RELATIVE AGE EFFECT IN TOP LEVEL EUROPEAN SOCCER LEAGUES

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Abstract
The main objective of this study was to determine the existence of Relative Age Effect (RAE) across top level European soccer leagues. Birthdates from 5507 professional soccer players were collected. The collected data showed unequal distributions of birthdates with the over-representation of players born in first few months of the year and an under-representation of players born late in the year. There were significant differences between expected and observed frequencies for month and quarter distribution of birthdates. RAE remains problem for the large number of players born later in the selection year. Result maintain high on the importance list even in youth academies which ultimately favors players born in the first quarter or in the first half of the year. Consequently, there is potential for "talent loss" because of the extreme dropout of players born in the last quarter or in the second half of the year.

Key words: *RAE, distribution, bias, talent identification, selection process.*

Introduction

In order to try to make competitions equal, football federations set up a system of age categories based on birthdates of participants. Actually, this system is cut off in January and comprises 2 consecutive years (that means one category can be players born in 2004-2005, next category players born 2002-2003, next category players born 2000-2001…). In this system of age categories, it can happen that players born at the beginning of the year compete against players 23 or 24 months younger than them. The difference in the chronological age between children in a single age group is known as a Relative Age Effect (RAE).

RAE is evident in numerous sports and especially during adolescence (Sherar, Baxter-Jones, Faulkner and Russell 2007, Schorer, Baker, Büsch, Wilhelm and Pabst 2009, Delorme, Boiché and Raspaud 2010). At advanced ages, several extra months of development can't make a huge difference. For example, if a player is born in early January 1986 and other is born in late December 1986 difference of 12 months is about 3.3% of life and maturing days are long gone. However, when kids start to play soccer, usually at the age of 6 difference of 12 months is about 16.6% of current life.

Also, every following year player born in January is older than the other one and is more mature and developed. During youth soccer academy players are often exposed to heavy training routines and numerous matches where players who can dominate on the pitch tend to be selected as talents. Relatively older players have cognitive, motor and functional abilities at a higher level than relatively younger teammates and are often selected in better teams. During the adolescence and growth spurt RAE is never so obvious. During the peak height velocity (PHV) some players can gain up to 13-15 cm per year and 9-12 kg in mass which can result in huge anthropometric differences between soccer players. These differences can be crucial during the selection process. With adults RAE shouldn't have any impact. There is no valid argument why the player born in February should be better than the one born in November. The effect is widely explored for the last few decades and it is interesting to see whether situation has changed or not. So the main objective of this paper was to determine the existence of RAE throughout top level European soccer leagues.

Materials and methods

A total of 5507 male players were evaluated from top 5 soccer leagues in Europe (Spain, France, England, Germany and Italy) and the second division of these countries. In France Ligue 1 (n=540) Ligue 2 (n=521), in Germany Bundesliga 1 (n=447) Bundesliga 2 (n=476), in Italy Serie A (n=574) Serie B (n=603), in England Premier League (n=545) Championship (n=707) and in Spain 1st Division (n=524) 2nd Division (n=571) during the season 2014-2015. Birthdates were collected to quantify Relative Age Effect. Birthdates for all players were related to the European cut off, compiled into Months (January to December), into Quarters (Q1 - January, February, March, Q2 - April, May, June, Q3 - July, August, September, Q4 - October, November, December) and into Half a Year (H1-January to June, H2 - July to December).

Observed frequencies were the ones obtained in 5 top level European leagues and 5 second leagues. Expected frequencies were the total number of frequencies divided by the number of months and quarters. To determine observed versus expected frequencies nonparametric Chi-square statistical analysis was used. Microsoft excel was used for graphical presentation of the given results.

Results and discussion

Table 1 Observed versus expected frequencies of birthdays by month of the year (N=5507).

	Total Observed	Difference versus expected	
January	593	134	χ^2 =172.30**
February	549	90	
March	581	122	
April	497	38	
May	503	44	
June	450	-9	
July	403	-56	
August	434	-25	
September	414	-45	
October	365	-94	
November	364	-95	
December	354	-105	

**p<0.001

Looking at table 1 it can be seen that there is asymmetry in the frequencies of the birthdays. There are more players born in the first few months of the year when compared with last few months. These results are somewhat expected and according to previous studies (Helsen, Winckel and Williams 2005, Williams 2010, Del Campo, Vicedo, Villora and Jordan 2010). Largest number of players were born in January (593) and least players were born in December (354). Differences between observed and expected (χ^2 =172.30) are statistically significant with p<0.001.

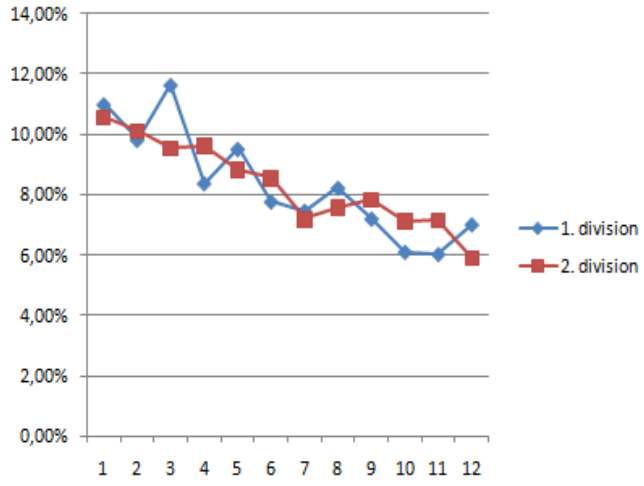

Figure 1 Monthly distribution of birthdays from top level European soccer leagues (N=5507).

Table 2 Observed versus expected frequencies of birthdays by quarter of the year (N=5507).

	Total Observed	Difference versus expected	
Quarter 1	1713	336	χ^2 =160.42**
Quarter 2	1457	80	
Quarter 3	1254	-123	
Quarter 4	1083	-294	

**p<0,001

Figure 1 shows that RAE exists not only in the first divisions but also in the second divisions. It can be seen that results from the first and second division are similar; there is unequal distribution with majority of players born earlier in the calendar year. Table 2 presents observed versus expected frequencies of birthdays according to the quarter of the year. With p<0.001 it is evident that there is unequal sum of observed and expected frequencies (χ^2 =160.42). As shown in table 1, the largest number of birthdays are in the first quarter of the year (from January to March) while the lowest number is in the last quarter (from October to December).

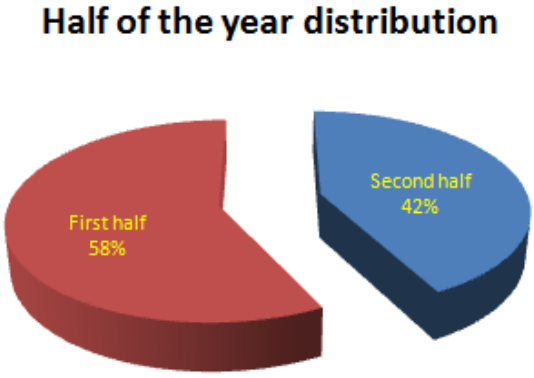

Figure 2 Percentage of players born in the first and second half of the year (N=5507).

As expected when taking into consideration tables 1 and 2 there is a greater number of soccer players from top level European teams that are born in the first half of the year 58% (figure 2). Relative age effect (RAE) is phenomenon found in numerous sports and in different age categories (Musch and Grondin 2001, Cobley, Schorer and Baker 2009, Delorme, Boiche and Raspaud 2010). Apparently, numerous studies and years of practice didn't change much. RAE is still very well present. Even though professional senior players should not differ in birth date distribution throughout the year they actually do which is evident from the previous tables and figures. There are few possible reasons why the RAE is present in professional soccer.

Main reason for this kind of distribution of birthdays is in the youth soccer academies. Player evaluation spans throughout childhood and adolescence so more mature (relatively older) players have advanced physical and cognitive development during all phases of selection process. That generates biased distribution among birthdates of players. Relatively younger players that are born later in the year are less physically developed and are often substitutions with less playing experience. They are more likely to dropout from soccer. Delorme, Boiche and Raspaud (2010) evidenced higher proportions of dropout in last quarter of the year. They also found that there are no significant differences in dropout for U-7 age category and for adults. However, all other categories from U-9 until U-18 had higher proportions of dropout in the last

quarter. Also, the dropout was highlighted in the last quarters of U-13 and U-15 categories. Jimenez and Pain (2008) analyzed birthdate distributions among Spanish senior teams, U-21, U-19 and U-17 teams. There were as much as 52% and 55% of players born in first 4 months whilst 12% and 15% born in the last 4 months of the year in U-17 and U-19 teams. Williams (2010) also found RAE on the FIFA U-17 world cup competition while Del Campo et. al. (2010) confirmed RAE in Spanish youth soccer for both elite groups and amateurs. It is evident that this phenomenon is spread across Europe and especially in national youth selections. With majority of young "national team talents" reaching to professional status it could be discussed how RAE incorporates in professional soccer.

Conclusion

In conclusion birthdate distributions across top level European leagues confirmed the existence of relative age effect (RAE). There is unequal distribution of birthdates in favor of players born early in the year. Even though relative age has little to none influence in the professional status during childhood and adolescence several months of maturation could make a huge difference. One of the major problems is the tendency of soccer coaches' for the result in early ages and doing so physical component of the game take major part in selection process.

There are several negative consequences of RAE. The dropout during childhood can potentially discourage some kids from practicing soccer, and maybe even from doing other sports. This scenario can cause some health related issues later on if kids avoid healthy and active lifestyle. RAE during adolescence can also produce problems. Relatively younger players are often used only as substitutes and with less playing experience they are more likely to dropout from soccer. It can result in lower self-esteem which is not uncommon for the given age. Also, there is a large chance for "talent loss" because of the effect. At later stages professional soccer players differ mainly in "skill" level but in early stages physical component of the game is very dominant and could appear as "talent". This phenomenon is evidently increasing over time instead of decreasing. It is up to the whole soccer community and especially soccer coaches to learn about this phenomenon. Furthermore, it is in every club's long-term interest to reduce potential "talent loss". There are a few possible solutions but still the best solution remains talent identification throughout comprehensive and longitudinal skill evaluation. Coaches should give all players a chance to play and develop before selecting some as potential talents and others as bad players. When focusing on result in early stages, clubs and coaches often make mistakes in selection process. That is reason why RAE is still present in top level European leagues.

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EFEKT RELATIVNE DOBI U NAJBOLJIM EUROPSKIM NOGOMETNIM LIGAMA

Sažetak

Glavni cilj ovog istraživanja bio je utvditi postojanje efekta relativne dobi (ERD) kod najboljih europskih nogometnih liga. Prikupljeni su datumi rođenja od 5507 profesionalnih nogometaša. Prikupljeni podaci pokazali su nejednaku distibuciju rezultata s većim brojem igrača rođenih u prvih nekoliko mjeseci godine i manjim brojem igrača rođenih pred kraj kalendarske godine. Dobivene su značajne razlike između očekivanih i dobivenih frekvencija rođendana za mjesece i za kvartale u godini. Efekt relativne dobi ostaje problem za velik broj igrača rođenih kasnije u selekcijskoj godini. Očigledno je kako je rezultat i dalje visoko na listi prioriteta u nogometnim školama i akademijama što u konačnici pogoduje igračima rođenim u prvim kvartalima ili prvoj polovici godine. Posljedično, postoji velika mogućnost "gubitka talenata" zbog ekstremnih odustajanja igrača rođenih u drugoj polovici ili pred sam kraj kalendarske godine.

Ključne riječi: *ERD, nejednaka distribucija, identifikacija talenata, proces selekcije.*

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