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## LETTER TO THE EDITOR

### Relative age effect and performance in elite male and female water polo players



#### *Effet de l'âge relatif et performance chez des hommes et femmes joueurs de waterpolo d'élite*

#### 1. Introduction

In order to avoid very large age differences children, both in school and sport, are organized into annual age groups. For that, a given birth-date is used as a cut-off date, which in most countries it is 1<sup>st</sup> January. However, against what it is intended to achieve, an overrepresentation of participants born in the first months after this cut-off date has been observed; this is known as the Relative Age Effect (RAE). As such, in some sports a larger proportion of athletes born in the first quarter of the year has been described in comparison to the smaller proportion of those born in the last quarter. This underrepresentation of the relatively younger athletes is a matter of concern because athletes born in the last months of the year are not given equal opportunities [1].

The reason for the RAE to occur seems to be that relatively older children and adolescents are taller and heavier, and they display better performance; hence, they have more opportunities to be selected for better teams. The presence of the RAE has been confirmed specifically in the most popular sports [1], such as football, basketball, rugby, hockey, skiing and others, particularly in men. However, similar RAE studies in women are scarce; in the case of water polo, to the best of our knowledge, they are non-existent.

It has been demonstrated that, amongst other factors, anthropometry is an important factor for success in water polo. In fact, male [2] and female [3] players belonging to national squads were found to be taller and heavier. Further, positive correlations have been demonstrated between throwing velocity or ball speed and body size [4,5]. Therefore, it appears that some anthropometric characteristics, particularly stature and body mass, are relevant in water polo. For this reason, it could be hypothesized that RAE is

present in elite water polo players. However, RAE has also been related to the competitiveness influenced by the popularity of some sports, and in this regard, taking into account that water polo is not a popular sport in many countries, one could speculate that RAE would not be present.

With this in mind, our purpose was to define to what extent the relative age effect is present at elite level in water polo; and secondly, we aimed to investigate if the relative age had an influence in performance, in both genders.

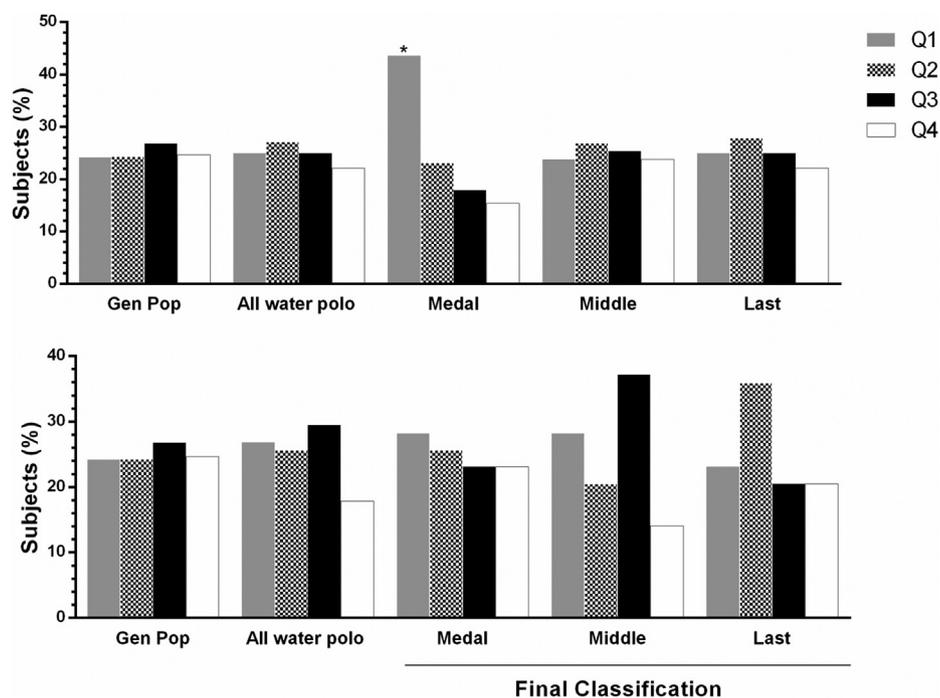
Data of the national teams (156 women and 208 men) participating in the 2016 Belgrade (Serbia) European Championships retrieved from the official web site were analysed ([http://wpbelgrade2016.microplustiming.com/indexWPBelgrade\\_web.php](http://wpbelgrade2016.microplustiming.com/indexWPBelgrade_web.php)).

The date of birth, height and weight, final classification and game parameters (played minutes, number of shots and number of goals, number of shots per minute (shots/min), number of goals per minute (goals/min)) by gender were recorded. We also calculated the efficiency of the goals (number of goals per time unit/number of shots per time unit, all multiplied by 100). The Body Mass Index (BMI, weight (kg)/height<sup>2</sup> (m)) and the Reciprocal of the Ponderal Index (RPI, height (cm)/weight<sup>1/3</sup> (kg)) were also calculated.

Birthdates were divided in four quarters: Q1 (1 January to 31 March), Q2 (1 April to 30 June), Q3 (1 July to 30 September) and Q4 (1 October to 31 December). The distribution of the birthdates was compared with the distribution of the births of the general population of the participating countries (<http://ec.europa.eu/eurostat>) using the Chi squared Goodness of Fit.

Regarding the final classification, teams were grouped as follows: medal group (1<sup>st</sup> to 3<sup>rd</sup>); middle group (4<sup>th</sup> to 13<sup>th</sup>) and last group (14<sup>th</sup> to 16<sup>th</sup>).

Also, to determine the relevance of the birth-date, anthropometric and game variables in the final overall performance, a stepwise multiple regression analysis was performed. To this end, the position achieved in the final classification was represented by a number. Since in the results it is easier to understand that "a larger number is better", we reversed the order of the final classification. The dependent variable was the (reversed) final classification transformed into logarithm. The independent or



**Figure 1** Birth dates of the general population (Gen pop) and of the male (above) and female (below) water polo players. \* $P < 0.05$  compared to the general population.

**Table 1** Multiple stepwise regression analysis of the final classification as the dependent variable for men and women.

	Predictor variables	$\beta$	$P$	$R^2$	$R^2$ Change	F change (sig.)
Men	Goal efficiency	0.221	0.003	0.062	0.062	11.433**
	Goal efficiency, month	-0.216	0.003	0.094	0.032	6.006*
	Goal efficiency, month, RPI	0.189	0.010	0.119	0.026	4.959*
	Goal efficiency, month, RPI, age	0.154	0.039	0.141	0.022	4.324*
Women	Goal efficiency	0.608	<0.001	0.458	0.458	107.165***
	Goal efficiency, age	0.192	0.003	0.491	0.033	8.200**
	Goal efficiency, age, height	0.157	0.016	0.514	0.023	5.918*

RPI: reciprocal ponderal index.

\*  $P < 0.05$ .

\*\*  $P < 0.01$ .

\*\*\*  $P < 0.001$ .

predictor variables included were the rest of the variables. The level of statistical significance was set at  $P < 0.05$ .

As shown in Fig. 1, the distribution of the month of birth was even when the total male and female populations were taken into account. However, in a deeper analysis we observed that in the medal group (only men), an overrepresentation of players born in the first quarter was evident: 43.6% of the players had been born in Q1, with only 15.4% in Q4. This distribution was significantly different from that of the general population (chi square goodness of fit:  $X^2: 8.591$ ,  $P < 0.05$ ).

The multiple regression analysis (Table 1) revealed that in the case of the female teams, 51.4% of the variability of the final classification could be explained by the efficiency of goals (45.8%), age (3.3%) and height (2.3%), whereas in the case of the male teams, the relevant variables were efficiency of goals (6.2%), month of birth (3.2%), RPI (2.6%) and age (2.2%), which accounted for 14.1% of the variability.

## 2. Discussion

In the present study, we aimed to ascertain if the RAE is present in elite water polo players and if this RAE is

related to performance. To this end, we investigated several parameters in the most important water polo competition in Europe, which is considered to be one of the greatest powers at the international level. Several studies on the RAE have been conducted in other sports. However, water polo studies in comparison are scarce. Thus we aimed to contribute to our knowledge of this sport in order to contribute to improving the performance of both male and female players.

An overrepresentation of players born in the first months after the cut-off date, known as the RAE, has been widely reported for many sports [1]. This phenomenon is a product of selection and competitiveness, and consequently it has been demonstrated for the most popular sports. However, because water polo is not a mainstream sport, one could expect that RAE may not necessarily be present. In the overall study of the data, taking all the squads into account, we did not observe an uneven distribution of the participants (neither in men nor in women) in terms of RAE, so it could be concluded that RAE is not present in elite level water polo teams. Nevertheless, upon deeper analysis, we found that in the case of men, almost half of the players (43%) in the medal winning group had been born in the first three months of the year, with only 15% having been born in the last months; this can clearly be considered to be a RAE. Moreover, the month of birth was included in the regression analysis. This RAE is the result of a bias in the selection of participants towards the relatively older ages, due to their larger body sizes and better performance. Thus, it is reasonable to consider that in countries with a long tradition in male water polo, where this is a popular and consequently, competitive sport, there is a selection of players towards the relatively older ones, a feature which is perpetuated until the adult level. In contrast, for female participants, there is not such a tight selection process, since it is a minority sport, thereby preventing RAE for being present.

In conclusion, in the present study, an overrepresentation of players born in the first months of the year was only detected in the male medal winners, probably due to the selection process of players from the young age in those nations in which water polo is a popular and competitive sport.

## Disclosure of interest

The authors declare that they have no competing interest.

## References

- [1] Cobley S, Baker J, Wattie N, McKenna J. Annual age-grouping and athlete development: A meta-analytical review of relative age effects in sport. *Sports Med* 2009;39:235–56.
- [2] Idrizovic K, Uljevic O, Ban D, Spasic M, Rausavljevic N. Sport-specific and anthropometric factors of quality in junior male water polo players. *Coll Antropol* 2013;37:1261–6.
- [3] De Siati F, Laffaye G, Gatta G, Dello Iacono A, Ardigò LP, Padulo J. Neuromuscular and technical abilities related to age in water-polo players. *J Sports Sci* 2016;34:1466–72.
- [4] Ferragut C, Abalde J, Vila H, Rodriguez N, Argudo F, Fernandes R. Anthropometry and throwing velocity in elite water polo by specific playing positions. *J Hum Kinet* 2011;27:31–44.
- [5] Platanou T, Varamenti E. Relationships between anthropometric and physiological characteristics with throwing velocity and on water jump of female water polo players. *J Sports Med Phys Fitness* 2011;51:185–93.

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