Relative Age Effect in Russian Elite Hockey

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Abstract

Bezuglov, E, Shvets, E, Lyubushkina, A, Lazarev, A, Valova, Y, Zholinsky, A, and Waśkiewicz, Z. Relative age effect in Russian elite hockey. *J Strength Cond Res* 34(9): 2522–2527, 2020—A considerable amount of literature has been published on relative age effect (RAE) in many sports; however, only a few studies have investigated this phenomenon in European elite ice hockey. The objective of this research was to study RAE prevalence in Russian elite ice hockey, which for years has been holding leading positions in global ice hockey. To estimate RAE prevalence, birthdates of recruits of leading ice hockey academies, players of the leading junior and adult teams, and most successful Russian-born National Hockey League (worlds' strongest ice hockey league) players were identified ($n = 2,285$). A high prevalence of RAE was identified. The number of players born in the first half of the year was higher than those born later in the year—65.5 and 34.5%, respectively. The RAE prevalence was high among all age groups of recruits of the leading Russian hockey academies and junior teams. In contrast to junior hockey, more players born in the fourth quarter of the year were identified in elite adult teams. The high prevalence of RAE in Russian hockey might be explained by the fact of a high level of competition among young players during recruitment to hockey academies. Moreover, the coaches aim to achieve immediate progress, thus selecting more mature players who are better physically developed. However, "later-born" are widely present in elite adult ice hockey leagues.

Key Words: ice hockey, Russian ice hockey, date of birth

Introduction

The term "relative age effect" (RAE) is used to describe an advantage in sports performance of children, born in the first half of the year ("early born") in comparison to those born later in the year ("later born") (7). The prevalence of RAE is explained by the physical and mental advantages of children born in the first months after the entry date in their selection year. It is most common in sports and education, where children are selected according to their chronological age (7). The most common entry date in sports is on January 1. Since the group distribution in Russia takes place all year round, starting on January 1 and ending on December 31, the players born in the first 6 months of the calendar year are considered "early born." In many sports, there is a disproportion in the date of birth distribution with more children having been born during the first half of the year. For instance, every Russian junior sports team comprises children born during January-February, who are 8–11 months older than those born during October-December, later in the year.

Relative age effect in sports was first reported in the 1980s in Canadian hockey. Barnsley et al. demonstrated that players born in October to December are less likely to play in junior hockey teams and are less likely to play for "top tier" teams (6,24). To date, several studies have demonstrated RAE in different sports, including soccer, basketball, and tennis. Edgar et al. described the birthdate distribution of 448 elite senior tennis players and 476 elite junior tennis players. They demonstrated a significant season of birth bias among elite senior players, with 58.9% being born in the first 6 months of the year. They also showed a season of birth bias among elite junior players, with 59.5% being born in the first 6 months of the year. This was considered a significant difference, associated with the cutoff date for the junior competition year.

The phenomenon was observed in male and female players, as well as in players from different world regions (12). Rubajczyk et al. identified RAE in young Polish male ($n = 3,849$) and female ($n = 3,419$) basketball players aged 14–22 years competing in the elite games of the Polish Junior Championships. The distribution of birthdates, body height, players match performance, and the results of teams participating in championships between 1994 and 2003 were identified. The greatest disproportion in the distribution of dates of birth was found in the U16 group of boys, with 71% born in the first half of the year (27). González-Víllora et al. identified the existence of RAE in European soccer players. Elite soccer players ($n = 841$) who were subjects in the UEFA European Soccer Championship in different categories (Elite, U-21, U-19 и U-17) were included in the study. However, RAE was not evident in the professional teams analyzed. However, it was present in the 3 lower categories analyzed (junior categories), with its influence being more significant on younger age categories (U-17) (17). Helsen et al. considered potential asymmetries in the birthdate distributions of junior soccer players across 10 European countries ($n = 2,175$). They examined the birthdates of players representing national junior teams (NJTs) in international competitions and analyzed the birthdates of players representing professional club teams in international junior tournaments. The authors show an overrepresentation of players born in the first

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quarter of the selection year (from January–March) for all the national junior selections for U-15 to U-18 age categories (19). In a meta-analysis by Cobley et al. (8), the authors demonstrated that RAE is most prevalent at the regional and national levels in highly popular sports involving adult (aged 15–18 years) male subjects.

Most studies evaluating RAE are done on North American hockey. Most of them demonstrate RAE, but its prevalence varies greatly. Wattie et al. investigated the relationship between relative age and performance at the elite level. They collected the year and month of birth for males and female players ($n = 4,500$). Players' birthdates were organized by month into quartiles (January–March, Aprir–June, July–September, and October–December). Analyses revealed RAE in the National Hockey League (NHL) players born after 1956, and no RAE was observed among birth quartiles in elite women players (30). Baker et al. showed significant RAE in 1,013 players drafted to play in the NHL between 2000 and 2005 (5). Parent-Harvey et al. examined birthdates of NHL players from 2011 to 2012 season ($n = 748$). The birthdates were categorized into either quarters or half-years. They found a significant difference when comparing birth halves. The actual birth half numbers were 424 for half the first half of the year and 324 for the second half. However, no RAE was identified according to birth quarters (25). Wire et al. examined the prevalence of the RAE among 660 Canadian female ice hockey players. They identified a higher proportion of players born in the first half of the year (60%) as compared with the second half (40%). They anticipated that the increasing growth and popularity of women's ice hockey will result in the RAE becoming even more pronounced at all levels of participation (31).

Only few studies have investigated RAE in European elite ice hockey. No RAE was observed for Swedish players (21). Authors assume that RAE's absence in the Swedish players may reflect lower subject number, competitive level, and sociocultural support, as well as greater variation in skill level (21). Stenling et al. in another study examined RAE in Swedish women's elite and junior elite ice hockey. Relative age effect was present in all age groups, from the youngest players (5–6 years) to the elite players. The elite and junior elite sample showed RAE among defensemen and forwards but not among goalies (28). Romman et al. demonstrated a high prevalence of the RAE in Swiss junior hockey. They evaluated 344 Swiss male elite junior ice hockey players (age 15.3 ± 1 year). The percentage of players born in the first quarter was 42.4%, in contrast to 10.5% born in the last quarter (26). The only study examining RAE in European elite male adult hockey is a study by Delorme et al. that demonstrated statistically significant RAE in French male ice hockey (9), but it must be noted that French ice hockey teams do not belong to world's top-tier teams.

So far, very little attention has been paid to the prevalence of RAE in Russian elite male ice hockey, which for years has been holding leading positions in global ice hockey. As of 2017, more than 600,000 people in Russia were actively playing ice hockey, among them, 20,000 were professional players, and more than 700 ice hockey organizations are registered in Russia. Russian national ice hockey team was 5 times Olympic medalist and IIHF Ice Hockey World Championship winner since 1992. Russia was ranked second to Canada in the IIHF Men's World Ranking (2). The Kontinental Hockey League (KHL) has become one of the strongest hockey leagues in Europe and considered by many as the second-best league in the world behind the NHL (29).

Not only Russian, but also outstanding Belarussian, Latvian, Kazakhstan, and Finnish teams participate in KHL. Players of the leading European national teams are represented in KHL teams.

Currently, there are 45 Russian players in the National Hockey League (3), and Alexander Ovechkin among them is considered one of the best players in the history of the NHL (1,23). Therefore, studying the prevalence of RAE in elite hockey might be of great practical interest, and the main aim of this study was determination of existence of RAE from the youngest till adult Russian players. It was hypothesized that RAE is widely spread in Russian elite ice hockey players of all age groups.

Methods

Experimental Approach to the Problem

The conduction of this study at this research institution was also approved by the local ethics committee of the Sechenov First Moscow State Medical University. The cross-sectional study design was used in the present research to analyze the birthdates of male ice hockey players of various ages (minimum age 7 years) living and playing in Russia, Canada, and the United States ($n = 2,285$). Birthdates of Russian players of the NHL from the 1998 to 2018 seasons were examined. The players played at least 10 matches in the NHL ($n = 196$) were evaluated; goalies ($n = 11$) were not included into the analysis. The birthdates of players of the 8 leading teams of the KHL ($n = 175$), players of the 8 leading teams of the Supreme Hockey League (SHL) ($n = 176$), players of Russian junior teams U-16, U-17, U-18, and U-20 ($n = 112$), players of the 8 top-tier teams of the Russian Junior Hockey League (RJHL) ($n = 369$), and draftees of the 5 leading Russian ice hockey academies ($n = 1,257$) were evaluated. The composition of the analyzed sample is shown in Table 1.

Subjects

The inclusion criteria for the academies were (a) at least 10 years' experience in ice hockey training, (b) boarding schools for permanent residence of players, (c) at least 5 players for the junior and junior teams, and (d) all age groups are represented among players.

The exclusion criteria were (a) only residents of the neighboring region were involved in training, (b) no boarding school for young players to live permanently, and (c) less than 5 players for the junior and junior teams graduated the academy.

Research included representatives of the following ice hockey leagues and levels:

- National Hockey League is the world's strongest ice hockey league. Best Russian hockey players go to play in NHL teams. Many of them also represent the Russian National Hockey Team when playing at the Olympic Games or IIHF World Ice Hockey Championship.
- Kontinental Hockey League is the strongest ice hockey league in Russia and neighboring states, which comprises the best Russian and Russian-born players from North America. At international competitions where the number of NHL players is limited (e.g., Euro Hockey Tour), the Russian National Ice Hockey Team is represented by KHL players.

Table 1
The composition of the analyzed sample.*

Ice hockey league or level	Total ($n = 2,285$)
NHL	196
KHL	175
SHL	176
NJT	112
RJHL	369
Academies	1,257

*NHL = National Hockey League, KHL = Kontinental Hockey League, SHL = Supreme Hockey League, NJT = National Junior Teams, RJHL = Russian Junior Hockey League.

Table 2

The percentage of "early-born" and "later-born" players in the analyzed groups.*†

Group	Early born, *n* (%)	Later born, *n* (%)
NHL, $n = 196$	114 (58.2)	82 (41.8)
KHL, $n = 175$	100 (57.1)	75 (42.9)
SHL, $n = 176$	113 (64.2)	63 (35.8)
NJT, $n = 112$	77 (68.8)	35 (31.2)
RJHL, $n = 369$	242 (65.6)	127 (34.4)
Academies, $n = 1,257$	851 (67.7)	406 (32.3)

*NHL = National Hockey League, KHL = Kontinental Hockey League, SHL = Supreme Hockey League, NJT = National Junior Teams, RJHL = Russian Junior Hockey League.

†Early-born are defined as players born from January 1 to June 31, later-born are defined as players born from July 1 to December 31.

- The SHL is the second strongest league in Russia. It comprises KHL farm teams or independent teams whose players are not drafted into the Russian National Team.
- National Junior Teams. The best players of the RJHL teams and academies are drafted to the Russian National Junior Ice Hockey Teams. Therefore, the professional level of the NJTs is on average higher than that of the RJHL teams
- The RJHL comprises best Russian junior players, who make up the Russian junior ice hockey teams. Some of the RJHL teams are the KHL junior teams. The best hockey academy graduates are grafted to the rosters of the RJHL teams.
- Academies recruit young players not only from the cities where the academies are located but from all over the country.

Procedures

Birthdates of the hockey players were obtained from the web-pages of the KHL (khl.ru), the SHL (vhlru.ru), the RJHL (mhl.khl.ru), and by querying the Google Web Search or by directly contacting the administration of the academies. An independent expert checked all data obtained. Because the group distribution in Russia takes place all year round—starting on January 1 and ending on December 31—the players born in the first 6 months of the calendar year are considered "early born."

Players' birthdates were organized by month into quarters, with the first quarter composed of players born in January–March ("early-born"), the second quarter of players born in April–June, the third quarter of players born in July–September, and the fourth quarter of players born in October–December ("later-born"). For each one of these birthdate groups, the relative sample size was calculated using the formula "100 × number of the date of birth group/total number". Relative age effect was defined as a higher relative sample size of the first quarter compared with the other birthdate quarters.

Statistical Analyses

Analysis was performed with SPSS Statistics v.23.0 software (IBM). Chi-square test was used to compare the number of "early-born" and "later-born" players in different leagues and to compare different age groups of the "later-born players." Results were considered statistically significant at $p < 0.05$.

Results

Relative age effect was observed in all age groups at all tier-levels of the Russian elite hockey. There were more players born in the first half of the year as compared with the second half (65.5 and 34.5%, respectively) (Table 2 and Figure 1).

Table 3 shows differences between the numbers of "early-born" players on various tier levels of the Russian hockey. In all cases, when the difference was statistically significant ($p < 0.05$), there was a greater number of "early-born" players in the lower tier leagues. "Early-born" players are significantly more prevalent in the academies than in the SHL ($p = 0.039$), the RJHL ($p = 0.009$), and the NJT ($p = 0.006$). There were more "early-born" players in the NJT than in the KHL ($p = 0.025$).

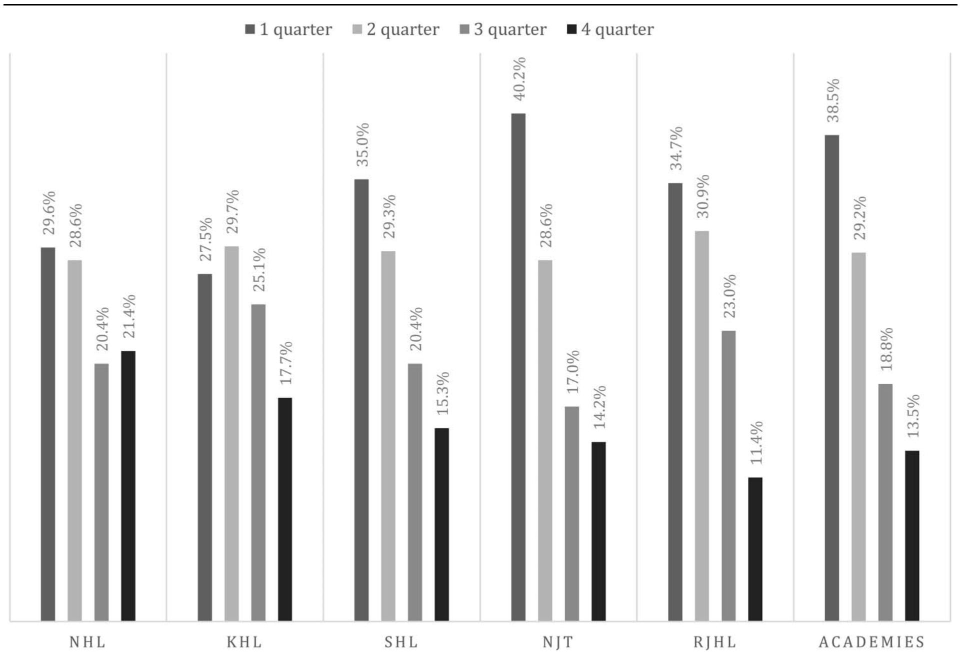

Figure 1. Quarterly birthdates of players in the analyzed groups. NHL = National Hockey League; KHL = Kontinental Hockey League; SHL = Supreme Hockey League; RJHL = Russian Junior Hockey League.

Table 3

Differences between the numbers of "early-born" players on various tier levels of the Russian hockey (*p* values).*†‡

	NHL	KHL	SHL	NJT	RJHL	Academies
NHL	—	0.65	0.25	0.06	0.22	0.6
KHL		—	0.12	**0.02**	0.09	0.92
SHL			—	0.4	0.9	**0.04**
NJT				—	0.29	**0.01**
RJHL					—	**0.01**
Academies						—

*NHL = National Hockey League, KHL = Kontinental Hockey League, SHL = Supreme Hockey League, NJT = National Junior Teams, RJHL = Russian Junior Hockey League.
†Early born are defined as players born from January 1 to June 31, and later born are defined as players born from July 1 to December 31.
‡Statistically significant values are shown in bold. χ^2 test was used.

Table 4 shows differences between the numbers of "later-born" players on various tier levels of the Russian hockey. In all cases, when the difference was statistically significant ($p < 0.05$), there was a greater number of "later-born" players in the higher tier leagues. "Later-born" players are significantly more prevalent in the NHL and the KHL than in the academies ($p = 0.029$ and $p = 0.043$) or the RJHL ($p = 0.029$ and $p = 0.043$, respectively).

The distribution analysis of birthdates of ice hockey academies draftees and in junior teams showed high prevalence of RAE among all age groups (Figures 2 and 3).

Table 5 shows differences between the numbers of "later-born" among various age groups at the ice hockey academies. The number of the "later-born" players in the U17 group was significantly higher than in the U14 and U12 groups ($p = 0.04$ and $p = 0.02$), and the number of the "later-born" players in the U16 group was higher than in the U15 and U12 ($p = 0.04$ and $p = 0.02$ respectively). Interestingly, the predominant number of the "later-born" players is observed in the U16 and U17 groups.

Discussion

This study represents the first attempt to investigate the RAE in the Russian elite ice hockey. It was most pronounced in all age groups of the junior teams. Compared with the junior teams, adult teams exhibited a lower level of RAE. These results corroborate the findings of the previous studies, which showed RAE prevalence among junior hockey and RAE's reversal in adult elite leagues (26,28).

It was showed that "later-born" players are more successful in adult elite leagues, which is illustrated by a significantly higher number of such players in the NHL and the KHL, in contrast to junior teams of the RJHL and the hockey academies. The prevalence of RAE in ice hockey might be explained by the fact that young players are drafted according to their calendar age and not their physical maturity and physical prowess. However, it seems evident that children born in the first half of the year are better physically developed than their peers born in the second half (11). A large number of children who are less physically developed are at risk of being identified as not eligible and might be dismissed from coaching at leading ice hockey academies. In infant age, the difference in physical development among children born in different halves of the same calendar year might be significant. For instance, young players born in the first half of the year were taller, had longer legs, and a larger fat-free mass than their younger peers (16).

Table 4

Differences between the numbers of "later-born" players on various tier levels of the Russian hockey (*p* values).*†‡

	NHL	KHL	SHL	NJT	RJHL	Academies
NHL	—	0.37	0.13	0.12	**0.01**	**0.01**
KHL		—	0.55	0.44	**0.04**	**0.03**
SHL			—	0.81	0.19	0.51
NJT				—	0.41	0.82
RJHL					—	0.28
Academies						—

*NHL = National Hockey League, KHL = Kontinental Hockey League, SHL = Supreme Hockey League, NJT = National Junior Teams, RJHL = Russian Junior Hockey League.
†Early born are defined as players born from January 1 to June 31, and later born are defined as players born from July 1 to December 31.
‡Statistically significant values are shown in bold. χ^2 test was used.

Moreover, by being identified as talented, children are exposed to higher levels of coaching and allowed to compete in an elite environment, which is beneficial for their performance development (8,13,18). Gibbs et al. noted that being born later increases the chance for elite play. Older born players are highly present in All-Stars and the Olympic rosters (15). However, Nolan et al. noted that despite the globalization of hockey and changes in minor hockey, RAE, that is, a strong linear relationship between the month of birth (from January to December) and the proportion of players in the leagues studied, still exists (24). "Later-born" hockey players are not less talented than their "older" counterparts, which is proven by the fact that they score more and command higher salaries in the elite hockey leagues (4,10,14).

These findings suggest that the RAE prevalence is determined by the level of competition and the early specialization in a given sport. Moreover, coaches often aim to achieve instant progress possibly because their income is dependent on the performance results of their trainees. There are several ice hockey academies in Russia, which are sponsored by the state. These academies are better equipped and employ the best coaches. Hence, the selection of recruits to enter such an academy is highly competitive, compared with regular hockey academies. Academy's funding and the career perspectives of the coaches are to a great extent dependent on how successful the match performance of the academy's teams is.

The mentioned factors might lead to selection bias toward more physically mature children, who can withstand intensive competition with more experienced junior players. The primary selection in Russian ice hockey is done at the age of 6–7 years. At this age, even a slight chronological difference in several months could lead to substantial physical and cognitive development differences.

Therefore, it seems that early-maturing children, whose skeletal age is greater than their chronological age, receive higher chances for career development in elite hockey. This notion can be supported by the findings of Muller et al. who investigated the RAE in elite under-9 soccer. They discovered a high percentage of early-maturing athletes among those born in the last quarter of the year (22). It is important to bear in mind that the skeletal age assessment is error prone. Therefore, it cannot be used as a valid indicator of chronological age (20).

Moreover, in highly competitive sports, children are often recruited before they are 9 years old, and thus, getting into the academy at an older age without training experience is rather difficult (10).

These facts could explain the RAE toward "early-born" players in all age groups. Such RAE patterns have been identified

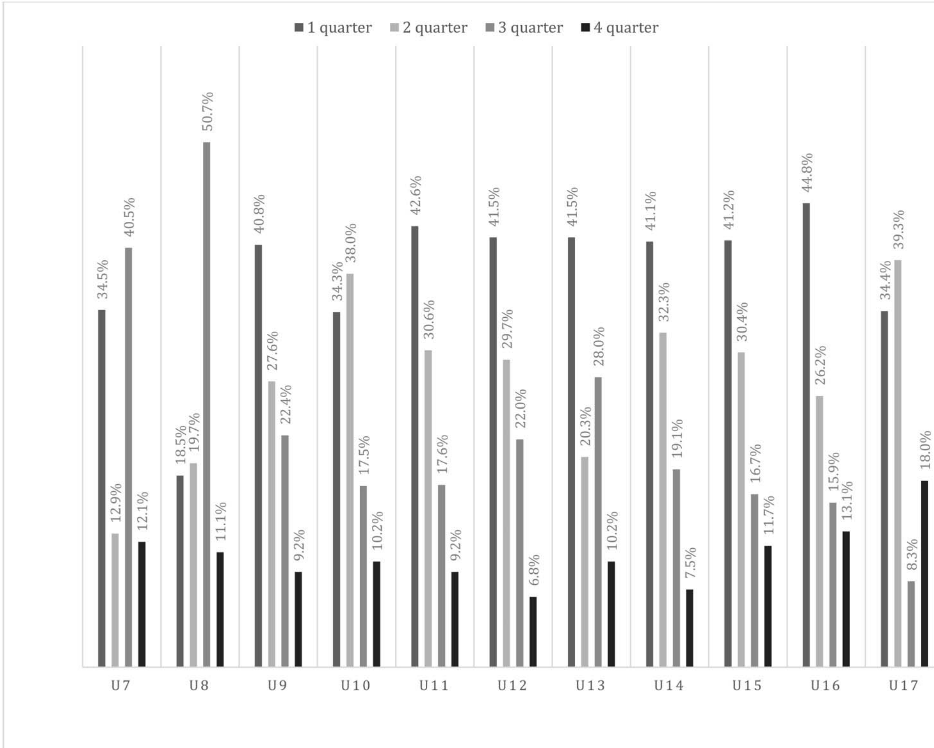

Figure 2. Quarterly birthdates of players by age group at ice hockey academies.

in many studies, examining junior soccer (Spain, Germany, France) and ice hockey (Canada) in countries, where these sports are widely spread. It can, therefore, be assumed that the main reasons for the high RAE prevalence in Russian hockey are the physiological advantages of the "early-born" children during primary selection, early specialization, which makes hockey academy admittance impossible to players older than 10 years, and competitive environment of the elite hockey academies, which young players are exposed to upon recruitment.

The limitations of the study include the lack of data on the prevalence of RAE in Russian regional hockey academies, where it is presumably less prominent because of lesser competition. It could have allowed to better study competition effect on RAE in junior hockey better.

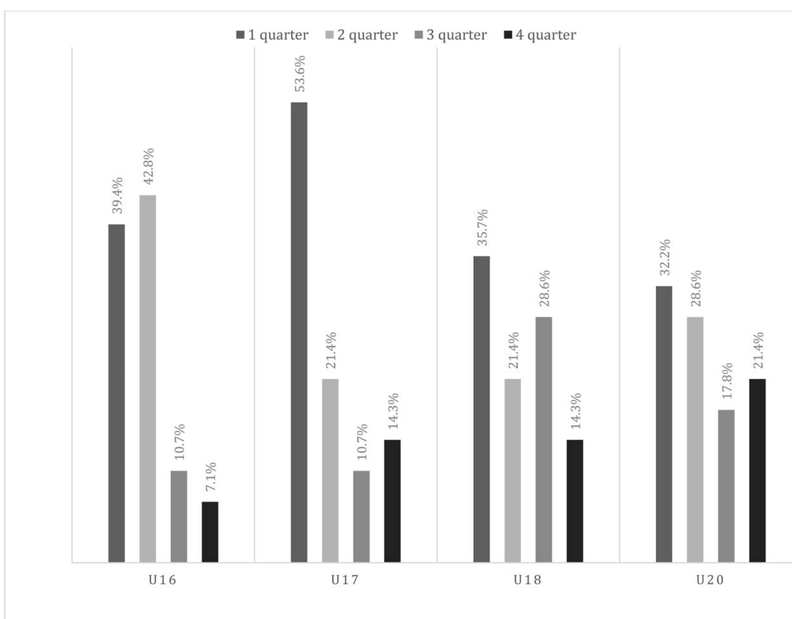

Figure 3. Quarterly birthdates of players by age group in junior teams.

Table 5

Differences between the number of "later-born" players among different age groups at the ice hockey academies (*p*-values).*

	U7	U8	U9	U10	U11	U12	U13	U14	U15	U16	U17
U7	—	0.29	0.53	0.64	0.50	0.17	0.64	0.25	0.34	0.34	0.28
U8		—	0.69	0.84	0.68	0.28	0.83	0.39	0.48	0.17	0.24
U9			—	0.81	0.99	0.54	0.83	0.67	0.75	0.15	0.13
U10				—	0.8	0.33	0.99	0.46	0.56	0.15	0.13
U11					—	0.49	0.82	0.64	0.73	0.11	0.097
U12						—	0.35	0.84	0.79	**0.02**	**0.02**
U13							—	0.48	0.58	0.16	0.14
U14								—	0.94	0.95	**0.04**
U15									—	**0.04**	0.07
U16										—	0.83
U17											—

*Statistically significant values are shown in bold. Chi-square test was used.

Future research should focus on finding solutions to mitigate the RAE in elite junior sports. These could include briefing of coaches on the topic of RAE, modification of the play system for minor age players, the introduction of performance tests considering the precise age of recruits, and the increase of specialization age in soccer and ice hockey.

The study revealed a high prevalence of RAE at all ages and all levels of Russian elite hockey. However, there is a statistically significant increase in the number of "later-born" in the most competitive adult leagues where the most powerful Russian hockey players play.

The most likely cause of RAE in Russian hockey is the preference by coaches of better physically developed children for primary selection at the age of 6–7 years and the inability to get into the leading children's academies after the age of 10 years for children who do not have the appropriate level of training.

Practical Applications

Identification of the widespread prevalence of RAE in Russian elite hockey should lead to measures to combat this phenomenon, such as biobanding, the introduction of quotas for "later-born" players in teams, allowing late-maturing children to play in the younger calendar year, and the development of physical tests taking into account biological age.

One of the most important measures could be instructing the coaches on the RAE problem. Another promising approach is "biobanding". The hallmark of this approach is that recruits are selected according to their biological and not chronological age. Biobanding is currently widely used in the US soccer teams.

Another important point is raising the awareness of coaches about this problem.

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