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Research article

The relative age effect in youth soccer players from Spain

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Abstract
The purpose of this study was to identify the existence of Relative Age Effect (RAE) at youth level in both elite and amateur Spanish soccer clubs, and also to carry out an analysis providing with information on how this effect has evolved in recent years. We have obtained information on the youth teams of the 20 clubs belonging to the Spanish Professional Football League (LFP) in two separate seasons (2005-2006 and 2008-2009) as well as data on five youth academies belonging to amateur clubs. The collected data revealed an over-representation of players born in the first months of the selection year in all groups of analysis (Elite 2005-2006, Elite 2008-2009 and Amateurs), although only the Elite groups showed significant variations in birth-date distribution in relation to the Spanish population. The results showed a reduction in RAE from the 2005-2006 season to the 2008-2009 season. The following variables – playing position, the number of years each player has spent in their specific age group and the category of the team at each club were shown not to have influence on the extent of RAE.

Key words: Relative age effect, season-of-birth bias, selection processes, talent identification, youth soccer.

Introduction

The participants in youth sports are grouped by age, which is a selection criterion used to safeguard equal opportunities (Helsen et al., 2005), however, considerable complexities can arise due to the existence of significant inter-individual variations relating to growth and maturity both in infancy and, above all, in adolescence (Malina et al., 2004). The difference in chronological age between children in a single age group is known as relative age and its consequences as the Relative Age Effect (RAE). A large number of research studies provide information on the existence of RAE in both educational and sporting environments (Bell et al., 1997; Musch and Grondin, 2001; Sprietsma, 2007; Strøm, 2004 and identify it as the possible cause of the variations observed in the performance of children born in the same year (Barnsley et al., 1992). As a consequence, children born at the start of the year may be more advanced in cognitive, emotional and physical terms than other children born at the end of the year (Malina, 1994; Musch and Grondin, 2001; Williams et al., 1970).

Among the hypotheses most widely used to explain these observed differences is the maturational theory, which is based on potential maturational differences attributable to age variations in a single class or age group. In discussing this, Martin et al. (2004) state that neurological maturation can manifest itself in different capabilities such as the self-regulation of attention, emotion and other functions such as memory (Siegler, 1991), selective attention (Miller, 1991), certain aspects of metacognition (Garner, 1991) and inhibition control (Barkley, 1998). Yet, in addition to this, numerous studies seem to suggest that both anthropometric size and conditional capabilities are linked to maturational development and are conditioned by age (Malina, 1994; Malina et al., 2004). Some authors have linked RAE to the development of expertise, as this maturational advantage appears to be the main reason why children born at the start of the year are selected ahead of their colleagues and enter a more advanced educational process offering greater development of expertise as a result. A second theory linked to the preceding one concerns what Martin et al. (2004) term as the self-concept and holds that the accumulated effect of maturational disadvantages reduces the child's self-esteem and leads to them becoming less involved in tasks and activities and achieving worse results as a consequence (Pellegrini, 1992). Although they have been studied on several occasions, these explanations have not received sufficient empirical support to date (Bickel et al., 1991; Spitzer et al., 1995). A third and widely accepted hypothesis, linked to physical and psychological factors, concerns experience (Helsen et al., 2005) and holds that the greater the experience of subjects born in the first months of the year, the greater the potential advantage they have over the rest.

In addition to these hypotheses, Musch and Grondin (2001) describe another series of factors related to the sport setting and which clearly encourage RAE, such as the level of competition, the popularity of sport, the system of two-year age categories, early specialization in the selected sport, the expectations of the coaches responsible for the evaluation and selection processes, and the date the school year starts.

The relative age effect has been studied in relation to a large number of sports, such as baseball (Grodin and Koren, 2000; Thompson et al., 1991; 1992), cricket (Edwards, 1994), American football (Daniel and Janssen, 1987), handball (Ryan, 1989), swimming (Baxter-Jones et al., 1995; Ryan, 1989), tennis (Baxter-Jones et al., 1995; Giacomini, 1999) and volleyball (Grodin et al, 1984).

There are two sports that stand out above the rest, however, namely soccer (Barnsley et al., 1992; Baxter-Jones et al., 1995; Glamer and Vincent, 2004; Helsen et al., 2005; Simmons and Paull, 2001) and ice hockey (Barnsley and Thompson, 1988; Boucher and Mutimer, 1994; Grondin et al., 1993; Hurley et al., 2001), the latter

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providing the origins for research of this type in the sports setting.

The issue of RAE in soccer has been analysed with some studies focusing on the professional leagues in countries such as Belgium (Helsen et al., 1998; 2000; 2005), England (Dudink, 1994) or Germany (Bäumler, 2000). Other research studies have sought to contrast data from several professional clubs, such as the one conducted by Verhulst (1992), in which data from several European leagues such as the French, Belgian and Dutch leagues was analysed, or the research carried out by Musch and Hay (1999), who assessed the birth dates of professional players in the Australian, Brazilian, German and Japanese leagues. Both studies revealed a high incidence of RAE, as evidenced by the fact more than 55% of players were born in the first six months of the year. This type of analysis has also been conducted on international competitions. For example Barnsley et al. (1992) carried out research on the 1990 World Cup and discovered that some 55% of players in full national teams were born in the first half of the year, that figure rising to an average of 79% in both the U-17 and U-20 World Cups, indicating a higher incidence of RAE.

Similarly, a series of studies on young footballers playing for both national teams (Barnsley et al., 1992; Baxter-Jones et al., 1995; Glamser and Vincent, 2004; Helsen et al., 2005; Idafe and Matthew, 2008) and clubs (Helsen et al., 2005; Idafe and Matthew, 2008; Simmons and Paull, 2001) have been conducted. The study carried out by Idafe and Matthew (2008) was focused in Spanish national youth teams from U-17 to U-21 level and the youth teams of the clubs belonging to the Spanish Professional Football League. Their research reveals significant RAE in favour of players born in the first quarter of the year, both in national teams and in clubs.

Therefore, the RAE effect in soccer seems evident, resulting that young players with potential are overlooked (Helsen et al., 2005; Simmons and Paull, 2001; Vaeyens et al., 2005). Thus, the aims of this study are to identify the scale of RAE at youth level in elite clubs and sports academies belonging to amateur clubs and identify the possible spread and evolution of RAE in elite clubs.

Methods

Sample

Table 1 presents the sample of young players used in this study. The Elite 2005-2006 group comprises a total of 834 players forming part of the youth teams of 20 clubs belonging to the Spanish Professional Football League, born between 1986 and 1994 (Source: Royal Spanish Football Association). The Elite 2008-2009 group comprises 2,786 players belonging to the youth teams of 20 clubs belonging to the Spanish Professional Football League, born between 1989 and 1997 (Source: individual clubs). The Amateur group comprises 591 players belonging to the youth teams at five amateur Spanish soccer academies, data was obtained in the 2006-2007 season and pertains to players born in between 1988 and 1996 (Source: individual clubs). The fourth group, entitled Spanish Population, comprises all the births in Spain falling within the range of dates under analysis in the study (1986-1997), this group acts somehow as a control group (Source: Spanish National Institute of Statistics).

Procedure

The sample was compiled using three different sources. The data pertaining to the Elite 2005-2006 group was obtained from the website of the Royal Spanish Football Association. Data for the Elite 2008-2009 group was obtained by sending a letter to youth soccer directors at all the clubs in the Spanish Professional Football League. The letter set out the objectives of the research work and stated that the information provided by the clubs would be treated confidentially. From a total of 42 clubs, a total of 20 agreed to take part. The sample from the sports academies was obtained through direct approach.

All information was provided voluntarily by the participating clubs and related to all young players taking part in officially organised tournaments. The data included the players' dates of birth (day, month and year), position (goalkeeper, defender, midfielder or striker), age group (Under 11, Under 13, Under 15 and Under 18), the number of years each player has spent in their specific age group (one, two or three) and the category of the team at each club (A, B or C teams). Data relating to the Spanish Population was obtained from the Spanish National Institute of Statistics.

Table 1. Sample sizes in each category for the four groups, season of collection dates, and period for which players were considered.

Date	Group	Category	Sample	Total
2005-2006 *(Born 1986-1994)*	**Elite 1**	Under 11	110	834
		Under 13	184	
		Under 15	234	
		Under 18	306	
2008-2009 *(Born 1989-1997)*	**Elite 2**	Under 11	546	2768
		Under 13	686	
		Under 15	644	
		Under 18	892	
2006-2007 *(Born 1988-1996)*	**Amateurs**	Under 11	163	591
		Under 13	169	
		Under 15	145	
		Under 18	114	
2008-2009 *(Born 1986 - 1997)*	**Spanish population**			4738110

Table 2. Distributions of birth dates by groups.

Group	Birth Months												
(Year of Birth)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	χ^2
Elite 1	147	140	112	78	72	83	51	38	37	37	23	16	309.57 **
(2005-2006)		399			233			126			76		293.78 **
Elite 2	486	376	342	273	261	211	213	163	132	124	108	79	719.06 **
(2008-2009)		1204			745			508			311		641.57 **
Amateurs	70	60	57	51	60	44	39	55	59	35	30	31	38.42
(2006-2007)		187			155			153			96		29.09 **

** $p < 0.001$

Statistical analysis

January was selected as the first month of the selection year and December as the last. Observed birth-date distributions were thus calculated per month and quarter based on the information collated on each group in the sample, while expected birth-date distributions were calculated per month and quarter for the corresponding years based on the information obtained on the Spanish Population.

To test for an unequal month distribution in the selection of soccer players for youth teams, and to detect if this distribution varied between the three groups analysed, the chi-square and Kruskal-Wallis tests were conducted (Fallowfield et al., 2005; Vaeyens et al., 2005). Attempts were then made using the Mann-Whitney U-test to identify the groups in which the relative age effect is present, by comparing them with the Spanish Population, and the months in which the effect arises and/or was more noticeable (Idafe and Matthew, 2008). However, these tests did not reveal clear links that can help shed light on the relative age effect detected (Hair et al., 2006; Idafe and Matthew, 2008). As a result, and with the intention of identifying the possible influence that variables such as the position of the player, the age group, the number of years each player has spent in their specific age group and the category of the team they play in may exert on RAE, a univariate analysis of variance (ANOVA) was conducted on the information obtained (Idafe and Matthew, 2008; Vaeyens et al., 2005). The SPSS 15.0 program was used to perform all tests and an alpha level of 0.05 was used for all procedures.

Results

The distribution of players per month and quarter of birth is given in Table 2 along with the results of the chi-square test. This table also reveals how the distribution of players varies considerably in each of the three groups studied, both per month (Elite 2005-2006, $\chi^2 = 309.57$, $p < 0.001$; Elite 2008-2009, $\chi^2 = 719.06$, $p < 0.001$; Amateurs, $\chi^2 = 38.42$, $p < 0.001$) and per quarter (Elite 2005-2006, $\chi^2 = 293.78$, $p < 0.001$; Elite 2008-2009, $\chi^2 = 641.57$, $p < 0.001$; Amateurs, $\chi^2 = 29.09$, $p < 0.001$).

The results shown in Figure 1 show how the birth-date distribution of the soccer players in the three groups under analysis (Elite 2005-2006, Elite 2008-2009 and Amateurs) differed from that of the Spanish Population. It was noted that the birth-date distribution of players decreased from January to December, with the biggest variations in comparison to the Spanish Population occurring at the start of the year (January, February and March) and the end of the year (September, October, November and December) and with the biggest differences being observed in the two Elite groups, both at the beginning and the end of the selection year. Also, and by means of the Kruskal-Wallis Test, it was noted that distributions of births in the three groups differed significantly amongst them.

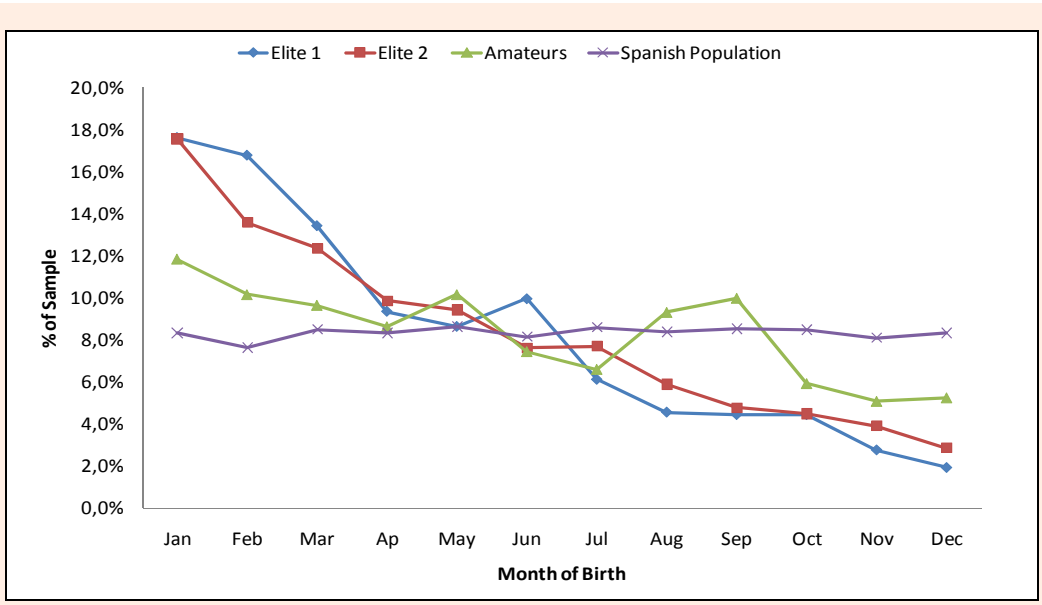

Figure 1. Birth date distributions (%) by group with comparative data for the Spanish population.

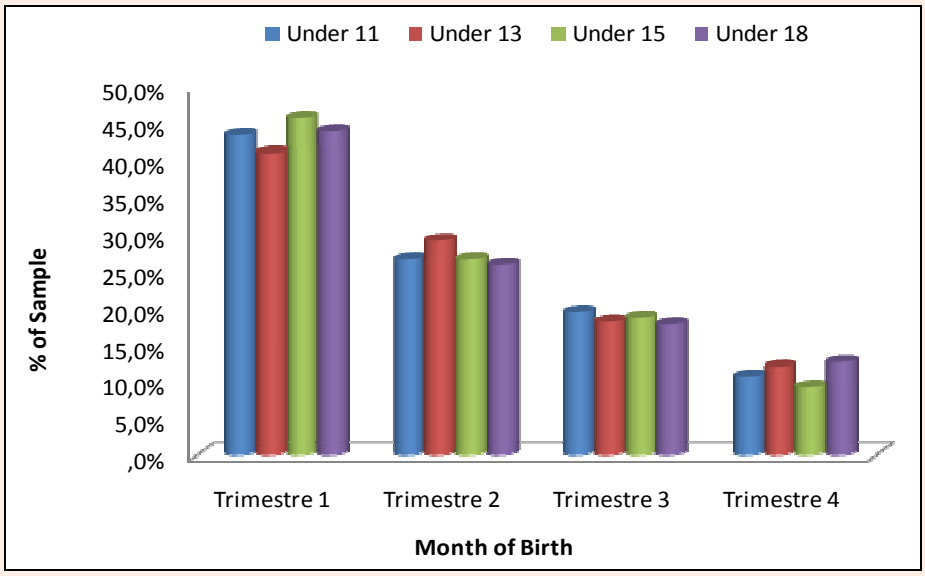

Figure 2. **Influence of category in Elite 2.**

By comparing the observed distribution of births per month in the three groups (Elite 2005-2006, Elite 2008-2009 and Amateurs) with the expected distribution of births per month of the Spanish Population, there were significant differences in the Elite 2005-2006 and Elite 2008-2009 groups but not in the Amateurs group ($p > 0.05$). In the case of the Elite 2005-2006 group, statistically significant differences were noted in the months of January ($z = -2.78$, $p = 0.005$), February ($z = -2.58$, $p = 0.01$), September ($z = -1.97$, $p = 0.048$), October ($z = -1.97$, $p = 0.048$), November ($z = -3.32$, $p = 0.001$) and December ($z = -4.26$, $p = 0.0001$). In the Elite 2008-2009 group, however, significant differences were apparent in the months of January ($z = -2.86$, $p = 0.004$), October ($z = -2.13$, $p = 0.033$), November ($z = -2.60$, $p = 0.009$) and December ($z = -3.68$, $p = 0.0001$). The two Elite groups were then compared with the Amateurs group. This comparison revealed that the observed distribution of births in the Elite 2005-2006 and

Elite 2008-2009 groups differed significantly from the observed distribution of births in the Amateurs group. With regard to the Elite 2005-2006 group this statistical variation occurred in the months of January ($p = 0.003$), February ($p = 0.0001$), March ($p = 0.03$), August ($p = 0.0001$), September ($p = 0.0001$), November ($p = 0.023$) and December ($p = 0.001$), while in the Elite 2008-2009 group significant differences were detected in January ($p = 0.001$), February ($p = 0.024$), August ($p = 0.002$), September ($p = 0.0001$) and December ($p = 0.003$).

Finally, and with a view to detecting any type of RAE variation in the two seasons analysed, the observed distribution of births per month was also compared. This comparison revealed that the distribution of players in the Elite 2005-2006 group was greater than and significantly

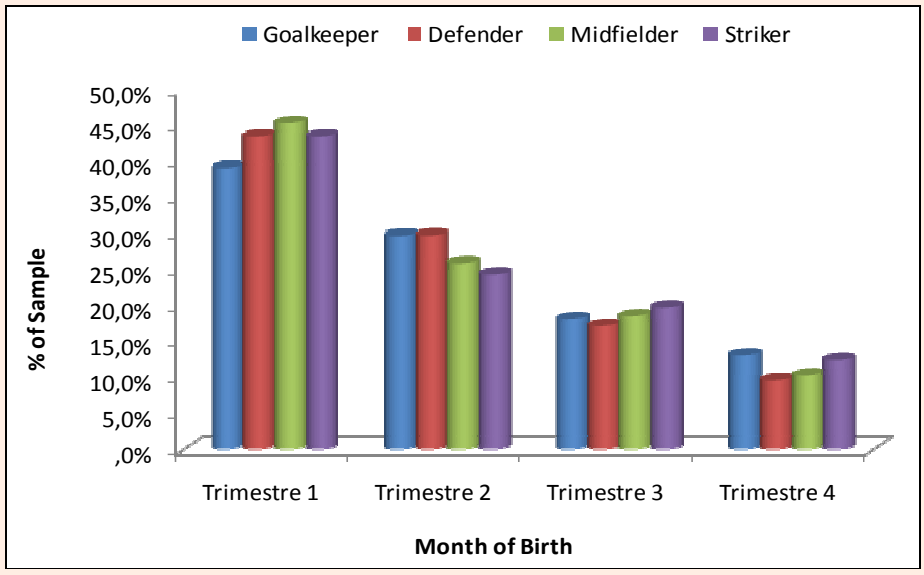

Figure 3. **Influence of position in Elite 2.**

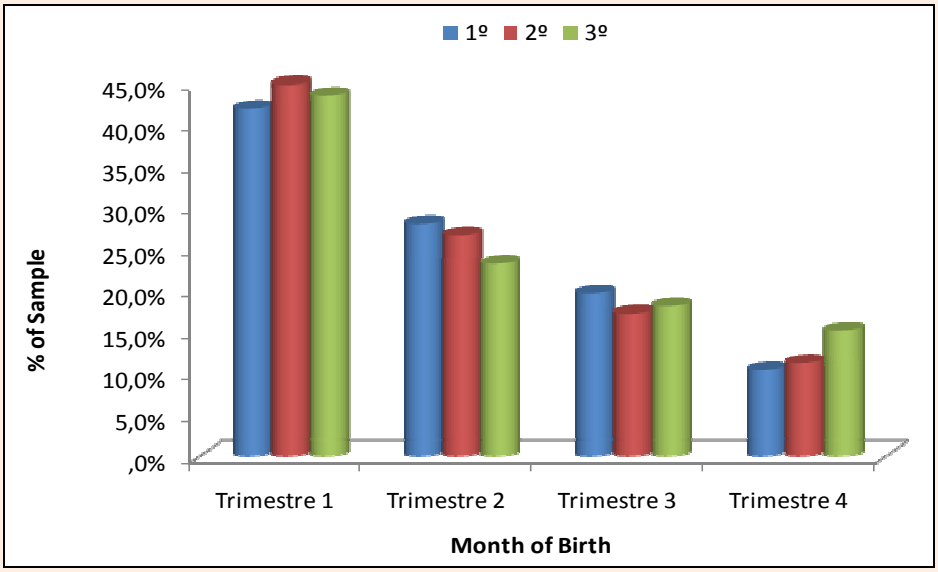

Figure 4. **Influence of year in Elite 2.**

different to that of the Elite 2008-2009 group (see Figure 1) in the months of February ($p = 0.021$) and June ($p = 0.031$). The observed differences in the other months were not statistically significant, however.

We also sought to ascertain whether aspects such as the age group the player competes in, their position on the pitch, the number of years they have spent in their specific age group and the category of the team they play in has an influence on the variations of the observed distribution of young soccer players per month. The aim in doing so was to identify any influence of said variables on RAE. With a view to determining this, a multivariate analysis of variance (MANOVA) of the information per quarter (T) was conducted on the Elite 2008-2009 group. This group was selected because the data obtained was more up-to-date. Figures 2, 3, 4, and 5 show the estimated distribution of players per quarter based on the different variables. As the figures reveal, the distribution of players decreases as the number of quarters increases. However, it does appear that this decrease occurs uniformly in each variable. This is the reason why no significant influence or difference is noted in the estimated distribution of players in relation to the age group they compete in ($F_{.491} = 0.468$, $p > 0.05$), their position on the pitch ($F_{.561} = 0.535$, $p > 0.05$), the number of years they have spent in that category ($F_{1.14} = 1.094$, $p > 0.05$) and the category of the team they play in ($F_{1.65} = 1.580$ $p > 0.05$).

Discussion

Up to now players playing at all youth levels for registered Spanish soccer teams have been grouped together

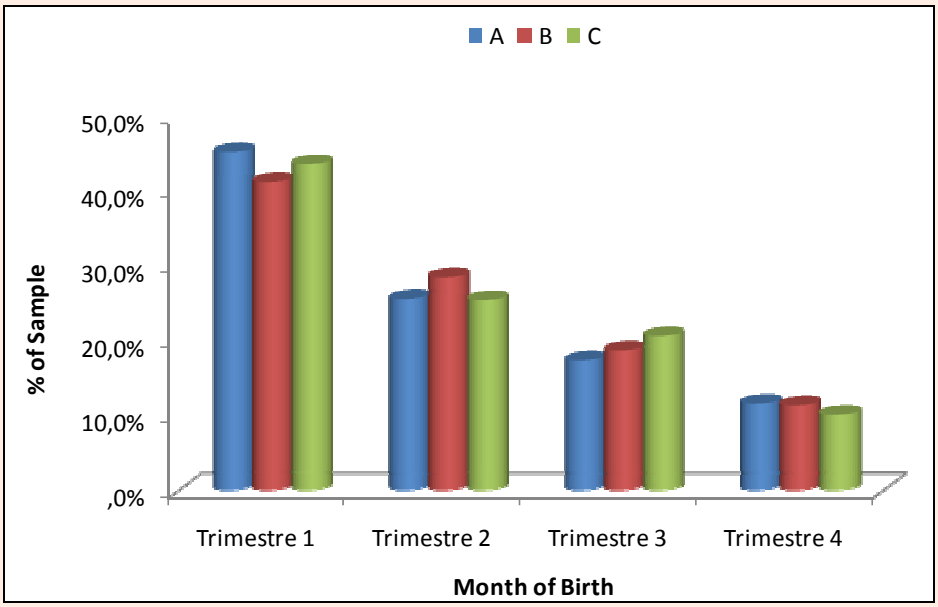

Figure 5. **Influence of group in Elite 2.**

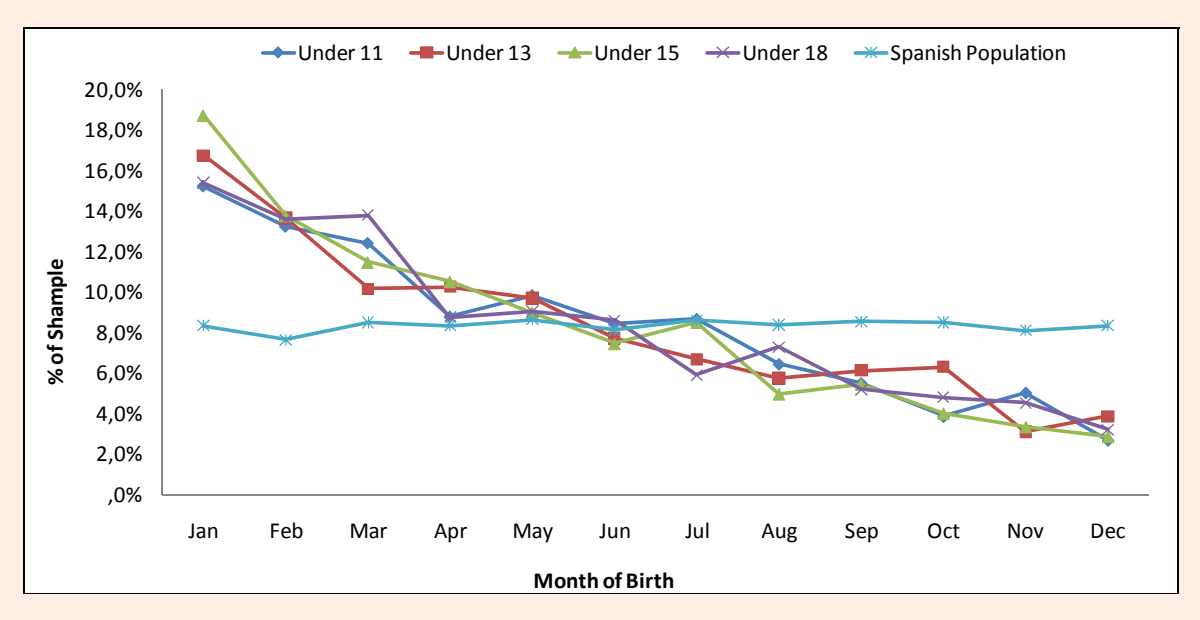

Figure 6. Monthly distributions (%) of total number of selections by category.

according to their chronological age. The selection period used for this purpose starts on 1 January and ends on 31 December, in line with the decision taken in 1997 by the Fédération Internationale de Football Association (FIFA), which applies to all international competitions. Youth competitions in Spanish soccer (Under 11, Under 13, Under 15 and Under 18) are thus composed by two-year categories, apart from the last one, in which players may remain for a maximum of three years. This selection criterion was brought in to ensure that the development of young players was linked to their age, the aim being to ensure fair competition and to give everyone the same chance of success (Helsen et al., 2005). Unfortunately, the criterion has not achieved its intended objectives (Malina, 1994; Musch and Grondin, 2001).

The results detailed in this study reveal a biased distribution of young soccer players' in favour of players born in the first months of the year, a conclusion that was also reached in previous studies Barnsley et al. (1992), Bäumler (2000), Baxter-Jones et al. (1995), Dudink (1994), Helsen et al. (1998), Helsen et al. (2000) and Vaeyens et al. (2005). In contrast to prior research on Spanish youth soccer by Barnsley et al. (1992), García and Salvadores (2005), Helsen et al. (2005) and Idafe and Matthew (2008), this biased distribution affects both the youth teams of the clubs belonging to the LFP and the youth teams of amateur clubs, albeit to a lesser extent. Nevertheless, although there is evidence of RAE in all the groups of players analysed, only the information relating to the Elite 2005-2006 and Elite 2008-2009 groups differs significantly from the Spanish Population. An explanation for these results can be found in what Idafe (2008) described as the availability of players, by virtue of which teams in higher leagues, with a better reputation and based in large towns and cities, such as those included in the Elite 2005-2006 and 2 groups, have a much better chance of finding players when putting together their teams, and usually attract the more skilful ones. However, other teams in lower leagues and from smaller towns, or from a major town or city but located close to a big club, as is the case with the teams in the Amateur group, have much less opportunity to select players. These findings seem to suggest that the reason why RAE is more evident in the Elite groups lies in the detection of players, which is more thorough in the Elite groups. However, the effect does not increase as the age group increases (Figure 6), which leads us to believe that the most decisive point of the process of training elite players is the moment at which they are recruited, more decisive than the selection process.

Another possible explanation for the presence of RAE in the two Elite groups can be found in the maturational theory (Fenzel, 1992; Helsen et al., 2000; Malina et al., 2004; Malina, 1994, 1999; Philippaerts et al., 2006; Reilly et al., 2000; Simmons & Paull, 2001). This theory holds that when players are selected for a team, there is a bias towards selecting boys born in the first months of the year and who possess an advanced maturational age for their selection year, which gives them a range of anthropometric, cognitive and physical advantages over other young players born in the last months of the same year. And there is more likelihood of this happening the greater the reputation and the economic resources of the club, the higher the division it plays in and the greater the opportunities it has to select players.

The population distribution shown in Figure 1 seems to point to the existence of RAE in the youth teams of amateur clubs, despite the fact that the differences in the distribution of players in relation to the Spanish Population are not significant, and the fact that there are significant differences with the Elite groups (1 and 2). These results show that the main cause of RAE in elite soccer would seem to be the talent identification processes.

When data of both Elite groups were compared, results showed that there were not significant differences between them, although it was noted that RAE in the Elite 2008-2009 group was shorter (see Figure 1). Despite of the short gap in the time of both samples, these results

could be a sign of decreasing in the RAE in the youth teams of LFP clubs. This reduction can probably be put down to the increasing awareness among elite teams of the risk they run of losing future talents when basing their selection criteria primarily on the maturational development of players, as shown in the studies carried out by Helsen et al. (2005), Simmons and Paull (2001) and Vaeyens et al. (2005), for example. The results being obtained by clubs such as Athletic Bilbao (Mujika et al., 2009) are in all probability contributing to this change in awareness.

Finally, we sought to gauge the possible influence that other aspects relating to soccer teams may have on RAE, such as the categories into which clubs divide their youth teams (*U* (10-11), *U* (12-13), *U* (14-15) and *U* (16-18)), the position the players occupy on the pitch (goalkeeper, defender, midfielder or striker), the number of years they have spent in a specific age group (one, two or three) and the category of the team they play in at the club (A, B or C teams). The distribution of these variables in the Elite 2008-2009 group (see Figures 2 to 5) and the results obtained by means of the multivariate analysis of variance (MANOVA) show that the observed differences in the distribution of players in each variable are not significant and cannot therefore be linked to RAE.

As we have stated, RAE is a determining factor, therefore, in player selection but does not impact on in their allocation to different categories, positions or teams. Bearing this in mind, we believe it is necessary to make a distinction between "detection" in the sense of recruiting players for the youth academies of elite teams and "selection", understood as a screening process that occurs when players receive training at their clubs and which results in this specific relative age effect being reduced considerably when they turn professional, as demonstrated for example in the research work conducted by Idafe (2008) on Spanish soccer, or the studies of Helsen et al. (1998) and Vaeyens et al. (2005) on international soccer.

Various solutions have been proposed for this problem. These include changing the structure of the competitive system and propose changing or creating a calendar in which cut-off dates are alternated (Hurley et al., 2001), creating smaller age groups (Glamser and Vincent, 2004), allowing players to move up a category at the end of a chronological year (García and Salvadores, 2005), or separating players into categories based on their performance, the aim being to ensure they all receive the same competitive opportunities (Kaiserman, 2005). The most logical of these proposals, in terms of their ability to reduce RAE, are those that seek to delay the process whereby players are grouped together according to performance criteria or that aim to delay the moment at which youngsters specialise in a single sport.

The structure of the competitive system is very difficult to change, however, thus hampering the implementation of the solutions referred to above. That said, it would be more feasible for the technical directors of clubs and sporting academies to implement solutions designed to change the way they operate internally, such as grouping teams together by quarterly periods or reducing the pressure that results exert on players taking part in competitions. Any attempts by clubs or soccer academies to tackle the problem must involve raising the awareness of and training coaches, trainers, scouts and directors. Parents and players should be kept informed that the real potential of a soccer player will not become apparent until they reach the end of their maturation process. As a result, therefore, they must make a special long-term commitment to themselves.

Given the existence of the relative age effect in Spanish youth soccer, it is our belief that future research should set out to explore the problem in greater detail and identify its roots cause. We are therefore of the opinion that the possible influence of RAE in soccer schools should be assessed and the drawbacks of the talent identification processes used by elite clubs identified.

Limitations of the study

There are some limitations in our study. First, one of the purposes was to know the evolution of RAE in the last years in Spanish youth soccer, in this sense more studies in the next seasons should be carried out to affirm that the decreasing in RAE is a steady evolution, and not a fluctuation. Another limitation of our study is that our data did not include match-based variables (match involvement, number of selections for matches, and time played). These variables have demonstrated to provide a more reliable indication of the relative age effect in soccer (Vaeyens et al., 2005). Finally, recreational level and the causes of dropping out of federative soccer should be study in order to complete the map of RAE in Spanish youth soccer.

Conclusion

The collected data revealed the existence of RAE in Spanish youth soccer. This effect was stronger in elite population than in amateur, what supported RAE for success in soccer. LFP elite clubs were analysed in two different seasons. The results showed a reduction in RAE from the 2005-2006 season to the 2008-2009 season. Data revealed that the extend of RAE did no depend on variables such as playing position or the number of years each player has spent in their specific age group. The variable category of the team was neither relevant in the level of RAE, what seems to indicate that the moment of recruitment of players for the youth academies of elite teams is a major point in the development of RAE.

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Key points

- There was RAE in all groups analyzed, although only the Elite groups showed significant variations in birth-date distribution in relation to the general population.
- RAE is more evident in the Elite groups than in the Amateur probably because of the detection process, which is more thorough in the Elite groups.
- Playing position, number of years in their specific age group and category of the team did not have any influence on the extent of RAE.
- Any attempts to prevent RAE should be based on a stable sport policy and the implication of all the stakeholders in the system. All of them should think in the development of a player as a long-term project.

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