

The influence of relative age on the selection of players for elite events in junior football

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Abstract

The aim of this research is to expand knowledge about the influence of relative age on the selection of players for elite junior football events (UEFA European Championship, Confederation of African Football, ASEAN Football Federation Championships, UEFA Youth League). Among elite clubs, we have included national teams for the UEFA European Championship U19, U17 2022, men and women, UEFA Youth League in the years 2019/2020, 2021/2022, 2022/2023, CAF U20 2021, AFF U19 2022. In individual teams, we determined the months in which the players were born and then assigned them to the respective quarter. In total, we tracked 4048 players from 158 teams in categories from U17 to U20 at national and club level. To obtain the necessary data, we used the basic mathematical-statistical method Chi-square (goodness-of-fit test). Among men, we found the smallest differences between the first and last quarter, in the number of players born in each quarter of the calendar year in CAF 2021. This means that the influence of relative age on the inclusion of a player on the roster in this age category disappears. We found the biggest quarterly differences in all years of UEFA Youth League 2019/2020, 2021/2022, 2022/2023. We also compared two women's championships, namely EURO WU17 and WU19. In this case, there was a difference in the number of female players born in one month, especially in the first and second quarters of the calendar year. Based on the results, we recommend that coaches utilise somatic acceleration (biological age) as a selection criterion during the initial screening of talented players along with other factors when assessing the appropriateness of including a player on the team roster.

Key words: youth football, relative age, selection of players, elite championships

Introduction

Researchers in various fields (e.g. education, epidemiology and sports) have proven that the social policy of annual age grouping, which is most often applied in school and sports, interacts with the characteristics of the developing individual (i.e. chronological relative age). This indirectly creates a developmental phenomenon that benefits some and disadvantages others (Baker, Schorer, & Cobley, 2010). Categorizing by age is natural in certain areas of our society, such as school, sports or clinical psychology (Gutiérrez Díaz del Campo, 2013). Gutiérrez, Viciedo, González-Villora, & Jodán (2010) state in their study that in youth sports, players are grouped by age, a selection criterion used to ensure equal conditions for development. However, due to the existence of inter-individual differences regarding growth and maturity, significant complications can arise both in infancy, but more prominently in adolescence.

Sport performance arises as an adaptive and dynamic outcome of the interplay between the context (rules, characteristics of the opponent, etc.) and the individual characteristics of an athlete (anthropometry, physical abilities, technical-tactical level and psychological state) (Glazier, 2010).

In youth football competitions, players are arranged chronologically by age into two or three levels according to individual categories. Children born shortly before the end of the calendar year (31st December) suffer as a result of being placed in the same age categories as their peers, who were born in the first three months of the same year. This age difference between individuals in the same age group is referred to as relative age, and its consequence is known as the relative age effect (RAE) (Musch & Grondin, 2001), which is associated with youth and adult sports performance (Wattie, Cobley, & Baker, 2008). The maximum relative age difference is almost 1 year (Musch & Grondin, 2001).

There are a large number of studies in which authors investigate the factors that influence the development and progression of talented players in various sports.

The relative age effect in football means the predominance of people born in the first months of the year to the disadvantage of individuals born later on in the year. The relative age effect (RAE) refers to the less frequent presence of people born in the last months of the calendar year from which the new age category is classified. RAE occurs in various fields, while sport is an area in which this effect manifests itself somewhat more extensively (Pérez-González, Fernández-Luna, Vega, & Burillo, 2018).

The term relative age effect refers to the consequences of physical and psychological differences that may exist between those born earlier and later in the same calendar year (Yagüe, Molinero, Ángel, & Redondo, 2020).

From a morphological, psychological and physiological point of view, the advantages resulting from earlier dates of birth often mean that, especially in the junior categories, these relatively older individuals are perceived as athletically talented (Bozděch, Agricola, & Zháněl, 2019).

Trainers tend to choose more advanced or more physically fit athletes who have the same chronological age because they meet the high-performance requirements. Based on this, young athletes of both sexes born earlier, with advanced development and an increased state of maturity, are expected to perform better than those born in the last quarter. In addition, older and more talented athletes are exposed to more training experience (skills, tactics and training load) as well as an advanced cognitive environment, giving them opportunities for better results (Ntozis et al., 2021). The process of identifying and selecting talents ought to be based on a multidimensional view so as to avoid overlooking talent as not all athletes who shine at the beginning of their career continue to do so in adolescence (Gómez-Lopez, Sánchez, Sánchez, & Turpín, 2017). The selection of youth players according to their current performance creates an effect that subsequently leads to inefficient talent selection (Augste & Lames, 2011).

Nowadays, the structures of football competitions are designed based on date of birth, so the relevance of RAE remains important, especially in sports where anthropometric characteristics are important (Alcaraz, Da Costa, & Batista, 2022).

Yagüe et al., (2020) found in their research that in all analysed leagues (115 UEFA and 110 COMNEBOL), with the exception of the English Premier League, there was an overrepresentation of individuals born in the first months of the year. Their study therefore supports the conclusion that the effect of relative age is prevalent and exists in international football.

Materials and methods

The goal of the research is to illustrate how relative age affects the selection of youth players for national teams or club teams for the final tournaments. We investigated the differences in the number of players of different age categories of elite football clubs in terms of the quarter in which they were born. We also investigated the differences between the European (also in terms of gender), African and Asian championships. Among the elite clubs, we included representative selections for the UEFA European Championship U19 (n=163 men, n=160 women), U17 (n=321 men, n= 134 women) 2022, UEFA Youth League 2019/2020 (n=931), 2021/2022 (n=919), 2022/2023 (n=852), CAF U20 2021 (n=344), AFF U19 2022 (n=224).

In individual teams, we determined the months in which the players were born and then assigned them to the respective quarter. In total, we tracked 4048 players from 158 teams in categories from U17 to U20 at national and club level.

We obtained information about the dates of birth of individual players from the official websites of the organizers of specific championships (UEFA, CAF, AFF) and from the transfermarkt web portal. We recorded the results ($\neq 0.01$) in a previously prepared collection sheet. We expressed the representation of players in individual quarters as percentages in figures, and when determining statistical significance, we used the mathematical-statistical method Chi-square (test of goodness of fit) to calculate relational analysis. Subsequently, the monitored data from rosters of individual teams from each championship was analysed using comparative approaches.

The results

Using comparative analysis and the mathematical-statistical Chi-square method (test of goodness of fit), we demonstrated the connection between the month of birth and the choice of players for selected football tournaments.

Table I - Number of players born in individual quarters according to individual championships

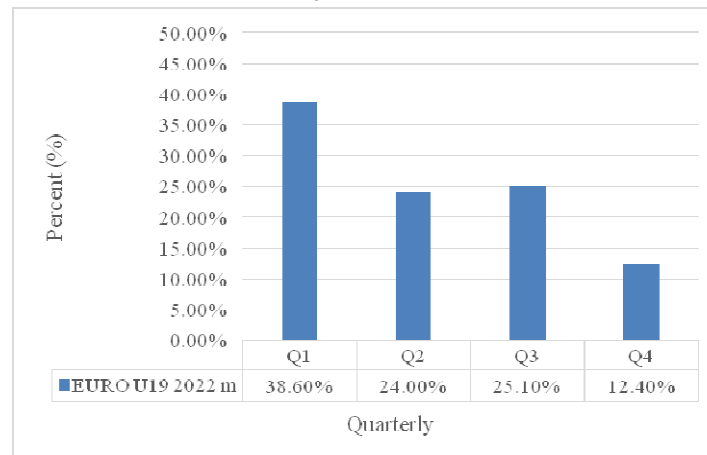
	<u>1st quarter</u>	<u>2nd quarter</u>	<u>3rd quarter</u>	<u>4th quarter</u>	Σ (n)
EURO U19 2022	63 (38.6%)	39 (24%)	41 (25.1%)	20 (12.4%)	163
EURO U17 2022	140 (43.6%)	83 (25.9%)	61 (19%)	37 (11.5%)	321
EURO WU19 2022	43 (26.9%)	57 (35.6%)	34 (21.3%)	26 (16.3%)	160
EURO WU17 2022	47 (35.1%)	33 (24.6%)	32 (23.9%)	22 (16.4%)	134
LM Youth 2022/23	370 (43.4%)	234 (27.5%)	137 (16.1%)	111 (13.1%)	852
LM Youth 2021/22	410 (44.6%)	230 (25%)	153 (16.6%)	126 (13.7%)	919
LM Youth 2019/20	401 (43.1%)	262 (28.1%)	161 (17.3%)	107 (11.5%)	931
CAF U20 2021	99 (28.6%)	90 (26.1%)	63 (18.4%)	92 (26.8%)	344
AFF U19 2022	80 (35.7%)	63 (27.9%)	30 (13.5%)	51 (22.8%)	224
Σ (%)	40.8%	27%	17.6%	14.6%	(100%) 4048

A total of 4048 players were involved in the research, of which at the EC U/WU19 (n = 163 men, n = 160 women), U/WU17 (n = 321 men, n = 134 women) 2022, in the UEFA Youth League 2019/2020 (n = 931), 2021/2022 (n = 919), 2022/2023 (n = 852), in the competitions CAF U20 2021 (n = 344), AFF U19 2022 (n = 224). The results indicate that there is a dominance of players born in the first quarter in almost all competitions, except CAF U20 2021 and EURO WU19 2022. As many as 1653 players (40.8%) were born in the first quarter out of 4048 (100%), 27% of the monitored players were born in the second quarter, 17% of the monitored players in the third and 16.1% in the last, fourth, quarter.

EURO U19 2022

The total number of nominated players for EURO U19 2022 in the category of older teenagers was 163. We divided the players nominated for this tournament according to the quarters in which they were born. Comparing the first quarter to other quarters, there is a decrease in the number of players included. More specifically, the difference in the number or percentages is more than three-fold between the first and last quarter.

Figure I - percentage comparison of the number of players born in individual quarters at EURO U19 2022

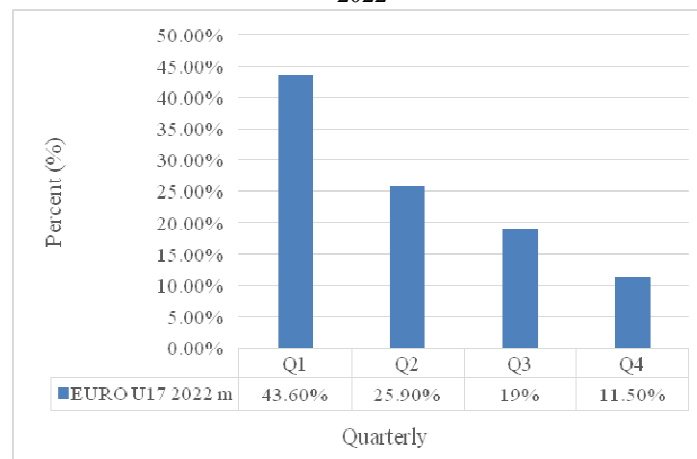


The differences between the numbers of players born in individual quarters are statistically significant ($\chi^2_{(3)} = 22.79$; $p \leq 0.01$).

EURO U17 2022

The total number of nominated players for EURO U17 2022 in the category of younger teenagers was 321. We assumed a gradually decreasing number of players born in the second half of the calendar year. We hypothesised that in this category the differences would be of greater significance. This was expected to be a prevalent phenomenon especially between the first and last quarters as players in the category of younger teenagers (approx. 16 years old) are in the adolescent period from the development point of view, the course of which is very individual.

Figure II - percentage comparison of the number of players born in individual quarters at EURO U17 2022

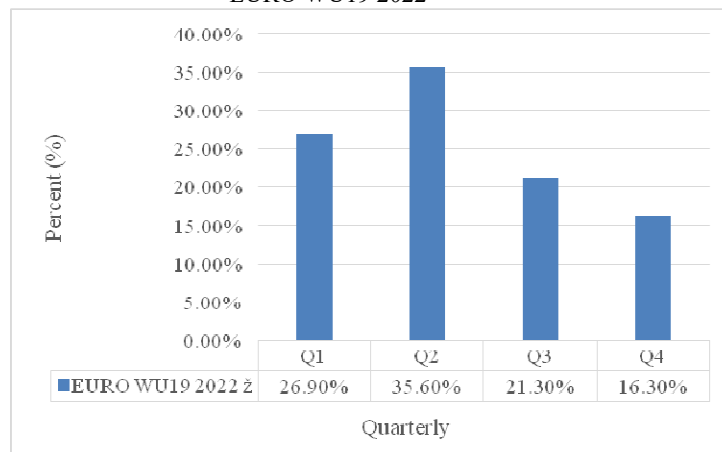


The differences between the numbers of players born in individual quarters are statistically significant ($\chi^2_{(3)} = 72.51$; $p \leq 0.01$).

EURO WU19 2022

The total number of nominated players for EURO U19 2022 in the category of older teenagers was 160. In this category, the dominance of players born in the first quarter was not manifested, but the second quarter became dominant. Although we assumed statistically less significant differences in this category, after calculating the relationship analysis in the WU19 category, the differences are statistically significant ($\chi^2_{(3)} = 13.25$; $p \leq 0.01$).

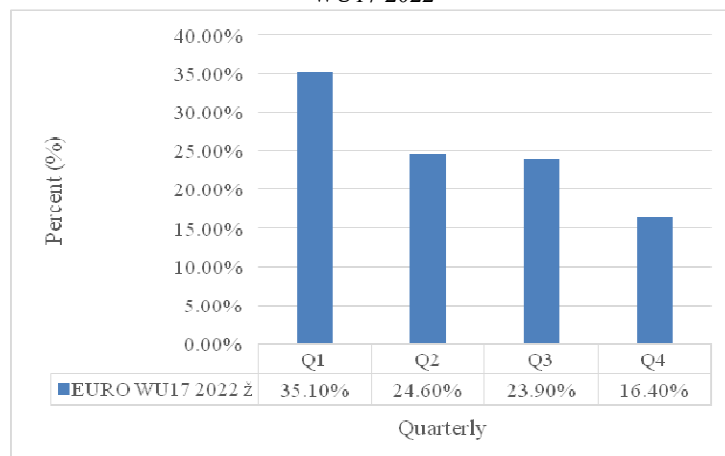
Figure III - percentage expression of the number of female players born in individual quarters at EURO WU19 2022



EURO WU17 2022

The total number of nominated female players for EURO U17 2022 in the category of younger teenagers was 321. In this instance, most female players were born in the first quarter. The second and third quarter showed comparable numbers (identical percentage values) in terms of each other however still showed a decrease in relation to quarter one. The most notable difference arose between the first quarter and the last quarter as the latter had approximately half the number of players of the first quarter. Similarly to the previous category (WU19), we did not expect statistically significant differences between individual quarters, which may be a consequence of the smaller width of the player base in women's football. In this case, we are often not talking about selection, but about the recruitment of talented youth, from whom national team coaches draw and suppress the overall influence of RAE. The differences between individual quarters are statistically significant (but at a lower level of statistical significance) ($\chi^2_{(3)} = 9.46$; $p \leq 0.05$).

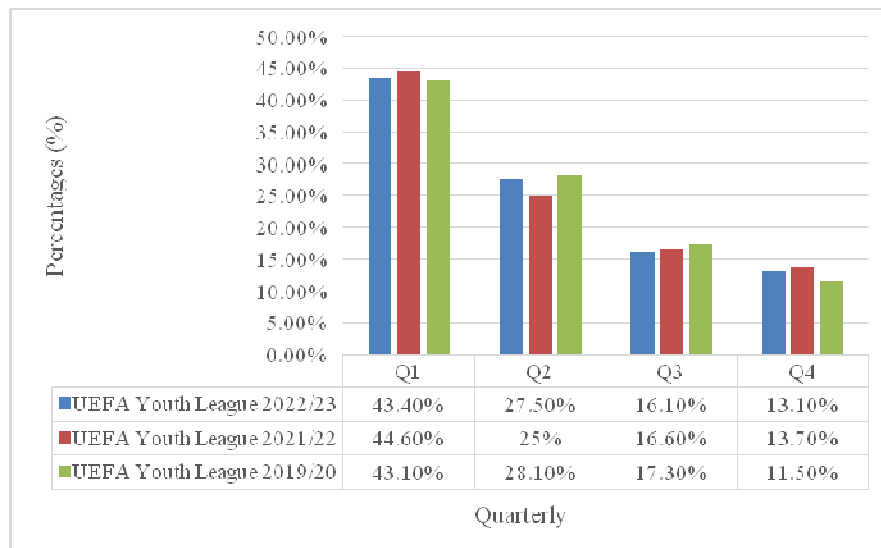
Figure IV - percentage expression of the number of female players born in individual quarters at EURO WU17 2022



UEFA Youth League 2022/2023, 2021/2022, 2019/2020

The total number of nominated players on the club rosters of teams that have been included in UEFA Youth competitions League 2022/2023 ($n = 852$), 2021/2022 ($n = 919$), 2019/2020 ($n = 931$) in the under-19 category was 2702. When comparing the differences in the number of players in these competitions born between the first and last quarter, we found that this difference (more than 3 times) is the largest among all the competitions we selected (following figure).

Figure V - percentage expression of the number of players born in individual quarters included in the rosters of teams playing in UEFA Youth competitions League 2022/2023, 2021/2022, 2019/2020

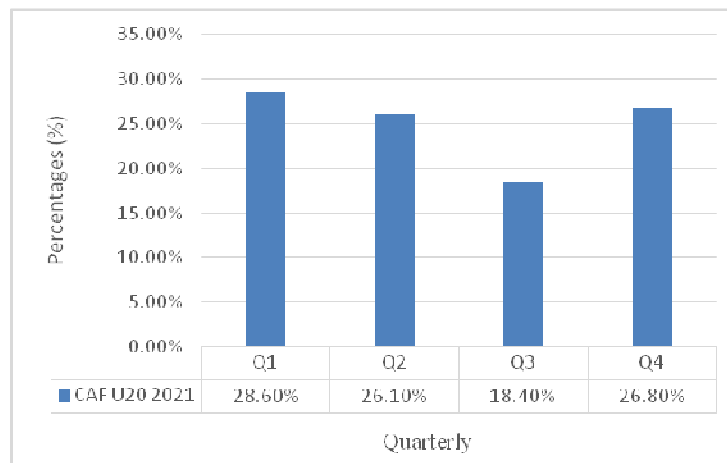


Differences between the numbers of players born in individual quarters-
UEFA Youth League (2022/2023) are statistically significant ($\chi^2_{(3)}=193.75$; $p \leq 0.01$).
UEFA Youth League (2021/2022) are statistically significant ($\chi^2_{(3)}=213.91$; $p \leq 0.01$).
UEFA Youth League (2019/2020) are statistically significant ($\chi^2_{(3)}=215.34$; $p \leq 0.01$).

CAF U20 2021

The total number of nominated players for the CAF 2021 in the under-20 category was 344. In this case, we assumed minor or no statistically significant differences in individual quarters. The differences between individual quarters are statistically significant ($\chi^2_{(3)}=8.72$; $p \leq 0.05$). This phenomenon appeared in men's competitions only on the African continent, which may be the result of a different way of selecting talents in contrast to Europe but also by different anthropometric characteristics of African players, which are conditioned by the genetic specificities

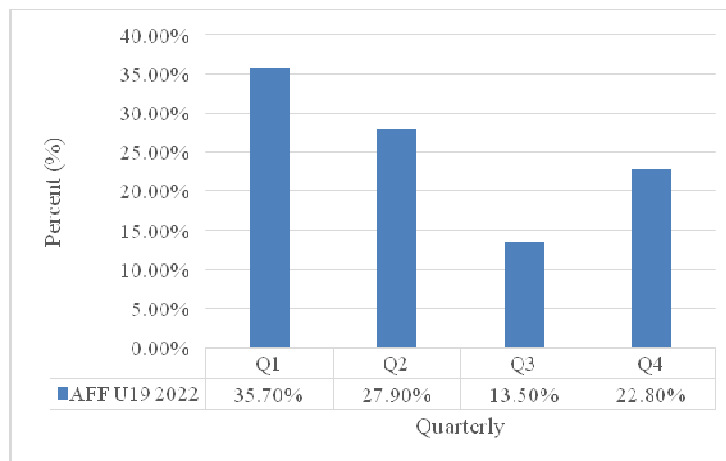
Figure VI - percentage expression of the number of players born in individual quarters at CAF U20 2021



AFF U19 2022

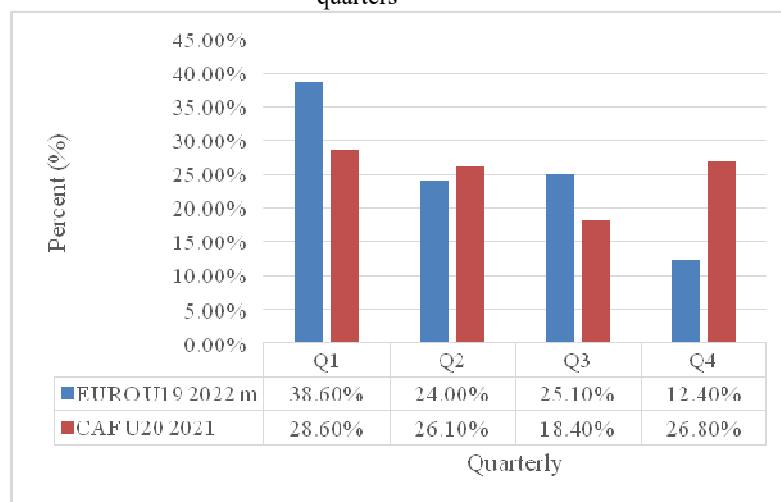
The total number of nominated players for AFF 2022 in the under-19 category was 224. The differences between individual quarters are statistically significant ($\chi^2_{(3)}=23.68$; $p \leq 0.01$).

Figure VII - percentage expression of the number of players born in individual quarters at AFF U19 2022



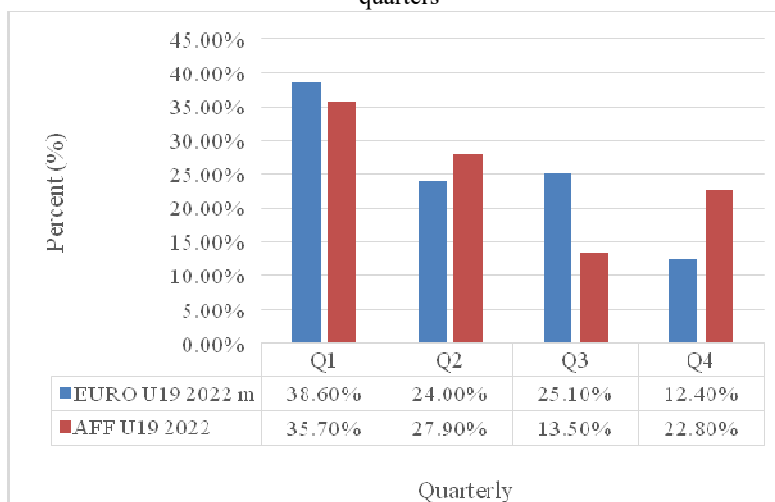
Comparison of monitored indicators between EURO U19 2022 and CAF U20 2021

Figure VIII - mutual comparison of monitored indicators at two selected tournaments in individual quarters



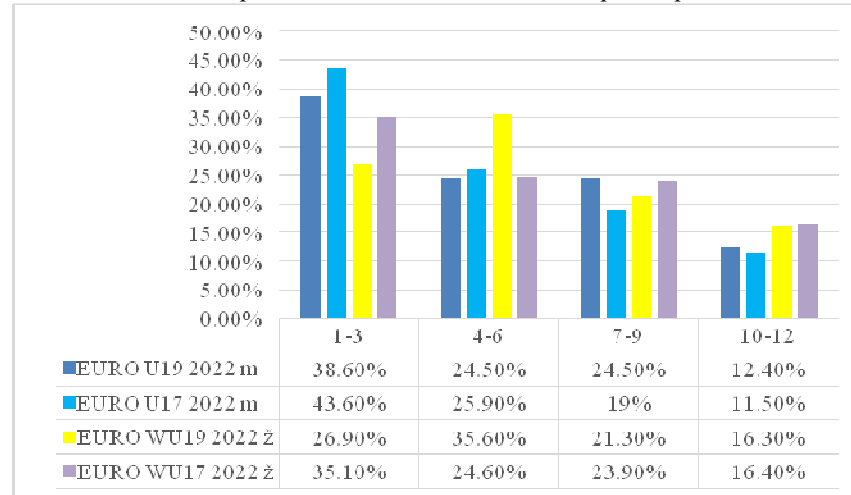
Comparison of monitored indicators between EURO U19 2022 and AFF U20 2022 tournaments

Figure IX - mutual comparison of monitored indicators at two selected tournaments in individual quarters



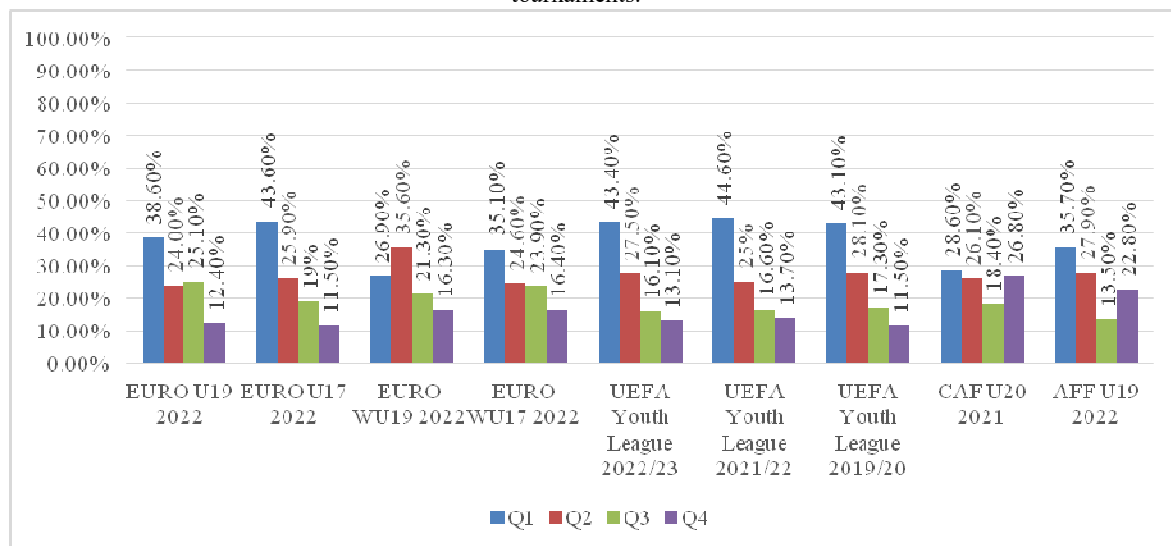
Comparison of EURO U19/WU19 and EURO U17/WU17 2022

Figure X - head-to-head comparison of the number of players born in each quarter in the men's and women's European Under-17 and Under-19 Championships in 2022



Overall comparison of monitored indicators at selected tournaments

Figure XI - percentage expression of the number of players born in individual quarters in all selected tournaments.



Discussion

We show the influence of relative age on the number of players born in individual quarters included in the squads of elite football teams at national and club level in several age categories. We included 4048 players from a total of 158 teams in the research. The research was focused on youth categories. We monitored the selected indicators in categories from U17 to U20 (WU17, WU19) at a total of 9 championships. The total number of players involved by category was as follows EC U/WU19 (n = 163 men, n = 160 women), U/WU17 (n = 321 men, n = 134 women) 2022 men and women, UEFA Youth club tournaments League 2019/2020 (n = 931), 2021/2022 (n = 919), 2022/2023 (n = 852), CAF U20 2021 (n = 344), AFF U19 2022 (n = 224).

Barnsley, Thompson, and Leagault (1992) observed the effect of relative age on the inclusion of players on the rosters of teams at the U17 and U19 World Championships in 1989 and the effect of relative age in the senior category at the World Cup in 1990. In the youth categories, they found statistical significance that confirmed at the 1% level of statistical significance ($p < 0.01$). This effect was not confirmed in the senior category. The topic of relative age was further addressed by Augste & Lames (2011), who observed the connection between relative age and the success of German elite soccer teams under 17 years of age. In their research, there was a significant correlation between relative age and the success of German soccer teams ($n=41$). Therefore, it appears that the selection of early-born athletes can be an important aspect of success in youth soccer. Gutierrez et al. (2010) investigated the influence of the relative age of young Spanish soccer

players at the amateur and professional level. Their research showed that the influence of relative age was greater in elite teams than in amateur ones. This was probably due to more careful selection of talent in elite teams (and more pressure on coaches to obtain better results) than in amateur teams.

Deprez, Vaeyens, Coutts, Lenoir, & Philippaerts (2012) dealt with the relative age study on the influence of players' birth month on anthropometric characteristics. They estimated biological maturity and their performance through the performance of 1606 elite Flemish youth soccer players (U10-U19) in Yo-Yo Intermittent Recovery Test. Overall, more players were born in the first quarter (37.6%) compared to the last quarter (13.2%). However, the results did not show any significant differences in the anthropometric variables and performance of the Yo-Yo IR1 test players born between quarters. There was a trend that players born in the 1st quarter were taller and heavier than players born in the 4th quarter. Steingröver, Wattie, Baker, Helsen, & Schorer (2017) pointed out the composition of player teams at top events held between 2007 and 2015 in the U17 category. The study included players who took part in the U17 World Cup in Korea 2007, Nigeria 2009, Mexico 2011, the United Arab Emirates 2013 and Chile 2015. In all the monitored championships, statistically significant differences were found between the numbers of players born in individual quarters ($p < 0.01$). Their research shows that players born later in the year are less likely to participate in a top event. Mujika, Vaeyens, Matthys, Santisteban, Goiriena, & Philippaerts (2009) dealt with the difference in team composition (in terms of the number of players born in individual quarters) in the Athletic Bilbao club and school teams. In the categories U11 - U14, of the 4382 players who were registered in clubs located in the Basque professional club region, 28.6% of players were born in the first quarter. In the sample of 189 footballers from U11 - U18 selected for the academy of the elite club, there were up to 46.6% of players born in the first quarter. Relative Age Effect (RAE) in the Youth Champions League (UEFA Youth League) in the U17, U19 and U21 categories and the senior Champions League were additionally investigated by González-Víllora, Pastor-Vicedo, & Cordente (2015). They found that in youth categories, the number of players born in the first months of the calendar year is significantly higher ($p < 0.01$) than the number of players born in the months of the second half of the year. The greatest impact of RAE was recorded in the U17 category ($n = 145$), compared to the remaining age categories (U19; $n = 144$, U21; $n = 184$). The total number of players included in the study was 841, in the years 2011-2012. Statistical significance was not demonstrated in the senior category of soccer players ($n = 368$) playing in the Champions League ($p > 0.05$). Among the teams that played the final stages of the competitions (quarter-finals, semi-finals and finals), they observed a higher representation of players born in the first half of the calendar year, with the exception of the Portugal U19 selection. This may indicate that players who are born earlier may be more successful in elite sports, but the results are influenced by the vast majority of youth included in the research.

If we compare the results of our research with prior research, we can observe the dominance of players born in the first three months in clubs that played in the UEFA Youth League. In our research, the biggest difference between the first and last quarter in terms of the number of players born in the mentioned quarters was also demonstrated in the youth Champions League across all monitored years. We can compare the research of Steingröver et al. (2017), where they also confirmed high statistical significance at the U17 World Championship 2007-2015 between the number of players born in individual quarters ($p < 0.01$). If we compare the dominance of players (playing in Europe) born in the first quarter in the aforementioned studies and our results with the quarterly age distribution of players playing on the African continent, clear differences are visible (see figure X). In Africa, the distribution of players' birth dates was noticeably more even. We could attribute this phenomenon to talent selection systems (e.g. Europe) where players born in the first three months of the calendar year are preferred. That is, in Europe, young players are often selected according to biological, skeletal and anthropometric conditions (compared to team sports players). These players often end their sports career after two years, which can be caused by the advantage resulting from the date of their birth (Figueiredo, Goncalves, Coelho e Silvia, & Malina, 2009). Furthermore, a factor of genetically determined physical predispositions of African players. Similarly, we compared players born in individual quarters with players of teams playing in Asia and Europe, the difference in the number of players born in the first quarter was approximately 3% (EURO U19 38.7%, AFF U20 35.7%), in the latter case there was a difference of 10.4% (EURO U19 22.8%, AFF U20 12.4%) (see figure XI). If we compare the differences in the number of players born in the last quarter for EURO U19 and CAF U20, we find that the difference in the last quarter is 14.4% (EURO U19 = 12.4%, CAF U20 = 26.8%). We also analysed two women's youth tournaments EURO WU17/19 2022. In this case, the predominance of players born in the first quarter was confirmed only in the U17 category. However, the extent of the influence of relative age in women's football can be questioned, since the size of the player base is incomparably smaller than in the boys' age category. On the basis of which we often do not talk about the targeted selection of talents (according to the selection criteria), but rather about the recruitment of players, which is a recurring mistake of coaches and clubs. Romann, Rössler, Marie, & Faude (2018) showed in their results that popular sports, which include football, show a higher influence of RAE. The study included 18,859 athletes in all sports of the national Swiss talent development program (70 types of sports). They compared the impact of RAE between men and women, where the impact of RAE was shown to be greater in men than in women. A growing body of research shows that the effect of relative age in sport is a worldwide phenomenon and that it exists in many, but not all, competitive sports.

Conclusion

Our research pointed to statistically significant differences in the number of players born in individual months of the calendar year (Q1-Q4). The results showed the most obvious differences when we compared players playing in Europe and in Africa. We could attribute this fact to different criteria for selecting talented youth or what coaches identify as precocious talent can be explained as premature physical maturity taking advantage of the RAE. We noticed the biggest differences in the first or in the last quarter (see figure X). We compared two EURO championships WU17 and WU19. In this case, there was a difference in the number of female players in individual months, especially in the first and second quarters. We believe that the influence of RAE in women's youth football is less significant. This is probably a consequence of a smaller player base, i.e. coaches have less options when selecting talented youth. Calendar (mainly January, February, March) and sports age have a demonstrable influence on the selection of talented players for teams, but this influence is smaller for African players and in youth female categories. Our hypotheses were confirmed, but there were quarterly differences in the percentage of players from the point of view of the continents. In conclusion, we can state that the magnitude of RAE's influence on the selection of players for elite tournaments is different from the point of view of the continents. However, we can consider that the choice of the appropriate method(s) of selecting sports talent is questionable. Pubescent potential is constantly changing during adolescence, so individuals talented in one area can eventually become talented in something completely distinct, or their talent can be lost if not properly developed (Simonton, 1999). Some studies show that a preliminary determination of these variables is not even possible due to their instability (Blanksby, Bloomfield, Elliot, Ackland, & Morton, 1986; Bloomfield, Blansby, & Ackland, 1990).

Based on our findings, we recommend in training practice:

- the initial selection of talented youth should not be based on the current performance of the players, but it is necessary to assume an increase in the performance of smaller later born players,
- in subsequent researches, to a greater extent focus on intercontinental differences in the influence of RAE on the selection of players for elite football events,
- the predominance of players born in Q1 (or in the first half of the year) may be influenced by the fact that coaches in junior categories in elite competitions include in their squads players who have a temporary biological advantage resulting from their date of birth (not only from talent) and, on the contrary, do not select they do not include players born in Q3-Q4 who do not yet have similar level of biological maturity,
- to inform coaches about the facts mentioned above, about the influence of RAE when including players in junior competitions on team rosters.

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