Selection of the oldest: Relative age effects in the UEFA Youth League

Simon Takacs[1,*] and Michael Romann[1]

Abstract: Differences in age within annual cohorts (relative age) result in performance discrepancies between children and youths and also bias the talent selection process in many sports. The consequences stemming from the relative age approach are referred to as relative age effects (RAEs). In this study, we analyzed the prevalence of RAEs according to the playing positions and countries of 1208 youth soccer players who participated in the new UEFA Youth League. Our comparisons showed significant RAEs with medium effects. Youth players born in Q1 were 3.35 times more likely to be selected than players born in Q4. Significant RAEs were found for every age group (1996, 1997, 1998 and 1999), but younger age groups showed significantly higher RAEs than the older age groups. The analysis did not reveal any influence of playing position on the size of the RAEs. However, the results showed significant differences in relation to country, as well as the absence of RAEs in players from Belgium, Bulgaria, Cyprus and Slovenia. All in all, the UEFA Youth League is highly biased by RAEs. Thus, it seems RAEs reflect a type of developmental barrier that is preventable if appropriate solutions are implemented in the future.

Keywords:
youth soccer, birth date, age group, playing position, player selection

Introduction

In both education and sport it is common practise to group children into chronological age categories. The aim of such age categories is to recognize children's development, provide fair competition and create equal opportunities (Musch & Grondin, 2001). The use of age categories helps to avoid large age differences between children, although within-category differences in age still occur. In most European countries, the selection period starts in January (Helsen et al., 2012). Children born in January are almost one year older than children born in December, but they are in the same annual cohort. The difference in age between children in the same age category is referred to as relative age, while its consequences are known as relative age effect (RAE) (Musch & Grondin, 2001).

RAEs are mainly explained by the maturation-selection hypothesis, which proposes that relatively older children and adolescents are more likely to have more developed anthropometric characteristics due to advances in maturation (Gil et al., 2014; Müller, Hildebrandt, & Raschner, 2015; Romann & Cobley, 2015). Additionally, relatively older children tend to enter puberty earlier, which can increase differences in growth and development within an age group. A child's stage of puberty, height and weight are all contributors to sport skills such as aerobic resistance and sprinting or vertical jump performance (Malina, Eisenmann, Cumming, Ribeiro, & Aroso, 2004; Malina, Ribeiro, Aroso, & Cumming, 2007) which results in an advantage in most sports, especially those sports where physical characteristics are important (Till, Cobley, O'Hara, Cooke, & Chapman, 2013). It is believed that cumulative mechanisms reinforce RAEs and hence

[1] *Swiss Federal Institute of Sport Magglingen, Switzerland*
** Corresponding author: Bundesamt für Sport BASPO, Eidg. Hochschule für Sport Magglingen EHSM, CH-2532 Magglingen, Switzerland. Email: simon.takacs@baspo.admin.ch*

ISSN 1869-0459 (print)/ ISSN 1869-2885 (online)

create a vicious circle. The advanced sports performances of relatively older children and adolescents lead to positive feedback that increases their intrinsic and extrinsic motivation (Helsen, van Winckel, & Williams, 2005). Furthermore, better performance levels result in a selection advantage for older players and may also influence psychological factors (e.g., confidence, commitment) (Helsen, Hodges, Van Winckel, & Starkes, 2000).

RAEs in soccer

The most significant RAEs appear in culturally popular, important and highly competitive sports (Cobley, Baker, Wattie, & McKenna, 2009). Soccer is one of the most popular sports worldwide and competitive involvement begins at an early age when compared to other youth sports (Helsen et al., 2005). The prior studies and investigations have demonstrated that RAEs exist in both youth and elite professional soccer.

While RAEs in youth soccer can be explained by maturation discrepancies and physical precocity, the RAEs in elite professional soccer are said to be a consequence of the biased talent selection process (Helsen, Starkes, & Van Winckel, 1998). In youth soccer, the relatively older players have a higher chance of being selected, enjoy better support and attract more attention from coaches and associations. Unselected players show higher dropout rates and, in many cases, they drop out of the sport before the age of 16 (Helsen et al., 1998). It is therefore assumed that the increased early dropout rate of unselected players, who are mainly those born later in the selection period, is responsible for the RAEs seen in elite professional soccer teams. A biased squad consisting of a higher number of players born early in the selection period could certainly maintain RAEs at even the senior level (Romann & Fuchslocher, 2013). Relative differences in age are particularly significant for children (e.g., one year is ten percent of the lifetime of a ten-year-old child) and during puberty the stages of maturity can differ strongly (Malina et al., 2004). In adulthood, the majority of players are fully mature and so they can compete on a more equal footing, which tends to reduce the effect sizes.

In the previous literature, links between RAEs and playing positions have been observed, which could certainly have biased the talent identification process. Generally, it is hypothesized that stronger RAEs arise for those playing positions where height and strength are an advantage (Till et al., 2013). In youth soccer, there are already differences in anthropometric and physiological predispositions among the playing positions (Lago-Peñas, Casais, Dellal, Rey, & Domínguez, 2011). Goalkeepers and (central) defenders tend to be taller and heavier and to have a higher BMI compared to midfielders and forwards. Similar differences in anthropometric and fitness characteristics have also been established according to birth distribution and age categories (Carling, le Gall, Reilly, & Williams, 2009). These findings support the hypothesis that playing positions affect the distribution of players across the birth quartiles. In soccer, a few researchers have identified stronger RAEs in goalkeepers and defenders than in midfielders and strikers (Romann & Fuchslocher, 2013; Sedano, Vaeyens, & Redondo, 2015).

Further, the size of the RAEs in soccer could be influenced by the playing style and the physical demands of the specific soccer league. For instance, while the German *Bundesliga* had the players with the greatest stature, body mass and BMI, the Spanish *La Liga* contained the highest quality players (Bloomfield, Polman, Butterly, & O’Donoghue, 2005). These anthropometric and cultural differences may have an impact on playing style. The physical and technical requirements of professional soccer differ in the various European soccer leagues (Dellal et al., 2011; Oberstone, 2011). It has been suggested that soccer players have to adapt both physically and technically when they transfer from one professional soccer league to another. Another possible explanation for the discrepancies in RAEs among countries is the size of the country and the depth of competition in its league. Schorer et al. (2015) suggest that smaller countries with less prominent soccer leagues show RAEs less frequently. The depth of competition seems to be a crucial factor influencing the appearance of RAEs, with a high intensity of competition tending to induce stronger RAEs (Musch & Grondin, 2001).

In European soccer, the most important events are the UEFA European Championship (national team level) and the UEFA Champions League (club level). Analogous to these elite professional soccer competitions, there exist similar competitions for youth soccer. Helsen et al. (2005) examined diverse UEFA tournaments and identified clear RAEs for all the national youth teams in the U-15, U-16, U-17 and U-18 age categories. They also showed considerable RAEs in European tournaments at the club level, although the research here was limited to U-12 and U-14 club teams. In 2013, UEFA (the Union of European Football Associations) launched a new tournament for elite youth clubs called the UEFA Youth League. In order to effectively counteract RAEs in soccer, such prestigious championships organized by well-known associations have to be analyzed. UEFA exerts a strong influence on European soccer and should therefore set an example. Indeed, UEFA has the opportunity to construct regulations that force clubs and national federations to reduce RAEs in youth soccer.

The aim of the study was to determine the RAEs exhibited by elite male youth soccer players from the UEFA Youth League. Players with birthdays in the first quarter of the year were expected to be overrepresented in the sample. In addition, it was supposed that the younger age groups would reveal greater effect sizes compared to the older age groups. Further, defenders and goalkeepers were assumed to show stronger RAEs in comparison to midfielders and forwards. Due to the different depths of competition and styles of playing soccer among countries and leagues, it was hypothesized that the RAEs would differ between the countries of the participating teams.

Method

The UEFA Youth League is a prestigious European soccer championship at the club level for elite youth players. Some 32 clubs from 18 different countries participated in the UEFA Youth League in 2014/2015. The championship was open to the youth teams of the 32 elite professional clubs that qualified for the group stage of the UEFA Champions League 2014/2015 (UEFA, 2015). In September 2014, each club had to submit a roster of a maximum of 40 players to UEFA. Prior to the matches, the clubs had to select 20 of the 40 players to participate. The roster of 40 players could be amended during the championship. Due to these changes, the rosters could have contained more than 40 players at the end of the UEFA Youth League 2014/2015. The UEFA Youth League 2014/2015 was an U-19 championship; therefore, all the players must have been born on or after 1 January 1996 (UEFA, 2015). The final rosters, including players' nationalities, birth dates, positions (goalkeeper, defender, midfielder and forward), number of games played and number of goals scored, were obtained at the end of the UEFA Youth League 2014/2015 from the UEFA website (UEFA, 2015). The complete set of rosters comprised a total of 1208 players. This study was approved by an independent institutional ethical review board of the Swiss Federal Institute of Sport Magglingen, Switzerland and is in accordance with the principles expressed in the Declaration of Helsinki. However, all data are reported anonymously.

Procedure

The birth month of each player was recorded in order to define the birth quarter (Q). As the cut-off date for the UEFA Youth League is 1 January, the first month of the selection period was month one (January), while month twelve (December) represented the last month of the selection period. This procedure was performed for all players on all of the team rosters, as was the case in the majority of previous RAE studies (Cobley et al., 2009).

The year was divided into four quarters (Q1 represents January, February and March; Q2 represents April, May and June; Q3 represents July, August and September; and Q4 represents October, November and December). The observed birth date distributions of all the players were calculated for each quarter.

From the original data, chi-square tests and odds ratios (ORs) were calculated. Chi-square analyses were used to determine whether the observed distributions were statistically different from the expected distributions. In this study, neither the birth dates of all registered players nor the distribution of live births in the countries were available. Due to this, currently published studies perform all analyses based on the theoretical assumption that birth dates are equally distributed across all quarters (i.e., 25 percent per quarter) (Cobley et al., 2009; Helsen et al., 2005). This assumption should be valid, since in most countries the birth dates for humans are equally distributed over the year and do not exhibit significant seasonal variations (Martinez-Bakker, Bakker, King, & Rohani, 2014). In addition, the effect sizes were computed in order to qualify the results of the chi-square tests. If the degree of freedom is above 1, then the appropriate index of effect size is Cramer's V (V) (Cramer, 1999). For the chi-square analyses, the magnitude of the effect size was measured using V. According to Cramer (1999), for df = 3 (which is the case for all comparisons of birth quarters), V = 0.06 to 0.17 indicates a small effect, V = 0.18 to 0.29 denotes a medium effect, and V ≥ 0.29 illustrates a large effect. To compare RAEs between different groups (age groups, playing positions and countries), the Kruskal-Wallis test and the Mann-Whitney U test were used. All statistical analyses were carried out using SPSS 16.0. An alpha level of $p < 0.05$ was applied as the criterion for statistical significance.

Results

As can be seen in Table I, in the analysis of all the selected players participating in the UEFA Youth League 2014/2015, a significant RAE occurred ($\chi^2 = 250.97$, $P < 0.01$). More than 40% of the UEFA Youth League 2014/2015 players were born in Q1, while only 12.8% were born in Q4. The odds ratio of 3.35 illustrates that youth players born in Q1 were more than three times more likely to be selected for the UEFA Youth League 2014/2015 than players born in Q4. The effect size in the analysed sample is medium (V = 0.26).

RAEs according to age group

In every age group (1996, 1997, 1998 and 1999), a significant overrepresentation of players born in Q1 was found ($P < 0.01$). The effect size in the age groups varied between medium (1996 and 1997) and large (1998 and 1999). The younger age groups showed greater RAEs than the older age groups. Further analyses showed significant differences in RAEs between the age groups ($\chi^2 = 8.69$, $P < 0.05$). Pairwise comparisons identified a significant difference in RAEs between the 1996 and 1998 age groups ($U = -2.79$, $P < 0.01$) as well as between the 1997 and 1998 age groups ($U = -2.03$, $P < 0.05$). The RAEs in the 1998 age group were stronger than those in the 1996 and 1997 age groups. The odds ratio declined continuously from the 1999 age category to the 1996 age category.

RAEs according to playing position

The analysis of goalkeepers, defenders, midfielders and forwards illustrated significant RAEs for every playing position ($P < 0.01$). As Table 2 shows, the strongest effect size was observed for midfielders (V = 0.29). The differences in RAEs between the playing positions were not significant ($\chi^2 = 4.70$, $P = 0.19$).

Table 1
RAEs in the UEFA Youth League 2014/2015 according to age groups

Age Group	n	% Q1	% Q2	% Q3	% Q4	χ^2	V		Effect	OR Q1/Q4		95% CI
All	1208	43.0	25.8	18.3	12.8	251.0	0.26	**	medium	3.35	*	(2.80, 4.02)
1996	419	38.9	26.0	22.2	12.9	58.5	0.22	**	medium	3.02	*	(2.22, 4.11)
1997	453	41.3	27.8	18.3	12.6	85.5	0.25	**	medium	3.28	*	(2.44, 4.42)
1998	288	50.3	23.6	12.8	13.2	107.3	0.35	**	large	3.82	*	(2.67, 5.46)
1999	47	51.1	19.1	17.0	12.8	17.4	0.35	**	large	4.00	*	(1.63, 9.79)

Note: Q1 to Q4 = quarter 1 to 4; $\chi 2$ = Chi2-value; V = Cramer's V; *P<0.05; **P<0.01; OR = Odds ratio; 95% CI= 95%-Confidence Interval.

Table 2
RAEs in the UEFA Youth League 2014/2015 according to playing positions (n=1208)

Playing Position	n	% Q1	% Q2	% Q3	% Q4	χ^2	V		Effect	OR Q1/Q4		95% CI
Goalkeeper	137	36.5	27.0	25.5	10.9	18.3	0.21	**	medium	3.33	*	(1.87, 5.94)
Defender	375	44.3	25.6	18.4	11.7	88.7	0.28	**	medium	3.77	*	(2.70, 5.27)
Midfielder	445	44.7	27.6	15.3	12.4	115.7	0.29	**	large	3.62	*	(2.68, 4.88)
Forward	251	41.8	22.3	19.5	16.3	39.7	0.23	**	medium	2.56	*	(1.78, 3.68)

Note: Q1 to Q4 = quarter 1 to 4; $\chi 2$ = Chi2-value; V = Cramer's V; *P<0.05; **P<0.01; OR = Odds ratio; 95% CI= 95%-Confidence Interval.

RAEs according to country

The analysis of the RAEs relating to the home countries of the participating teams is shown in Table 3. Except for Belgium, Bulgaria, Cyprus and Slovenia, significant RAEs were identified for all countries ($P < 0.05$). The strongest RAEs were found for Turkey ($V = 0.51$) and Sweden ($V = 0.45$). For England, a significant RAE with an overrepresentation of players born in Q1 (31.4%) and Q4 (29.9%) was observed. Different from the other countries, England's selection year for talent development begins in September. The sizes of the RAEs differed significantly between the home countries of the participating teams ($\chi^2 = 39.95$, $P < 0.01$).

Discussion

The analysis of all the UEFA Youth League 2014/2015 players revealed a medium, but still highly significant, RAE. While the births in Europe are evenly distributed across the year (Martinez-Bakker et al., 2014), in the analyzed sample some 68.9% of the youth soccer players were born in the first half of the year, while only 31.1% were born in the second half. Compared to other studies concerning soccer (Cobley et al., 2009), the UEFA Youth League 2014/2015 manifested a surprisingly strong RAE. Cobley et al. (2009) emphasized three influential factors for RAEs: sport context, skill level and age category. They detected higher risks of RAEs for adolescents (15-18 years) at an advanced level of competition (i.e. regional or national representation) in popular sports like basketball, ice hockey and soccer. Similar to those findings, our sample was highly vulnerable to RAEs, since the UEFA Youth League is a highly competitive soccer championship for adolescents.

Age groups

As mentioned above, the UEFA Youth League 2014/2015 was an U-19 Championship. All of the registered players were born between 1996 and 2000, although almost three quarters of them were born in 1996 and 1997. Nonetheless, it is astonishing that players who were almost four years younger than the age limit were selected to take part in the

UEFA Youth League. Despite the fact that a lot of considerably younger players got the chance to participate, a highly significant RAE was observed in every age category (1996, 1997, 1998 and 1999). The largest effect sizes were found in the 1998 and 1999 age categories. More than 70% of the players in these age categories were born in the first half of the year. In the 1996 and 1997 age categories, serious RAEs were still present, although they tend to decrease during adolescence. The declining odds ratio also supports our assumption that the younger age groups (i.e., those in adolescence) would reveal stronger RAEs. Differences in maturation start to equalize after puberty, until physical development is finished in adulthood (Malina et al., 2004). This seems to be a plausible explanation for the slightly decreasing RAEs from the age of 15 to 18.

Table 3
RAEs in the UEFA Youth League 2014/2015 according to countries[1] (n=1208)

Country (number of teams)	n	% Q1	% Q2	% Q3	% Q4	χ^2	V		Effect	OR Q1/ Q4		95% CI
Belarus (1)	27	40.7	40.7	7.4	11.1	10.8	0.36	*	large	3.67	*	(1.02, 13.15)
Belgium (1)	43	34.9	27.9	23.3	14.0	4.0	0.18		no	2.50		(0.97, 6.45)
Bulgaria (1)	40	32.5	27.5	22.5	17.5	2.0	0.13		no	1.86		(0.74, 4.66)
Cyprus (1)	40	32.5	32.5	20.0	15.0	3.8	0.18		no	2.17		(0.82, 5.70)
England[2] (4)	157	34.4	15.9	19.7	29.9	14.0	0.17	**	med.	1.15	*	(0.78, 1.70)
France (2)	70	40.0	31.4	15.7	12.9	14.0	0.26	**	med.	3.11	*	(1.47, 6.60)
Germany (4)	153	47.7	24.2	17.0	11.1	47.3	0.32	**	large	4.29	*	(2.53, 7.29)
Greece (1)	41	43.9	31.7	19.5	4.9	13.7	0.33	**	large	9.00	*	(2.09, 38.8)
Italy (2)	77	41.6	28.6	23.4	6.5	19.5	0.29	**	large	6.40	*	(2.49, 16.43)
Netherlands (1)	42	45.2	28.6	16.7	9.5	12.3	0.31	**	large	4.75	*	(1.62, 13.97)
Portugal (3)	115	52.2	20.0	15.7	12.2	46.7	0.37	**	large	4.29	*	(2.39, 7.67)
Russia (2)	59	42.4	39.0	13.6	5.1	24.2	0.37	**	large	8.33	*	(2.52, 27.61)
Slovenia (1)	40	35.0	22.5	22.5	20.0	2.2	0.14		no	1.75		(0.73, 4.17)
Spain (4)	163	45.4	25.8	20.9	8.0	47.2	0.31	**	large	5.69	*	(3.16, 10.27)
Sweden (1)	40	57.5	20.0	15.0	7.5	23.8	0.45	**	large	7.67	*	(2.30, 25.54)
Switzerland (1)	36	41.7	30.6	16.7	11.1	8.2	0.28	*	med.	3.75	*	(1.24, 11.30)
Turkey (1)	28	60.7	10.7	25.0	3.6	21.7	0.51	**	large	17.00	*	(2.26, 127.77)
Ukraine (1)	37	43.2	40.5	8.1	8.1	16.9	0.39	**	large	5.33	*	(1.55, 18.31)

Note: Q1 to Q4 = quarter 1 to 4; $\chi 2$ = Chi2-value; V = Cramer's V; *P<0.05; **P<0.01;
OR = Odds ratio; 95% CI= 95%-Confidence Interval; med. = medium
[1] Countries of the 32 participating teams
[2] Start of the selection year: September

Playing positions

The present results do not suggest any influence of playing positions on the extent of RAEs in male youth soccer and support the findings of Del Campo, Vicedo, Villora, and Jordan (2010). All playing positions exhibited a highly significant overrepresentation of players born in Q1. The largest effect sizes were observed for midfielders and defenders. While the strong RAEs for defenders are in line with the findings of previous research (Romann & Fuchslocher, 2013; Sedano, Vaeyens, & Redondo, 2015), the notably strong RAEs for midfielders are a far less common observation. A possible explanation for the high overrepresentation of midfielders born early in the year could be the importance of central midfielders for success in soccer. Due to developmental and experiential advantages, the players who perform the best at the moment (i.e., those who are relatively older) are often used in the central midfield position.

All in all, the link between playing positions and RAEs still remains unclear in youth soccer. For future studies, we propose a more precise subdivision of playing positions. The aggregation of specific playing positions (e.g., central defender, wing defenseman) to an upper-level grouping (e.g., defender) poses the risk that different physical and technical demands are summarized and so no longer represent the requirements of single playing positions (Di Salvo et al., 2007). For instance, external and central defenders differ significantly in terms of height and BMI (Lago-Peñas et al., 2011).

Countries

The analysis of RAEs relating to the home countries of the participating teams identified significant differences in the RAEs. In England, each academy player (except for the Barclays U21 Premier League) is allocated to an age group based on his age on 31 August in the year (Premier League Limited, 2015). The results for England's UEFA Youth League 2014/2015 clubs (Arsenal FC, Chelsea FC, Liverpool FC and Manchester City FC) showed a significant overrepresentation of players born in Q4 and Q1, which was probably induced by the cut-off date of 31 August in the English sports system (Helsen et al., 2012). These results are in line with previous findings, wherein RAEs occurred independently of diverse cut-off dates (Musch & Grondin, 2001). Given that the cut-off date for the UEFA Youth League was 1 January, the data concerning the participating English clubs were neither reversed nor excluded.

It should be noted that in only four out of 18 countries (Belgium, Bulgaria, Cyprus and Slovenia) were no significant RAEs observed. As many authors have suggested, the depth of competition has a relevant influence on the size of RAEs (Musch & Grondin, 2001; Schorer et al., 2015). Increasing competition tends to evoke greater RAEs. According to the *FIFA Men's World Ranking* (FIFA, 2015), Bulgaria, Cyprus and Slovenia are among the four worst ranked countries out of the 18 countries listed in Table 3. A similar picture is presented regarding the UEFA rankings for club competitions (UEFA, 2015). Out of the 32 teams that qualified for the UEFA Champions League 2014/2015, *PFC Ludogorets Razgrad* (Bulgaria), *Apoel FC* (Cyprus) and *NK Maribor* (Slovenia) were ranked among the four weakest club teams. In addition, the youth teams of those clubs bowed out of the UEFA Youth League 2014/2015 during the group stage. The poor ranking of these countries and clubs, as well as the performance of the corresponding youth teams, leads to the assumption that the soccer leagues in Bulgaria, Cyprus and Slovenia are less competitive. According to Musch and Grondin (2001), this could be a possible explanation for the nonappearance of RAEs in the teams representing those countries. However, the interaction between these moderating factors seems to be more complicated and further studies are required to justify this finding.

Belgium is ranked at the top of the *FIFA Men's World Ranking* (FIFA, 2015) and is known for having good development measures in place for young soccer players as well as proactive measures to reduce RAEs in soccer. There exist so-called 'future' soccer teams which mainly consist of late developing soccer players who did not have the chance to be selected for the regular teams. These teams are implemented at the level of U16 and U17 teams alongside the regular teams (Helsen et al., 2012) and may have an positive impact on RAEs in Belgian soccer.

The greatest asymmetries in birth dates were detected for Sweden and Turkey. More than 60% of the players from the team representing Turkey were born between January and March. In the team representing Sweden, 77.5% of the players were born in the first half of the year. Neither the literature nor any other variables could explain the extremely significant asymmetries in the clubs representing Sweden and Turkey. Nonetheless, in other studies both Sweden (Helsen et al., 2005) and Turkey (Poli, Ravenel, & Besson, 2015) also showed peak values.

Possible solutions

Today's famous and prestigious international youth sports championships (e.g. Youth Olympic Games, FIFA U-17 World Cup) lead to high selection pressure and increased levels of competition. Relatively older athletes have a higher chance of being identified as a talent and so are more likely to be nominated for the championship (Helsen et al., 2005; Romann & Fuchslocher, 2014). This raises the question of whether these prestigious youth sports championships foster the wrong incentives for athletes, coaches, clubs and associations. Presumably, youth coaches and young athletes are measured by their success at important youth sports championships. A change must therefore take place in the ethos of youth sport. Our objective should be to facilitate equal opportunities in youth sport. The focus should not solely be on winning, but rather on developing the expertise and sport skills necessary for the elite stage (Cobley et al., 2009; Fuchslocher, Romann, & Gulbin, 2013). Coaches should select athletes with the highest future potential rather than just the best athletes with the highest chance of winning in the present. For the best possible success in elite soccer, it is important that the real talents are selected and supported. In particular, clubs and associations with smaller talent pools should prevent increased dropout rates of relatively younger players and possible talents.

Other possible solutions to counteract RAEs are described by Cobley et al. (2009). As practiced in Belgium, the establishment of 'current' and 'potential' teams is one possible solution. Another commonly proposed solution is the creation of smaller age groups in order to reduce the physical differences within the age groups. For team sports such as soccer, where players are often assessed based on multiple standard anthropometric and physiological/fitness tests (e.g., sprint times, vertical jump), corrective adjustments could help to better inform and improve validity in player evaluation and selection procedures (Romann & Cobley, 2015). All in all, the talent identification processes need to be improved and the focus should be on sport skills rather than physical attributes (Helsen et al., 2000).

Limitations

The analysis of the RAEs relating to countries was limited by the number of teams and subjects participating in the tournament. Most countries were represented by only one team. On average, there were 38 registered players per team. Therefore, the extent to which a generalization from one or a few club teams to a whole country is reasonable remains questionable.

Main findings and conclusion

Overall, the study's findings identified considerable RAEs in the UEFA Youth League 2014/2015. In soccer, adolescents competing at a high level seem to be highly vulnerable to RAEs. Comparisons between single age categories illustrated decreasing RAEs from the age of 15 to 18. The results of the present study do not suggest any influence of the playing position on the size of the RAEs in soccer. Medium to large RAEs were shown in all countries except Belgium, Bulgaria, Cyprus and Slovenia. Between the countries, significant differences concerning RAEs existed. The depth of competition rather than the style of playing soccer is suggested to be a possible reason for the differences in RAEs between countries. Indeed, in most sport systems relatively older players have a better chance of becoming an elite professional soccer player, but only because today's talent development process is biased by physical attributes rather than focusing on sport skills. To minimize RAEs in the UEFA Youth League, UEFA should adopt detailed regulations that force clubs and associations to improve their talent identification processes.

References

Bloomfield, J., Polman, R., Butterly, R., & O'Donoghue, P. G. (2005). An analysis of quality and body composition of four European soccer leagues. *Journal of Sports Medicine and Physical Fitness, 45*, 58-67.

Carling, C., le Gall, F., Reilly, T., & Williams, A. M. (2009). Do anthropometric and fitness characteristics vary according to birth date distribution in elite youth academy soccer players? *Scandinavian Journal of Medicine & Science in Sports, 19*(1), 3-9.

Cobley, S., Baker, J., Wattie, N., & McKenna, J. (2009). Annual Age-Grouping and Athlete Development: A Meta-Analytical Review of Relative Age Effects in Sport. *Sports Medicine, 39*(3), 235-256.

Cramer, H. (1999). *Mathematical methods of statistics*. Princeton: Princeton University Press.

Del Campo, D. G. D., Vicedo, J. C. P., Villora, S. G., & Jordan, O. R. C. (2010). The relative age effect in youth soccer players from Spain. *Journal of sports science & medicine, 9*(2), 190.

Dellal, A., Chamari, K., Wong, D. P., Ahmaidi, S., Keller, D., Barros, R., …, Carling, C. (2011). Comparison of physical and technical performance in European soccer match-play: FA Premier League and La Liga. *European Journal of Sport Science, 11*(1), 51-59.

Di Salvo, V., Baron, R., Tschan, H., Calderon Montero, F. J., Bachl, N., & Pigozzi, F. (2007). Performance characteristics according to playing position in elite soccer. *International Journal of Sports Medicine, 28*(3), 222-227.

FIFA. (2015). FIFA/Coca-Cola-Weltrangliste. Retrieved 30.12, 2015, from http://de.fifa.com/fifa-world-ranking/index.html

Fuchslocher, J., Romann, M., & Gulbin, J. (2013). Strategies to Support Developing Talent. Schweizerische Zeitschrift für Sportmedizin und Sporttraumatologie, 61(4).

Gil, S. M., Badiola, A., Bidaurrazaga-Letona, I., Zabala-Lili, J., Gravina, L., Santos-Concejero, J., . . . Granados, C. (2014). Relationship between the relative age effect and anthropometry, maturity and performance in young soccer players. *Journal of Sports Sciences, 32*(5), 479-486.

Helsen, W., Baker, J., Michiels, S., Schorer, J., Van Winckel, J., & Williams, A. M. (2012). The relative age effect in European professional soccer: Did ten years of research make any difference? *Journal of Sports Sciences, 30*(15), 1665-1671.

Helsen, W., Hodges, N., Van Winckel, J., & Starkes, J. (2000). The roles of talent, physical precocity and practice in the development of soccer expertise. *Journal of Sports Sciences, 18*(9), 727-736.

Helsen, W., Starkes, J., & Van Winckel, J. (1998). The influence of relative age on success and dropout in male soccer players. *American Journal of Human Biology, 10*(6), 791-798.

Helsen, W., van Winckel, J., & Williams, A. M. (2005). The relative age effect in youth soccer across Europe. *Journal of Sports Sciences, 23*(6), 629-636.

Lago-Peñas, C., Casais, L., Dellal, A., Rey, E., & Domínguez, E. (2011). Anthropometric and physiological characteristics of young soccer players according to their playing positions: relevance for competition success. *The Journal of Strength & Conditioning Research, 25*(12), 3358-3367.

Malina, R. M., Eisenmann, J. C., Cumming, S. P., Ribeiro, B., & Aroso, J. (2004). Maturity-associated variation in the growth and functional capacities of youth football (soccer) players 13–15 years. *European Journal of Applied Physiology, 91*(5), 555-562.

Malina, R. M., Ribeiro, B., Aroso, J., & Cumming, S. P. (2007). Characteristics of youth soccer players aged 13-15 years classified by skill level. *British Journal of Sports Medicine, 41*(5), 290-295.

Martinez-Bakker, M., Bakker, K. M., King, A. A., & Rohani, P. (2014). Human birth seasonality: latitudinal gradient and interplay. *Proceedings of the Royal Society, 28,* 20132438.

Müller, L., Hildebrandt, C., & Raschner, C. (2015). The Relative Age Effect and the Influence on Performance in Youth Alpine Ski Racing. *Journal of Sports Science and Medicine*, 14, 16-22.

Musch, J., & Grondin, S. (2001). Unequal Competition as an Impediment to Personal Development: A Review of the Relative Age Effect in Sport. *Developmental Review, 21*(2), 147-167.

Oberstone, J. (2011). Comparing Team Performance of the English Premier League, Serie A, and La Liga for the 2008-2009 Season. *Journal of Quantitative Analysis in Sports, 7*(1).

Poli, R., Ravenel, L., & Besson, R. (2015). Relative age effet: a serious problem in football. *CIES Football Observatory Monthly Report, 12*, 1-8.

Premier League Limited (2015). The Premier League Handbook, season 2015/16. London: The Football Association Premier League Limited.

Romann, M., & Cobley, S. (2015). Relative age effects in athletic sprinting and corrective adjustments as a solution for their removal. *PLoS One, 20*(3).

Romann, M., & Fuchslocher, J. (2013). Relative age effects in Swiss junior soccer and their relationship with playing position. *European Journal of Sport Science, 13*(4), 356-363.

Romann, M., & Fuchslocher, J. (2014). Survival and success of the relatively oldest in Swiss youth skiing competition. *International Journal of Sports Science and Coaching, 9*(2), 347-356.

Schorer, J., Cobley, S., Bräutigam, C., Loffing, F., Hütter, S., Büsch, D., …, Baker, J. (2015). Developmental contexts, depth of competition and relative age effects in sport: a database analysis and a quasi-experiment. *Psychological Test and Assessment Modeling, 57*(1), 126.

Sedano, S., Vaeyens, R., & Redondo, J. C. (2015). The Relative Age Effect in Spanish Female Soccer Players. Influence of the Competitive Level and a Playing Position. *Journal of human kinetics, 46*(1), 129-137.

Till, K., Cobley, S., O'Hara, J., Cooke, C., & Chapman, C. (2013). Considering maturation status and relative age in the longitudinal evaluation of junior rugby league players. *Scandinavian Journal of Medicine & Science in Sports, 24*(3), 569–576.

UEFA. (2015). UEFA Youth League.Retrieved 15.12.2015 from http://de.uefa.com/uefayouthleague/index.html

Appendix: Participating clubs in the UEFA Youth League 2014/2015

Club	Country	n
FC BATE Borisov	Belarus	27
RSC Anderlecht	Belgium	43
PFC Ludogorets Razgrad	Bulgaria	40
APOEL FC	Cyprus	40
Arsenal FC	England	41
Chelsea FC	England	38
Liverpool FC	England	39
Manchester City FC	England	39
AS Monaco FC	France	33
Paris Saint-Germain	France	37
Bayer 04 Leverkusen	Germany	40
Borussia Dortmund	Germany	40
FC Bayern München	Germany	31
FC Schalke 04	Germany	42
Olympiacos FC	Greece	41
AS Roma	Italy	37
Juventus	Italy	40
AFC Ajax	Netherlands	42
FC Porto	Portugal	43
SL Benfica	Portugal	35
Sporting Clube de Portugal	Portugal	37
FC Zenit	Russia	27
PFC CSKA Moskva	Russia	32
NK Maribor	Slovenia	40
Athletic Club	Spain	40
Club Atlético de Madrid	Spain	43
FC Barcelona	Spain	39
Real Madrid CF	Spain	41
Malmö FF	Sweden	40
FC Basel 1893	Switzerland	36
Galatasaray AŞ	Turkey	28
FC Shakhtar Donetsk	Ukraine	37

The Authors

Simon Takacs is a research associate at the Swiss Federal Institute of Sport Magglingen. He focuses on the promotion of young talent in the Swiss nationwide extracurricular program called Jugend und Sport (J+S).

Michael Romann is the head of training science at the Swiss Federal Institute of Sport Magglingen. His research interests lie primarily in the area of talent identification and talent development.