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Influence of the Selection Level, Age and Playing Position on Relative Age Effects in Swiss Women's Soccer

Michael Romann[1*] and Jörg Fuchslocher[1]

Abstract: Relative age effects (RAEs) refer to age differences in the same selection year. In this study, 6,229 female soccer players representing the entire Swiss female soccer population were evaluated to determine the prevalence of RAEs in Swiss women's soccer. Significant RAEs existed in the self-selected extracurricular (n = 2987) soccer teams and the subgroup of talent development teams (n = 450) in the 10 to14 age category. No significant RAEs were found for players 15 years of age or older (n = 3242) and the subgroup of all national teams (n = 239). Additionally, significantly stronger RAEs were observed in defenders and goalkeepers compared to midfielders in national teams. Our findings show that in Switzerland, RAEs apparently influence the self selection and talent selection processes of women's soccer in the 10 to 14 age category. However, in contrast to male soccer we found no RAEs in elite women's soccer teams.

Keywords:
talent development, selection, female soccer, birth date

Children are grouped by age for sport activities to reduce the effects of developmental discrepancies. However, this procedure leads to age differences between individuals in the same annual cohort. This can lead to an age difference of almost 12 months between the youngest and the oldest participants, known as relative age effects (RAEs). RAEs were initially observed in school settings, describing the link between the month of birth and academic success (Bigelow, 1934; Dickinson & Larson, 1963). In sports, RAEs have gained increasing awareness among sports scientists and coaches over the last three decades. Early research from 1984 until today has identified a consistent prevalence of RAEs within a variety of sports at the junior level (Cobley, Baker, Wattie, & McKenna, 2009). Soccer is among a group of highly popular sports, such as ice hockey, with the highest prevalence of RAEs (Cobley et al., 2009). In some exceptional activities like golf (Côté, Macdonald, Baker, & Abernethy, 2006), where physical attributes are less important, RAEs have not been identified. In dance and gymnastics, no or even inverse RAEs have been shown to exist (Baxter-Jones & Helms, 1996; Malina, Bouchard, & Bar-Or, 2004; van Rossum, 2006).

In male soccer, different mechanisms have been proposed for explaining the causes of RAEs. Maturational differences and physical attributes (e.g., greater aerobic power, muscular strength, and height) appear to be mainly responsible (Carling, le Gall, Reilly, & Williams, 2009). As RAEs are based on chronological age, relatively older children consistently have an advantage, favouring an advanced maturation (Schorer, Cobley, Busch, Brautigam, & Baker, 2009). It is also important to note that an even higher impact results from biological age differences, which refer to psycho-physical maturity and can lead to variations of more than two years (Malina & Bielicki, 1992). Additional explanations for relatively older children's superior performance involve psychological development,

[1] *Swiss Federal Institute of Sport, Magglingen, Switzerland*
[*] *Corresponding author: Alpenstrasse 16, 2532 Magglingen, Switzerland. E-mail: michael.romann@baspo.admin.ch*

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practice experience, and mechanisms related to the selection processes (Musch & Grondin, 2001). Once selected, the relatively older children also experience better coaching, more positive feedback, deeper involvement, and more intense competition, all of which enhance performance (Sherar, Baxter-Jones, Faulkner, & Russell, 2007). On the other hand, children with a relative age disadvantage play at a competitively lower level and have less support and training. As a consequence, those children are less likely to reach the highest levels in elite sports (Helsen, Starkes, & Van Winckel, 2000) and are more likely to drop out of a particular sport (Delorme, Boiché, & Raspaud, 2010a). Musch and Grondin (2001) described factors related to the sport setting that may increase RAEs in male sports, such as the sport's popularity, the level of competition, early specialization, and the expectations of coaches who are involved in the selection process. Generally, soccer's importance and popularity has increased during the last decade, resulting in a higher number of players who wish to play soccer (Cobley, Schorer, & Baker, 2008; Wattie, Baker, Cobley, & Montelpare, 2007). The increasing participation and infrastructure intensifies the competition to be selected for elite teams. Additionally, there has been an increasing emphasis of clubs to detect young players who are likely to become world-class performers (Wattie, Cobley, & Baker, 2008). Finally, in international junior soccer, there may be a focus on winning instead of developing talent for the elite stage (Helsen, Hodges, Van Winckel, & Starkes, 2000).

Most studies concerning RAEs in soccer, however, have been focused on male athletes and researchers still need to understand the mechanisms that affect RAEs, as well as confirm whether RAEs exist in female contexts (Cobley et al., 2009).

As part of the Training of Young Athletes (TOYA) longitudinal study, Baxter-Jones and Helms (1994) carried out a study examining RAEs in elite female athletes. The researchers showed that almost 50% of elite female swimmers and 8 to 16-year-old tennis players were born in the first quarter of the selection year. In the same way, Delorme and Raspaud (2009) observed a significant relative age effect in all female and male youth categories in French basketball.

Although there has been an exponential growth in the number of women playing soccer worldwide (Williams, 2007), Musch and Grondin (2001) observed that the effect of an athlete's gender on RAEs still remains neglected. To our knowledge, only three studies to date have investigated RAEs in women's soccer. On one hand, RAEs were observed among all registered female players in the French federation (Delorme, Boiché, & Raspaud, 2010b), but no RAEs were found among high-level female soccer players (Delorme, Boiché, & Raspaud, 2009). On the other hand, Vincent and Glamser (2006) compared the relative age effect among 1,344 male and female soccer players of the U.S. Olympic Development Program. In their study, marginal RAEs were shown for girls at the national and regional levels and no RAEs for those playing at the state level. However, the results revealed large RAEs for boys at all levels. Hence it can be stated, that the available data concerning RAEs in female soccer is sparse and reveals contradictory results.

In Switzerland, women's soccer is rapidly gaining popularity, which may be due to the success of the men's soccer team (Swiss Federal Office of Sport, 2010). Despite the country's small population (7.7 million), the Swiss male senior team was listed 13th in January 2010 in the FIFA world ranking, and the male Swiss U-17 team won the European Cup in 2002 and the World Cup in 2009. Due to these achievements, Tschopp, Biedert, Seiler, Hasler, and Marti (2003) assumed that the Swiss soccer federation may have a relatively efficient and successful talent development system. However, RAEs have still not been investigated in Swiss women's soccer.

In previous literature, links between male RAEs, maturation, and playing positions have been identified, which could have biased the talent identification process. More mature players with more experience in soccer perform better in ball control by using their body size. In addition, a player's level of maturity significantly contributes to variations in shooting accuracy (Malina et al., 2005). In boys' soccer, forwards were found to be significantly leaner than midfielders, defenders, and goalkeepers. A discriminating variable of male defenders compared to midfielders and strikers is their lower leg power (Gil, Gil, Ruiz, Irazusta, & Irazusta, 2007). Interestingly, in contrast to the selection bias of RAEs, senior male players born late after the cut-off date have been shown to earn systematically higher wages (Ashworth & Heyndels, 2007). This effect was reported as being strongest for goalkeepers and defenders, but not evident for forwards. It was speculated that this pattern could reflect a bias in talent scouts' selection of teams and playing positions. This finding is consistent with Grondin and Trudeau (1991), who demonstrated a link between male ice hockey players' RAEs and playing positions. In their analysis, the RAEs were strongest among defenders and goalkeepers. Moreover, physical attributes and playing positions are related to the magnitude of RAEs in both men's handball (Schorer, Cobley, Busch, Brautigam, & Baker, 2009) and men's rugby (Till et al., 2009). Whether there is a link between RAEs and playing positions in women's soccer has not been analyzed to date.

Given the relevance of RAEs and their potential for introducing a bias in talent identification, it is worth examining RAEs in the overall setting of Swiss women's soccer. Therefore, the purposes of this study were twofold: first, to examine the prevalence and size of RAEs at the different age and performance levels of Swiss women's soccer, and second, to identify if playing positions modify the prevalence and size of RAEs.

Methods

Participants

The Swiss system of talent identification, selection, and development is based on three levels of performance (Figure 1). The first level is a nationwide extracurricular program called *Jugend und Sport* (J+S), which is offered for all children interested in a specific sport. Soccer is one of 77 disciplines available. The minimum duration for a J+S course is at least 30 weeks per year with one training session per week. Every soccer training session has to last at least 60 minutes.

J+S contains $n = 6{,}157$ registered female soccer players ranging from 10 to 20 years of age, which is 1.4% of the female Swiss population ($N = 440{,}934$). The female Swiss population was defined as the number of live female births in Switzerland in the respective age groups. The second level is the national talent detection and development program of J+S. These players ($n = 1{,}067$) are assisted by licensed soccer trainers and are expected to train more than 400 hours per year (Swiss Federal Office of Sport, 2010). The Swiss Soccer Association and the Swiss Olympic Association jointly established the cut-off criterion for adoption into the program as 400 hours. All data for the Swiss population, J+S and the talent development program of J+S involve the 2009–2010 season. The national teams ($n = 167$) represent the third level. The inclusion criterion for a national team player was the selection to a Swiss national under-17 (U-17), under-19 (U-19), or the senior team (A team) in the 2007–2008, 2008–2009, and 2009–2010 seasons.

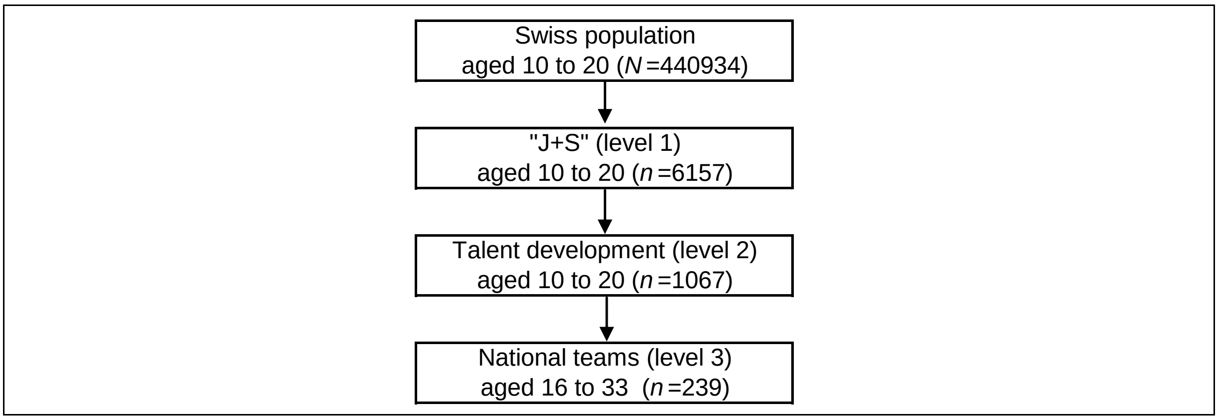

Figure 1. Overview of the different levels of selection in Swiss women's soccer.

In total, we examined the birth-date distributions of three Swiss national teams for each of three seasons (nine in total) in order to calculate the relationship between RAEs and playing positions. Comparisons were carried out between the datasets of the junior national teams, players in the talent detection (TD) program, all registered J+S players, and the entire Swiss population.

Procedure

All 6,229 female soccer players were grouped according to the month of the selection period. The birth month of each player was recorded to define the birth quarter (Q). The cut-off date for all soccer leagues in Switzerland is January 1st.

The year was divided into four quarters (Q1 represents January, February, and March; Q2 represents April, May, and June; Q3 represents July, August, September; and Q4 represents October, November, and December). The observed birth-date distributions of all players were calculated for each quarter. The expected birth-date distributions were recorded from the J+S database, where all players who participate in organized soccer activities are registered. Beforehand, the Swiss Youth Sport database was analysed in order to verify that there are no statistical differences between the birthdates of all registered J+S player's (aged 10–20 years) and all corresponding birth dates of the Swiss female population (aged 10–20 years). According to Delorme et al., (2010a) we used the distribution of J+S (all registered players) as a basis (expected distributions) to evaluate RAEs instead of the female Swiss population. If a biased distribution already existed among the entire population of registered players (J+S; level 1), the same pattern would arise among the elite (level 3) as well, and bias the conclusions drawn about RAEs among the elite.

From these original data, odds ratios (*OR*s) were calculated for Q1 versus Q4. All statistical analyses were carried out using SPSS 16.0. Chi-square tests were used to assess differences between the observed and expected birth date distributions. If the differences were significant then post hoc tests were used to determine the mean differences between the quarters. In addition, effect sizes were computed to qualify the results of the chi-square tests. The appropriate index of effect size is the phi coefficient (φ) if there is one degree of freedom (*df*), and Cramer's V (V) is appropriate if the *df* is above 1 (Aron, Aron, & Coups, 2002).

For the chi-square analyses, the magnitude of the effect size was measured using φ and V. According to Cohen (1977) and Cramer (1999), for $df = 3$ (which is the case for all comparisons of birth quarters), $V = 0.06$ to 0.17 described a small effect, $V = 0.18$ to 0.29 described a medium effect, and $V \geq 0.30$ described a large effect. An alpha level of $p < 0.05$ was applied as the criterion for statistical significance.

Results

Prevalence of RAEs in Swiss Women's Soccer

Significant RAEs were found already in the subgroup of all registered J+S players who were 10 to 14 years old (Table 1). The distribution showed a small but significant overrepresentation of Q1 elite players and a significant underrepresentation of Q4 elite players compared to the respective Swiss population. However, no significant RAEs were found for the 15- to 20-year-old age group of J+S players.

The analyses of talent development teams revealed similar findings as for the J+S players. There were significant RAEs in the 10- to 14-year-old age group and no RAEs in the 15- to 20-year-old age group. For all players in the 10- to 14-year-old age group, the chi-square and post hoc tests highlighted an overrepresentation of players born at the beginning of the selection year and a decreasing number of players born at the end of the year. For all national elite teams, no significant RAEs were identified.

The peak of the RAEs was found in the U-10 and the U-11 talent development teams, where 66.6% of the players were born in the first half of the year (Figure 2). This ratio is lower in the higher age categories, ranging from 59% to 49% in the U-12 to U-18 talent development teams.

Table 1. Birth-Date Distribution of the Swiss Female Soccer Population

Category	Q1	Q2	Q3	Q4	Total	χ^2	*p*	*OR* Q1/Q4	*V*	Effect
SP (10-20)	109682	111428	113838	105986	440934			1.03		
(%)	24.8%	25.3%	25.9%	24.0%						
J+S (10-14)	794	811	728	654	2987	16.08	< 0.001	1.21	0.04	no
(%)	26.6%	27.2%	24.4%	21.9%						
J+S (15-20)	781	856	831	774	3242	6.1	> 0.05	1.01	0.03	no
(%)	24.1%	26.4%	25.6%	23.9%						
TD (10-14)	135	123	119	73	450	16.9	< 0.001	1.85	0.11	small
(%)	30.0%	27.3%	26.4%	16.2%						
TD (15-20)	167	161	152	137	617	2.47	> 0.05	1.22	0.04	no
(%)	27.1%	26.2%	24.4%	22.3%						
U-17	20	29	23	15	87	4.7	> 0.05	1.33	0.13	small
(%)	23.0%	33.3%	26.4%	17.2%						
U-19	24	20	22	14	80	2.8	> 0.05	1.71	0.11	small
(%)	30.0%	25.0%	27.5%	17.5%						
A-Team	23	17	21	11	72	4.7	> 0.05	2.09	0.15	small
(%)	31.9%	23.6%	29.2%	15.3%						

Note. SP = Swiss population; J+S = Players of extracurricular soccer teams; TD = Players of talent development teams; *OR* = Odds ratio; *V* = Cramer's V.

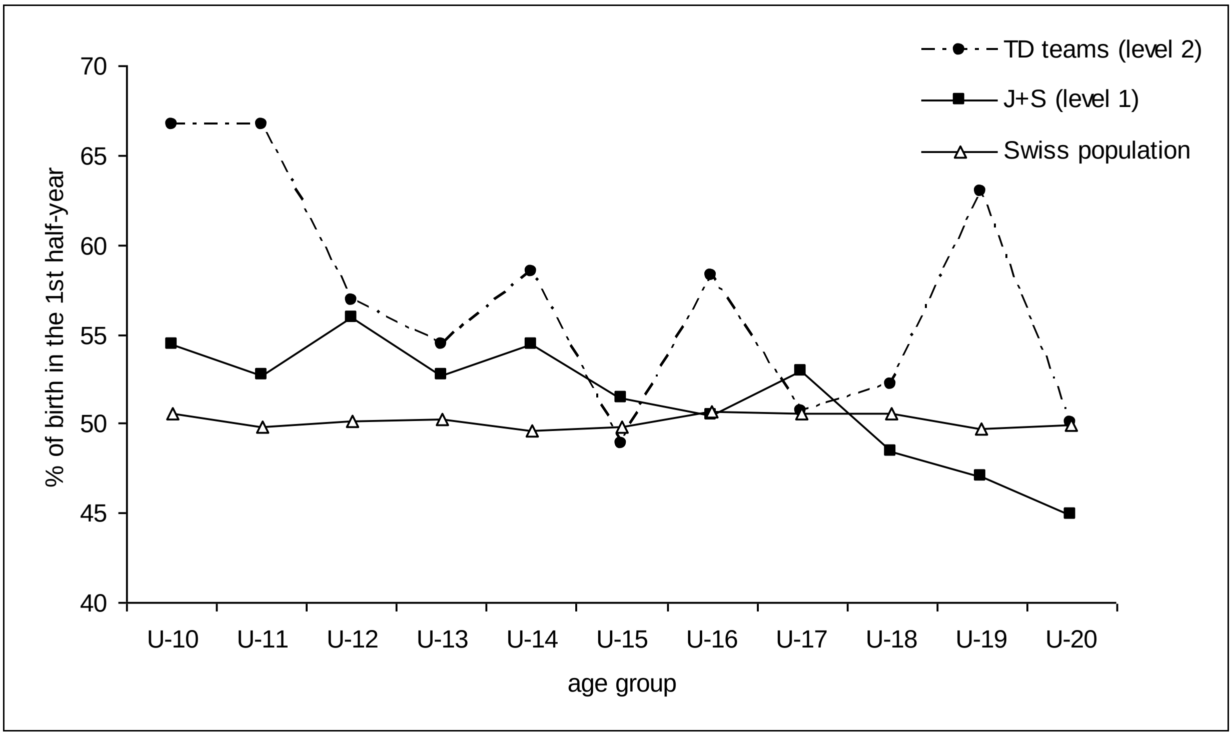

Figure 2. Distribution of births in the first half year of talent development teams (level 2) compared to the Swiss population and all registered J+S players (level 1).

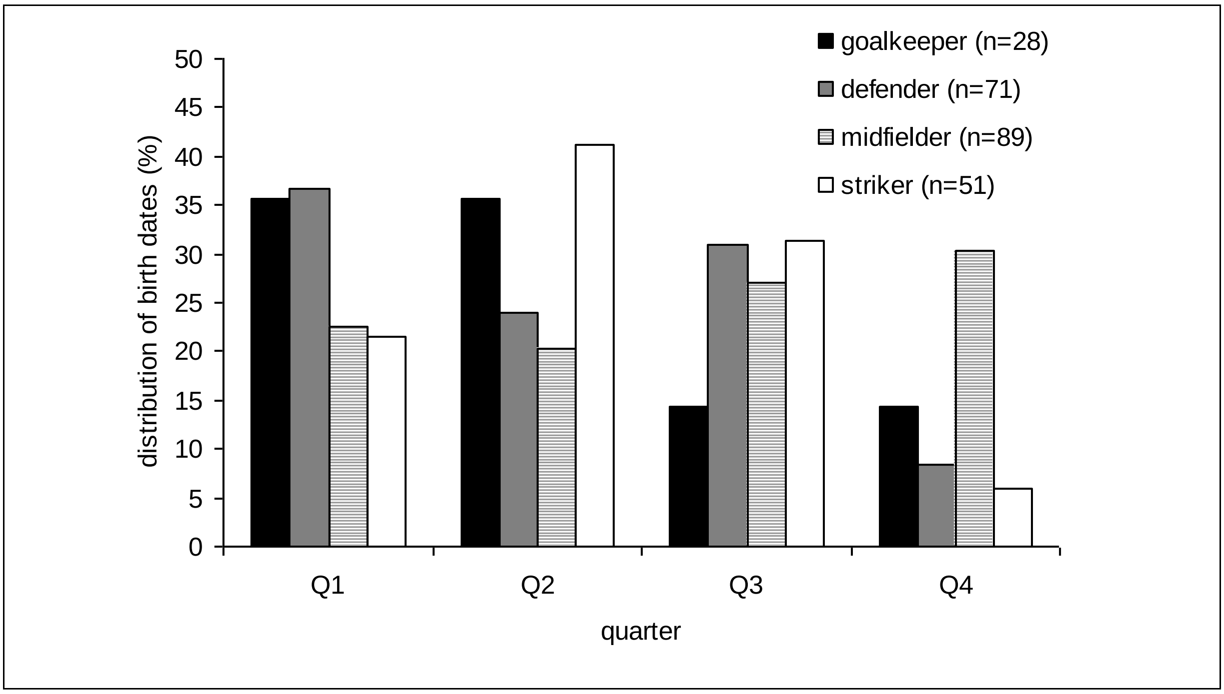

Figure 3. Distribution of playing positions and birth quarters in U-17 to A-teams (Level 3).

Playing Positions

The birth date distributions for playing positions in the national elite U-17 to A-teams are presented in Figure 3. Chi-square tests showed significant differences for defenders and strikers compared to the J+S distribution ($p < 0.05$). Defenders were overrepresented in Q1 (36.6%) and Q3 (31.0%), and underrepresented in Q4 (8.5%). Strikers were overrepresented in Q2 (41.2%) and Q3 (31.4%), and underrepresented in Q4 (5.9%).

In a second analysis, we calculated the distribution of birth dates between the different playing positions. Defenders and goalkeepers were significantly ($p < 0.05$) overrepresented in the beginning of the year compared to midfielders. The remaining comparisons were not significant.

Discussion

Prevalence of RAEs in Swiss Women's Soccer

Interestingly, the self-selected J+S players (Level 1, 10 to 14 years), which represent the respective regularly playing soccer population, already showed RAEs and differed significantly from the Swiss population's distribution. We found small but consistent RAEs in the 10- to 14-year-old age group of talent development players (Level 2). However no significant RAEs were found in the 15- to 20-year-old age groups at all levels (J+S, talent development and national level). Moreover, we demonstrated that playing positions are interrelated with the prevalence and size of RAEs in female soccer. In the present study, the defenders and goalkeepers showed significantly higher RAEs compared to midfielders.

In line with previous studies, no RAEs were detected in the highest selection levels of all female junior age categories (15- to 20-year-olds; Delorme et al., 2010b; Vincent & Glamser, 2006). A possible explanation might be that female anaerobic and aerobic characteristics, running speed and physical fitness performance reach a plateau shortly after menarche (Haywood & Getchell, 2001; Thomas, Nelson, & Church, 1991). Similar developments of gross motor skill performance, agility, jumping and kicking tests have been found for girls (Gabbard, 2000; Thomas & French, 1985). Therefore, some of the physiological benefits of being born early in the selection year might disappear in the 15- to 20-year-old age group. In fact, after menarche adolescent girls' athletic performance is poorly related to maturity status (Malina, 1994). Accordingly, late maturing girls frequently catch up with their peers who matured early and even produce superior athletic performances. In addition, late maturing girls generally have a more ectomorphic, linear physique with longer legs and relatively narrow hips, less body mass for their stature, and less adipose tissue (Malina, Eisenmann, Cumming, Ribeiro, & Aroso, 2004). In other words, early physical development is an advantage before and during puberty. However, early physical development acts as a socially constructed disadvantage for young women after puberty because a high relative age could facilitate their dropout from elite soccer (Delorme et al., 2010b). In addition, the physical characteristics needed for athletic performance are sometimes inconsistent with the stereotyped idea of an ideal female body (Choi, 2000). Traditionally, soccer as a contact sport has been considered gender-inappropriate for women. Researchers have argued that social pressures to conform to a socially constructed gender role, such as stereotyped ideas of femininity, could pressure early maturing girls to drop out of contact sports such as soccer, which may explain why the birth date distribution reveals no RAEs among elite players (Vincent & Glamser, 2006).

As pointed out, the self-selected J+S teams (level 1) in the 10 to 14 age group already showed small RAEs. In other words, girls born in the first half of the selection year are more likely to begin playing soccer compared with their younger counterparts. Those born in Q3 and Q4, probably because of their less advantageous physical and psychological attributes, show a kind of self-selection process before even trying to play soccer. One explanation could be that girls who mature early are generally taller and heavier, with more body mass for stature than late maturing girls (Baxter-Jones, Thompson, & Malina, 2002). This leads to athletic performance advantages early in puberty. It is important to note that, due to the possible self-selection (level 1), coaches of the talent development program (level 2) had to perform their selections using an unequally distributed pool of players, which could have increased RAEs in level 2.

In the present study, playing positions of all national players (level 3) were interrelated with the prevalence and size of RAEs in women's soccer. The defenders and goalkeepers showed significantly higher RAEs compared to midfielders. Recently, Schorer et al. (2009) showed that RAEs of male back court handball players on the left side are stronger than those on the right side. These results provide evidence that height, laterality and playing position affect the magnitude of RAEs in men's handball. This is in line with the observation that tall soccer players also tend to have an advantage, especially goalkeepers and central defenders (Di Salvo et al., 2007; Reilly, Bangsbo, & Franks, 2000). It can be speculated that Swiss coaches in women's soccer may also tend to select relatively older defenders and goalkeepers who are taller and more mature.

To optimize the talent development system in Switzerland further, the challenge seems twofold. On one hand, it seems important to include disadvantaged players due to RAEs in soccer activities at an early age. On the other hand, it is crucial to keep players involved in soccer after puberty ends.

Possible Solutions

Several solutions to reduce RAEs have been proposed in the literature. One solution is to establish "current" and "potential" teams: the "current" team contains the best players, both technically and physically, at the selection time, while the "potential" team contains players who are technically skilled, but who are lacking in terms of their physical development (Brewer et al., 1995). Barnsley and Thompson (1988) have suggested creating more age categories with a smaller bandwidth (e.g., six months rather than one year). This change would result in smaller RAEs and fewer physical differences between players within any specific age category. A single change in the selection date would result in an equal shift of RAEs (Helsen et al., 2000). Therefore, Grondin et al. (1984) recommended an alteration of the activity year's cut-off dates. A yearly rotation for the cut-off date might work, since all players would then experience the advantage of a higher relative age at some point in their soccer career (Hurley et al., 2001). One potential solution could be to change the mentality of youth team coaches (Helsen et al., 2000). Coaches should pay more attention to technical and tactical skills when selecting players, as opposed to over-relying on physical characteristics such as height and strength. Additionally, they should find a better balance between short-term success and a more process-oriented approach to instruction (Helsen et al., 2005).

The challenge for Switzerland will be to keep players who are physically or psychologically disadvantaged due to RAEs involved in the sport until they have fully matured. In the current Swiss system, players who are accepted on elite teams start benefiting quite early from receiving more support, a higher level of competition, increased training, longer playing times, more positive feedback and improved coaching. Alternatively, unselected players may tend to have lower self-esteem and show higher dropout rates (Helsen et al., 1998). Delorme et al. (2010a) illustrated that dropout rates result from two major processes. First, children born late in the selection year may be less likely to join a sport in which weight, height, or strength are seen as relevant for performance. It is important to note that the first phenomenon cannot be solved by federations reducing the RAEs. Second, those who are involved in a sport are more likely to drop out and have fewer chances to be selected.

The decrease in RAEs may substantially enhance performance at the elite senior level in the future, especially for Switzerland, which has a rather shallow talent pool due to the limited number of inhabitants. Interestingly, in the current Swiss coach education programme, only junior national level coaches are confronted with RAEs during their education. According to our data, the consequences of RAEs should be taught at all levels of coach education, particularly for coaches of talent development teams in the 10 to 14 age categories. Therefore, from our point of view, implementing rotating calendar cut-off dates and furthering the education of all soccer coaches may counteract future RAEs in Swiss soccer. Moreover, in Switzerland, talent identification and player development should be viewed as more long-term processes. In contrast to aspects of performance, assessments of skill and potential should be emphasised (Vaeyens, Lenoir, Williams, & Philippaerts, 2008). In any case, it would be a significant step forward for coaches and federations to select the teams with the highest potential in future elite soccer instead of the team with the highest chance of winning in the present (Helsen et al., 2000).

Main Findings and Conclusion

Based on the present data, we argue that small, but significant RAEs bias the participation and the selection process of women's soccer in Switzerland up to the age of 14 years. However, our results indicate that RAEs do not influence the talent identification process of Swiss national elite teams. The RAEs seem to be largest already in the U-10 and U-11 squads, where three-quarters of the selected players were born in the first half of the year. Additionally, higher RAEs were observed in defenders and goalkeepers compared to midfielders. To minimize RAEs in Swiss women's soccer, a systematic education for all soccer coaches regarding RAEs could be established

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The Authors

Michael Romann is a post-doctoral research associate at the Swiss Federal Institute of Sport Magglingen. His research interests lie primarily in the area of talent identification and talent development.

Jörg Fuchslocher is the head of training science at the Swiss Federal Institute of Sport Magglingen. His main research focus is the area of skill acquisition, talent identification and expert performance.