Paper : Coaching

The Recent Trend of Relative Age Effect in Japanese Male Professional Soccer Players

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The details about relative age effect in Japanese male professional soccer players are not readily at hand. This study clarifies the recent trend of relative age effect in Japanese male professional soccer players using data from 2011 season to 2020 season. Our study had two analytical perspectives: In analysis 1, we examined the relative age effect in all Japanese male professional soccer players in each season from 2011 to 2020; in analysis 2, we studied the relative age effect in Japanese male professional soccer players who newly registered in the league in each season from 2012 to 2020. There were significant differences in the proportion of Q1 (April–June) –Q4 (January–March) of every season in analysis 1, and Q1/Q4 were 2.0– 2.3. Effect sizes (ω) were 0.23–0.29. There were significant differences in the proportion of Q1–Q4 of every season except for the 2013 season in analysis 2 and Q1/Q4 were 1.6–3.2. Effect sizes (ω) were 0.22–0.46. In conclusion, relative age effect in Japanese male professional players is continuously present in recent years and is equally present in young soccer players who recently registered for the first time. The strength of the relative age effects does not demonstrably change from the 2011 to the 2020 season because effect size did not consistently increase or decrease.

Keywords: birthday, football, Japan

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1. Introduction

Relative age effect (RAE) is a variance caused by difference of birthdate within same age group (Pedersen et al., 2022; Musch and Grondin 2001; Helsen et al., 2012). Roughly a maximum one-year difference occurs depending on the birthdate among the same age group and advantages and disadvantages occur in various aspects due to the differences in physical and psychological development. RAE has been examined for many years, with some reports focusing on schoolwork and sports (Cobley et al., 2009; Smith et al., 2018). Additionally, many studies have been conducted on RAE of various athletes who played soccer (Yagüe et al., 2018; Brustio et al., 2018), baseball (Katsumata et al., 2018; Nakata 2017), basketball (Delorme et al., 2011), handball (Schorer et al., 2009), swimming (Cobley et al., 2018), track and field (Brazo-Sayavera et al., 2018; Nakata and Sakamoto 2011), sumo (Nakata and Sakamoto, 2011), rugby (Till et al., 2010), and alpine skiing (Müller et al., 2015; 2017).

Studies regarding RAE of soccer players have been conducted worldwide (Sasano et al., 2020; Götze and Hoppe 2020; Figueiredo et al., 2021; Vincent and Glamser 2006; Delorme et al., 2009), with a recent study focusing on World Cup players (U-17, U-19, senior) (Pedersen et al., 2022). Pedersen et al. (2022) study found that the younger the age group is, the more clearly the RAE appears, that RAE is stronger in males than in females, and that RAE becomes stronger year by year. In this way, research has clarified the recent trend of RAE in the world's top-level soccer players. Some methods to reduce the RAE have been suggested in previous studies (Helsen et al., 2012; Mann and Ginneken, 2017). For example, Helsen et al. (2012) proposed cut-off rotation so that the disadvantaged players are not constant. For example, the U-10 generation covers 9-year-old players born from January to December and 10-year-old players born from April to December. The U-12 age group covers 10-year-old players born from January to March, 11-year-old players born from January to December, and 12-year-old players born from June to December. However, the effectiveness of this proposal has not been verified. Mann and Ginneken (2017) reported that wearing shirts with the player's relative age removed selection bias when scouting soccer players. However, because RAE remains (Pedersen et al., 2022), these methods have not been proven to be widely effective or efficient. The RAE of soccer players firmly exists and, if anything, is thought to be increasing in strength worldwide rather than weakening (Pedersen et al., 2022). From the perspective that all soccer players should be given equal opportunities regardless of their birthdate, the problem of RAE in soccer players is an important theme that must be examined further in the future.

There are some extant studies about the RAE of Japanese male professional soccer players (J league soccer players). Uchiyama (1996), the first to study the topic, reported that RAE was present in Japanese male professional soccer players in the 1993 season because the number of the players born from April to June was 2.2 times more than that of players born from January to March. Incidentally, the cutoff date in Japan is April. In a 2010 study of the RAE of Japanese male soccer players (Nakata and Sakamoto, 2011), the number of players in Q1 (April–June) was 34.7%, which was the highest quarter, and the number of players in Q4 (January–March) was 14.6%, the lowest quarter. The latest study about RAE of Japanese male soccer players analyzed the data of the 2018 season (Sasano et al., 2020) and found that the number of players in Q1 was 33.1%, which was the highest, and the number of players in Q4 was 16.1%, the least. These studies show the existence of RAE as far back as 1993 and still in existence in 2018 (Nakata and Sakamoto, 2011; Sasano et al., 2020; Uchiyama, 1996). In addition, in a study conducted more than 20 years ago (Musch and Hay, 1999), it was reported that RAE of Japanese male soccer players was stronger than that of Brazil, German, and Australian professional soccer players. Therefore, the RAE of Japanese male soccer players may have some characteristics that differ from that of the other country's soccer players; it is therefore necessary to focus on RAE of Japanese male soccer players.

As stated above, because the study of the RAE of soccer players will be important in the future, it is necessary to constantly update the latest information and details to consider appropriate countermeasures. The RAE of Japanese male soccer players was examined (Nakata and Sakamoto, 2011; Sasano et al., 2020; Uchiyama, 1996) in seasons of 1994, 2001, 2010, and 2018; this is a long investigation interval and does not show the latest detailed trend of RAE. The trend of RAE in Japanese male soccer players changes over time, and in fact it was reported that the RAE in soccer players who participated in the World Cup from 2006 to 2018 became stronger in the previous study (Pedersen et al., 2022). In addition, a 2003 project invited players born from January to March to training camp in a search for good players in Japan (Asahi Newspaper, 2014); these actions may affect the RAE of Japanese male soccer players. By investigating the RAE of the recent Japanese male soccer players in detail, the recent trend of RAE will be clear among the players who recently registered in the Japanese male soccer league (J league).

This study aimed to clarify the recent trend of RAE in Japanese male soccer players from the 2011 to the 2020 season. There are two viewpoints of analysis: Analysis 1 examined the RAE of all players who registered in the J league in each season (2011–2020 season), while analysis 2 examined the RAE of players who newly registered in the 2012–2020 season.

2. Methods

2.1. Players

Analysis 1

The players in analysis 1 were 12,858 J league players who registered in each season from 2011 to 2020 (the actual number of the players was 3,133). There were 4,612 players in the J1 league, 5,681 players in the J2 league, and 2,565 players in the J3 league. In addition, because the J3 league was established in the 2014 season, J3 players were included from the 2014 season. Because the players who came from foreign countries were excluded from the analysis, all players were Japanese. The average age of the players was 26.1 ± 5.0.

Analysis 2

The players in analysis 2 were 2,323 J league players who newly registered in each season from 2012 to 2020. There were 779 players in the J1 league, 849 players in the J2 league, and 695 players in the J3 league (who were included from the 2014 season). Because the players who came from foreign countries were excluded from the analysis, all players were Japanese. The average age of the players was 22.7 ± 4.4.

2.2. Data-collection methods

The data of the subject's birthdate were obtained from the J league official site (https://www.jleague.jp/). The data of players lacking the birthdate information and players who came from foreign countries were excluded from the analysis. The data-collection period was from August 2021 to September 2021.

2.3. Statistical analysis

The same analyses were conducted in both analysis 1 and 2. At first, the number and proportion of the players in each month of the subject's birth month were calculated. As with the previous study (Musch and Hay, 1999), the Spearman-rank correlation coefficient was calculated, and the significance was examined to determine the relationship between the difference of birth month and the number of players in each month. Because the cutoff month is April in Japan, April is assigned "1" and March is assigned "12" in this analysis.

Following the previous studies (Nakata and Sakamoto, 2011; Sasano et al., 2020), the birth month of the players was classified into four groups: Q1 (April–June), Q2 (July–September), Q3 (October–December), and Q4 (January–March). The number and the ratio of the players in each group were calculated. In addition, a goodness-of-fit test was conducted to examine the difference in the ratios among from Q1 to Q4. The expected values were calculated based on the birth month distribution of Japanese male people at birth from the demographic survey conducted by the Ministry of Health, Labor and Welfare of Japan. In analysis 1, the birth month of Japanese born from 1985 to 1994 was indexed because the average age of J league players from 2011 to 2020 was approximately 26.1 years old. As a result, the expected values were 24.9%, 26.2%, 24.8%, and 24.1% in Q1, Q2, Q3, and Q4, respectively. In analysis 2, the birth month of Japanese born from 1990 to 1998 was indexed because the average age of newly registered J league players from 2012 to 2020 was approximately 22.7 years old. As a result, the expected values were 25.1%, 26.2%, 24.7%, and 24.0% in Q1, Q2, Q3, and Q4, respectively.

A multiple comparison test was performed when a significant difference was observed in the goodness-of-fit test with ω calculated as the effect size. The effect size ω is judged to be small, moderate, and large, when ω is 0.10, 0.30, 0.50, respectively (Cohen 1988). Following the previous study (Sasano 2020), Q1/Q4 was calculated to examine the difference in the ratios of Q1 and Q4. In addition, S1/S2 was calculated to examine the difference between the sum of the ratios of Q1 and Q2 (S1) and the sum of the ratios of Q3 and Q4 (S2). Statistical analysis software IBM SPSS Statistics Version 27 and js-STAR were used for analysis. The statistical significance level was set at 5%.

3. Results

Analysis 1

Table 1 shows the numbers and ratios of each month for birth month of the players in each season as well as the Spearman's rank correlation coefficient, which was −0.84 or higher and significant in all seasons. **Figure 1** shows the ratio of each month for birth month of the players in each season and reflects part of **Table 1**. Every line in **Figure 1** shows a downward trend.

Table 2 shows the numbers and ratios of Q1–Q4 in each season, the results of the goodness-of-fit test, effect sizes, and results of multiple comparison tests. The goodness-of-fit test showed significant differences in the ratios of Q1 to Q4 in all seasons. A multiple comparison test showed significant differences between Q1 and Q4 in all seasons. In the 2014, 2015, 2016, and 2017 seasons, the results of multiple comparison tests were Q1 > Q2 > Q3 > Q4, ω ranged from 0.23 to 0.29. Q1/Q4 was 2.0–2.3, and S1/S2 was 1.6–1.8.

Analysis 2

Table 3 shows the numbers and ratios of each month for birth month of the players who newly registered to the J league in each season as well as the Spearman's rank correlation coefficient. Except for the 2013 season, the Spearman's rank correlation coefficient was −0.84 or higher, which was significant. **Figure 2** shows the ratio of each month for the birth month of the players in each season and reflects part of **Table 3**. In general, every line in **Figure 2** shows a downward trend.

Table 4 shows the numbers and ratios of Q1–Q4

Table 1 The distribution of the subject's birth month in each season

		April	May	June	July	August	September	October	November	December	January	February	March	Sum	r	p
2011	n	87	105	70	86	76	91	74	54	63	43	45	45	839	-0.84*	<0.01
	%	10.4	12.5	8.3	10.3	9.1	10.8	8.8	6.4	7.5	5.1	5.4	5.4	100.0		
2012	n	106	107	89	85	83	100	77	51	72	51	43	46	910	-0.93*	<0.01
	%	11.6	11.8	9.8	9.3	9.1	11.0	8.5	5.6	7.9	5.6	4.7	5.1	100.0		
2013	n	108	110	79	83	81	93	73	59	68	56	42	52	904	-0.92*	<0.01
	%	11.9	12.2	8.7	9.2	9.0	10.3	8.1	6.5	7.5	6.2	4.6	5.8	100.0		
2014	n	148	148	120	107	104	120	93	80	85	67	61	69	1202	-0.94*	<0.01
	%	12.3	12.3	10.0	8.9	8.7	10.0	7.7	6.7	7.1	5.6	5.1	5.7	100.0		
2015	n	187	159	134	133	124	140	107	94	98	80	69	79	1404	-0.94*	<0.01
	%	13.3	11.3	9.5	9.5	8.8	10.0	7.6	6.7	7.0	5.7	4.9	5.6	100.0		
2016	n	183	156	130	131	117	134	95	93	86	80	75	78	1358	-0.94*	<0.01
	%	13.5	11.5	9.6	9.6	8.6	9.9	7.0	6.8	6.3	5.9	5.5	5.7	100.0		
2017	n	188	167	143	143	136	131	107	100	94	80	79	80	1448	-0.99*	<0.01
	%	13.0	11.5	9.9	9.9	9.4	9.0	7.4	6.9	6.5	5.5	5.5	5.5	100.0		
2018	n	186	183	155	172	132	150	102	105	101	83	84	87	1540	-0.95*	<0.01
	%	12.1	11.9	10.1	11.2	8.6	9.7	6.6	6.8	6.6	5.4	5.5	5.6	100.0		
2019	n	188	194	154	189	146	154	110	108	99	83	83	75	1583	-0.95*	<0.01
	%	11.9	12.3	9.7	11.9	9.2	9.7	6.9	6.8	6.3	5.2	5.2	4.7	100.0		
2020	n	196	183	165	197	168	169	129	112	112	85	82	72	1670	-0.91*	<0.01
	%	11.7	11.0	9.9	11.8	10.1	10.1	7.7	6.7	6.7	5.1	4.9	4.3	100.0		

Note. *: p<0.05

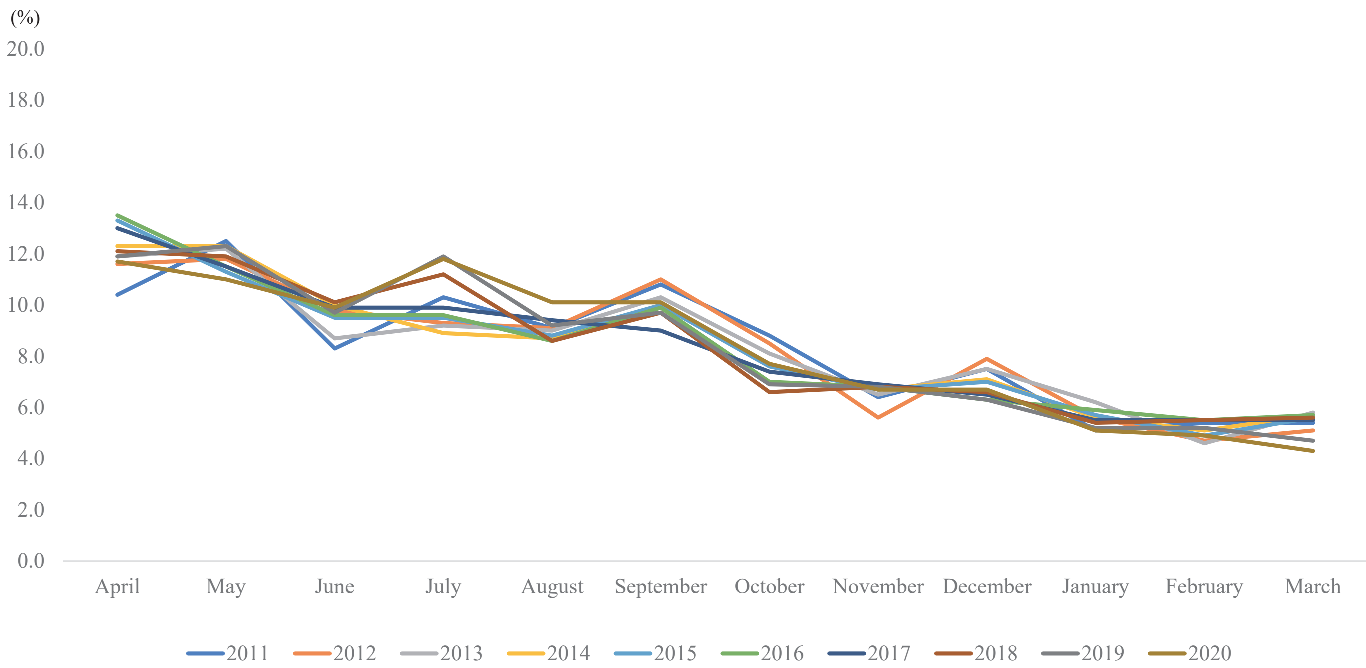

Figure 1 The ratio for birth month of the players in each month

in new registered players in each season, test results of the goodness-of-fit test, effect sizes, and results of multiple comparison tests. The goodness-of-fit test showed significant differences in the ratios of Q1–Q4 in all seasons except for the 2013 season. A multiple comparison test revealed a significant difference between Q1 and Q4 except for 2013; ω ranged from 0.16 to 0.45 Q1/Q4 was 1.6–3.2, and S1/S2 was 1.2–2.3. Except for the 2013 season, ω was 0.31–0.45, Q1/Q4 was 2.0–3.2, and S1/S2 was 1.6–2.3.

4. Discussion

Because the cutoff date is April in Japan, the results of **Table 1 and 2** were obtained. It can therefore be said that RAE was consistently observed in Japanese male soccer players who registered in each season from 2011 to 2020. Previous studies have investigated

Table 2 The distribution of Q1–Q4 in each season

		Q1	Q2	Q3	Q4	Sum	χ^2	p	ω	Multiple Comparison test	Q1vsQ4	S1vsS2
2011	n	262	253	191	133	839	43.3*	<0.01	0.23	Q1,Q2>Q3>Q4	2.0	1.6
	%	31.2	30.2	22.8	15.9	100.0						
2012	n	302	268	200	140	910	60.0*	<0.01	0.26	Q1,Q2>Q3>Q4	2.2	1.7
	%	33.2	29.5	22.0	15.4	100.0						
2013	n	297	257	200	150	904	48.1*	<0.01	0.23	Q1,Q2>Q3>Q4	2.0	1.6
	%	32.9	28.4	22.1	16.6	100.0						
2014	n	416	331	258	197	1202	80.8*	<0.01	0.26	Q1>Q2>Q3>Q4	2.1	1.6
	%	34.6	27.5	21.5	16.4	100.0						
2015	n	480	397	299	228	1404	93.3*	<0.01	0.26	Q1>Q2>Q3>Q4	2.1	1.7
	%	34.2	28.3	21.3	16.2	100.0						
2016	n	469	382	274	233	1358	90.8*	<0.01	0.26	Q1>Q2>Q3>Q4	2.0	1.7
	%	34.5	28.1	20.2	17.2	100.0						
2017	n	498	410	301	239	1448	98.3*	<0.01	0.26	Q1>Q2>Q3>Q4	2.1	1.7
	%	34.4	28.3	20.8	16.5	100.0						
2018	n	524	454	308	254	1540	108.5*	<0.01	0.27	Q1,Q2>Q3,Q4	2.1	1.7
	%	34.0	29.5	20.0	16.5	100.0						
2019	n	536	489	317	241	1583	129.9*	<0.01	0.29	Q1,Q2>Q3>Q4	2.2	1.8
	%	33.9	30.9	20.0	15.2	100.0						
2020	n	544	534	353	239	1670	135.5*	<0.01	0.28	Q1,Q2>Q3>Q4	2.3	1.8
	%	32.6	32.0	21.1	14.3	100.0						

Note. *: p<0.05

Table 3 The distribution of the subject's birth month in each season (newly registered players)

		April	May	June	July	August	September	October	November	December	January	February	March	Sum	r	p
2012	n	31	23	38	15	18	18	15	8	15	14	4	11	210	-0.87*	<0.01
	%	14.8	11.0	18.1	7.1	8.6	8.6	7.1	3.8	7.1	6.7	1.9	5.2	100.0		
2013	n	16	18	7	6	10	10	9	13	7	10	8	7	121	-0.36	0.25
	%	13.2	14.9	5.8	5.0	8.3	8.3	7.4	10.7	5.8	8.3	6.6	5.8	100.0		
2014	n	48	38	36	32	28	33	24	24	23	15	23	23	347	-0.94*	<0.01
	%	13.8	11.0	10.4	9.2	8.1	9.5	6.9	6.9	6.6	4.3	6.6	6.6	100.0		
2015	n	51	31	26	35	29	26	31	22	21	20	12	18	322	-0.88*	<0.01
	%	15.8	9.6	8.1	10.9	9.0	8.1	9.6	6.8	6.5	6.2	3.7	5.6	100.0		
2016	n	47	26	33	33	24	23	18	21	8	14	15	7	269	-0.94*	<0.01
	%	17.5	9.7	12.3	12.3	8.9	8.6	6.7	7.8	3.0	5.2	5.6	2.6	100.0		
2017	n	31	33	32	25	29	19	21	11	14	10	9	11	245	-0.93*	<0.01
	%	12.7	13.5	13.1	10.2	11.8	7.8	8.6	4.5	5.7	4.1	3.7	4.5	100.0		
2018	n	24	39	22	33	18	22	12	10	17	13	13	9	232	-0.84*	<0.01
	%	10.3	16.8	9.5	14.2	7.8	9.5	5.2	4.3	7.3	5.6	5.6	3.9	100.0		
2019	n	34	40	28	38	28	22	15	16	18	17	10	8	274	-0.90*	<0.01
	%	12.4	14.6	10.2	13.9	10.2	8.0	5.5	5.8	6.6	6.2	3.6	2.9	100.0		
2020	n	37	27	33	32	38	32	27	22	17	18	10	10	303	-0.85*	<0.01
	%	12.2	8.9	10.9	10.6	12.5	10.6	8.9	7.3	5.6	5.9	3.3	3.3	100.0		

Note. *: p<0.05

the RAE of Japanese male soccer players in 1993, 2001, 2010, and 2018, and confirmed the existence of RAE (Sasano et al., 2020, Nakata and Sakamoto, 2011). The results of this study were consistent with those of previous studies. However, previous studies have only investigated four seasons with long intervals, so it is significant that this study has clarified the trends of RAE for the past 10 years, including the latest information up to 2020. Soccer is a very popular sport, and there are competitions and selections from an early age. Competition is as fierce in Japan as it is in many countries. In young age groups, physiques differ greatly depending on the month of birth, so players born between January and March have some disadvantage at the selection. A clear RAE has been seen for soccer players who belong to high-level academies overseas (Carling, 2009; Kelly et al., 2020), and it has also been seen for players enrolled in J league academies (Hirose, 2009). Thus, players born between January and March often miss the chance to play at a high level in their youth. Differences in playing opportunities and

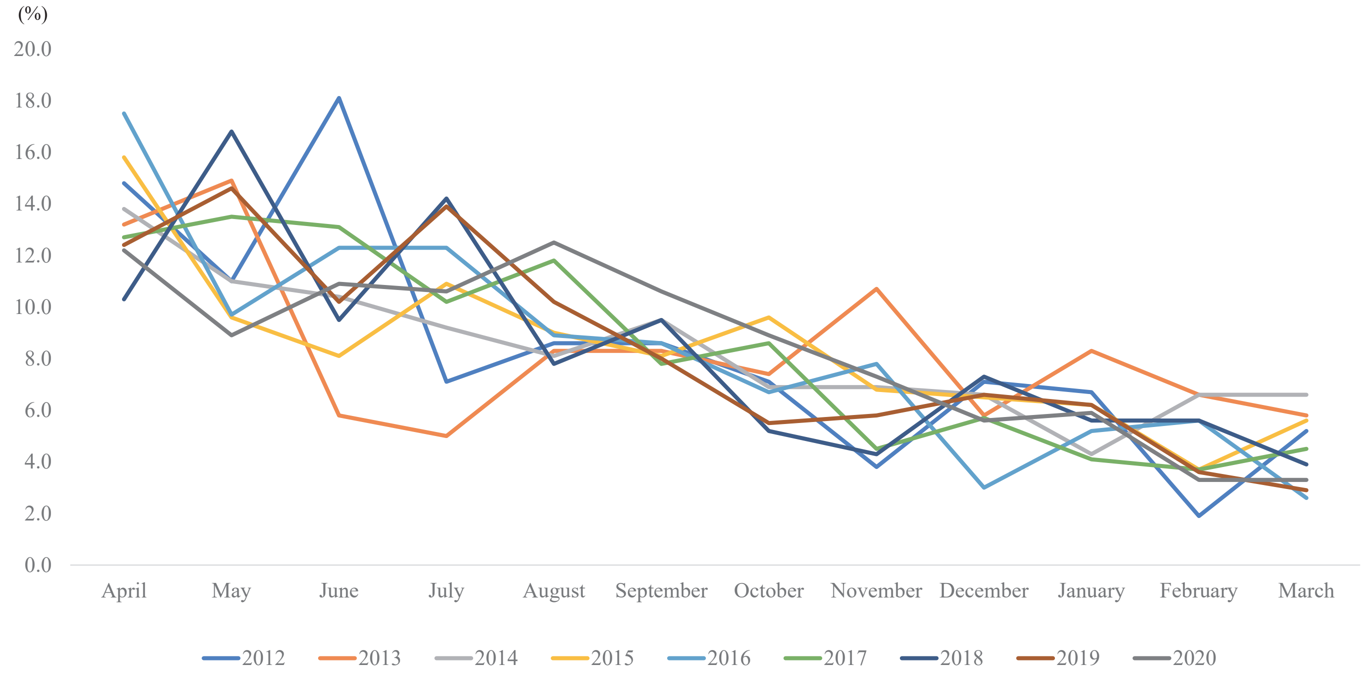

Figure 2 The ratio for birth month of the players in each month (newly registered players)

Table 4 The distribution of Q1–Q4 in each season (newly registered players)

		Q1	Q2	Q3	Q4	Sum	χ^2	p	ω	Multiple Comparison test	Q1vsQ4	S1vsS2
2012	n	92	51	38	29	210	42.6*	<0.01	0.45	Q1>Q2, Q3, Q4	3.2	2.1
	%	43.8	24.3	18.1	13.8	100.0						
2013	n	41	26	29	25	121	5.37	0.15	0.16		1.6	1.2
	%	33.9	21.5	24.0	20.7	100.0						
2014	n	122	93	71	61	347	22.7*	<0.01	0.33	Q1>Q3, Q4	2.0	1.6
	%	35.2	26.8	20.5	17.6	100.0						
2015	n	108	90	74	50	322	19.7*	<0.01	0.31	Q1, Q2>Q4	2.2	1.6
	%	33.5	28.0	23.0	15.5	100.0						
2016	n	106	80	47	36	269	41.8*	<0.01	0.45	Q1, Q2>Q3, Q4	2.9	2.2
	%	39.4	29.7	17.5	13.4	100.0						
2017	n	96	73	46	30	245	38.4*	<0.01	0.43	Q1, Q2>Q3, Q4	3.2	2.2
	%	39.2	29.8	18.8	12.2	100.0						
2018	n	85	73	39	35	232	28.5*	<0.01	0.37	Q1, Q2>Q3, Q4	2.4	2.1
	%	36.6	31.5	16.8	15.1	100.0						
2019	n	102	88	49	35	274	39.5*	<0.01	0.43	Q1>Q2>Q3, Q4	2.9	2.3
	%	37.2	32.1	17.9	12.8	100.0						
2020	n	97	102	66	38	303	30.0*	<0.01	0.38	Q1, Q2>Q3>Q4	2.6	1.9
	%	32.0	33.7	21.8	12.5	100.0						

Note. *: p<0.05

environments among youth because of differences in birthdays are some of the factors that result in RAE in J-League players.

In this study, Q1/Q4 was 2.0–2.3 (**Table 2**). In the previous study investigating the RAE of Japanese male professional soccer players (Sasano, 2020), Q1/Q4 was 2.2 in 1993, 2.5 in 2001, 2.4 in 2010, and 2.1 in 2018. Although the Q1/Q4 values were slightly low compared to 2001, no remarkable Q1/Q4 differences were observed between this study and a previous study (Sasano 2020). In this study, S1/S2 was 1.6–1.9. The previous study (Sasano, 2020) found 2.0 in 1993, 2.0 in 2001, 1.7 in 2010, and 1.7 in 2018. Although the S1/S2 values in this study were slightly lower than in 1993 and 2001, no substantial S1/S2 differences were observed between this study and a previous study (Sasano, 2020). Sasano (2020) analyzed Japanese male soccer player RAEs in 1993, 2001, 2010, and 2018 and found that the RAE had weakened in recent years because the effect size had decreased. Since there is no major difference between the results of Q1/Q4 and and S1/S2 obtained in this study and those found in a previous study (Sasano, 2020), it would be difficult to state that this result supports the results of the previous study (Sasano, 2020), which found that the RAE had weakened in recent years. Looking at the effect size from 2011 to 2020 in **Table 2** of this study, the effect size did not change significantly, ranging from 0.23 to 0.29. Moreover, as shown in **Table 4**, looking at the data for newly registered Japanese male soccer players from 2012 onwards, although the effect size fluctuates slightly from 0.22 to 0.46, there is no consistent trend of decrease or increase. There is no perceptible change in the magnitude of the RAE over the 10 years after 2011.

In this study, the RAE of newly registered Japanese male soccer players from 2012 to 2020 was examined to further clarify the recent trends in RAE. Except for in 2013, RAE was observed even in newly registered players. Regarding the results of the multiple comparison tests, most of the results for all registered Japanese male soccer players were Q1 > Q2 > Q3 > Q4 and Q1, Q2 > Q3 > Q4 (**Table 2**), but the results of the multiple comparison test for newly registered Japanese male soccer players slightly varied, and no significant difference was found between Q3 and Q4 (**Table 4**). The statistically significant differences are affected by the number of players. Because the number of newly registered players was lower than the total number of registered players, the difference in the number of total registered players and newly registered players was considered one of the factors that caused the differences among the results of the multiple comparison tests. However, Q1/Q4 for newly registered Japanese male soccer players is between 2.0 and 3.2 (excluding 2013), and there are several seasons when it is close to 3.0. Because the Q1/Q4 of all registered players was 2.0–2.3, it can be asserted that the Q1/Q4 of newly registered Japanese male soccer players is slightly higher. S1/S2 is 1.6–2.3 for newly registered Japanese male soccer players (excluding the 2013 season), and there are values greater than 1.6–1.9 for all registered Japanese male soccer players. From these results, it can be said that there is a clear RAE even for relatively young players who newly registered between the 2012 and 2020 seasons.

Although the exact reason why there was no significant difference in the proportions from Q1 to Q4 in 2013 season is unclear, it may be due to the implementation of the club license system in the J League from February 1, 2012. It is possible that it was more difficult than usual to contract new players because each club prioritized efforts to meet the license standards. In fact, there were only 121 new players who were registered to the J League in 2013, which was less than half of most other seasons. This small number of players may have influenced the results of the 2013 season.

Aside from the 2013 season, RAE is clearly present in the other seasons, but as mentioned above, when looking at the effect size, there is no constant trend of increase or decrease. It can therefore be asserted that there is no change in the strength of the RAE in the nine seasons from 2012 to 2020 even for newly registered Japanese male soccer players. In the previous study that analyzed the RAE of soccer players (U-17, U-19, seniors) who participated in the World Cup (Pedersen at al., 2022), the effect size gradually increased (1997–2019 for U-17 and U-19, and 2006–2018 for seniors). It is considered that RAE is becoming more pronounced year by year, due to the fact that many teams, mainly top clubs, are actively scouting and selecting players from a young age. Based on the analysis of the effect size, no trend toward a stronger RAE for Japanese male soccer players was observed in the present results. Therefore, the tendency of the RAE of Japanese male soccer players may be slightly different from that of the world as a whole.

Since the 2003 recruiting project in Japan that specifically invited players born in January to March to a camp (Asahi Newspaper, 2014), attention has been paid to the bias in the birth months of soccer players worldwide, including in Japan. Such action and efforts may affect the results of this study. Alternatively, January is used as a cutoff date in accordance with international standards for the players of the Japanese national team. As a result, because of the April cutoff date, the RAE may have weakened. It is not clear why there is no change in the RAE, but in any case, it is important that it remains present in Japanese male soccer players. Although the trend of the RAE of Japanese male soccer players may be different from that of the world at present, it may change in the future. This study analyzed only up to the 2020 season. It is necessary to investigate the actual detailed situation of the RAE in the future.

Regarding the relative age effect, it has been noted that later-born players among the same age group selectively drop out (Williams and Reilly, 2000), and research has primarily been conducted from the perspective of unequal opportunities for children to play sports. In addition, from the perspective of improving competitiveness, there is concern that excellent soccer players who are far from the cutoff date may be overlooked. For these reasons, several proposals have been made to reduce the RAE of soccer players (Helsen et al., 2012; Mann and Ginneken, 2017). To also identify good players in Japan, a 2003 project invited players born from January to March to a training camp (Asahi Newspaper, 2014). Although research on the RAE of soccer players has been conducted for many years and several countermeasures considered, there is still an RAE in the top-level football countries of the world, which is stronger in more recent studies (Pedersen et al., 2022). Pedersen et al. (2022) concluded that these findings were because of the increased physical burden being placed on soccer players and the development of stronger scout systems to acquire young players, especially in top soccer clubs. As it is expected that the playing intensity of soccer will continue to increase in the future (Nassis et al., 2020), there is a high possibility that competitiveness will increase further. Therefore, the competition for young soccer players with good physiques is unlikely to reduce; it is unlikely that RAE will go away any time soon. It would be necessary to investigate the reality of RAE in soccer players in the future. From the standpoint of providing equal opportunities for children to play sports (soccer), developing soccer players, and spreading soccer, it is important to discuss the development of appropriate countermeasures for RAE. The results of this study could be useful in guiding future soccer player RAE research and developing RAE countermeasures.

In conclusion, the RAE of Japanese male professional soccer players (players registered in each season) has been observed continuously from the 2011 to the 2020 seasons. The proportion in Q1 has ranged from 2.0 to 2.3 times compared with the proportion in Q4. For players newly registered after the 2012 season, except for the 2013 season, RAE has been seen in the 2012–2020 season. Except for 2013, the Q1 rate has ranged from 2.0 to 3.2 times compared with the proportion ion Q4. From 2011 to 2020, because there is no constant increase or decrease in the seasonal changes of effect size for both registered players in each season and newly registered players, it can be concluded that there is no significant change in the strength of the RAE.

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