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Maturity Status, Relative Age and Constituent Year Effects in Young Iberian Kayakers

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Abstract: Like in other sports systems, in kayaking, young athletes are commonly grouped by their birth years. This study analyzed maturity status, relative age, and constituent age effects in young Under 14 (U14) and 16 (U16) Iberian male kayakers. One hundred and thirty (U14: n =80; U16: n = 50) young kayakers aged 14.10 ± 1.06 years were assessed for anthropometry, performance, maturity, and sport experience. The year was divided into four birth quarters (BQ). There were no significant differences in the kayaker's distribution by BQ in both categories (U14, p = 0.348; U16, p = 0.709) or total sample (p = 0.783). Six of the ten best kayakers in the U14 category were born in the year's first half, and eight were among the U16 kayakers. Talent detection and selection systems based solely on the young kayakers' performances may imply some bias. One of the ways to get around this situation would be to adopt a grouping system similar to bio-banding, allowing the maximum number of practitioners to experience the possibility of obtaining competitive success.

Keywords: talent identification; maturation; performance; kayaking

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1. Introduction

In Portugal and Spain, during the various age-group competitions, different experience levels and skill may be found among the paddlers participating in the National Championship. To provide equal opportunities during competition, like in other sports systems, in kayaking, young athletes are commonly grouped by their birth year.

Maturation is a process that involves many body changes [1]. It plays a crucial role in improving motor skills; and maximizing motor skill proficiency is ideal in childhood. [2]. Previous research, considering performance [3], with young paddlers has focused on maturational and morphological analysis of the best athletes in their categories [4–7], and reported that the most mature kayakers obtain the best performances. More recently, Fernandes et al. [8] showed that years of practice were crucial in youth kayaking success besides maturity. Therefore, talent identification batteries must consider aspects of maturity in performance variations [9], preventing the drop out of less mature children derived from an absence of competitive success or a perceived absence of ability [10].

Meanwhile, relative age (RA) concerns a child's chronological age inside their age group and is defined by the date of birth and the cut-off selection date [11]. The relative age effect (RAE) is a frequent occurrence in youth sports [12] and is characterized by the discrepancy between athletes' observed and expected birth date distributions [13]. Thereby, children born early in the selection year have a higher probability of experiencing successful participation and maintaining it.

It is important to notice that RA and biological maturation are independent constructs. RA depends on birth and cut-off dates, and biological maturation depends on genetics and environmental context. Also, there is a considerably more extensive range for variation in biological maturity in a single-year age group than in RA. While in RA, differences are limited to twelve months, maturity can differ up to six years [11].

For instance, regarding chronological age, a person born in January is nearly twelve months older than some other person born in December of the same year. Consequently, the physical and psychological differences that can be observed may perhaps be attributed to this singularity [4,14]. Furthermore, when studying under 13 and 15 football players, Altimari et al. [5] stated that stature, body mass, and lean body mass were influenced by the birth date in these categories. Additionally, Sandercock et al. [6] presented significant differences between birth months in an analysis of physical fitness test performances. Such an advantage could justify, to some extent, the bias in sports selection credited to the peculiarities of the RAE.

Also, RAE may show up well before puberty, and it is more likely that these differences result from the context in which children are inserted, resulting in the possibility of experiencing different environments with implications for their development, which is probably more associated with age than maturity [7]. For that reason, almost all competitive sports are organized into age categories, presumably, to reduce such differences. Most likely, participants are grouped by chronological age to guarantee honest competition and opportunity [3].

The influence of the relative age effect phenomena is explained as influencing several sports, including swimming [15,16], football [17], and basketball [18]. Nevertheless, reversed RAE has also been reported, like in the cases of athletics [19] and futsal [20]. Moreover, this inverse RAE has been explained in sports where performance demands high technical skills [21], and physical qualities may be secondary [22].

Regarding kayaking, the only study focusing on the RAE phenomena was conducted by Isorna-Folgar et al. [23], pointing out that young athletes born in January, February, and March have a higher probability of being chosen for development training camps. However, more is needed to configure certainty about achieving international sporting success in later years. Indeed, youngsters with the potential to reach the elite level born late in the year have an inferior opportunity to participate in sports when they have already passed puberty [24]. In most sports, children born early in the year have better performances than children born later in the year. However, this tendency is not found in adult athletes, with no clear correlation between performance and date of birth [25].

Besides the RAE, another fact that may influence performance is the Constituent Year Effect (CYE). This term refers to the effects of the birth year observed in groups with more than one age group [26]. During the youth training process, the older athletes of the category tend to have an advantage over the younger ones. This advantage is accentuated mainly due to the physical differences resulting from the maturation processes.

This study intended to analyze maturity status and the RAE, and to evaluate the influence of CYE in young Iberian male kayakers, considering how it may impact the opportunity equity of the young kayakers in the complex and frail system of identification, detection, selection, and development of young kayaking talents.

2. Materials and Methods

2.1. Participants

This study evaluated 130 young Iberian male kayakers aged 14.10 ± 1.06 years born between 1 January 2003 and 31 December 2006. Data was collected regarding kayakers' experience, anthropometry, performance, and maturity status. All participants passed the mandatory medical examinations required by the respective national federation. Kayakers with less than one year of practice were automatically excluded from the assessment. The Ethical Committee approved all procedures. Written informed consent was obtained from parents or legal guardians.

2.2. Design and Procedures

To assess RAE, kayakers born between 1 January 2003 and 31 December 2004, were categorized as under 16 years of age (U16). Kayakers born between 1 January 2005, and 31 December 2006 were classified as under 14 years of age (U14). Uniformity of birth season of broader populations from different regions was assumed. Birth quarters (BQ) were defined as 1st BQ: 1 January to 31 March, 2nd BQ: 1 April to 30 June, 3rd BQ: 1 July to 30 September and 4th BQ: 1 October to 31 December. To assess the CYE, the athletes were also divided by year of birth [3]. The participants were distributed as follows: 50 U16, 15.24 $\pm$ 0.61 years, 80 U14, 13.40 $\pm$ 0.54 years.

Data were collected at the Spanish and Portuguese National Championships, and the competitions took place with about a month of difference. Racecourse conditions were flat water with no current alongside good weather with no wind (less than 0.5 $m \cdot s^{-1}$), which were verified in both competitions. Kayakers were assessed considering their competition schedule and throughout the day.

Two certified level 3 International Society for the Advancement of Kinanthropometry (ISAK) evaluators took all anthropometric measures following the ISAK procedures. Body mass (kg) was assessed using a digital scale SECA 878 (SECA, Hamburg, Germany), and stretch stature, and sitting height (cm) were assessed with a portable stadiometer SECA 206 (SECA, Hamburg, Germany). Before the sessions, to prevent measurement inaccuracies, all instruments were calibrated. Relative technical error of measurement [27] ranged between 0.03% and 0.11% for anthropometric measures.

For performance, the competition officials considered the time, in seconds, required for the kayakers to complete the race, 3000 and 5000 m for the U14 and U16, respectively. Also, the distribution of birth quarters of the participants who obtained the ten best performances in each category was analyzed.

Biological development was assessed by somatic maturation [1], the percentage of the predicted adult height (PAH%) defined the maturity status, and the Khamis and Roche [28] method was used to estimate the paddlers predicted adult height (PAH). Mean parental stature was corrected according to Epstein et al. [29]. Also, maturity offset was obtained to estimate the distance in years from the peak growth velocity for height (PHV), that the athlete is currently in [30]. Kayakers were classified as late, on time (average), or early maturing based on the PAH% converted to a z-score [13,31,32]. A z-score between -1.0 and +1.0 categorized the kayaker as on time in maturity status. A z-score < -1.0 classified the kayaker as late, while a z-score > +1.0 classified the kayaker as early maturing [32].

2.3. Statistical Analysis

The data distribution and the homogeneity of variance were tested using Kolmogorov–Smirnov and Levene's, respectively. Birth year intervals (frequency) and distributions of kayakers by maturity status were determined by BQ for all kayakers and evaluated with the Chi-square statistic. Descriptive statistics were determined by BQ in each category and by year of birth and compared with a one-way analysis of variance (ANOVA) with the post hoc Bonferroni test. Estimated effect sizes (η2) were also calculated. The level of significance was set as $p < 0.05$. SPSS Statistics 27.0 (SPSS Inc., Chicago, IL, USA) was applied to perform the statistical analysis.

3. Results

The frequency of month and years of birth by quarter of the young Iberian kayakers, for U14, 16, and the total sample are summarised in Table 1. There were no significant differences in the kayakers' distribution by BQs, for the category of participation (U14, $p = 0.348$; U16, $p = 0.709$) or total sample ($p = 0.783$). Despite that, when analyzing the total sample, the kayakers born in the 3rd BQ were slightly more represented (28.5%). Examining by category of participation, this tendency was observable only for the U14, where the athletes born in the 3rd BQ represented 37.3% of all the participants. For the U16 category, the tendency was to observe more paddlers born in January, February, and March.

Table 1. Frequency of month and year of birth by quarter for U14, 16 and the total sample of kayakers.

Age Group	n	Birth Year	Mean ± SD CA (Years)	1st BQ n	1st BQ %	2nd BQ n	2nd BQ %	3rd BQ n	3rd BQ %	4th BQ n	4th BQ %	Expected Frequency	χ^2
U14 Kayakers	80	2006, 2005	13.40 ± 0.54	18	22.5	17	21.3	27	33.8	18	22.5	20	3.300 (ns)
	29	2006	12.82 ± 0.32	8	27.6	6	20.7	8	27.7	7	24.1	7.3	0.379 (ns)
	51	2005	13.73 ± 0.29	10	19.6	11	21.6	19	37.3	11	21.6	12.8	4.137 (ns)
U16 Kayakers	50	2004, 2003	15.24 ± 0.61	15	30.0	12	24.0	10	20.0	13	26.0	12.5	1.040 (ns)
	26	2004	14.73 ± 0.32	8	30.8	5	19.2	5	19.2	8	30.8	6.5	1.385 (ns)
	24	2003	15.78 ± 0.26	7	29.2	7	29.2	5	20.8	5	20.8	6	0.667 (ns)
Total Sample	130	2006, 2005, 2004, 2003	14.10 ± 1.06	33	25.4	29	22.3	37	28.5	31	23.8	32.5	1.077 (ns)

CA: chronological age; BQ: birth quarter; (ns): non-significant.

Maturity status distribution was significant for the total sample in both categories, and was also significant regarding U16 kayakers born in 2003 and 2004 and U14 kayakers born in 2005 (Table 2).

About the ten best kayakers in each category, three U14 kayakers were born in 2006 and seven in 2005. In the U16, two kayakers were born in 2004 and eight in 2003. Four early maturers were among the top ten performers in both categories. All early maturers in the U14 category were born in 2005, with three born in the first two BQ's. In the U16, all four were born in the first two BQ's. Also, regarding the U16 kayakers, seven early maturers were observed in the total sample (n = 50); six were born in 2003, and five in the 1st and 2nd BQ's.

Considering the kayakers' characteristics by BQ and year of birth, Tables 3 and 4 summarise the data from the U14 and U16 athletes, respectively. Table 3 shows that, regardless of CA, whoever has more years of practice obtains the best performances despite their maturational status. In the U16 category (Table 4), the kayakers born in the 1st BQ were significantly ($p < 0.05$) older than the athletes born in the 4th BQ, $F(3; 46) = 6.294$, $p = 0.001$, $\eta 2 = 0.29$. Naturally, these kayakers were observed as taller (174.06 ± 6.66 cm), $F(3; 46) = 0.713$, $p = 0.549$, $\eta 2 = 0.04$, heavier (66.09 ± 8.40 kg) $F(3; 46) = 0.946$, $p = 0.426$, $\eta 2 = 0.06$, and also faster (1406.16 ± 75.29 s), $F(3; 46) = 2.313$, $p = 0.088$, $\eta 2 = 0.13$. However, they do not present themselves as being the most mature. That characteristic was verified in the athletes born in the 2nd BQ (96.70 ± 1.13 PAH%).

Kayakers born in 2003 were significantly ($p < 0.05$) more mature (97.38 ± 0.8%), $F(1; 48) = 56.353$, $p = 0.000$, $\eta 2 = 0.54$, and more experienced (5.06 ± 2.00 years), $F(1; 48) = 11.456$, $p = 0.001$, $\eta 2 = 0.19$, than those born in 2004 (94.85 ± 1.44 %, 3.25 ± 1.77 years). They, consequently, obtained the best performances.

Table 2. Distributions of the kayakers' maturity status based on PAH% by BQ for the total sample of U14 and 16, top ten U14 and 16, and CYE (U14, 2005; 2006 and U16, 2003; 2004).

	BQ of U14 Total Sample					BQ of U14 Top Ten					BQ of Kayakers Born in 2006					BQ of Kayakers Born in 2005				
	1st	2nd	3rd	4th	χ^2	1st	2nd	3rd	4th	χ^2	1st	2nd	3rd	4th	χ^2	1st	2nd	3rd	4th	χ^2
Maturity status U14	n = 18	n = 17	n = 27	n = 18		n = 1	n = 5	n = 4	n = 0		n = 8	n = 6	n = 8	n = 7		n = 10	n = 11	n = 19	n = 11	
PAH%:																				
Early	5	2	2	0		1	2	1	0		0	0	0	0		5	2	2	0	
On time	13	11	18	14		0	3	3	0		8	4	4	4		5	8	14	11	
Late	0	4	7	4	49.075 (s)	0	0	0	0	0.400 (ns)	0	2	4	3	2.793 (ns)	0	1	3	0	35.765 (s)
	BQ of U16 total sample					BQ of U16 top ten					BQ of kayakers born in 2004					BQ of kayakers born in 2003				
Maturity status U16	n = 15	n = 12	n = 10	n = 13		n = 5	n = 3	n = 0	n = 2		n = 8	n = 5	n = 5	n = 8		n = 7	n = 7	n = 5	n = 5	
PAH%:																				
Early	5	1	0	1		3	1	0	0		1	0	0	0		4	1	0	1	
On time	9	11	8	8		2	2	0	2		6	5	3	4		3	6	5	4	
Late	1	0	2	4	33.640 (s)	0	0	0	0	0.400 (ns)	1	0	2	4	17.154 (s)	0	0	0	0	6.000 (s)

PAH: predicted adult height; BQ: birth quarter; (s): significant; (ns): non-significant.

Table 3. Characteristics (means and standard deviations) of U14 kayakers by birth quarter (n = 80), year of birth (2006, n = 29 and 2005, n = 51) and results of ANOVA, and estimated effect sizes (η^2).

	1st BQ (n = 18)	2nd BQ (n = 17)	3rd BQ (n = 27)	4th BQ (n = 18)			Born in 2006 (n = 29)	Born in 2005 (n = 51)		
Variables	**Mean (± SD)**	**Mean (± SD)**	**Mean (± SD)**	**Mean (± SD)**	**F**	**η2**	**Mean (± SD)**	**Mean (± SD)**	**F**	**η2**
CA (years)	13.69 ± 0.53 *	13.47 ± 0.49 *	13.39 ± 0.46	13.03 ± 0.50	5.464	0.18	12.82 ± 0.32 †	13.73 ± 0.29	162.093	0.68
Years of practice (years)	3.33 ± 1.46	3.64 ± 1.69	3.25 ± 1.54	2.97 ± 1.13	0.618	0.02	3.41 ± 1.52	3.22 ± 1.44	0.302	0.00
Stretch stature (cm)	164.43 ± 7.68	163.65 ± 10.44	163.45 ± 10.07	163.60 ± 8.81	0.043	0.00	159.49 ± 9.77 †	166.17 ± 8.02	10.907	0.12
Sitting height (cm)	85.05 ± 4.43	85.81 ± 5.45	85.18 ± 5.89	86.08 ± 3.71	0.186	0.01	83.54 ± 5.04 †	86.59 ± 4.64	7.478	0.08
Body mass (Kg)	55.26 ± 11.24	55.89 ± 8.55	52.75 ± 10.96	57.53 ± 11.82	0.765	0.03	52.34 ± 10.87	56.60 ± 10.43	2.986	0.04
Maturity offset (years)	0.03 ± 0.69	0.02 ± 0.81	−0.12 ± 0.91	−0.13 ± 0.62	0.272	0.01	−0.59 ± 0.66 †	0.24 ± 0.67	28.985	0.27
APHV (years)	13.66 ± 0.56	13.44 ± 0.66	13.52 ± 0.71	13.17 ± 0.46	1.999	0.07	13.41 ± 0.64	13.48 ± 0.63	0.248	0.00
PAH (cm)	180.75 ± 5.81	181.62 ± 8.17	182.18 ± 6.22	183.63 ± 6.53	0.593	0.02	182.12 ± 7.43	182.03 ± 6.17	0.003	0.00
PAH (%)	90.94 ± 2.13	90.06 ± 3.04	89.66 ± 3.20	89.07 ± 3.31	1.265	0.05	87.52 ± 2.81 †	91.25 ± 2.17	43.809	0.36
3000 m time (s)	915.01 ± 124.53	864.82 ± 124.86	843.24 ± 109.86	871.43 ± 103.55	1.413	0.05	861.77 ± 108.32	875.18 ± 121.28	0.244	0.00

CA: chronological age; APHV: age at peak height velocity; PAH: predicted adult height; BQ: birth quarter. * Significant difference ($p < 0.05$) compared to 4tu BQ. † Significant difference ($p < 0.05$) compared to born in 2005.

Table 4. Characteristics (means and standard deviations) of U16 kayakers by birth quarter (n = 50), year of birth (2004, n = 26 and 2003, n = 24) and results of ANOVA, and estimated effect sizes (η^2).

	1st BQ (n = 15)	2nd BQ(n = 12)	3rd BQ (n = 10)	4th BQ (n = 13)			Born in 2004 (n = 26)	Born in 2003 (n = 24)		
Variables	**Mean (± SD)**	**Mean (± SD)**	**Mean (± SD)**	**Mean (± SD)**	**F**	**η2**	**Mean (± SD)**	**Mean (± SD)**	**F**	**η2**
CA (years)	15.58 ± 0.50 *	15.43 ± 0.52 *	15.10 ± 0.56	14.77 ± 0.52	6.294	0.29	14.73 ± 0.32 †	15.78 ± 0.26	154.055	0.76
Years of practice (years)	4.00 ± 1.42	4.62 ± 2.16	3.95 ± 3.16	3.92 ± 1.78	0.299	0.02	3.25 ± 1.77 †	5.06 ± 2.00	11.456	0.19
Stretch stature (cm)	174.06 ± 6.66	170.99 ± 4.34	171.89 ± 6.72	172.63 ± 4.34	0.713	0.04	171.96 ± 5.37	173.12 ± 5.87	0.531	0.01
Sitting height (cm)	91.89 ± 3.98	90.00 ± 3.17	89.84 ± 3.82	90.83 ± 2.93	0.937	0.06	90.20 ± 3.13	91.34 ± 2.94	1.312	0.03
Body mass (Kg)	66.09 ± 8.40	62.09 ± 5.41	63.18 ± 7.23	62.76 ± 5.34	0.946	0.06	62.05 ± 6.85	65.45 ± 6.38	3.272	0.06
Maturity offset (years)	1.97 ± 0.74	1.59 ± 0.48	1.41 ± 0.64	1.36 ± 0.55	2.674	0.15	1.25 ± 0.58 †	2.00 ± 0.49	23.430	0.33
APHV (years)	13.61 ± 0.53	13.83 ± 0.55	13.68 ± 0.57	13.40 ± 0.39	1.508	0.09	13.48 ± 0.57 †	13.78 ± 0.42	4.545	0.09
PAH (cm)	180.07 ± 4.85	176.83 ± 4.52	180.02 ± 7.31	181.93 ± 4.54	1.987	0.12	181.30 ± 5.30 †	178.11 ± 5.19	4.602	0.09
PAH (%)	96.64 ± 1.83	96.70 ± 1.13	95.50 ± 1.77	95.25 ± 1.74	2.633	0.15	94.85 ± 1.44 †	97.38 ± 0.82	56.353	0.54
5000 m time (s)	1406.16 ± 75.29	1455.37 ± 102.20	1497.72 ± 80.11	1464.11 ± 89.81	2.313	0.13	1489.25 ± 94.59 †	1409.46 ± 65.37	11.845	0.19

CA: chronological age; APHV: age at peak height velocity; PAH: predicted adult height; BQ: birth quarter. * Significant difference ($p < 0.05$) compared to 4tu BQ. † Significant difference ($p < 0.05$) compared to born in 2003.

4. Discussion

This study's main objective was to analyze maturity status, the RAE, and to evaluate the influence of CYE in young Iberian male kayakers. As a result, the main findings of this study were that in the U14 (n = 80), unlike the U16 (n = 50), the maturational status does not seem to be a decree of competitive success. Therefore, the CYE appears to influence the performance only in the U16 category. Also, no statistically significant differences were found for the RAE in the total sample (n = 130) or the two categories assessed. Nevertheless, a substantial part of the ten best kayakers of each category was born between January and June and were early maturers.

The present study showed that the older U16 kayakers born in the 1st BQ achieved better performances than their peers born in other BQ's. On the contrary, the fastest kayakers in the U14 category were born in the 3rd BQ. Furthermore, those with more years of practice obtained the best performances in both cases. Recently, Fernandes et al. [8] stated that the young kayakers who achieved better performances were maturely advanced and had more years of specific practice. Moreover, López-Plaza et al. [33] showed negative and significant correlations between performance and chronological age and presented significant performance maturity-based differences at 1000, 500, and 200 m.

The relative age effect is properly documented in team sports, mainly soccer [5,11,13,34]. However, the same does not occur for kayaking, where the RAE phenomenon is practically unstudied. For example, Isorna-Folgar et al. [23] reported that 37.5% of the paddlers who participated in the Spanish National Training Camps were born in the 1st BQ; however, those who achieved medals in World Championships or Olympic Games were primarily born in the 4th BQ (35.1%). Moreover, analyzing the fifteen male Iberian kayakers who participated in the Tokyo Olympics, eleven were born in the 3rd and 4th BQ, five in the 3rd BQ, and six in the 4th BQ. This fact, associated with the need for technical mastery that kayaking imposes, can explain why the RAE may not be observed at the senior elite level. However, there is the possibility of finding an inverse RAE. In the beginner categories, it is more likely to find RAE than in older age groups. The clarification may be related to the APHV and the age at which puberty occurs, which may undeniably increase the variances in physical traits between athletes born in different BQ's of the same year [35].

With 56.3%, the U14 (13.40 $\pm$ 0.54 years) has shown a higher percentage of births in the 3rd and 4th BQ's, 33.8% in the 3rd BQ alone. Interestingly, this percentage increases to 37.3% when looking only at the U14 (13.73 $\pm$ 0.29 years) born in 2005. On the other hand, in the U16 total sample (15.24 $\pm$ 0.61 years), 54% were born in the first two BQ's and 30% in the 1st BQ alone. It was also found that 58.4% of kayakers born in 2003 (15.78 $\pm$ 0.26) were born in the first two BQ's. The 3rd BQ was where the highest number of kayakers in the total sample (n = 130) were born (28.5%).

Considering the CYE, in the U14 category, significant differences ($p < 0.05$) were observed between athletes born in 2006 and those born in 2005, in CA, stretch stature, sitting height, maturity offset, and PAH%. Although, these were not only not reflected in significant differences in performance, as the younger kayakers were the ones with better performances. This fact may be due to the possibility that the differences mentioned above were masked by the years of practice, 3.41 $\pm$ 1.52 years in athletes born in 2005 and 3.22 $\pm$ 1.44 years in athletes born in 2006. Moreover, it is known that young kayakers usually obtain the best performances with more years of specific practice [8].

Another explanation may be the fact that despite the 2005-born kayakers (13.73 $\pm$ 0.29 years) being practically a whole year older than the ones born in 2006 (12.82 $\pm$ 0.32 years), both were still relatively close to the PHV, 0.24 $\pm$ 0.67 and -0.59 ± 0.66 years, respectively. The fact is consistent with the 87.52 $\pm$ 2.81 PAH% for the kayakers born in 2006 and 91.25 $\pm$ 2.17% for those born in 2005, indicating that the U14 kayakers were somewhat in the early stages of the maturation process. As stated by Cumming et al. [36], concerning data for soccer players, the majority of players with a PAH% $\geq$ 85.0 to <90.0% are early pubertal, players with a PAH% $\geq$ 90.0 to <95.0% are mid-pubertal, and players with a PAH% $\geq$ 95.00% are late pubertal.

Considering the U16 category and following the same rationale, it was found that athletes born in 2003 were significantly older (15.78 ± 0.26 years) and significantly further away from the PHV (2.00 ± 0.49 years), consequently being closer to their predicted adult height. Additionally, the ones with significantly best performances (1409.46 ± 65.37 s) were significantly more experienced (5.06 ± 2.00 years). This data for U16 kayakers corroborates previous findings [8,33], reaffirming the importance of controlling for maturation at this kayakers' sports development stage.

When performing correlations, comparisons, and regressions, CA is usually a significant variable in kayaking [8,33,37]. Thus, those born earlier in the year probably present superior stretch stature, body mass, sitting height, muscle mass, and kayaking experience, and possibly obtain better performances.

Moreover, in a sport that presents difficulties in retaining athletes at the senior levels, it is essential to consider the implications of these facts in the early dropout of kayaking. Gardner et al. [38] stated that it is possible to predict young athletes' dropout using enjoyment and behavioral intentions as indicators. Usually, young athletes born in the same year follow the same training programs, and those born in later BQ's often feel frustrated when attaining worse sports results. However, the lack of sports success is one of the factors that leads youth athletes to drop out. Under these circumstances, coach and parental support are essential to persuade the adolescent to continue the sporting activity despite a temporary lack of sports success. Therefore, youth sport is complex. Kayaking is no different, with the addition that it takes place in various water planes and the need for practitioners to move in unstable boats with the same characteristics as those used by senior athletes. Therefore, a talent detection and selection system based solely on the young kayakers' performances may imply some bias. It could confer some competitive advantage to individuals who, by chance, are maturely advanced or have been born earlier than their peers. This study is not without limitations. For example, a study limitation is the assumption of a uniform birth season of broader populations and age sub-groups from different regions. Similarly, despite an effort to evaluate all the U14 and 16 kayakers participating in the competition, the sample size is still limited, so data must be interpreted cautiously.

5. Conclusions

Given the constraints that maturation issues impose during the different stages of an individual's growth to adulthood, all categories have their specificity. The U14 and U16 male categories are particularly susceptible to these issues, as they are categories where more significant maturational differences can be observed. As demonstrated by the main findings in this study, namely in the U16 category, the CYE and the maturity status seem to influence the performance, which could imply rethinking how young kayakers are distributed in the category of participation, by looking to find a new format that provides equity in kayaking participation. For example, in Portugal and Spain, U14 and U16 kayakers are sub-grouped by year of birth, with the older kayakers categorized as group A and the youngest as group B. One way of refining this form of distribution of participants would be to adopt a grouping system similar to the bio-banding suggested by Cumming et al. [36].

Additional strategies may include selecting athletes to integrate training groups or primary teams to achieve immediate performances (first team) and other training or secondary teams to develop the athletes to obtain the best performances in the medium to long term. Future studies may also consider including motivational and behavioral variables and training environments, such as social context, coach and parental support, coach experience, peer acceptance, enjoyment, quality of the training sessions, and previous training experiences in other sports.

Therefore, trying to ensure that coaches and sports decision-makers do not make swift decisions, and guarantee equal opportunities for young kayakers at different stages of maturational development as much as possible. Thus, allowing the maximum number of practitioners to experience an enjoyable sporting environment with the possibility of obtaining competitive success.

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