Relative age effect in Brazilian soccer players: a historical analysis

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Abstract

Relative Age Effect (RAE) refers to the differences in age between individuals grouped together for some performance activity. This study aimed to track the existence of RAEs in Brazilian football players throughout history. The sample consisted of 202951 players registered in the Brazilian Football Confederation (CBF). The individuals in the sample were born from 1921 to 1996 and played football professionally. The players were grouped into blocks of years, according to the years of their birth. The results revealed that the RAE presented in Brazilian soccer players and was showed a progressive growth over the years. Thus, the present study confirmed the hypothesis that RAE is present in Brazilian soccer players.

Keywords: Relative Age Effect, Brazilian Soccer Players and Historical Analysis.

1. Introduction

In soccer, as in many sports, grouping by chronological age is a commonly employed method in an attempt to “age-match” participants, hence reducing the potential physical and cognitive variation. For example, in a system where the 1st day of January is the cut-off date, a child born in January is grouped with a child born in December. This method is used to provide appropriate development, fair competition, and equal opportunity (Helsen, Winckel, & Williams, 2005; Musch & Grondin, 2001). However, this strategy does not seem to be sensitive enough to prevent the Relative Age Effects (RAE). RAE refers to differences in age among individuals grouped together for some performance activity (Barnsley & Thompson, 1988).

The results of previous studies indicate that RAE is reported in soccer in several countries, including the United States (Glamser & Vincent, 2004; Vincent & Glamser, 2006); Belgium (Helsen, et al., 2005); Denmark (Helsen, et al., 2005); England (Helsen, et al., 2005); France (Helsen, et al., 2005); Germany (Helsen, et al., 2005); Italy (Helsen, et al., 2005); The Netherlands (Helsen, et al., 2005); Portugal (Folgado, Caixinha, Sampaio, & Maçãs, 2006;
Helsen, et al., 2005), Spain (Campo, Vicedo, Villora, & Jordan, 2010; Helsen, et al., 2005; Jiménez & Pain, 2008), Sweden (Helsen, et al., 2005), and Brazil (Costa et al., 2009).

An important hypothesis to explain RAE in soccer is based on the selection processes used in elite sports. In popular elite sports, such as soccer in Brazil, the selection process is strong, because there is a larger pool of potential players for a certain type of group in a certain kind of sport (Campo, et al., 2010; Musch & Grondin, 2001). In addition, Cobley and his colleagues (2008) examined RAE in German professional soccer players over the years and reported a progressive growth of soccer participation in Germany from 1950 to 1990. In this case, the increased popularity of soccer may have propagated RAE over time through the intensification of competition and selection methods.

In competitive sports, like soccer in Brazil, the RAE can be explained by biological maturity. During adolescence, there is a considerable variation in the growth and biological maturity of individuals of the same chronological age (Malina, Eisenmann, Cumming, Ribeiro, & Aroso, 2004). Younger players who are less physically mature could be disadvantaged compared to players of the same chronological age who are more biologically mature (Cobley, Baker, Wattie, & McKenna, 2009; Musch & Grondin, 2001). Especially in soccer, younger players who are less biologically mature could have a disadvantage in functional capacities when compared to more biologically mature players (Malina, Eisenmann, et al., 2004).

Thus, older players seem to be bigger, stronger, faster, and have better coordination than younger players (Delorme, Boiche, & Raspaud, 2010). As a result, RAE can hold other consequences besides those physical benefits. Older players have more opportunity to participate in sports competition and, consequently, enhance psychological (eg. motivation, competitive anxiety, anticipation, and others), technical and tactical abilities, which can be important characteristics for the development of athletes (Baker & Logan, 2007; Malina, Eisenmann, et al., 2004; Williams & Reilly, 2000).

Based on previous studies (Cobley, et al., 2008; Costa, et al., 2009), it was hypothesized that RAE is present in Brazilian soccer players and its effect has progressively grown over the years (Cobley, et al., 2008). Thus, the present study aimed to trace the existence of RAEs in Brazilian soccer players throughout history.

2. Method

2.1. Data Collection
Data were collected from the archives of the Brazilian Football Confederation (CBF). A total of 202951 registered athletes in the CBF whose birth year ranged from 1921 to 1996, and all were registered professional football players until 2011.

2.2. Procedure
The players’ dates of birth were firstly categorized into quarters (Q) to examine RAE. The calendar year from January 1st to December 31st (Q1-January, February, March; Q2-April, May, June; Q3-July, August, September; Q4-October, November, December) was used.
All athletes were grouped into blocks of 10-years, according to their year of birth, except the players born from 1991 to 1996. The categories of birth decade were used to group players and detect changes in trends of participation throughout history. A similar strategy was used by Cobley et al. (2008) to analyze RAE in German soccer players throughout their participation history.

Thus, the players who were born from 1921 to 1996 were grouped into eight subgroups. The first group consisted of players born from 1921 to 1930 (n=2271); the second, from 1931 to 1940 (n=5732), and so on (i.e., 1941-1950, n=8938; 1951-1960, n=14633; 1961-1970, n=28869; 1971-1980, n=39,528; 1981-1990, n=61549), until reaching the final group, which was composed of players born from 1991 to 1996 (n=41430).

2.3. Statistical analyses
Chi-square tests ($\chi^2$) were conducted on the dates of birth of each athlete, according to the four quarters to determine the significance of deviations for the expected number of births in each quarter. Similar to others studies on relative age (Barnsley & Thompson, 1988; Barnsley, Thompson, & Legault, 1992; Costa, et al., 2009; Côté, MacDonald, Baker, & Albernethy, 2006), the expected values were calculated based on the assumption of an even distribution of birth throughout each quarter of the year.

The standardized residuals (Std) were used to determine which quarter contributed most to the value of $\chi^2$. According to Portney and Watkins (2000), residuals that are close to or greater than 2.00 are generally considered important.

$$\text{Std Residual} = \frac{O - E}{\sqrt{E}}$$

The Effect Size analysis of the $\chi^2$ was calculated by the following equation (Portney & Watkins, 2000):

$$\omega = \sqrt{\frac{\chi^2}{n}}$$

The level of significance was set at $p \leq 0.05$. Statistical procedures were carried out by the SPSS for Windows®, version 18.0.

3. Results

Table 1 shows the frequency distribution and chi-square value of the dates of birth of the athletes in the blocks. The observed distribution was not statistically different from the expected distribution in 1921-1930 [$\chi^2 (3) = 5.518; p= 0.138; \omega = 1.56$] and 1931-1940 [$\chi^2 (3) = 3.200; p= 0.362 ; \omega = 0.75$].

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Table 1: Chi-Square, Effect Size values and related observed frequencies per group of years

<table>
<thead>
<tr>
<th>Subgroups</th>
<th>Q1</th>
<th>Q2</th>
<th>Q3</th>
<th>Q4</th>
<th>$\chi^2$</th>
<th>P</th>
<th>$\omega$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1921-1930</td>
<td>522 (23%)</td>
<td>569 (25%)</td>
<td>589 (26%)</td>
<td>592 (26%)</td>
<td>5.518</td>
<td>0.138</td>
<td>1.56</td>
</tr>
<tr>
<td>1931-1940</td>
<td>1392 (24%)</td>
<td>1442 (25%)</td>
<td>1483 (26%)</td>
<td>1415 (25%)</td>
<td>3.200</td>
<td>0.362</td>
<td>0.75</td>
</tr>
<tr>
<td>1941-1950</td>
<td>2231 (25%)</td>
<td>2223 (25%)</td>
<td>2371 (26%)</td>
<td>2113 (24%)</td>
<td>15.010</td>
<td>0.002*</td>
<td>1.30</td>
</tr>
<tr>
<td>1951-1960</td>
<td>3594 (25%)</td>
<td>3780 (26%)</td>
<td>3828 (26%)</td>
<td>3431 (23%)</td>
<td>27.174</td>
<td>&lt;0.001*</td>
<td>1.36</td>
</tr>
<tr>
<td>1961-1970</td>
<td>7424 (26%)</td>
<td>7539 (26%)</td>
<td>7195 (25%)</td>
<td>6711 (23%)</td>
<td>55.846</td>
<td>&lt;0.001*</td>
<td>1.39</td>
</tr>
<tr>
<td>1971-1980</td>
<td>10282 (26%)</td>
<td>10332 (26%)</td>
<td>9825 (25%)</td>
<td>9089 (23%)</td>
<td>100.647</td>
<td>&lt;0.001*</td>
<td>1.60</td>
</tr>
<tr>
<td>1981-1990</td>
<td>17850 (29%)</td>
<td>16460 (27%)</td>
<td>14603 (24%)</td>
<td>12636 (20%)</td>
<td>1000.852</td>
<td>&lt;0.001*</td>
<td>4.03</td>
</tr>
<tr>
<td>1991-1996</td>
<td>14373 (35%)</td>
<td>11373 (28%)</td>
<td>8881 (22%)</td>
<td>6409 (15%)</td>
<td>3400.660</td>
<td>&lt;0.001*</td>
<td>9.05</td>
</tr>
</tbody>
</table>

* $p<0.05$

The results of 1941-1950 [$\chi^2 (3) = 15.010; p=0.002 ; \omega = 1.30$] and 1951-1960 [$\chi^2 (3) = 27.174; p<0.001 ; \omega = 1.36$] demonstrated that the observed distribution was statistically different. The standardized residuals analysis (Table 2) showed higher discrepancy for Q3, in 1941-1950 and Q2 and Q3 in 1951-1960 for the other quarters.

The results of the other blocks {1961-1970 [$\chi^2 (3)= 55.846; p<0.001 ; \omega = 1.39$]; 1971-1980 [$\chi^2 (3) =100.647 ; p<0.001 ; \omega = 1.60$]; 1981-1990 [$\chi^2 (3) =1000.852 ; p<0.001 ; \omega = 4.03$] and 1991-1996 [$\chi^2 (3)=3979.727; p<0.001 ; \omega = 9.05$]} demonstrate that the observed distribution was statistically different. The standardized residuals analysis (Table 2) showed higher discrepancy for Q1 and Q2 for 1961-1970; 1971-1980; 1981-1990 and 1991-1996 for the other quarters (Table 02).

Table 2: Standardized Residuals per Quarter

<table>
<thead>
<tr>
<th>Years</th>
<th>Q1</th>
<th>Q2</th>
<th>Q3</th>
<th>Q4</th>
</tr>
</thead>
<tbody>
<tr>
<td>1941-1950</td>
<td>-0.07</td>
<td>-0.24</td>
<td><strong>2.89</strong></td>
<td>-2.57</td>
</tr>
<tr>
<td>1951-1960</td>
<td>-1.06</td>
<td><strong>2.01</strong></td>
<td><strong>2.81</strong></td>
<td>-3.76</td>
</tr>
<tr>
<td>1961-1970</td>
<td><strong>2.43</strong></td>
<td><strong>3.79</strong></td>
<td>-0.26</td>
<td>-5.96</td>
</tr>
<tr>
<td>1971-1980</td>
<td><strong>4.02</strong></td>
<td><strong>4.53</strong></td>
<td>-0.57</td>
<td>-7.98</td>
</tr>
<tr>
<td>1981-1990</td>
<td><strong>19.85</strong></td>
<td><strong>8.65</strong></td>
<td>-6.32</td>
<td>-22.18</td>
</tr>
</tbody>
</table>

Std $>2.00$

4. Discussion

The present study aimed to track the existence and possible changes of RAEs in Brazilian soccer players throughout history. The results showed that RAE is present in Brazilian soccer players and that this effect has progressively increased over the years, mainly after the 1960s, when physical preparation was widely adopted by staff in soccer clubs.
Previous studies (Ashworth & Heyndels, 2007; Cobley, et al., 2008; Costa, et al., 2009; Helsen, et al., 2005; Jiménez & Pain, 2008; Vincent & Glamser, 2006; Williams, 2010) have suggested that RAE is evident in soccer. Specifically, in Brazil, the present study demonstrated that RAE is currently (1991-1996) present in soccer players with large effect size ($\omega = 9.05$).

RAE is present in soccer and this hypothesis has been confirmed by the previous studies (Ashworth & Heyndels, 2007; Cobley, et al., 2008; Costa, et al., 2009; Helsen, et al., 2005; Jiménez & Pain, 2008; Musch & Hay, 1999; Vincent & Glamser, 2006; Williams, 2010). The investigation about RAE in soccer has been strongly analyzed in Europe and Brazil (Cobley, et al., 2009). However, in Africa, Asia, and other countries of South America there is little research on RAE, in comparison to Brazil and Europe (Cobley, et al., 2009). In addition, it is important to assess RAE in other countries to verify if this is a worldwide phenomenon. Moreover, other countries might provide meaningful information about the role of RAE in their population (Cobley, et al., 2009).

Some hypotheses to explain RAE in soccer players are based on the popularity of the sport and the biological maturity process of the players. The mechanisms commonly hypothesised to explain RAE are based on the selection processes used in elite sports (Musch & Grondin, 2001). According to Musch and Grondin (2001) the strongest evidence for RAE exists in the most competitive sports when the sport’s popularity in a given country is high. So, the selection process is influential because there are larger pools of potential players in each category. For example, there are 11 places on a soccer team, and that in a given team, there are 11 young soccer players of a given age group interested in occupying these places. In such a case, there is no reason to expect a RAE, because everyone will have a place on the team. However, suppose that there are 1110 young soccer players interested in playing in this soccer team. In such a case, there will be strong competition to obtain a place, and RAEs are much more likely to occur (Musch & Grondin, 2001). Considering the idea that RAE occurs when selection process is harder, the results of this study revealed that the selection process of young soccer players in Brazil have progressively increased over the years, as demonstrated by the increased value of chi-square [$\chi^2(3) = 15,010$] for 1991-1996 ($\chi^2(3) = 3,797,727$)] and Std Residuals for the first quarter [$\chi^2(3) = 39,46$] from 1941 to 1996, over the block of years.

In literature on RAE, biological maturity is considered a mechanism that provides advantage in sports or activities with physical contact (Delorme, Boiche, & Raspaud, 2009) and is more important than motor skills for these abilities (Van Rossum, 2006). However, this hypothesis has not presented consistent results yet. For instance, RAE did not occur in activities whose motor skills are more important than physical capacity (Van Rossum, 2006), but it was demonstrated in male shooting sports (Delorme & Raspaud, 2009) and Nascar racing (Abel & Kruger, 2007). In addition, it would be interesting to investigate RAE in different playing positions in team sports (Ashworth & Heyndels, 2007; Schorer, Cobley, Büsch, Bräutigam, & Baker, 2009). For instance, Ashworth & Heyndels (2007) observed stronger RAE in goalkeepers and defenders, which did not occur to compared to forwards in soccer.

Some authors are concerned to express the need to remove RAE inequality (Baker, Schorer, & Cobley, 2010; Cobley, et al., 2008). The results of this study showed that, in Brazil, over the
years, the young players born at the end of the year had reduced possibilities to achieve excellence. Thus, it is important to create mechanisms to control RAE. For instance, Cobley et al. (2008) suggest that an increased number of soccer teams can maximize opportunities and reduce competition and the need for selection, consequently decreasing RAE. Another alternative is the modification of the annual age groupings (eg. from January to June) or changes in age-grouping range (Baker et al., 2010).

In addition, coaches of youth players (10-16 years of age) should not pressure athletes to win, especially in age groups where performance is affected by biological maturation (Malina, Eisenmann, et al., 2004). This phenomenon is controlled in younger categories, this effect in the other age groups (after 16 years of age) may be limited or eliminated, since biological maturation becomes less variable in early adulthood (Malina, Bouchard, & Bar-Or, 2004).

The present study corroborated the hypothesis that relative age effect is present in Brazilian soccer players and that this effect has progressively increased over the years.

5. Conclusion

Relative Age Effect is present in some sports. Especially in soccer, Relative Age Effect can be a worldwide phenomenon. The major explanation for this hypothesis is based on the worldwide popularity. The results of the present study have demonstrated that the Relative Age Effect has increased over the years among Brazilian professional soccer players. These results also demonstrate that the current selection process in youth age groups can fail to provide opportunities for all younger soccer players, especially the ones born at the end of the year. Biological maturity is used to explain the advantages of the players that were born in the beginning of the year in youth age groups when the professional players formation is started. So, the major result demonstrated that a change in the selection process is mandatory in youth age groups, although the present study has investigated only Brazilian players. So, other countries that soccer is popular should also be investigated. In addition, a historical analysis of the Relative Age Effect can be performed in other countries that soccer is consolidated in the world scenario (eg. European countries) and the countries that soccer is not as consolidated yet (eg. African countries).

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6. References


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