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Research article

The Relative Age Effect in the 10 Best Leagues of Male Professional Football of the Union of European Football Associations (UEFA)

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Abstract

The aim of the present research was to observe the relative age effect on professional soccer players of the ten best leagues of the Union of European Football Associations (UEFA), according to the IFFHS (International Federation of Football History and Statistics). The sample consisted of 5201 professional players who participated in the professional leagues during the 2016-2017 season. The birth date of each player was classified in four quartiles (Q1, Q2, Q3 and Q4). The frequencies (fr) and percentages (%) of the birth quartiles were analyzed. The chi square test (X^2) and degrees of freedom (gl) were performed to check the differences in the intergroup distribution. Likewise, *odd ratios* were calculated for the different quartiles, where Q4 was the reference group according to the different leagues studied, playing positions (goalkeeper, defender, midfielder and forward) and classification (first four places, half-of the table and four last places). To calculate the size of the effect on the nominal variables, the Cramer V test was carried out. The results confirmed a greater representation of players born in Q1 and Q2, indicating statistically significant values ($p < 0.05$) for all the leagues studied, except in the Eerste Klasse A (Belgium). This significance was repeated for the demarcation variables in the field, with a greater effect in the case of the midfielders. Finally, the RAE also affected the three groups according to teams´ classification. The conclusions confirm the effect of the RAE in the sample studied, which would require a review of the talent selection processes in football in order to balance the chances of success of players born at the end of the year.

Key words: Professional soccer, date of birth, positions, classification, talent, RAE.

Introduction

Population grouping by its chronological age is common in certain areas of our society (school, sports, clinical, etc.). The different categories that emerge from these groupings reveal differences in development among the subjects that comprise it. These differences of up to twelve months of age is what is known as relative age, and its consequences make up the so-called Relative Age Effect (RAE) (Campbell, 2013; Dixon et al., 2011; Gutiérrez Díaz del Campo, 2013). In sports, January 1, is globally accepted as the beginning of the year of selection, although in certain sports and countries, such as August 1 or September 1, have even been used. In soccer, the FIFA (International Federation of Football Association) established in 1997 the cut-off date on January 1, and is based on our twelve-month calendar. This circumstance that aims to comply with the principle of equal opportunities, which in principle seems appropriate and correct, has the weakness of avoiding the idea that the maturation of each individual occurs at a different chronological age (Torres-Unda et al., 2012). This agreement, in the end, can negatively affect those born in the last months of the year (sports abandonment, demotivation due to sports, low self-esteem, etc.). By contrast, would benefit those born in the first months of the year, granting them greater possibilities of success (Sykes et al., 2009).

RAE studies in Sports context have their beginnings in similar research in educational field (Hurley et al., 2001), where different studies analyze RAE in education. Gutiérrez Díaz del Campo (2013) organizes them around the following contents: academic achievements; specific learning or academic problems; leadership; physical education and school sports, and self-esteem in schoolchildren.

As in Educative field, since the first studies aimed at sports of Grondin et al. (1984), with Canadian ice-hockey and volleyball players, and Barnsley et al. (1985) with ice-hockey players in Canada, search in RAE as the main variable, has grown in different fields, including team sports (Delorme et al., 2013; Hancock et al., 2013; Romann and Fuchslocher, 2013; Schorer et al., 2013) and individuals (Albuquerque et al., 2012; Delorme et al., 2009; Edgar and O'Donoghue, 2005; Loffing at al., 2010). On the other hand, considering not only the verification of the RAE, but the relationship with other variables, some data can be obtained in relation to any of these issues: individual performance of the player or athlete (minutes played), nationality, demarcation of the players, collective performance of the sports group (classification of teams, level of competition of the teams, sports results), etc.; yet considering, there are already some investigations that address several of these variables (Arrieta et al., 2016; Auguste and Lames, 2011; Delorme et al., 2009; Saavedra et al., 2016; Sedano et al., 2015; Vaeyens et al., 2005).

The broad spectrum of studies relating RAE and soccer, can be organized around three research contexts: professional elite male football, women's soccer, and minor categories. Although it must be borne in mind that some studies contrast and compare some of these contexts (Barnsley et al., 1992; Edgar and O'Donoghue, 2005; Helsen et al., 2005; Salinero et al., 2013; Vincent and Glamser, 2006).

Research in professional football revolve around two areas: the professional leagues of each nation and the

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international competitions of national teams (World Cups, European Cups, etc.). Examples of professional football studies are those carried out in Belgium (Helsen et al., 2005; Vaeyens et al., 2005), in Germany (Auguste and Lames, 2011; Cobley et al., 2008), in Australia (Van den Honert, 2012), in Turkey (Mulazimoglu, 2014), in Norway (Wiium et al., 2010) and in Spain (Gutiérrez Díaz del Campo et al., 2010; Prieto et al., 2015; Salinero et al., 2014).

In this way, several studies are centered on different countries, thus Salinero et al. (2013), with a sample of 2763 players from the leagues of the United Kingdom, Germany, Italy, France and Spain, corroborate the presence of the RAE. In the same line, the study by Padrón-Cabo et al. (2016), aims to analyze the incidence and magnitude of the RAE on professional soccer players, and how it affects depending on their position, the leagues where they play, the level of the competition, the level of the team and its nationality. The sample consisted of 12,144 professional players who participated in 15 FIFA professional leagues (1st and 2nd division) during the 2014-2015 season. The RAE influence was found in all the leagues analyzed, except in the Premier League (England) and the K-League Classic (South Korea). Finally, another example is the study of Musch and Hay (1999) that deals with the study of professional players from Germany, Australia, Brazil and Japan, this latter, being the one that shows the highest decompensation by semesters (66 in semester 1/34 in semester 2) and Germany the lowest, (56 in semester 1/44 in semester 2).

Although it is evident that most RAE studies are referred to men's football, there is also evidence of this effect in women's football (Romann and Fuchslocher, 2013; Sedano et al., 2015; Van Den Honert, 2012). The results seem to show, regardless of the sport, a lower presence than in their male counterparts or even absence of the RAE. Vincent and Glamser (2006) compare the RAE of 1,344 17-year-old female and male soccer players included in the United States Olympic Development Program (ODP) in 2001. Results revealed a strong effect in the case of male´s sport, compared to a weak effect in the case of women's. However, Sedano et al., (2015) conducted a study with 4035 female players from five levels of competition in Spain and the results revealed that the date of birth distributions of all the soccer players' groups, except for the lowest level, showed an overrepresentation of players born in the first quartile.

Despite the relative age effect is a widely studied topic, there are not too many studies with such a large sample, and to the best or our knowledge, there is no research aimed at the professional elite male football of the UEFA Confederation best leagues, correlating the variables players positions, and final classification. Therefore, the aim of this study is to verify the RAE in the professional male soccer of the ten best national leagues of the UEFA Confederation during the 2016/2017 season, as well as to verify the possible differences and correlations between the RAE and the players´ position, and the final classification.

Methods

Participants

The universe of this study is composed of all the players of the top 10 leagues of the UEFA Confederation, corresponding to the 2016/2017 season (Table 1). The leagues analyzed were : Premier League (England), Ligue 1 (France), Santander League (Spain), Bundesliga (Germany), Serie A (Italy), Primeira Liga (Portugal), Eerste Klasse A (Belgium), SüperLig (Turkey), Bundesliga (Austria) and Eredivisie (Holland). The population under study is made up of 5201 male professional soccer players distributed in the 178 teams belonging to those leagues.

Table 1. Distribution, number (fr) and percentage (%) of the players analyzed according to the competition.

		N	fr
COMPETITION	**Liga Santander (Spain)**	523	10.1%
	Ligue 1 (France)	596	11.5%
	Bundesliga (Germany)	543	10.4%
	Premier League (England)	573	11.0%
	Serie A (Italy)	632	12.2%
	Eerste Klasse A (Belgium)	450	8.7%
	SüperLig (Turkey)	522	10.0%
	Bundesliga (Austria)	297	5.7%
	Eredivisie (Netherlands)	521	10.0%
	Primeira Liga (Portugal)	544	10.5%
TOTAL football players		5201	100.0%

In the present study, different variables have been handled, being categorized and conceptualized in Table 2.

Table 2. Definition of the variables.

Variable	Definition
Birth quartile	The date of birth of the players has been classified in 4 quartiles (Helsen et al., 2012, Romann and Fuchslocher, 2013): Q1 (1st of January – 31st of March), Q2 (1st of April – 30th of June), Q3 (1st of July – 30th of September) and Q4 (1st of October – 31st of December)
Playing Position	The players were classified according to the different roles that are given in football: goalkeepers, defenders, midfielders and strikers
Classification	It refers to the qualifying position of the teams of the leagues studied during the 2016-2017 season. The teams have been classified into 3 groups adapting the criteria used by Vogelbein et al. (2014): high (the first 4 teams of each league, n = 40), media (the teams that are neither between the first 4, nor last 4, n = 98) and low (the last 4 teams of each league, n = 40).

Procedure

To select the 10 best leagues of the UEFA Confederation, the International Federation of Football History & Statistics (IFHHS) website was consulted, in order to verify the list "The strongest league in the world 2015" (published in January 2016). The information concerning this research was obtained from the websites www.livefutbol.com and www.transfermarkt.es, verifying the information with the official website of the corresponding soccer leagues: England (www.premierleague.com), France (www.ligue1.com), Spain (www.lfp.es), Austria

(http://www.oefb.at). Germany (www.bundesliga.de), Italy (www.legaseriea.it), Portugal (www.ligaportugal.pt), Belgium (www.jupilerleague.be), Turkey (http://www.tff.org) and the Netherlands (www.eredivisie.nl). The year was divided into four quarters. Players born between January 1 and March 31, belong to the first quartile (Q1). Born between April 1 and June 30 were included in the second quartile (Q2). Those between July 1 and September 30 in the third quartile (Q3). Finally, players born between October 1 and December 31, belonged to the fourth quartile (Q4).

Statistical analysis

In the present study, a frequency analysis was carried out through the elaboration of contingency tables, showing both the frequency (fr) and the percentage (%). To check the homogeneity of the distribution throughout the four quartiles, an analysis of the frequencies observed and expected from the birth months was performed, using the chi-squared test (x^2) and the degrees of freedom (gl), according to the different leagues under study. Most of the investigations assume the theory that the distribution is similar in all the quartiles of the year, that is, 25% of cases per quartile (Campos et al., 2017; Helsen et al., 2012). This hypothesis should be taken as valid, since in most countries, the distribution of births is similar throughout the year, and there are no significant variations (Roenneberg and Aschof, 1990).

Subsequently, to check differences in the distribution between subgroups, *odd ratio* was calculated for all the quartiles, where Q4 was the reference group. A higher *odd ratio* would indicate a higher probability of the members of that group compared with the reference group (Q4).

To calculate the size of the effect in those nominal variables, the Cramer V test was performed. Values of V = 0.06 to 0.17 would refer to a small effect; V = 0.18 to 0.29 to a medium effect, and V> 0.30 would refer to a large effect size (Cramer, 2016).

The level of significance taken into account was $p < 0.05$. Data analysis was carried out using the *Statistical Package for Social Sciences* (SPSS 23.0, IBM Corp., Armonk, NY, USA), as well as with *Windows Office Excel 2010*.

Results

The distribution of the sample, shows significant differences in relation to the uniform distribution that could be expected ($X^2 = 74.278$, $p = 0.000$ ***), more likely even in the case of Q1 compared to the reference quartile (Q4), data that are reinforced by the *odd ratio*. However, the values of Cramer's V, are described as a *small* effect size (V = 0.07) according to the literature, which would indicate a discrete effect of the RAE on the total set of all the leagues.

A league-by-league detailed analysis (Table 3), reflects that the probability of belonging to Q1 is statistically significant ($p < 0.05$). Although it is still noteworthy, only in the case of the Premier League (England), the frequency of Q4 is similar to Q1 and greater than Q2 and Q3, which is reflected in the *odd ratio*. The exception would come with the Eerste Klasse A (Belgium), which does not show significant differences in the distribution of its players in the different quartiles, being relatively uniform.

In line with these results, the effect size observed of the RAE would be considered *large* in the case of Series A (Italy) (V = 0.30), and *medium* in the case of the Santander League (Spain) (V = 0.26), Bundesliga (Germany) (V = 0.23), SüperLig (Turkey) (V = 0.22), Bundesliga (Austria) (V = 0.19) and Eredivisie (Netherlands) (V = 0.26).

Table 3. Quarterly distribution (Q) of the dates of birth of the players and odd ratio in relation to the subgroups according to the competition

League	*Quarterly (Q)*									*Odd-ratio (CI 95%)*		
	Q1	Q2	Q3	Q4	Total	X²*	gl†	p‡	V§	Q1-Q4	Q2-Q4	Q3-Q4
Total	1641 (31.6)	1339 (25.7)	1244 (23.9)	977 (18.8)	5201	66.441	27	.000	0.07			
Liga Santander (Spain)	177 (33.8)	142 (37.2)	120 (9.6)	84 (16.1)	523	34.927	3	.000	0.26	2.107 (2.021-2.197)	1.690 (1.641-1.741)	1.429 (1.401- 1.458)
Ligue 1 (France)	176 (29.5)	152 (25.5)	157 (12.6)	111 (18.6)	596	15.074	3	.002	0.16	1.586 (1.494-1.684)	1.369 (1.314-1.426)	1.414 (1.352-1.479)
Bundesliga (Germany)	179 (33.0)	130 (23.9)	143 (26.3)	91 (16.8)	543	29.162	3	.000	0.23	1.967 (1.880-2.059)	1.429 (1.395-1.464)	1.571 (1.524-1.619)
Premier League (England)	164 (28.6)	122 (21.3)	131 (22.9)	156 (27.2)	573	8.340	3	.039	0.12	1.051 (1.039-1.063)	0.782 (0.829-0.738)	0.840 (0.875-0.806)
Serie A (Italy)	221 (35.0)	166 (26.3)	156 (24.7)	89 (14.1)	632	55.684	3	.000	0.30	2.483 (2.405-2.564)	1.865 (1.825-1.906)	1.753 (1.719-1.788)
Eerste Klasse A (Belgium)	126 (28.8)	120 (23.7)	101 (22.4)	103 (22.9)	450	4.098	3	.251	0.10	1.223 (1.111-1.347)	1.165 (1.083-1.253)	0.981 (0.990-0.972)
SüperLig (Turkey)	176 (33.7)	132 (25.3)	117 (22.4)	97 (18.6)	522	25.877	3	.000	0.22	1.814 (1.734-1.898)	1.361 (1.330-1.393)	1.206 (1.189-1.223)
Bundesliga (Austria)	97 (32.7)	73 (24.6)	62 (30.9)	65 (21.9)	297	10.165	3	.017	0.19	1.492 (1.381-1.612)	1.123 (1.098-1.148)	0.954 (0.963-0.945)
Eredivisie (Netherlands)	169 (32.4)	149 (28.6)	125 (24)	78 (15)	521	35.399	3	.000	0.26	2.167 (2.076-2.262)	1.910 (1.843-1.980)	1.603 (1.562-1.645)
Primeira Liga (Portugal)	156 (28.7)	153 (28.1)	132 (24.3)	103 (18.9)	544	13.191	3	.004	0.16	1.515 (2.076-2.262)	1.485 (1.843-1.980)	1.282 (1.562-1.645)

* X^2=chi square, † gl = degrees of freedom, ‡ p = level of significance, § V = Cramer´s V

Table 4. Quarterly distribution (Q) of the dates of birth of the players and odd ratio in relation to the subgroups according to the position of play in the field.

Game Position	*Quarterly (Q)*				Total	X^{2}*	gl†	p‡	V§	*Odd-ratio (CI 95%)*		
	Q1	Q2	Q3	Q4						Q1-Q4	Q2-Q4	Q3-Q4
Total	1641 (31.6)	1339 (25.7)	1244 (23.9)	977 (18.8)	5201	11.489	9	.244	.03			
Goalkeeper	197 (31.1)	172 (27.1)	139 (21.9)	126 (19.9)	634	19.565	3	.000	0.18	1.565 (1.496-1.637)	1.365 (1.323-1.408)	1.103 (1.092-1.114)
Defender	522 (31.5)	424 (25.6)	408 (24.6)	305 (18.4)	1658	57.083	3	.000	0.19	1.711 (1.680-1.743)	1.390 (1.374-1.406)	1.338 (1.325-1.351)
Midfielder	604 (33.5)	457 (25.3)	428 (23.7)	316 (17.5)	1805	93.515	3	.000	0.23	1.911 (1.885-1.937)	1.446 (1.435-1.457)	1.354 (1.345-1.363)
Forward	318 (28.8)	286 (26)	269 (24.4)	230 (20.9)	1102	14.675	3	.000	0.12	1.383 (1.324-1.444)	1.243 (1.207-1.280)	1.170 (1.146-1.195)

* X^{2}=chi square, † gl = degrees of freedom, ‡ p = level of significance, § V = Cramer´s V

Table 5. Quarterly distribution (Q) of the dates of birth of the players and odd ratio in relation to the subgroups according to the final qualifying position in the 2015-16 season.

Classification	*Quarterly (Q)*				Total	X^{2}*	gl†	p‡	V§	*Odd-ratio (CI 95%)*		
	Q1	Q2	Q3	Q4						Q1-Q4	Q2-Q4	Q3-Q4
Total	1641 (31.6)	1339 (25.7)	1244 (23.9)	977 (18.8)	5201	11.489	9	.244	.03			
The first 4 teams	356 (30.5)	345 (29.6)	257 (22)	208 (17.8)	1166	52.093	3	.000	.211	1.712 (1.678-1.747)	1.659 (1.628-1.691)	1.236 (1.226-1.246)
Half of table	898 (31.3)	721 (25.2)	692 (24.1)	555 (19.4)	2866	33.245	3	.000	.170	1.618 (1.573-1.665)	1.299 (1.279-1.319)	1.247 (1.231-1.263)
The last 4 teams	387 (33.1)	273 (23.4)	295 (25.2)	214 (18.3)	1169	52.964	3	.000	.213	1.808 (1.769-1.848)	1.276 (1.265-1.288)	1.379 (1.363-1.395)

* X^{2}=chi square, † gl = degrees of freedom, ‡ p = level of significance, § V = Cramer´s V

Attending to the distribution of the month of birth based on the game position (Table 4), the probability of belonging to Q1 is statistically higher in all positions (p=0.000). This fact, would be linked to a substantial RAE effect size, *moderate* in the case of the goalkeeper (V = 0.18), defender (V = 0.19) and midfielder (V = 0.23). These new novel data make its discussion necessary.

Finally, as Table 5 shows, there are also significant differences in the distribution of the month of birth, according to their teams´ classification (2016/2017 season). Being more frequent, players born in Q1 in the subgroups taken into account (first four places classified, classified in the mid-table, and belonging to the last four places). Once again, moderate effects depending on the classification obtained within the corresponding UEFA Confederation are obtained, with consequences of the RAE observed in all groups. A greater cluster of players in the Q1, remarkable at statistical level, together with a moderate Cramer V in the three classification groups ($V_{\textit{four first places}} = 0.211$; $V_{\textit{half-table}} = 0.170$; $V_{\textit{four last positions}} = 0.213$), would corroborate the importance of the date of birth of European professional football players by the time of stablishing detection criteria, recruitment and selection of talents. These results must be analyzed with caution, since not all leagues have the same number of teams, the same number of players, as well as the conditioner of the differences in terms of competitive level.

Discussion

The main aim of the present research was to determine the importance of the RAE in the professional male elite football of the ten best National UEFA Leagues during the 2016/2017 season, as well as to verify the possible differences and correlations between the RAE and the playing-position and the final classification in the championship. The relative age effect is significant in the UEFA confederation, with a greater number of players born in the first quarter of the year (Q1). This fact can induce that coaches´ decisions and selection were reached attending primarily to anthropometric, physical and physiological variables, closely related to the RAE, since Q1 players will have these qualities more developed than those born in any of the remaining quarters. This circumstance coincides, in part, with Williams study (2010), over U-17 players, where RAE appears present in all FIFA Confederations, except in the national teams of the African continent, where the effect observed is the opposite, an overrepresentation of Q4 belonging players.

Our study about the RAE over the variable League, revealed that this phenomenon is present in a significant way in all leagues analyzed, except in the Eerste Klasse A (Belgium). This idea of the significant effect of the RAE in the European professional leagues is demonstrated by Helsen et al., (2012), during the 2010-2011 season for all leagues analyzed (England, Germany, Belgium, Netherlands, Spain, France, Italy, Denmark and Sweden) except the Portuguese. Padrón-Cabo et al., (2016) revealed in turn, that this phenomenon is present in all leagues observed (Spain, Germany, Italy, France, Portugal, Holland, Belgium, Ukraine, South Africa, Australia, Mexico and Brazil), except in the Premier League (England) and the K-

League Classic (South Korea). From these studies, low participation or popularity of soccer, cannot be ascribe as reasons for the no-RAE-influence in these leagues. Reasons often argued as explanation for the non-appearing relative age effect.

Regarding professional football, one of the sports that requires the presence and participation of experienced players along with ice hockey, this same effect is confirmed, but with studies referring only to the league of a certain country. In Spain, several studies confirm a greater representation of players born in Q1 (Prieto et al., 2015; Pérez Jiménez and Pain, 2008; Salinero et al., 2014). While comparing these studies, it seems that in Spain this relative age effect suffers fluctuations, with an important increase since the beginning of the 90s and, while currently there´s a tendency to decrease. In Turkey, Mulazimoglu (2014) certifies in an investigation with 2936 soccer players, the existence of the RAE in the professional category teams and in the young elite players of the best clubs. In other countries, several studies´ data, resemble to described in our present investigation related to this variable, such as those performed in Belgium (Helsen et al., 2005; Vaeyens et al., 2005), in Germany (Auguste and Lames , 2011; Cobley et al., 2008), in Australia (Van den Honert, 2012).

The relative age effect has also been studied in other sports. Finding both, coincidences and mismatches with our present study. Thus, Delorme et al. (2009), in a study of the french basketball league evince the relative age effect, as well as Schorer et al. (2009) do, in men's elite Handball in Germany, and Grondin and Koren (2000) in professional baseball players in Japan. However, Nakata and Sakamoto (2012) did not find significant differences in terms of the RAE in male players of the Japanese V-League (volleyball), although they did in women, attributing this cause to the popularity of volleyball within female gender.

The analysis by playing position reveals the significance of the RAE. In our study, the positions more affected by the RAE were the midfielders and defenders. This may be because in these positions, more developed physical qualities may represent a competitive advantage. Specifically, the defender position requires having specific anthropometric characteristics as suggested in some research (Delorme et al., 2010; Reilly et al., 2000; Shephard, 1999; Salinero et al., 2013). Such data are coincident with the studies of Salinero et al. (2014) and to a lesser extent, with those of Padrón-Cabo et al. (2016), who conclude that the RAE affects all positions, being defenders the most affected position, and goalkeeper the least. However, there is a significant disagreement with Prieto et al. (2015), who appreciate the existence of RAE in the positions of defender and striker, not so in goalkeepers and midfielders. In our study, the midfielder is the playing position with a stronger effect, possibly because it is a position with important physical needs and continuous physiological demands, as well as, wide external and internal added-load in their performance in relation to others positions. Consulted bibliography consider the defenders unanimously, the most affected position by the RAE, with certain discrepancy within the other playing positions. However, the small influence of the RAE on the goalkeeper is surprising, except for the study carried out by Lesma et al. (2011), since it is a position that requires a considerable height for a good performance (Reilly et al., 2000).

On the other hand, an approach to the incidence of the RAE on the final classification of the teams in their corresponding leagues, shows that the relative age effect occurs both in low-level teams, medium and top-level ones. Significant differences were found, in the three groups studied, when comparing Q1 vs Q4, Q2 vs Q4 and Q3 vs Q4. However, our results do not suggest that the *odd ratio* Q1 vs Q4 is higher in the teams that have a better classification, nor that they have a higher relative age in their players. Williams (2010) reveals the same results after appreciating the existence of RAE in the teams of his studio (with young players), regardless of the final classification in the league. On the other hand, also with young players, Auguste and Lames (2011) discovered a positive correlation between the RAE and the final classification, reinforcing the interpretation that success in the first German league U-17 may be due, to some extent, to a higher relative age of the players.

Based on the foregoing, it seems that knowing about the relative age effect is crucial for coaches and sports professionals. Some studies related to RAE and sport, indicate the possibility of, that recruitment and selection processes came influenced by this phenomenon. This fact can suppose and cause a loss of natural talent among the subjects that does not belong to the first quartile of the year (Q1), which leads us to suggest a possible revision of the current processes of recruitment and selection of players, thus avoiding harm to those born in the last months of the year.

In order to limit the RAE, the scientific literature has addressed this issue, highlighting the relevance and conclusions of the proposals of the study by Hurley et al., (2001) in the Minor Hockey sport in Canada and the one proposed by Romann and Cobley (2015) for sprinters. In soccer, sport of our study, several authors (Helsen et al., 2005; Saavedra et al., 2016; Padrón-Cabo et al., 2016; Pancorbo, 1996) have suggested some solutions to be adopted by the sports clubs and institutions that manage football. In first place, the number of categories could be expanded (one per year), or even split the calendar year into two periods of six months. This would provide a smaller age difference between the players belonging to the same category and therefore, an evident minor difference in anthropometric values and physical maturation. A second option could be the presence of specialists from various fields (coaches, doctors and researchers) in the selection of talents, since it is a complex process that requires transversal information. The third solution, would pose the assumption by the coaches of a long-term vision in the selection process of football players, considering as long as possible, their potential and ability to develop in all areas susceptible to performance. This point, invites to revert to a beforehand, but currently renewed proposal, the "bio-banding" (Cumming et al., 2017). This strategy consists of grouping athletes according to the attributes related to growth and maturational development, instead of using the chronological age as the only selection criterion. In addition, this idea proposes to use the psychological and technical skills of the players as evaluative items of the recruitment and selection process´. This hybrid approach would preserve the positive effects

of grouping subjects by age, such as competitiveness among them, while reducing or mitigating the negative consequences of such criteria. Otherwise, with the prospect of immediate results, it will continue to be the physically more developed athletes, who will receive more opportunities and the relative age effect will persist. Finally, a possible solution could be to swap the cut-off dates from time to time, so that the youth football players, at some point in his sporting life, has the chance to benefit from competing with a higher relative age, although changes in age policy have turned out to be only partially successful (Haycraft et al., 2018). Finally, a last promising measure (Mann and van Ginneken, 2017) showed that RAE could be overcome if information about the age of the players is transmitted in an optimal way, bias can be eliminated making sure that playing-shirt numbers of athletes during the match would be ordered according to their age.

Conclusion

In view of the results of the present study, we conclude that the relative age effect was evident in professional male football players of the ten best leagues of UEFA in the 2016-17 season. In the analysis by leagues, the relative age is present in a significant way in all the leagues, except in the Eerste Klasse A (Belgium). Attending to players´ positions, there are also significant differences in the RAE in the four types analyzed by the study. However, considering Cramer's V, the bigger effect is observed in midfielders, while the minor in the forwards. Finally, there are significant differences depending on the classification of the team in the corresponding league, with a minor effect in the *mid-table* teams qualified.

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Key points

- The relative age effect (RAE) is present in a significant way in the top ten UEFA leagues in the 2016-17 season, except for the Eerste Klasse A (Belgium).
- According to player position (goalkeeper, defender, midfielder and forward), the defenders are those that show a greater RAE, and the forwards those that show a lesser effect.
- Based on the competitive ranking of each one of the best football European leagues, there is RAE at all levels of qualification. Being the teams of the middle part of the classification those that show a lower RAE.
- It is recommended to review the processes of talents' selection in football, in order to balance the chances of success of players borned at the end of the year.

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