

# The Relative Age Effect in Male Volleyball Championships

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**Abstract** Participants in youth sports are grouped by age, which is a selection criterion used to safeguard equal opportunities. The aim of this study was to examine the existence of a relative age effect (RAE) in male volleyball and to identify this influence in four different categories. Data were collected in four men's volleyball championships in 2015 (n=1105): Boys' U19 World Championship (n=393), Men's U21 World Championship (n=313), Men's U23 World Championship (n=234) and Men's World Cup (n=165). Thus, athletes were analyzed using two models. In the first model, they were divided into four groups based on month of birth; quarters Q1, Q2, Q3, and Q4 were January–March, April–June, July–September and October–December, respectively. In the second model, they were divided into two groups based on the month of birth; first and second semesters, January–June and July–December, respectively. Chi-squared tests were performed to investigate the RAE. The results revealed that the birth-date distributions of the four investigated groups of volleyball players showed an overrepresentation of players born in the first quartile, except in the Men's World Cup. Regarding the second model, the results revealed a greater predominance of athletes born in the first semester. Moreover, the RAE risk progressively decreased with an increase in level of volleyball.

**Keywords** Relative age effect, Sports, Youth categories, Talent selections

## 1. Introduction

Volleyball is now one of the largest five international sports, and the International Volleyball Federation (FIVB), with its 220 affiliated national federations, is the largest international sporting federation in the world [1]. Volleyball is considered a highly dynamic sport with intermittent characteristics. The offensive and defensive actions require strong development of the motor skills required to achieve the technical, tactical and physical demands of this complex sport. [2, 3, 4].

In team sports, a phenomenon of relative age effect (RAE) has been observed, resulting from differences in age among individuals competing in the same age category, where there is a tendency for coaches to select the relatively older athletes [5, 6]. Indeed, although the majority of studies revealed a significant RAE, this was not observed systematically for all sports, periods or sexes [7].

During childhood and adolescence there is variation

among individuals in the growth and maturation process with regard to progress toward the mature biological state [8]. Individuals tend to present different levels of strength, power, endurance, speed and anthropometric attributes, such as height and body mass [6]. As physical qualities are presented as one of the determining factors to achieve sporting success [9], the early matures have a momentary advantage over later maturers in sports, where performance is influenced by height, body mass, strength, power, lean mass, speed, aerobic power and endurance [8, 10]. However, previous studies have indicated that younger athletes can progress to be more successful than older ones, with the same year of birth, i.e., in ice hockey [11].

This phenomenon has been studied in many different sports, across widely varying samples and other factors in athletes, including soccer [6, 12, 13], basketball [7], swimming [14, 15], handball [16] and combat sports [17, 18]. This fact was studied by Okazaki, Keller, Fontana and Gallagher (2011), who assessed the RAE in volleyball athletes. The results revealed that the majority of birth dates in young volleyball players were in the early months of the year [5]. A recent study by Nakata and Sakamoto (2011) analyzed the RAE among Japanese athletes and observed a relative age effect in volleyball players [19].

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To our knowledge, no study has yet focused on the RAE in volleyball in different categories of the World Championships organized by the International Volleyball Federation. Due to the lack of related studies in all volleyball categories, the main purposes of the present study were to examine the distribution of birth dates of the volleyball athletes who participated in the 2015 World Championships in four different categories: Boys' U19, Men's U21, Men's U23 and Men's World Cup. Our hypothesis was that an RAE exists in volleyball, especially in the youth categories. This suggests the need to improve knowledge about the RAE in volleyball players so that these results can be used by coaches and performance analysts to adapt the formation of long-term volleyball players.

## 2. Methods

### 2.1. Procedure

A total of 1105 male players participated in the present study. The subjects participated in four editions of the world volleyball championships in 2015: Boys' U19 World Championship, Men's U21 World Championship, Men's U23 World Championship and Elite Men's World Cup. All players referenced on the competition page were selected for this study. These championships were chosen due to their high technical level, since they are considered the most important volleyball championships in the world. Table 1 presents the profile of each analyzed competition.

### 2.2. Measures

All the data used for further analysis was obtained from the official website of the International Volleyball Federation (FIVB), available at [www.fivb.com](http://www.fivb.com). This included information relating to the players, such as full names, day, month and year of birth as well as country they represent and category in which they competed.

The cut-off date in the FIVB system is January 1st. Thus, the birth months of players are classified in two forms: The first is divided into four quarters as follows: January-March (Q1), April-June (Q2), July-September (Q3) and October-December (Q4). Athletes younger than the target year for the competition were also analyzed according to their birth quarter. This method has been used when investigating the RAE for team sports. Thus, similar to other studies on RAE, the sample was composed of athletes from different countries and so the expected values were calculated based on the assumption of an even distribution of births throughout each quarter of the year, assuming that other factors would be rendered unimportant [16, 21].

### 2.3. Analyses

The RAE is identified when a significant difference is found between the expected theoretical number of players born per month or quarter (i.e., periods of a semester or three consecutive months) and the observed number of players [9]. A chi-square goodness-of-fit test was conducted to

determine whether the observed distribution per quarter significantly differed from the expected theoretical distribution. Traditionally, the expected distribution is based on the actual distribution of births in the global population of the studied country for the corresponding years. Data were analyzed using SPSS Version 17.0 (2013; SPSS, Inc., Chicago, IL, USA) software, using a significance level of 0.05.

## 3. Results

Table 1 summarizes the number of players in each category and their anthropometric characteristics based on the data collected from the FIVB website.

**Table 1.** Sample size and anthropometric characteristics in each category of 2015 FIVB male competitions

Group	Teams	Sample	Height	Weight
Boys' U19 World Championship	20	393	193.0±7.5	82.4±8.0
Men's U21 World Championship	16	313	194.6±7.9	83.4±8.3
Men's U23 World Championship Elite	12	234	193.3±8.8	83.4±9.4
World Cup	12	165	196.0±8.9	87.2±9.2

**Table 2.** Birth date distributions of national volleyball teams, expressed by semester (S)

	1S	2S	$\chi^2$	P
Boys' U19 World Championship	241 (61.3%)	152 (38.7%)	20.155	<0.001
Men's U21 World Championship	183 (58.5%)	130 (41.5%)	8.974	<0.01
Men's U23 World Championship	136 (58.1%)	98 (41.9%)	6.171	<0.05
Elite World Cup	86 (52.1%)	79 (47.9%)	0.279	>0.05
Total	646 (58.5%)	459 (41.5%)	31.646	<0.001

The distribution of the birth dates divided into two semesters is presented in Table 2. The observed distribution was significantly different from the four quarters for the following categories; U19 ( $P<0.001$ ), U21 ( $P<0.01$ ) and U23 ( $P<0.05$ ). However, in the World Cup (Elite) the birth dates were more evenly distributed ( $P>0.05$ ).

Table 3 shows the distribution by quarters of the dates of birth of the players. The results revealed that the distributions were significantly different for all categories when analyzing the 4 quarters; U19 ( $P<0.001$ ), U21 ( $P<0.01$ ), U23 ( $P<0.01$ ) and Elite ( $P<0.05$ ).

**Table 3.** Birth date distributions of national volleyball teams, expressed by annual quarters (Q)

	1Q	2Q	3Q	4Q	$\chi^2$	P
Boys' U19 World Championship	129 32.8%	112 28.5%	76 19.3%	76 19.3%	21.626	<0.001
Men's U21 World Championship	105 33.5%	78 24.9%	69 22.0%	61 19.5%	14.042	<0.01
Men's U23 World Championship	76 32.5%	60 25.6%	60 25.6%	38 16.2%	12.496	<0.01
Elite World Cup	41 24.8%	45 27.3%	52 31.5%	27 16.4%	8.067	<0.05
Total	351 31.8%	295 26.7%	257 23.3%	202 18.3%	42.797	<0.001

## 4. Discussion

In this study, we observed a skewed distribution of birth dates, known as the relative age effect (RAE), in the World U19, U21, U23 and Elite Volleyball Championships in 2015. The majority of the players were found to have birth dates in the first 6 months of the year. As the age of the athletes increased, the RAE gradually diminished. As predicted, the main findings confirm the existence of an RAE at almost all competitive levels of male volleyball with an overrepresentation of athletes born in the first quarter of the year. Our results support the presence of moderate RAEs in national volleyball teams, as 58.5% of these players were born in the first half of the year. A possible explanation may be that RAE has been observed in sports in which body size and strength play a key role [8]. Thus, in the early levels of selection, relatively older athletes may be favored because of their advantages in height and strength [11]. During the stages of childhood and adolescence, a more advanced biological maturation state has advantages in different physical and physiological characteristics, e.g., body composition, fat-free mass, aerobic power, strength, endurance and speed [8].

The main cause of RAE in volleyball might be attributed to the talent identification processes, which focus predominantly on the physical attributes. Considering that height is crucial, the presence of RAE in young categories is not a surprise. According to Musch and Grondin (2011), many promising talents are likely to be overlooked because of a relative age disadvantage due to the over-emphasized importance given to physical attributes in youth sports [9].

The RAE is usually explained on the basis of physical maturity. However, competitions based on chronological age involving young athletes not only give advantage to early maturing individuals, but also those who are born at the beginning of the competitive year with a larger time of practice in the sport, compared to individuals born at the end of the year (e.g., final quarter of the year). In this sense, many talented young volleyball players could be excluded from

major international competitions because they were born at the end of the year, although a possible consequence would be a decrease in practice due to the lower physical and physiological attributes [9]. That is, the relatively older children and players in the same age group are more likely to achieve sporting success than the younger children [19, 22, 23].

The differences in the RAE can be assigned according to the level of practice: the higher the level of practice, the greater the presence of RAE [7, 24, 25]. As the sample of the present study was composed of volleyball players who participated in the most important competitions of the season for each age group, it seems this could be a factor that possible maximizes the identification of RAE in young volleyball athletes.

Several suggestions for reducing RAEs in sports have been proposed. According to Barnsley and Thompson (1988), creating more age categories (e.g., half a year) is a factor that would reduce the RAE in sports development [26]. This change would result in smaller RAEs and less physical differences among players within any specific age group. Even if the main competitions around the world do not change, it is interesting for countries to establish this competition format for better development of the athletes. The decrease in RAEs may substantially enhance performance at the elite senior level in the future [27]. However, it is important to note that the identification of talent and player development to the adult categories, must be seen as a more long-term process.

The volleyball game is characterized by a complex of motor skills in a special way as fast and jerky movements of short distances with frequent change of direction and explosive power spikes. This is related to controlled use of the technical skills. The use of the RAE, mainly for the young athletes, must be considered since this chronological difference may influence on the results in the assessments of the athletes' performance as well as the capacity for the development of the timing and decision-making. The dynamics of changes in the body structure and maturation age directly affects the skills and physical fitness development. Thus, the focus must be on the player ability and not only on physical maturation. In short, the use of RAE should be used to decrease possible cognitive, physical and emotional differences among sport participants and doing so, enhancing psychological, technical, and tactical abilities [28, 29]. The limitation of this study is related to the sample, which was obtained from different countries. This detail is important because births are not evenly distributed throughout the year and are affected by environmental areas and cultural factors, similar to other studies [17].

## 5. Conclusions

In conclusion, the current study demonstrated the presence of RAE when analyzing volleyball competitions. In addition, RAE was more related to age, whereby in younger

competitions this phenomenon was observed in a more consistent way. Longitudinal studies are required to examine the consistency of the trends observed in this study, characterizing the youth volleyball competitions. This suggests the need for improved knowledge on the RAE in volleyball players so that the results can be used by coaches and performance analysts to adjust and reorganize the process of long-term volleyball training.

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