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Original

The Constituent year effect on masters triathlon athletes: an analysis of participation and ranking score

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ABSTRACT

Objectives. The study evaluated whether a participation- and performance–related constituent year effect exists among athletes participating in Brazilian Masters Triathlon competitions from 2011 to 2017.
Method: Using data from the website of the Brazilian Triathlon Confederation, the frequency of participation was analysed and ranking scores were compared on triathletes as a function of the constituent year.
Results: The results showed a participation-related constituent year effect for the total sample and for male (χ^2_4 = 30,778, p < 0.0001), but not for female (χ^2_4 = 5,932, p = 0.20). Also, participation-related constituent year effects existed during the fourth (χ^2_4 = 22,224, p < 0.001) and fifth (χ^2_4 = 10,794, p = 0.029) decade of life, but not for the sixth (χ^2_4 = 5,570, p = 0.234) decade. When comparing the three highest ranking scores as a function to the constituent year within any five-year age category, no significant difference was observed for the total sample, gender and decade of life.
Conclusions: The constituent year effect exists only in male triathletes; however, this phenomenon does not seem to influence the performance of the ranking.

Keywords: Sport participation; Masters; Relative age; Triathlon; Performance.

El efecto del año constituyente en los atletas de triatlón máster: un análisis de la participación y la puntuación de clasificación

RESUMEN

Objetivo: El estudio evaluó si existe efecto de año constituyente relacionado a la participación y al desempeño entre los atletas participantes de competiciones brasileñas Masters de 2011 a 2017.
Método: Utilizando datos del sitio web de la Confederación Brasileña de Triatlón, la frecuencia de participación fue analizada y las puntuaciones de clasificación fueron comparadas entre los triatletas en función del año constituyente.
Resultados: Los resultados mostraron un efecto año constituyente relacionado con la participación para la muestra total y para el sexo masculino (χ^2_4 = 30.778, p 0,0001), pero no para el femenino (χ^2_4 = 5.932, p = 0,20). Además, los efectos del año constituyente relacionados con la participación existieron durante la cuarta (χ^2_4 = 22.224, p 0,001) y quinta (χ^2_4 = 10.794, p = 0,029) década de vida, pero no para la sexta (χ^2_4 = 5.570, p = 0,234) década. Al comparar los tres puntajes más altos del ranking en función del año constituyente en cualquier grupo de edad de cinco años, no se observó diferencia significativa para el total de la muestra, sexo y década de vida.
Conclusiones: El efecto del año constituyente existe solo en triatletas del sexo masculino; sin embargo, ese fenómeno no parece influenciar el desempeño del ranking.

Palabras clave: Participación deportiva; Masters; Edad relativa; Triatlón; Desempeño.

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O efeito do ano constituinte em atletas de triatlo masters: uma análise da participação e da pontuação do ranking

RESUMO

Objetivo: O estudo avaliou se existe efeito de ano constituinte relacionado à participação e ao desempenho entre os atletas participantes de competições brasileiras masters de 2011 a 2017.

Método: Utilizando dados do site da Confederação Brasileira de Triatlo, a frequência de participação foi analisada e os escores de classificação foram comparados entre os triatletas em função do ano constituinte.

Resultados: Os resultados mostraram um efeito ano constituinte relacionado à participação para a amostra total e para o sexo masculino ($\chi^2_4 = 30.778$, p 0,0001), mas não para o feminino ($\chi^2_4 = 5.932$, p = 0,20). Além disso, os efeitos do ano constituinte relacionados à participação existiram durante a quarta ($\chi^2_4 = 22.224$, p 0,001) e quinta ($\chi^2_4 = 10.794$, p = 0,029) década de vida, mas não para a sexta ($\chi^2_4 = 5,570$, p = 0,234) década. Ao comparar os três maiores escores do ranking em função do ano constituinte em qualquer faixa etária de cinco anos, não foi observada diferença significativa para a total da amostra, sexo e década de vida.

Conclusões: O efeito do ano constituinte existe apenas em triatletas do sexo masculino; no entanto, esse fenômeno não parece influenciar o desempenho do ranking.

Palavras-chave: Participação esportiva; Masters; Idade relativa; Triatlo; Desempenho.

Introduction

In Masters sport, the athletes are individuals who, usually over 35 years old, continue to participate in competitions or who return to compete in a determined period of their life [1]. After the 1970s, there was an increasing number of sporting events for Masters categories and this population (e.g. middle- and older-aged adult) has been further studied by researchers of sports science [2]. As in triathlon, several other sports also distribute Masters athletes in five-year intervals (e.g. 40–44 years, 45–49 years, 50-54 years, and so on) with age categories labelled 'Year 1' (i.g. 40, 45, 50, 55...), 'Year 2' (i.g. 41, 46, 51, 56...), 'Year 3' (i.g. 42, 47, 52, 57...), 'Year 4' (i.g. 43, 48, 53, 58...), and 'Year 5' (i.g. 44, 49, 54, 59...). The aim of these age categories in Masters Athletes is to provide a fair playing field and, consequently, promote continuity in sports participation [3]. Also, this categorization of age is important for Masters competitors because associated with the promotion of physical, psychological and social well-being [3].

The established method for age categorization is a common strategy of organization in sport; however, though somewhat speculative, such a strategy has been a complex challenge in a sports context [4]. Grouping by age, whether in juvenile or older athletes, proposes to equal and fairness competition levels among participants based on a cut-off date [3]. However, Medic and colleagues [3] suggested that, the individual who are relatively younger in any age group are more likely to perceive advantages and opportunities within a competitive category and are thus more likely to approach competition whereas those who are relatively older in a category are more likely to perceive disadvantages, compromised opportunities within a competitive sphere, and will be more likely to avoid. This age-related disparity, associated with competitive disadvantages, opportunities, and sports participation, was defined as relative age effect [3, 5, 6]. This relative age effect in Masters sport, which is attributed to the participation- and performance–related advantage, was previously termed the constituent year effect [3].

Recent studies suggest there are problems related to age categorization practices in Masters athletes, indicating an age-related disparity that would be may be associated with psychosocial factors and, consequently, indicate the possible disruption of participation patterns [7,8]. This phenomenon, that incurs personal and social disparities in Masters sport, has been studied recently among Masters swimming and track and field athletes. The authors proposed that the relative age disparity can provide consequences for sports participation of Masters athletes in events and competitions due to anticipated disadvantages related to age-related decline and the motivational profile that this related to psychological mechanism [3,7,8]. Another study [3], it has been suggested that the participation-related constituent year effect in the Masters sport may exist, but it depends on gender, age, and type of sport. Therefore, it is important to analyze how the constituent year effect could influence the participation of Masters athletes in other sports, such as Triathlon.

Triathlon is an endurance sport with short and long-distance events (between 2 and 8 hours, respectively) that combine three consecutive modalities (e.g. swimming, cycling, and running) [9]. In the last three decades, the Masters triathletes have been of increased interest among researchers [10,11,12]; however, it is not yet known how the constituent year effect could affect the participation of Masters athletes in triathlon. Investigating this phenomenon in Masters triathletes is important because it may lead to promote effective strategies to attenuate the participation-related constituent year effect.

Previously, researchers suggested that age and gender seem to influence the performance of triathletes [13], but they did not evaluate or compare how a participation-related constituent year effect could be associated with the performance of Masters athletes. Previous studies proposed that the constituent year effect may also be associated with athletic performance [14]. In this study [14], the participants of the first constituent year presented higher performance than athletes of the third, fourth and fifth years of an age category. The authors claimed that younger athletes have higher levels of strength and cardiorespiratory capacity when compared to older athletes. Knowing the importance of cardiorespiratory parameters for triathletes [15], it is important to analyze not only a participation-related constituent year effect, but also other aspects associated with the performance of Masters athletes; for example, score obtained through performance in competitions.

Based on previous evidence [7,8], it was found that a participation-related constituent year effect existed was stronger for males than for females. Other studies suggest that this difference between genders is associated with the number of participants [16] and competitiveness in sport [2, 17]. Thus, we hypothesized that the constituent year effect be stronger for males than females Masters Triathletes. Also, it was suggested that athletes from the first constituent years, due to relative age disparities, may have a higher ranking score compared to older participants within the five-year age category. Therefore, the aim of this study was to examine whether a participation- and performance–related constituent year effect exists among Brazilian Masters Triathletes competitors.

Method

Data collection

Cross-sectional data archived for analysis across the rankings of participants in competitions from 2011 to 2017, were acquired from the Brazilian Confederation of Triathlon official Internet website [18] . The information gathered was the name of competitors, score obtained in the ranking, gender, and date of birth of each athlete. Age was calculated from the date of birth and the last date of the update of the ranking available on the site. There was no need for review by the local Institutional Review Board, because this information was collected from the Internet website. Championship data before 2011 and after 2017 were disregarded, as the athletes' ages and information were not listed for this year. Of the 1.738 entries, 1.444 were male and 294 were female. The age of entrants ranged from 40 years to 69 years. Athletes older than 69 were not included because of the relatively small number of participants.

Procedures

To determine a participation-related constituent year effect, the athletes were separated into five groups (i.g., 'Year 1' to 'Year 5'), in one of five different categories ranging over five constituent years. So, the triathletes born in 'Year 1' belonged to the first year of any five-year age category (i.g. 40, 45, 50, 55, 60, and 65). These same procedures were also adopted for 'Year 2' (i.g. 41, 46, 51, 56, 61, and 66.), 'Year 3' (i.g. 42, 47, 52, 57, 62, and 67), 'Year 4' (i.g. 43, 48, 53, 58, 63, and 68), and 'Year 5' (i.g, 44, 49, 54, 59, 64, and 69). Following the methodology of previous studies [3,7] , we separated and analyzed triathletes into age groups based on decades of life in order to examine whether a participation-related constituent year effect is influenced by age. So, the decades of life analyzed were the fourth (categories 40/44/ and 45/49), fifth (categories 50/54 and 55/59) and sixth (categories 60/64, and 65/69) decade of life. It is noteworthy that in the triathlon are considered Masters Athletes individuals 40 years of age or older [18] .

Ranking sorts the best Brazilian triathletes by category through the performance obtained throughout the year in competitions in which individuals participated. These competitions were Brazilian Championship, Brazil Triathlon Cup, South American Championship (Sprint & Standard), Pan American Championship (Sprint & Standard), and World Championship (Sprint & Standard). Finally, ranking scores were collected only from the three best triathletes of each constituent year (e.g, 'Year 1' to 'Year 5') to compare the score as a performance variable. It is noteworthy that the three best athletes of each year were chosen because they would represent the Top 3, as it is defined in the Olympics [19] .

Statistical analysis

Descriptive statistics were used to obtain the median, frequency counts and percentages. For data analysis, Chi-square goodness-of-fit tests (χ^2) were applied to verify differences between expected (i.e., 20%) and observed counts for each of the constituent years within the 5-year-age categories [8] . Effects sizes w (ES) were calculated as the ratio between the observed and the expected frequency and the standard deviation, following the methodology of recent studies [7] .

After verifying a parametric distribution in athlete's scores by Shapiro-Wilk test, ANOVA one-way (F) test with Bonferroni Post hoc was used to compare ranking scores as a function to the constituent year of the three best athletes. Significance level used was $p \leq 0.05$ and all statistical procedures were performed in SPSS version 26. Effect size (η^2) of the ranking score was also obtained during the analysis in the SPSS software.

Results

Participation

Table 1 shows expected and observed frequency of distribution for participation in competitions in each constituent year of the collapsed five–year age category distribution for a total sample, as well as by gender and decade of life (fourth, fifth, and sixth decade) separately. Chi-square test results for a total sample of athletes Brazilian Masters Triathletes competitors indicated the existence of a participation-related constituent year effect ($\chi^2_4 = 36{,}298$, $p < 0.0001$). Specifically, we found that significantly more triathletes competed in the Brazilian Masters Championships if they were in the first and second year of an age category and significantly fewer in the fourth and fifth year (effect sizes largest) of an age category.

Results also presented in Table 1 show a participation-related constituent year effect for male ($\chi^2_4 = 30{,}778$, $p < 0.0001$), but not in the female ($\chi^2_4 = 5{,}932$, $p = 0.20$) Masters athletes. Specifically in male athletes, the findings show significantly fewer triathlete competitors in the fourth and fifth constituent year of a category and more compete when they are in the first and second year of the same age category. As seen from Figure 1, both for total sample and gender male, it appears that there was a lower percentage of triathlete participation in the last years compared to the first years of an age category.

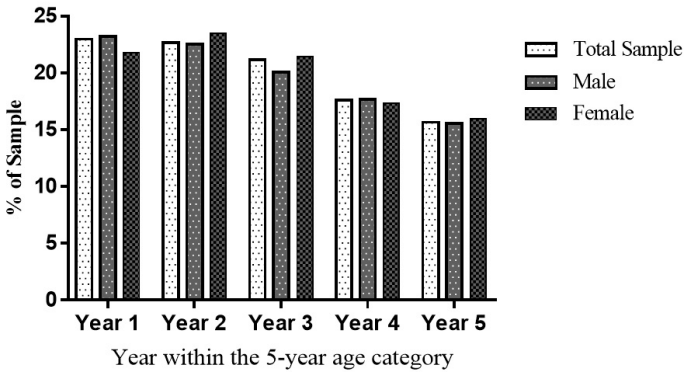

Figure 1. Percentage of the total sample by gender of the Brazilian triathletes as a function of the constituent year.

Results presented in Figure 2 suggest a participation-related constituent year effect across age. Findings indicated that a participation-related constituent year effect exists for triathletes who competed in the Brazilian Masters Championships during the fourth (n = 1171, $\chi^2_4 = 22{,}224$, p < 0.000) and fifth (n = 446, $\chi^2_4 = 10{,}794$, p = 0.029) decade of life, but does not exist during the sixth (n = 121, $\chi^2_4 = 5{,}570$, p = 0.234). Also, table 1 specifically shows a greater number of athletes competing in the first and second constituent year (fifth and fourth decade of life, respectively) and a number significantly lower of triathlon participants in the last year (fourth and fifth decade of life) of an age category.

Table 1. Frequency distribution, values, p values and effect sizes for total sample, gender and for decade of life.

		Observed frequency	Expected frequency	d.f.	χ^2	*p*	Effect size
Total sample	Year 1	399	347.6	1	7.60	0.006 *	0.92
	Year 2	394	347.6	1	6.19	0.01 *	0.83
	Year 3	367	347.6	1	1.06	0.3	0.35
	Year 4	306	347.6	1	4.96	0.03 *	0.74
	Year 5	272	347.6	1	16.44	0.0001 *	1.35
Male	Year 1	335	288.8	1	7.39	0.0007 *	0.98
	Year 2	325	288.8	1	4.54	0.03 *	0.77
	Year 3	304	288.8	1	0.80	0.3	0.32
	Year 4	255	288.8	1	3.96	0.05 *	0.72
	Year 5	225	288.8	1	14.09	0.0002 *	1.35
Female	Year 1	64	58.8	1	0.46	0.5	0.56
	Year 2	69	58.8	1	1.77	0.1	1.09
	Year 3	63	58.8	1	0.30	0.5	0.45
	Year 4	51	58.8	1	1.03	0.3	0.84
	Year 5	47	58.8	1	2.37	0.1	1.26
Fourth decade	Year 1	261	234.2	1	3.07	0.08	0.74
	Year 2	264	234.2	1	3.79	0.05 *	0.83
	Year 3	254	234.2	1	1.67	0.2	0.55
	Year 4	208	234.2	1	2.93	0.09	0.73
	Year 5	184	234.2	1	10.76	0.001 *	1.39
Fifth decade	Year 1	108	89.2	1	3.96	0.05 *	1.21
	Year 2	102	89.2	1	1.84	0.1	0.83
	Year 3	86	89.2	1	0.11	0.7	0.20
	Year 4	79	89.2	1	1.17	0.2	0.66
	Year 5	71	89.2	1	3.71	0.05 *	1.17
Sixth decade	Year 1	30	24.2	1	1.39	0.2	1.00
	Year 2	28	24.2	1	0.60	0.4	0.65
	Year 3	27	24.2	1	0.32	0.5	0.48
	Year 4	19	24.2	1	1.12	0.2	0.90
	Year 5	17	24.2	1	2.14	0.1	1.24

χ^2 = Chi square, d.f. = Degrees of freedom, p = p-value
* significant

Table 2. Comparison (mean ± standard deviation) of the ranking score per constituent year of the total sample, gender and for decade of life.

	Year 1	Year 2	Year 3	Year 4	Year 5	$F_{(4,10)}$	p	ES (η^2)
Total sample	2169.7 (± 389.7)	2241.6 (±359.1)	2769.5 (±693.2)	2915.5 (±296.2)	2014.7 (±169.8)	2.675	0.09	0.517
Male	2169.7 (±389.7)	2019.9 (±475.7)	2769.5 (±693.2)	2841.2 (±422.8)	1694.6 (±406.8)	3.040	0.07	0.549
Female	1613.5 (± 95.4)	1626.0 (±604.6)	1694.1 (±256.6)	2146.8 (±382.5)	1590.1 (±522.6)	0.954	0.37	0.276
Fourth decade	1920.8 (±369.4)	2241.6 (±359.1)	2581.7 (±843.9)	2694.9 (±405.5)	1525.1 (±410.2)	2.648	0.09	0.514
Fifth decade	1809.9 (±545.1)	1409.4 (±109.3)	1846.0 (±624.2)	2209.3 (±702.2)	1744.3 (±512.1)	0.839	0.53	0.251
Sixth decade	1196.0 (±215.8)	1117.4 (±137.6)	1003.3 (±102.2)	1119.0 (±254.0)	820.9 (±202.1)	1.763	0.21	0.414

Note: F = ANOVA one-way, p = p-value, *significant, ES = Effect size

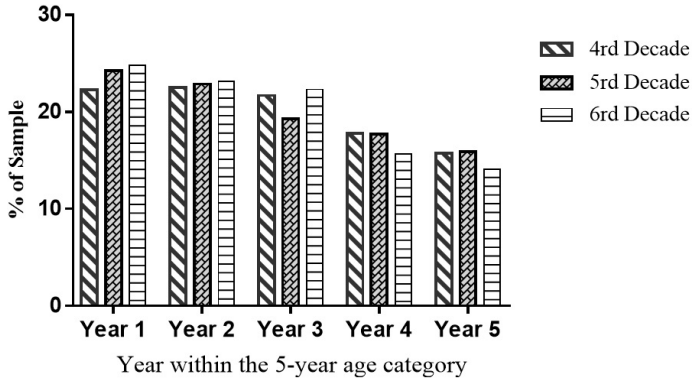

Figure 2. Percentage by decade of life of Brazilian triathletes as a function of the constituent year.

Ranking scores

The findings related to the comparison of ranking scores (Table 2) among the three best athletes of each constituent year (i.g., 'Year 1' to 'Year 5') for a total sample, by gender, and decade of life (fourth, fifth, and sixth decade), did not indicate significant differences in any of the analyses performed between the constituent years. This suggests that, although participation is higher in the first constituent years and lower in last years, the performance of the three best athletes are similar between the five constituent years.

Discussion

In our study, we sought to analyze, as well as previous studies [7,14], the constituent year effect in Masters sport by utilizing data on Masters Triathletes. Our results are consistent with recent studies [7,8], indicating that there is a participation-related constituent year effect for a total sample of Brazilian triathletes; significantly that more triathletes compete in Triathlon Championships when they are in their first and second constituent year than athletes in the fourth and fifth year of the same age category.

The results also indicated that participation-related constituent year effect was observed in males, specifically that fewer triathletes participate in competitions when they are in the last constituent year and less in the early constituent years of any five-year age category. Just like these findings, other studies that analyzed individual sports (i.g. swimming and athletics) indicated a stronger constituent year effect in men than women [3,7,8]. Other authors have argued that this difference between gender participation is associated with the number of athletes practicing sports [16] and competitive level [2,17]. Thus, it is suggested that this effect in triathletes is due to the competitive level and greater number of male (n = 1444) participants than females (n = 294).

The participation-related constituent year effect across age as a moderating factor, indicated this phenomenon exists for fourth and fifth decade of life, but not for triathlete competitors who are in the sixth decade of life. Thus, the likelihood of participating in the first and second year of an age category (specifically, in the fourth and fifth decade of life) was higher, whereas the likelihood of participating during the fifth year of an age category (specifically, in the fourth and fifth decade of life) was lower. These results are similar to other findings that showed a participation-related constituent year effect more observed from the fourth decade of life [3]. This phenomenon most evident in the last decades of life (fourth and fifth) can be explained by physiological mechanisms (i.e. i.e. maximal oxygen consumption, lactate threshold and exercise economy) associated with increasing age [20]. Thus, we proposed older athletes participate less when they are in the fifth year of an age category owing to possible changes in age-related performance. Also, it is suggested that this effect in triathletes was not found in the sixth decade of life due to the small number of participants.

Another aim of this study was to compare the ranking score of these triathletes as a function on the three best athletes of each constituent year. When comparing scores as a function of the triathlete constituent year, we did not find significant differences between years of an age category. Triathlete ranking scores are associated with performance obtained in these competitions. Nevertheless, although a participation-related constituent year effect was evident in Brazilian triathletes, we suggest performance would not be associated with this phenomenon. Previous findings have shown that athletes have significantly improved their performance over age, especially in older categories [21].

Importantly, some recent studies have evaluated a participation-related constituent year effect [7,8]. So, we also suggest that future studies should analyze both the participation-related constituent year effect of athletes in sport, and the performance variables between the constituent years, or to assess whether the increase in age could negatively influence the athlete's performance in Masters categories. Also, it would be interesting for future studies to analyze other factors that could be associated with a participation-related constituent year effect in Masters triathletes; for example motivation, increasing mortality rate [7], increased risk of cardiovascular diseases (endurance modalities) [22], and increased frequency of injuries throughout age [23].

The present study had a cross-sectional character, which may be a limitation, because longitudinal studies [24] seem to examine better the dynamics of within-individual decisions to participate in relation to the constituent years of any five-year age category. However, the results of this study are relevant both for sports science and for coaches and Masters triathlon athletes. According to the findings, we suggest some strategies to resolve a participation-related constituent year effect in triathlon athletes. The first suggestion would be to reduce the distribution of age categorization from five-years to three-years in an age category, especially after the fourth and fifth decade of

life. Knowing that motivation is a predominant factor related to the participation of Masters athletes [7], we also suggest triathlon coaches encourage [25] their athletes to participate in competitions and events. Also, we propose that coaches should guide and encourage their triathletes, so that older athletes (i.e., the last years of the category) continue to participate in competitions.

In conclusion, this study was the first to show a participation-related constituent year effect on triathlon athletes. We also evidence this phenomenon exists in male, but not in female triathletes. However, across decades of life, a participation-related constituent year effect was confirmed only in the fourth and fifth decade of life, but not in the sixth decade of life. These results propose the categorization of age in 5 years is causing a discontinuity in the participation of athletes in competitions, especially the fourth and fifth decade of life. Therefore, since performance has not changed through scoring, we suggest coaches further encourage their Masters triathletes to participate in competitions.

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