Influence of the Relative Age Effect on the Competitive Level and Playing Position of Male Japanese Elementary School Baseball Players

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This study examined the influence of the relative age effect (RAE) on the competitive level and playing position of male elementary school Japanese baseball players. The sample comprised the following: (1) 506 general male baseball players (BP) who were aged 11-12 (sixth grade) and who had not competed at the prefectural level and (2) 189 regionally selected players (SP) who were aged 11-12 (sixth grade) and who had been selected to compete at the prefectural level or a higher level. The subjects were divided into two groups based on their birth months (Semester 1 (S1): April-September and Semester 2 (S2): October-March). Prevalence ratio for each semester was calculated. Pearson’s chi-square test was employed to examine the RAE of each group and each playing position. Results of a chi-square test at each competitive level showed that the SP group was statistically significant (S1 > S2) but the BP group was not. The chi-square test for the pitcher and the elder (catcher, infielder, and outfielder) positions revealed statistical significance in the SP group (S1 > S2), with only the pitcher position showing statistical significance in the BP group (S1 > S2). The results indicated that the RAE was higher in more competitive level junior baseball players and that the RAE exerted a stronger influence on the pitcher position than on the elder positions.

Keywords: relative age effect, talent identification, development, baseball, elementary school

1. Introduction

Japanese public schools nominate a particular birth cutoff date (April 1st in Japan) for when children can enter school; that is, children born from April 2nd in the current year until April 1st in the following year are classified as being in the same age group, which means that there can be a difference of almost a full year between the oldest and youngest students. The impact of this age difference on the individual physical and mental development of students classified in the same age group is known as the relative age effect (RAE) (Musch and Grondin, 2001).

As the RAE has been an important factor in the selection of outstanding sports players and for determining those who are more likely to drop out of competitive team sports (Helsen et al., 1998; Lemez et al., 2014), the RAE has been used to examine the possibility of children playing at the competitive level, along with their playing position (Romann and Fuchslocher, 2013; Sedano et al., 2015, Schorer et al., 2009). It was found that those who played at a higher competitive level had a higher RAE than others players in the same age group (Musch and Grondin, 2001). A meta-analytical review also revealed that even though the competitive level tends to increase with age, the RAE was higher in junior players than it was in adult players (Cobley et al., 2009), suggesting that the RAE may be higher in junior players who play at more competitive levels. However, the correlation between the RAE and junior competitive level players has only been conducted for soccer (Romann and Fuchslocher, 2013) and ice hockey (Lemez et al., 2014). Some studies on the RAE of professional baseball players (Grondin and Koren, 2000; Nakata and Sakamoto, 2011), high school and university baseball players (Nakata and Sakamoto, 2012) have been conducted; however, the influence of the competitive level on
junior baseball players has not yet been investigated.

The relationship between the RAE and playing position has been examined in the case of football (Romann and Fuchslocher, 2013; Sedano et al., 2015), as well as handball (Schorer et al., 2009), and it has also been found that the RAE has a large effect on positions that require physical maturity in the junior period (Sedano et al., 2015). However, unlike other team sports, Japanese professional baseball players have shown the RAE regardless of position (Grondin and Koren, 2000). The roles required for each fielding position in baseball are different, with the pitcher being seen as the most important defensive position as they need to throw more pitches and fast balls than do other positions. As measures of body size and physical fitness, such as the body mass index, and physical performance, such as jump distance, running speed, and grip strength, all can affect throwing speed in junior baseball players (Nakata et al., 2013), these may be a possible reason for the RAE disparity in junior baseball players in the different positions. However, the possibility of a link between the RAE and playing positions in junior baseball players has not yet been analyzed.

Therefore, even though the RAE is surmised to vary in junior baseball players at different competitive levels and in different playing positions, there have been no categorical investigations into the matter. Grondin and Koren (2000) found a higher RAE in Japanese professional baseball players than in Major League players in the United States. In Japan, baseball is played in knockout tournaments in elementary school, which means that only the winning team proceeds to the next round. As there is a possibility that the more physically mature players in the same age group are pitching, it is expected that a player’s birth month may have a significant influence on the player’s competitive level and playing position in Japan.

Therefore, the aim of this study was to examine the influence of the RAE on the competitive level and playing position of male Japanese elementary school baseball players.

2. Method

The subjects were 695 male elementary school baseball players aged 11-12 (the sixth grade) who were divided into two groups on the basis of their competitive level: 506 general baseball players (baseball players, BP group) who had not yet competed at the prefectural level and 189 players (selected players, SP group) who had been selected to compete at the prefectural level or a higher level. All players had begun playing baseball either before or in fourth grade at elementary school. Players were asked to provide their birth date and main playing position: either pitcher or fielder such as catcher, infielder, or outfielder.

Elementary schools in Japan begin the academic year on April 1st and end on March 31st the following year; therefore, each grade has children who were born between April 2nd of the academic year and April 1st of the following year. Relative age was therefore coded into half-year (Albuquerque et al., 2015; Sixto et al., 2015) or quarter-year (Romann and Fuchslocher., 2013; Sedano et al., 2015) categories (Cobley et al., 2009). As the number of subjects in each position was small, the subjects were further divided into two on the basis of their birth month: Semester 1 (S1, April 2nd-September) and Semester 2 (S2, October-March (including April 1st)). The prevalence ratio for each semester was calculated by dividing the number of players in each semester by the total number of players.

Traditionally, the RAE is determined using Pearson’s chi-square goodness-of-fit test (Nicolas and Stéphane, 2015). Therefore, Pearson’s chi-square goodness-of-fit test was employed to examine the RAE of each group and each playing position. Based on similar studies on Japanese baseball players (Nakata and Sakamoto, 2012), the present study set the expected frequencies for all semesters at the same level for the goodness-of-fit test, with any result having a risk ratio of less than 5% being seen as statistically significant, and with effect sizes being assessed as w (Cohen, 1988). Cohen’s effect sizes were used for the interpretation of small (0.10-<0.30), medium (0.30-<0.50), and large (≧0.50) effects.

3. Results

Table 1 shows the number of players from each month at each competitive level, and Table 2 shows the number and prevalence ratio of players from each semester at each competitive level. The results of the chi-square test found that there was statistical
Table 1 Number of Players from Each Month at Each Competitive Level.

<table>
<thead>
<tr>
<th>Month</th>
<th>S1</th>
<th>S2</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>BP</td>
<td>51</td>
<td>47</td>
<td>47</td>
</tr>
<tr>
<td>SP</td>
<td>38</td>
<td>30</td>
<td>30</td>
</tr>
</tbody>
</table>

Table 2 Number and Prevalence Ratio of Players from Each Semester at Each Competitive Level.

<table>
<thead>
<tr>
<th>Semester</th>
<th>n</th>
<th>%</th>
<th>S1</th>
<th>n</th>
<th>%</th>
<th>S2</th>
<th>n</th>
<th>%</th>
<th>Total</th>
<th>$\chi^2$</th>
<th>p</th>
<th>w</th>
</tr>
</thead>
<tbody>
<tr>
<td>BP</td>
<td>271</td>
<td>53.6</td>
<td>235</td>
<td>46.4</td>
<td>506</td>
<td>2.561</td>
<td>0.213</td>
<td>0.07</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SP</td>
<td>153</td>
<td>81.0</td>
<td>36</td>
<td>19.0</td>
<td>189</td>
<td>72.429</td>
<td>&lt;0.001</td>
<td>0.62</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 3 Number and Prevalence Ratio of Players from Each Semester at Each Competitive Level and Playing position.

<table>
<thead>
<tr>
<th>Position</th>
<th>BP</th>
<th>n</th>
<th>%</th>
<th>S1</th>
<th>n</th>
<th>%</th>
<th>S2</th>
<th>n</th>
<th>%</th>
<th>Total</th>
<th>$\chi^2$</th>
<th>p</th>
<th>w</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pitcher</td>
<td>92</td>
<td>59.4</td>
<td>63</td>
<td>40.6</td>
<td>155</td>
<td>5.426</td>
<td>0.020</td>
<td>0.19</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fielder</td>
<td>175</td>
<td>49.9</td>
<td>176</td>
<td>50.1</td>
<td>351</td>
<td>0.003</td>
<td>0.957</td>
<td>0.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pitcher</td>
<td>111</td>
<td>86.0</td>
<td>129</td>
<td>14.0</td>
<td>240</td>
<td>67.047</td>
<td>&lt;0.001</td>
<td>0.72</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fielder</td>
<td>42</td>
<td>70.0</td>
<td>60</td>
<td>30.0</td>
<td>120</td>
<td>9.600</td>
<td>0.002</td>
<td>0.40</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

4. Discussion

This study analyzed the influence of the RAE on the competitive level and playing position in male Japanese elementary school baseball players. The results of the chi-square test for each competitive level indicated that only the SP group was statistically significant. Further, when a chi-square test was conducted on each playing position, both the pitcher and the fielder positions in the SP group were found to be statistically significant, while only the pitcher position was statistically significant in the BP group. From these results, therefore, it could be concluded that in junior baseball players, the higher the competitive level, the higher the RAE and that the RAE exerts a stronger influence on the pitcher position than on the fielder positions.

The results of the chi-square test for each competitive level indicated that only the SP group was statistically significant. The prevalence ratio of players born in S1 (April-September) in the SP group was 81%, which is higher than that in professional Japanese baseball players (62%) (Nakata and Sakamoto, 2011). A previous paper found that baseball players at a higher competitive level also had a higher RAE than other players in the same age group (Musch and Grondin, 2001). A meta-analytical review also found that even though the competitive level generally increased with age, the RAE was higher in junior players than in adult players. Therefore, the results of this study were judged to be valid.

Playing position has been found to be an influential factor concerning the RAE in team sports such as soccer and handball (Romann and Fuchslocher, 2013; Schorer et al., 2009; Sedano et al., 2015), with the RAE being found to be higher in playing positions that require greater physical maturity (Sedano et al., 2015). Therefore, in line with these findings, only the pitcher position was found to be statistically significant in the BP group in this study. In addition, while the effect size of the pitcher position in the SP group was only small, the effect size of the pitcher position in the SP group was large. The pitcher is seen to be the most important defensive position in a baseball team as they are required to...
throw more pitches and fast balls than are other positions. Measures of body size, such as body mass index, and physical performance, such as jump distance, running speed, and grip strength, all have been found to affect the throwing speeds of junior baseball players (Nakata et al., 2013). Therefore, there is a high possibility that physically mature players born earlier in the same age group would be in the pitcher position. Therefore, it was expected that a player’s birth month would have a significant influence on their competitive level and playing position in Japan. Therefore, it was concluded that the RAE was affected by a higher competitive level and that the RAE exerted more influence on the pitcher position than on the fielder positions. These findings may be a helpful reference for talent identification and development. If information about a player’s birth date is considered, the selection bias for positions associated with the RAE could be reduced.

Several limitations in this study should be acknowledged. First, this study only targeted the birth dates and playing positions of the subjects. However, previous studies have noted that there is the RAE for right-handed throwers but not for left-handed throwers (Grondin and Koren, 2000) and that the RAE was higher in 11-12-year-old hockey players than it was in hockey players less than 10 years old (Barnsley and Thomson, 1988; Helsen et al., 2005). Therefore, if handedness or another age group were included in the scope of this study, the results might have been different. Second, the results of this study indicated that physical maturity may be because of there being a higher RAE in the pitcher position than that in the fielder position. However, physical maturity was not investigated in this study. This limitation could be resolved in future research by investigating bone age and peak height velocity age to assess physical maturity. Third, the subjects were further divided into two groups on the basis of their birth month, because the number of subjects in each position was small. To identify the RAE in the junior period, large sample survey coded into quarter-year categories should be conducted in the future.

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