Smirnov test and quantile-quantile plots indicated a deviation from normal distribution. Consequently, the comparison of players' market values across the quarters of the year in each league employed the Kruskal-Wallis test. The effect size (η^2) for the Kruskal-Wallis tests was computed for all analyses, with 0.01 indicating a small effect, 0.06 denoting a moderate effect, and 0.14 representing a large effect, according to Cohen's²¹ criteria. The significance level was established at 0.05. The Statistical Package for the Social Sciences (SPSS), version 20.0 (Chicago, USA), was utilized for all analyses.

RESULTS

Relative Age Effects

The analyses of the players' quarters of birth indicated that the distribution of births was different from expected for all of the leagues analyzed (Figure 1).

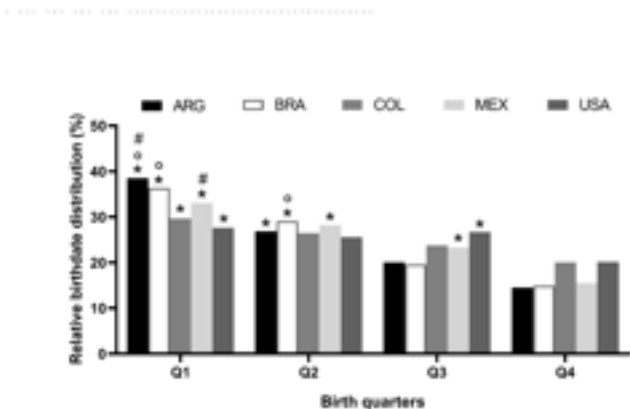


Figure 1. Analyses of the players' quarters of birth for all of the leagues analyzed.

In the case of the Argentinian league [$\chi^2 = 94.778$; $p < 0.001$; $w = 0.367$], post hoc analyses indicated a higher frequency of players born in Q1 [$p < 0.001$] and Q2 [$p < 0.001$] compared to those born in Q4. Furthermore, players born in Q1 exhibited a higher frequency compared to those born in Q2 [$p < 0.001$] and Q3 [$p < 0.001$]. In the case of the Brazilian league [$\chi^2 = 97.886$; $p < 0.001$; $w = 0.342$], post hoc analyses revealed a higher frequency of players born in Q1 and Q2 compared to those born in Q3 [$p < 0.001$] and Q4 [$p < 0.001$]. In the case of the Colombian league [$\chi^2 = 13.157$; $p = 0.004$; $w = 0.149$], post hoc analyses indicated that players born in Q1 [$p < 0.001$] were more frequent than players born in Q4. In the case of the Mexican league [$\chi^2 = 33.695$; $p < 0.001$; $w = 0.267$], post hoc analyses indicated that players born in Q1 [$p < 0.001$], Q2 [$p < 0.001$], and Q3 [$p = 0.008$] were more frequent than players born in Q4 and that players born in Q1 [$p = 0.006$] were more frequent than players born in Q3. Finally, in the case of the US American league [$\chi^2 = 12.853$; $p = 0.005$; $w = 0.12$], post

hoc analyses indicated that players born in Q1 [$p = 0.002$] and Q3 [$p = 0.006$] were more frequent than players born in Q4.

Market Value Analysis

The comparison of players' market values was conducted considering birth quarters for each of the leagues (Figure 2). Findings suggested that there were no variations in market values based on the players' birth quarters in Argentina [$H(3) = 2.507$; $p = 0.474$; $\eta^2 = -0.001$], Brazil [$H(3) = 0.517$; $p = 0.915$; $\eta^2 = -0.006$], Colombia [$H(3) = 2.125$; $p = 0.547$; $\eta^2 = -0.002$], Mexico [$H(3) = 5.236$; $p = 0.155$; $\eta^2 = 0.005$], and United States of America [$H(3) = 3.983$; $p = 0.263$; $\eta^2 = 0.002$].

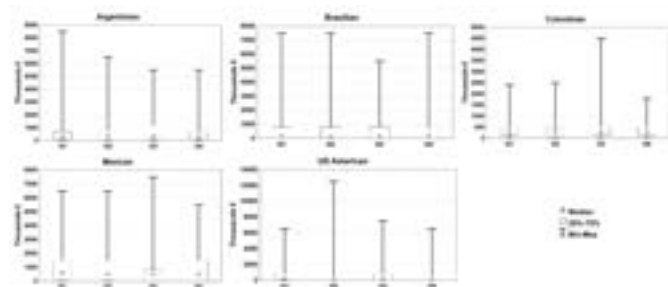


Figure 2. Comparison of players' market values considering birth quarters for each of the leagues.

DISCUSSION

The present study aimed two-fold: (i) analyze the RAE effect on players' representativeness in Argentinian (Superliga), Brazilian (Série A), Colombian (Liga Dimayor I), Mexican (Liga MX), and US American (MLS) soccer leagues, and (ii) analyze the RAE effect on players' market value on the above-mentioned leagues. Our findings showed that birth date was preponderant in participation in the major American leagues, corroborating the literature. In fact, the present study is in line with previous research developed in the top five European soccer leagues: La Liga (Spain), Premier League (England), Serie A (Italy), Bundesliga (Germany), and Ligue 1 (France), where the RAE was also noticed^{5,13}. Nevertheless, being born earlier did not influence the market value of those soccer players.

The present study clearly showed a higher frequency of soccer players born in the first months of the year at high levels in the major American leagues. In fact, all leagues presented differences between the number of players born in the first months of the year and the last quartile. For instance, in the Argentinian league, it is clear that being born in Q1 increases the probability of reaching the highest levels of this league since Q1 was statistically different from the other quartiles. Within the Brazilian league, there was a higher prevalence of athletes born in Q1 and Q2 compared to those born in Q3 and Q4. This suggests that athletes born before July are more prone to achieve the professional level in this league. In Colombia, the influence of RAE seems to be softer, with more differences between extremes (Q1 and Q4). In the Mexican and US leagues, although there was also a higher frequency of players from Q1 compared to Q4, players from Q2 and Q3 are also overrepresented, indicating a more even distribution of birthdates compared to the other leagues analyzed. These results are in line with previous investigations that reported the RAE phenomenon in soccer^{4,14,18}, especially in male players¹⁷. Indeed, soccer is a competitive sport with a high number of practitioners and a well-developed youth competition system^{5,18}. This suggests that maturation plays an important role in the selection of the most suitable athletes to play in youth categories, affecting the chances of reaching elite tiers. In other words, relatively older players usually benefit from demonstrating better results in physical fitness

and anthropometric characteristics, compared to their relatively younger peers^{4,20}, favoring the prevalence of such a deep RAE that it may persist along the athletes' developmental pathway up to the senior categories in some cases¹⁹.

Recently, the idea of implementing bio-banding has emerged to overcome RAE³. It refers to the grouping of players based on their maturation, i.e. grouping youth athletes within a chronological age range (between 11 to 15 years), into 'bands' or groups based on characteristic(s) other than chronological age for specific competitions and training³. This strategy is potentially useful for both identifying and developing talent, as athletes will be grouped based on the same "biological advantages". This strategy eliminates the impact of maturation-related variability by creating a suitable environment and challenges, equalizing competition, increasing the chances of success, avoiding injury due to mismatches in size, customizing training, and fostering talent development³. Nevertheless, it has been also highlighted that a process of education should be conducted on coaches, teachers, and all agents who make decisions in youth sports¹⁵.

Although maturation is indicated as one of the main triggers for developing RAE^{11,17}, that phenomenon seems to persist in senior teams, where maturation is not expected to play a major role¹. However, it has been shown that the RAE likelihood decreases in these contexts compared to younger categories¹. One explanation could be related to the overload in adolescent years because of greater demands, leading to withdrawal from competitive levels of participation preceding or during their senior years due to injury, overtraining, burnout, or boredom¹. This could be the reason why a relationship between RAE and market value has not been observed in the present study. Moreover, after reaching senior professional soccer categories, the market value of players is primarily determined by their sports performance, which is not expected to be influenced by maturational aspects at this point, leading to a leveling out of values among relatively younger and older players. As a result, market value is no longer influenced by age or birth month/semester¹⁹. The majority of the studies on this topic did not find that relationship²⁰, as in the present study. Nevertheless, it seems relevant to point out that the discrepancy in the players' market value seems to be very high, as represented in Figure 2, and the average of the values could be "hiding" this effect. Among this study's limitations is the fact that was only considered the market value of athletes based on a single season, only with male athletes, as well as players from only the top leagues. Considering that the RAE is modulated by individual, environmental, and task constraints²², is likely that the level of competitiveness has an impact on this effect, potentially yielding different results when considering other levels of competition. Future investigations should focus on longitudinal analysis, as well as female categories, and other levels of competition.

CONCLUSION

In summary, the results of the study showed that the distribution of births was different from expected for all of the leagues analyzed, with a predominance of athletes born in the first months of the year, suggesting the existence of RAE in the top American soccer leagues. This finding confirms that relatively older players are more likely to achieve high levels of competition than relatively younger ones.

Conversely, the findings suggested that there were no disparities in market values associated with the players' quarter of birth, irrespective of the leagues under examination. Since the market value of players is primarily determined by their sports performance, this finding reinforces the notion that, in elite senior soccer categories, the athlete's month of birth does not affect performance indicators. Coaches, stakeholders, and other professionals involved in the sport in the American top soccer leagues must be aware of the RAE phenomenon, considering that it affects the development and selection processes for elite male soccer players. Evidence indicates

that choices made based on physical characteristics or performance indicators without considering the differences related to age and maturational stages in youth categories will have an impact that lasts to the senior categories, leading to a loss of potential talents.

DISCLOSURE STATEMENT

No potential conflict of interest was reported by the authors.

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