

ORIGINAL SCIENTIFIC PAPER

Relative Age Effect in Senior Football Leagues in Former Yugoslav Republics

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Abstract

The relative age effect is considered to be the main cause of the uneven distribution of birthdates in sports teams, particularly in football. The aim of this paper is to examine the presence of the relative age effect in the leagues of the former Yugoslav republics and the differences in birthdates distribution between the leagues. To test hypotheses, we used publicly available information obtained from official websites, which regarded players who played in the analyzed leagues during the 2020/2021 season. The absolute results indicate that in five of the six observed leagues, the greatest number of players were born in the first quartal of the year. A more detailed observation of each league individually found a significant relative age effect among players who play in the Serbian, Croatian and Slovenian leagues, but not in Northern Macedonia, Montenegro, and Bosnia, and Herzegovina. Also, the results show that the quarterly distribution of analyzed leagues does not differ significantly. The results of this paper should serve the purpose of raising awareness about the presence of the relative age effect in regional football. All this should affect the creation of an environment in which all football players would have an equal chance for development and progress, reduce the chances of overlooking potential talents and ultimately raise the quality of football in the region.

Keywords: birth date, distribution, selection, maturity, football

Introduction

The generally accepted categorization by chronological age in sport aims to enable parity in competition and create a conducive environment for the development of young athletes (Musch & Grondin, 2001). However, in this setting, the differences between members of the same group can be more than eleven months (between those born at the beginning and those born before the end of the year), taking into account that the annual division is usually in question. These inequalities consequently have a potentially significant impact on the process of talent identification in sport (Wattie, Copley, & Baker, 2008).

To explain the differences between subjects of the same chronological age, ie group, the term relative age is used. The relative age effect is considered to be the “main culprit” for the uneven distribution of the date of birth, which is characterized by a significant deviation from the expected distribution with-

in the same chronological group. It is typical for this distribution that within the observed group we have a larger number of subjects born at the beginning compared to the end of the year (Copley et al., 2009; Delorme, Boiché, & Raspaud, 2010).

One of the explanations for such phenomena would be that children born relatively earlier are at a higher degree of biological maturation than relatively younger ones. Consequently, the older ones (born in January, February, and March) are more physically dominant and better coordinated than the younger ones (born in October, November, and December), and thus perform with more success. With success come awards as well as increased self-confidence, which certainly has a positive effect on the retention of this group of relatively older individuals in the sport (Vaeyens, Philippaerts, & Malina, 2005; de la Rubia, Lorenzo-Calvo, & Lorenzo, 2020).

The presence of the mentioned effect is especially pro-



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nounced in sports games, where physical characteristics have a direct impact on the outcome of activities. The authors have particularly established the existence of this phenomenon in hockey (Bezuglov et al., 2020), youth basketball (Arrieta et al., 2016), baseball (Nakata & Sakamoto, 2013), volleyball (Campos et al., 2016), handball (Wrang et al., 2018; de la Rubia et al., 2020) and tennis (Edgar & O'Donoghue, 2005).

The earliest research of the presence of the relative age effect in football appeared in the early 1990s. Barnsley et al. (1992) observed a distribution of date of birth in the sample of players participating in the 1990 World Cup in Italy and the World Championships held a year earlier in the category of players under the age of 17, which deviated significantly from the expected normal distribution. The authors also point out the astonishing fact that in the competition of football players under the age of 20, as many as 46.87% were born in the first and only 7.64% in the last quartal of the "football year" (Barnsley et al., 1992). According to the regulations of the time, the "football year" was considered to be the period from August 1 to July 31. Using the same reference period (August–July), a similar asymmetry was noted by Helsen, Starkses, and Van Winckel (1998) by observing the birth dates of young Belgian players, and by Verhulst (1992) who analyzed the birthdates of players who played in the first and second level of the competition in Belgium, Netherlands, and France.

In 1997, instead of August 1, FIFA set January 1 as the beginning of the selection period in the youth categories, and by doing harmonized "football" with the calendar year. Examining the impact of the change on the distribution of birth dates, Helsen et al. (2000) noted that after only two years of implementing this regulation, the proportion of players born at the beginning of the selection period was as high as before the change.

Observing the trends over the years, no decrease in the percentage of relatively older players in the total population of players who participated in world championships for under-17s was found. The consistency of this distribution in the period from 1997 to 2007 is shown in the results of research conducted by Williams (2010). The author also emphasizes that out of the total number of surveyed football players, as many as 40% were born in the first quartal of the year, compared to a noticeably smaller number, namely 16%, in the last one. A slight increase in the representation of relatively earlier births (born in the first quartal) from 29.3% to 31.9% was revealed by comparing the 2000/01 and 2010/11 competition seasons within the ten European senior professional leagues (Helsen et al., 2012). A special contribution to the influence of relative age in senior football was shown in the study by Yagüe et al. (2018), which showed that the relative age effect is present in a significant way in the top ten UEFA leagues in the 2016–17 seasons, regardless of team competitive ranking. On the other hand, Ramos-Filho and Ferreira (2020) found a reverse relative age effect, which means that players born at the end of the year reach the adult category with better performance qualities. Finally, Brustio et al. (2018) have showed that relative age effect exists in all ages and in seniors too in Italian football, but the effect size of this trend decreased as the age increased. The aforementioned indicates that the prevalence of this phenomenon has not decreased over the years, despite the great interest of the scientific and professional public.

In the former Yugoslavia, football enjoys the status of one of the most popular sports, and it would be important to de-

termine the presence of the relative age effect and its impact on the selection of football players from the region. Although this topic has been the subject of interest of the professional public around the world for many years, to our knowledge no one has so far dealt with a comprehensive analysis of the distribution of birthdates among football players playing in the former Yugoslavia leagues. Therefore, the aim of this paper is to examine the presence of the relative age effect in the leagues of the former Yugoslavia as well as its impact on player selection.

Methods

Subjects

The subjects in this study are football players who played in the leagues of the former Yugoslav Republics during the 2020/2021 season. The leagues covered by the analysis are: Linglong Tire Super League (Serbia), Croatia Telekom First Division (Croatia), First Telemach League Slovenia (Slovenia), Telekom 1. CFL (Montenegro), First MFL (Northern Macedonia) and MTel Premier League (Bosnia and Herzegovina). The total sample is 1900 distributed in 74 teams competing in the 6 mentioned leagues. This research was conducted in accordance with ethical standards derived from the Declaration of Helsinki adopted in 1964 and revised in 2013 and approved by the Singidunum University Ethics Committee (no. 82-1, decision made on 31st January 2022).

Data collection

Two variables were used in the preparation of this paper, namely the date of birth (more specifically the quarter in the year when the subject was born) and the league in which the subject played in the 2020/21 season. Players' birthdates were classified into one of 4 quarters (Helsen et al., 2012; Romann & Fuchslocher, 2013). Players born between January 1 and March 31 are ranked in the first quarter (Q1). By the same principle, players born between April 1 and June 30 are placed in the second quarter (Q2). The third quarter consisted of players born between July 1 and September 30 (Q3), while the last, fourth quarter consisted of players with birth dates between October 1 and December 31 (Q4).

The website <https://www.transfermarkt.com/> was used to search and collect the data required for this paper, while the information was checked and supplemented through the official websites of the leagues: Serbia (<https://superliga.rs/>), Croatia (<https://prvahn.hr/>), Slovenia (<https://www.nzs.si/prvaliga/>), Montenegro (<https://fscg.me/takmicenja/telekom-1-cfl/>), Northern Macedonia (<https://ffm.mk/prva-mfl/>), Bosnia and Herzegovina (<https://www.nfsbih.ba/takmicenja/nogomet-muskarci/m-tel-premijer-liga-bih/>). When it was available for additional verification of the authenticity of the data, the websites of the clubs were also consulted. The names, surnames, date, and year of birth of the players are taken from the team lists via the above-mentioned websites. It is considered that a player qualifies as a subject if he is in the match protocol at least once during the season. Players who made no appearance in the squad were not taken into consideration.

Statistical analysis

For the purposes of this paper, descriptive and comparative statistics were processed. Comparative analysis was performed using the Chi-square test for distribution (χ^2) and the Pearson Chi-square test for independence. This analysis checked the homogeneity of the distribution based on the comparison of

the observed and expected quarterly distribution of the birth dates. A large number of studies advocate the theory that the percentage of births during each quarter of the year is similar, i.e. 25% (Cobley et al., 2009; Campos et al., 2017), so in this paper this value is taken as the expected theoretical distribution. The effect of relative age was diagnosed when the observed distribution was statistically significantly different from the expected theoretical distribution.

To analyze the relationship between leagues and quarterly distribution, Pearson Chi-square test for independence was used. Specifically, if there is statistical significance it can be argued that the league has an impact on the quarterly distribution, but if not, then it can be said that the quarterly distribution is independent of the leagues. All tests were conducted using SPSS (v. 20, IBM Co., Chicago, IL, USA), and Microsoft Office Excel 2010. The obtained results were considered statistically significant when $p < 0.05$.

Results

The absolute results shown in Table 1 and Figure 1 indicate that in five of the six observed leagues, the largest number of players were born in the first quartal of the year. The only competition in which this was not the case was the League of Northern Macedonia, where most players were born in the second quarter – 28.46%. On the other hand, the lowest number of births is in the fourth quarter in all but the Montenegrin football league, where we can notice that those players born in the third quartal are less represented – 22.42%. Also, compared to other leagues, Montenegro has the highest percentage (23.32%) of football players born in the period of October - December (Q4). If we look at the total sample of 1900 respondents, we can see a trend that shows a decrease in the number of players by quarters from the beginning to the end of the year (first 30.58%, second 26.42%, third 23.16%, and fourth 19.84%; Figure 1).

Table 1. Absolute quarterly distribution of birth dates by leagues for the 2020/2021 season with corresponding χ^2 test for distribution

Country	Number of players	Q1	Q2	Q3	Q4	χ^2
Serbia	576	175	155	133	113	15.03*
Croatia	280	94	73	66	47	16.14*
Slovenia	259	88	66	55	50	13.20*
Montenegro	223	64	57	50	52	2.09
Northern Macedonia	260	70	74	67	49	5.63
Bosnia and Herzegovina	302	90	77	69	66	4.57
Total	1900	581	502	440	377	47.99*

(* statistically significant differences between observed and expected quarterly distribution; $p < 0.01$)

Figure 1 shows the distribution of birth dates by quarter of all six leagues presented here, but in addition it shows the statistical significance of differences in relation to the theoretically expected homogeneous distribution of both the whole sample

and each category individually. The analysis of the entire sample shows a distorted distribution that differs significantly from the expected uniform ($p < 0.001$), where we note that 581 of 1900 total subjects were born between January and March (30.58%).

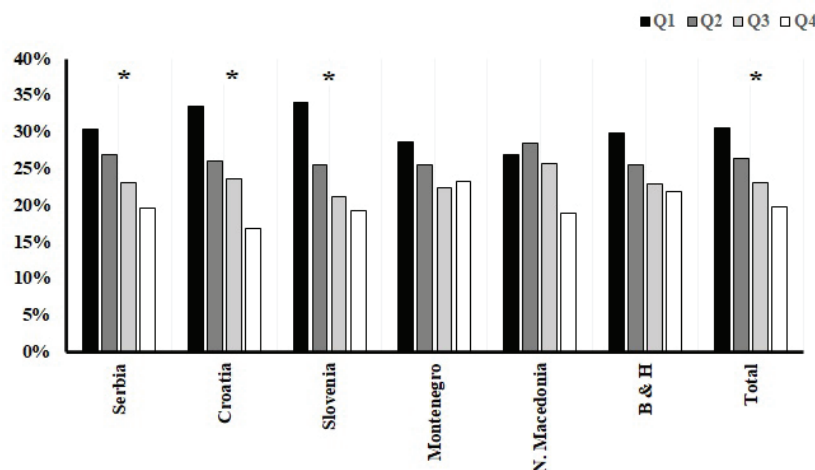


FIGURE 1. Relative quarterly distribution of birth dates by leagues for the 2020/2021 season (* statistically significant differences between observed and expected quarterly distribution $p < 0.01$; N. Macedonia - Northern Macedonia, B & H - Bosnia and Herzegovina)

A more detailed observation of each league individually, which is shown in Figure 1, found a significant relative age effect among players who play in the Serbian ($p = 0.002$), Croatian ($p = 0.001$), and Slovenian leagues ($p = 0.004$). The exceptions were competitions in Northern

Macedonia ($p = 0.131$), Montenegro ($p = 0.553$), and Bosnia and Herzegovina ($p = 0.206$), where there was no statistically significant difference between the observed and expected quarterly distribution, i.e. the relative age effect was not pronounced.

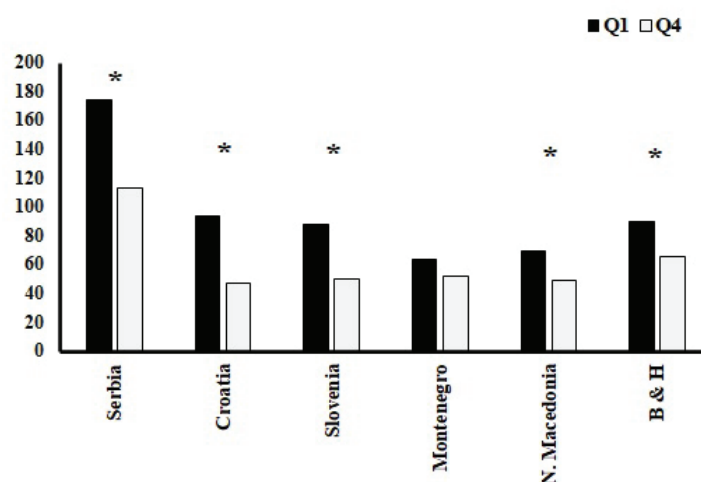


FIGURE 2. Differences in the number of players born in the first (Q1) and fourth quarter (Q4) (* statistically significant differences between observed and expected quarter distribution $p < 0.01$; N. Macedonia - Northern Macedonia, B & H - Bosnia and Herzegovina)

An additional comparison of Q1 and Q4 (Figure 2) indicates a significantly higher number of players born in the first quarter in 5 of the 6 leagues analyzed (Serbia $p < 0.001$; Croatia $p < 0.001$; Slovenia $p < 0.001$; Bosnia and Herzegovina

$p = 0.003$; Northern Macedonia $p = 0.003$). The only league in which it was not statistically significant, although there was a difference in favor of the Q1 is the Montenegrin league ($p = 0.096$).

Table 2. Differences in quarterly distribution between leagues (p values)

	Serbia	Croatia	Slovenia	Montenegro	Northern Macedonia	Bosnia and Herzegovina
Serbia	1	0.685	0.764	0.715	0.687	0.882
Croatia		1	0.843	0.294	0.418	0.453
Slovenia			1	0.563	0.296	0.713
Montenegro				1	0.529	0.980
Northern Macedonia					1	0.578
Bosnia and Herzegovina						1

Table 2 shows that the quarterly distribution of analyzed leagues does not differ significantly ($\chi^2 = 8.72$, $p = 0.892$). According to the Pearson χ^2 test for independence results, based on the differences between the two leagues observed separately, we didn't find any significant correlation between a quarterly distribution and any of the evaluated leagues ($\chi^2 = 0.186$ – 3.696 ; $p = 0.294$ – 0.980).

Discussion

The main goal of this study was to examine the significance of the relative age effect in football leagues from the former Yugoslav Republics during the 2020/2021 season. The effect of relative age was observed in Serbian, Croatian and Slovenian League, but not in the leagues of Montenegro, Northern Macedonia, and Bosnia and Herzegovina.

Some of the possible explanations according to which the relative age effect is present only in certain competitions could be that the quality of football and competitions in Serbian, Croatian and Slovenian leagues is higher compared to other analyzed countries because great competition in a particular sport can be the cause of the relative age effect (Musch & Grondin, 2001). Similar results are shown in the papers of other authors who have dealt with this topic. A significant relative age effect in European professional football is shown in many European leagues during the 2010/2011 season (England,

Germany, Belgium, Netherlands, Spain, France, Italy, Denmark and Sweden; Helsen et al., 2012). The only league not revealed in that season was Portugal (Helsen et al., 2012). Examining the ten best European leagues for the 2016/2017 season, Yagüe et al (2018) indicate that the relative age effect was not significant only in the Belgian league, while it was pronounced in all other leagues (England, Italy, Turkey, Austria, Netherlands, Portugal, Spain, France, Germany). Also, Padron-Cabo et al. (2016) point to the pronounced effect in the national leagues of Spain, Italy, Germany, France, Portugal, Netherlands, Belgium, Ukraine, South Africa, Australia, Mexico and Brazil, while it was not recorded in England and South Korea.

Certainly, the causes of the obtained results should be sought in the selection of players at younger ages. The prevalence of the relative age effect indicates the phenomenon that among young players who are classified according to chronological age, football players born at the very beginning of the year are more often selected than their relatively younger teammates. This is indicated by the results of studies in youth football in Switzerland (Romann & Fuchslocher, 2013), Türkiye (Mulazimoglu, 2014), Spain (Del Campo et al., 2010), Norway (Sæther, 2016), and Germany (Augste & Lames, 2010). However, Brustio et al. (2018) have shown that relative age effect exists in senior age in Italian football too, but it is significantly smaller because maturation status has a

smaller impact on the physical performance of adult players. Also, the influence of player migrations between sports teams has a great influence on the mentioned effects.

Therefore, we can conclude that the selection in which one of the basic criteria is physical characteristics can have a far-reaching negative impact that would later be reflected through less representation of relatively younger players in senior football. To a certain extent, the results of this paper speak in favor of that, because by comparing the number of players born in the first and fourth quarter, it was determined that in five of six leagues significantly more players were born in the first quarter. Although it is known that these initial developmental benefits are neutralized after the end of the maturation period and should not significantly affect the distribution in senior categories, observing the results of this study we can say that this is not entirely true. The reason for this phenomenon could be the current process of identifying and selecting talents in football, which is not fully objective and comprehensive, and as such causes the loss of potential talent (Jiménez & Pain, 2008).

Although scientific literature suggests some solutions to the problem of the relative age effect (shortening the age categories to 6 months, creating teams from players who have strong technical and tactical characteristics but are currently lagging behind their peers in physical development, rotation of administrative periods of age categories), perhaps the most important segment in solving this problem would be the con-

tinuous education of coaches who work with young categories in these formative years (Helsen et al., 2012). During the selection, coaches should pay more attention to the technical and tactical skills of football players and less to physical characteristics such as height and strength. Furthermore, shifting the focus from victory and short-term success to the process of player development should be the ultimate goal of coaches in youth categories.

All of this should affect the creation of an environment in which all football players would have an equal chance for development and progress, reduce the chances of overlooking potential talents, and ultimately help improve the quality of football in the region.

The results of this paper should serve the purpose of raising awareness of the presence of the relative age effect in regional football, which, although not observed in all analyzed competitions, is in the majority. It could be said that the major limitation of the existing study is the fact that it covers only one season. As the migration of players in the region is very frequent, a longer period of time is needed in order for us to be able to draw valid conclusions. Therefore, it is recommended that any future research should try to cover longer periods of time that would offer a better insight into whether trends observed in this study are constant or isolated. Also, future research should cover the area of the number of games played, since this research included players who appeared only once in match protocol during the season.

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Conflict of Interest

The author declares that there is no conflict of interest.

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