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Birthplace and birthdate of Brazilian Olympic medalists

Local de nascimento e data de nascimento de medalhistas olímpicos brasileiros

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Abstract – The aim of the present study was to analyze the association between birthplace and relative age with winning Olympic medals in Brazilian athletes. The sample consisted of 186 Olympic medalist athletes born in Brazil. Data analysis was performed through descriptive (incidence and percentage) and inferential statistics (Chi-Square to binary logistic regression). The association between population contingents and Olympic champions presented a significant result ($p < 0.05$); however, no significant associations were found with relative age. It was concluded that most Olympic medalists were born in places that present better living conditions, with intermediate MHDI, which appears only in cities with more than 100 thousand habitants, and relative age is not an important criterion in winning medals among athletes investigated.

Key words: Athletes; Sports; Age groups; Population.

Resumo – *O objetivo do presente estudo foi analisar a associação entre o local de nascimento e idade relativa com a obtenção de medalhas olímpicas em atletas brasileiros. A amostra foi constituída por 186 atletas medalhistas olímpicos nascidos em território brasileiro. A análise dos dados realizou-se por meio da estatística descritiva (incidência e percentual) e inferencial (Qui-Quadrado a regressão logística binária). A associação entre os contingentes populacionais e campeões olímpicos apresentou resultado significativo (p<0,05), porém, não foram encontradas associações significativas com a idade relativa. Concluiu-se que a maioria dos atletas medalhistas olímpicos nasceu em locais que apresentam melhores condições de vida, com o IDHM médio que aparece apenas nas cidades com mais de 100 mil habitantes, além de a idade relativa não ser um critério importante na obtenção de medalhas dos atletas investigados.*

Palavras-chave: *Atletas; Esportes; Grupos etários; População.*

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INTRODUCTION

Success in sport has been related to the birthplace of athletes and the proportion of their communities[1-4]. As described in specialized literature, it is important to point out that the birthplace provides an overview of the place where children spent their childhood and had contact with sports practice[4,5]. In the Brazilian context, few studies have studied this subject. In the available surveys, among these opportunities and experiences in certain environments, the national socioeconomic aspects related to demographic rates and Human Development Index (HDI) seem to condition the intrinsic and extrinsic motivation for sports practice[5,6], the type of activities experienced and the quality of sports talent training[5]. Therefore, the birthplace may limit or benefit the sporting performance. Studies have indicated that medium-sized cities tend to combine better sporting opportunities, while very small cities do not provide facilities with minimum conditions and in large cities, the difficulties are the costs and distances of athletes' displacement[4].

Recent studies on the birthplace have suggested that there is no significant interaction of this variable with the birthdate[1,3,4]. However, the birthdate that corresponds to the relative age is another element that has shown to be relevant for the formation of athletes[1]. Relative age is defined as the chronological difference of individuals born in the same year[7,8]. In the research field, several findings indicate a strong relation between relative age and sports involvement and progression, pointing out that athletes born in the first trimester or semester of the year tend to have more opportunities in sports teams, a fact that seems to be associated with greater psychobiological maturation in relation to those born in the last months of the year[9-13].

In assessing athletes' birthplaces, the findings of this study may foster further discussions on sport political issues on sports in the country in the case of differences between populations and the winning of Olympic medals that can be answered according to ease of access, safety and improvement of sports facilities. These conditions are often disregarded, although they may create a considerable disadvantage for practitioners who wish to achieve professional sport performance[13]. In addition, regarding relative age, data have demonstrated the need to follow the indications of Cobley, Baker[14] on reducing or eradicating sports inequalities, since annual age groups and the effects of relative age seem to limit the immediate and long-term participation of younger or late matured athletes. This occurs either for the positive development of young people through sports, or for the development of elite athletes.

Thus, despite the possible influence of birthplace and birthdate on athlete performance, few studies have investigated this issue in the Olympic context[15,16], in the various individual and team modalities and in Brazilian athletes of both sexes. Thus, the present study aimed to analyze the association between relative age (birth quartiles) and the birthplace (MHDI, region, population size) of Brazilian athletes with the first medal at the Olympic Games from 2000 to 2016.

METHODOLOGICAL PROCEDURES

Sample

The study sample consists of all the athletes born in the national territory, who won their first medal (gold, silver or bronze) in an edition of the Olympic Games from Sydney (2000); Athens (2004); Beijing (2008); London (2012); Rio de Janeiro (2016). The sample consisted of 186 Brazilian athletes of both sexes, distributed in 15 sports modalities: judo; swimming; aquatic marathon; gymnastics artistic; football; volleyball; athletics; beach volleyball; sailing; taekwondo; boxing; modern pentathlon; canoe sprint; shooting; basketball. Medal won by athletes occurred on average at 24.71 (± 4.16) years of age.

Procedures for data collection

Data referring to athletes - year of birth, hometown and year of the first Olympic medal - were collected by the Federal Government's Official Portal on the 2016 Olympic and Paralympic Games[17], considering only the first medal won by athletes.

Relative age was obtained according to the birthdate of Olympic athletes and divided in quarters: 1st quartile (January, February, March); 2nd quartile (April, May, June); 3rd quartile (July, August, September); 4th quartile (October, November, December).

The values in relation to the Municipal Human Development Index (MHDI) and the population contingent of cities were extracted from the database of the United Nations Development Program[18]. To determine the MHDI, the Atlas of Human Development classification was used in the Brazilian metropolitan regions. MHDI adjusts the global HDI for the reality of Brazilian municipalities and metropolitan regions[18]. Data were taken from the 1991 census because this census was the first to be released by UNDP. Since the HDI varies from 0 to 1 and has the following classification: Very low (0.00-0.49); Low (0.50-0.59); Intermediate (0.60-0.69); High (0.70-0.79); Very High (0.80-1)[18].

Statistical analysis

Descriptive analysis (frequency, percentage, mean and standard deviation) in each category of athletes' variables was initially performed. The chi-square test was used to compare differences among independent variables and to verify which categories of lower prevalence among dependent variables. Then, crude analysis of binary logistic regression was performed to estimate the odds ratio (OR) and the prevalence of being an Olympic medalist. The variables with p-value less than 0.20 were inserted together for analysis adjusted with the BACKWARD-WALD method. The power of the *Phi* (□) effect proposed by Cohen[19] (small: 0.1, medium: 0.3, large

0.5) was also calculated. In addition, the Hosmer-Lemeshow test (HL (df)) was used to verify the quality of the model for the exposed data. All analyses were performed in the SPSS version 18.0 program, adopting significance value of 5%.

RESULTS

Table 1 presents the descriptive data of variables involving Brazilian Olympic medalists from 2000 to 2016, such as sex, region, MHDI, birth quartile, sports modality and population.

Table 1. Absolute and relative frequency of athletes according to gender, birthplace (region, MHDI and population), birthdate (birth quartile) and sports modality of Brazilian Olympic medalists from 2000 to 2016.

Variable	Category	N	(%)
Sex	Male	119	(64.0)
	Female	67	(36.0)
Region	Southern	34	(18.3)
	Southeastern	109	(58.6)
	Mid-western	20	(10.8)
	Northern	5	(2.7)
	Northeastern	18	(9.7)
MHDI	Very low	25	(13.4)
	Low	77	(41.4)
	Intermediate	84	(45.2)
Birth quartile	Jan-Mar	48	(25.8)
	May-Jun	52	(28.0)
	Jul-Sep	49	(26.3)
	Oct-Dec	37	(19.9)
Modality	Individual	35	(18.8)
	Team	151	(81.2)
Population	≥2,500,000	49	(26.3)
	500,000-2,499,999	48	(25.8)
	100,000-499,999	48	(25.8)
	≤99,999	41	(22.0)

Table 2 shows the associations among variables, sex, region, MHDI, birth quartile, modality and population and whether or not the athlete was an Olympic champion.

There is a significant association between population and being or not an Olympic champion ($p < 0.05$).

Table 3 shows the crude logistic regression analysis for the condition of the athlete winning a gold medal. A significant association between cities with population of 100,000-499,999 and OR of 176% of the athlete being Olympic champion was observed. In the analysis adjusted by categorical variables sex and population, it was observed that there is a significant OR of 182%, considering people of the same sex, and of cities with population of 100,000-499,999. The model presented good fit to HL data (6) $\chi 2$ = 1.43, p = 0.96.

Table 2. Associations among variables sex, birthplace (region, MHDI and population), birthdate (birth quartile), sports modality and whether or not the athlete was an Olympic champion.

Variable	Category	No (n%)	Yes (n%)	χ^2	p-value	Φ
Sex	Male	76 (63.9)	43 (36.1)	0.75	0.38	0.06
	Female	47 (70.1)	20 (29.9)			
Region	Southern	22 (64.7)	12 (35.3)	5.02	0.28	0.16
	Southeastern	76 (69.7)	33 (30.3)			
	Mid-western	9 (45.0)	11 (55.0)			
	Northern	3 (60.0)	2 (40.0)			
	Northeastern	12 (72.2)	5 (27.8)			
MHDI	Very low	19 (76.0)	6 (24.0)	1.31	0.51	0.08
	Low	49 (63.6)	28 (36.4)			
	Intermediate	55 (65.5)	29 (34.5)			
Birth quartile	Jan-Mar	29 (60.4)	19 (39.6)	2.81	0.42	0.12
	May-Jun	33 (63.5)	19 (36.5)			
	Jul-Sep	37 (75.5)	12 (24.5)			
	Oct-Dec	24 (64.9)	13 (35.1)			
Modality	Individual	26 (74.3)	9 (25.7)	1.28	0.25	0.08
	Team	97 (64.2)	54 (35.8)			
Population	≥2,500,000	34 (69.4)	15 (30.6)	4.63	0.02*	0.17
	500,000-2,499,999	30 (62.5)	18 (37.5)			
	100,000-499,999	27 (56.3)	21 (43.8)			
	≤99,999	32 (78.0)	9 (22.0)			

p-value for the chi-square test (χ^2); * p-value≤0.05.

Table 3. Crude and adjusted logistic regression for association between Olympic gold medal and variables sex, birthplace (population, MHDI and region) and birthdate (birth quartile)

	Crude analysis		Adjusted analysis	
	OR (CI 95%)	p-value	OR (CI 95%)	p-value
Sex		0.38		0.31
(1) Men	1		1	
(2) Women	0.75 (0.39-1.43)		0.71 (0.36-1.38)	
Population		0.17		0.15
(1) ≤99,999	1			
(2) ≥2,500,000	1.57 (0.60-4.08)		1.66 (0.63-4.36)	
(3) 500,000-2,499,999	2.13 (0.83-5.47)		2.32 (0.89-6.05)	
(4) 100,000-499,999	2.76 (1.09-7.04)*		2.82 (1.10-7.20)*	
MHDI		0.52		
(1) Very low	1			
(2) Low	1.81 (0.65-5.06)			
(3) Intermediate	1.67 (0.60-4.64)			
Region		0.31		
(1) Northern	1			
(2) Southeastern	0.65 (0.10-4.08)			
(3) Southern	0.81 (0.12-5.59)			
(4) Mid-western	1.83 (0.25-13.4)			
(5) Northeastern	0.57 (0.07-4.55)			
Birth quartile		0.43		
(1) Oct-Dec	1			
(2) Jan-Mar	1.21 (0.50-2.94)			
(3) Apr-Jun	1.06 (0.44-2.56)			
(4) Jul-Sep	0.60 (0.23-1.52)			

OR: Odds Ratio. CI: Confidence Interval. * ≤0.05.

Table 4 shows the crude logistic regression analysis for the condition of the athlete winning the silver medal and it was observed that the OR of an athlete to win the silver medal reduces in 64% when he/she comes from a city with population of 100,000-499,999. In the analysis adjusted by categorical variables sex and MHDI, it was observed that considering people of the same sex and low MHDI, the chance of winning the silver medal is reduced in 61%. The model presented good fit to HL data (3) $\chi 2 = 1.68$ p = 0.64.

Table 4. Crude and adjusted logistic regression for association between Olympic silver medal and variables sex, birthplace (population, MHDI and region) and birthdate (birth quartile).

	Crude analysis		Adjusted analysis	
	OR (CI 95%)	p-value	OR (CI 95%)	p-value
Sex		0.07		0.05
(1) Men	1		1	
(2) Women	1.77 (0.96-3.27)		1.87 (0.99-3.50)	
Population		0.10		
(1) ≤99,999	1			
(2) ≥2,500,000	0.46 (0.20-1.07)			
(3) 500,000-2,499,999	0.47 (0.20-1.11)			
(4) 100,000-499,999	0.36 (0.15-0.85)*			
MHDI		0.14		0.10
(1) Very low	1		1	
(2) Low	0.62 (0.25-1.54)		0.63 (0.25-1.59)	
(3) Intermediate	0.41 (0.17-1.03)		0.39 (0.16-0.99)*	
Region		0.14		
(1) Northern	1			
(2) Southeastern	0.94 (0.15-5.86)			
(3) Southern	0.72 (0.10-4.93)			
(4) Mid-western	0.37 (0.05-3.06)			
(5) Northeastern	2.36 (0.31-17.85)			
Birth quartile		0.37		
(1) Oct-Dec	1			
(2) Jan-Mar	1.18 (0.47-2.98)			
(3) Apr-Jun	1.48 (0.60-3.63)			
(4) Jul-Sep	2.09 (0.85-5.15)			

OR: Odds Ratio. CI: Confidence Interval. * ≤0.05.

Table 5 shows the crude logistic regression analysis for the condition of the athlete winning the bronze medal; however, it was not possible to observe any significant OR. In the analysis adjusted by categorical variable birth quartile and sex, no significant OR was observed. The model presented good fit to HL data (7) $\chi 2 = 7.19$, p = 0.41.

Table 5. Crude and adjusted logistic regression for association between Olympic bronze medal and variables sex, birthplace (population, MHDI and region) and birthdate (birth quartile)

	Crude analysis		Adjusted analysis	
	OR (CI 95%)	p-value	OR (CI 95%)	p-value
Sex		0.88		
(1) Men	1			
(2) Women	0.94 (0.45-1.96)			
Population		0.88		
(1) ≤99,999	1			
(2) ≥2,500,000	1.34 (0.49-3.67)			
(3) 500,000-2,499,999	0.95 (0.33-2.74)			
(4) 100,000-499,999	1.26 (0.45-3.51)			
MHDI		0.55		
(1) Very low	1			
(2) Low	1.29 (0.38-4.33)			
(3) Intermediate	1.75 (0.54-5.68)			
Region		0.45		
(1) Northern	1			
(2) Southeastern	1.09 (0.45-2.70)			
(3) Southern	0.57 (0.17-1.97)			
(4) Mid-western	0.18 (0.02-1.40)			
(5) Northeastern	0.57 (0.07-4.50)			
Birth quartile		0.38		0.38
(1) Oct-Dec	1		1	
(2) Jan-Mar	0.79 (0.30-2.06)		0.79 (0.30-2.06)	
(3) Apr-Jun	0.49 (0.18-1.35)		0.49 (0.18-1.35)	
(4) Jul-Sep	0.46 (0.16-1.30)		0.46 (0.16-1.30)	

OR: Chance Ratio. CI: Confidence Interval. * <0.05.

DISCUSSION

The present study aimed to analyze the relationship between birthdate (birth quartile) and birthplace (MHDI, region, population size) of Brazilian athletes with winning the first medal in the Olympic Games from 2000 to 2016. It could be observed that the majority of Olympic medalists have the following characteristics: I) males; II) from the southeastern region; III) cities with intermediate MHDI; IV) born in the second quartile of the year; V) cities ≥2,500,000 inhabitants; VI) team sports. According to the odds ratio, athletes from cities with population of 100,000-499,999 have greater chance of winning a gold medal. Additionally, same-sex athletes have a reduced chance of winning the silver medal.

The results about the population size of the hometown of participants of the present study differ from some countries[2] and are in agreement with others[1], and in Brazil, medium and large cities seem to offer a greater development of athletes in sports. There was a significant odds ratio of 176% for same-sex athletes from cities with population of 100,000-499,999 and the possibility of the athlete being Olympic champion, a fact that differs from the population range presented by Balish, Rainham[2]. The authors[2] investigated the association between the proportion of cities and individual and team sports and found that communities with 10,000-100,000 inhabitants are more related to increase and development in sport, especially in team sports.

Such result is similar to results obtained by Rossing, Nielsen[20], who demonstrated greater possibility of development of high performance Danish athletes in cities between 30 and 50 thousand inhabitants. However, it diverges from the findings of Lidor et al.[21], who presented an association of the population contingent of their cities with higher chances for players who were born in a medium-sized city to be involved in high-performance sports, being larger in the range from 50,000 to 200,000 inhabitants than for players who were born in a city of different population sizes.

According to some studies[4,5,13], cities with larger populations appear to offer better conditions for the sports practice of children and young people. The justification lies in the fact that larger cities have higher quality clubs and leagues and therefore offer specialized training with qualified professionals. Thus, they are able to offer training camps, lodging, food, among other conditions that allow young athletes to develop their sports skills.

The smaller number of medalists and Olympic champions born in smaller cities with very low and low MHDI is probably due to the lower availability of resources for the development of sport in these communities. In addition, another influencing factor may be the poor management of public policies that could meet the needs of younger athletes in long-term sports development, with concerns about increasing involvement in sports, improving the qualities of established relationships, and generating appropriate facilities[4].

In the analysis of data related to birth quartiles, no significance was found in the crude and adjusted logistic regression for association between medalists and this variable. The findings are similar to findings in the national and international literature[1,9,11,22,23], where there is no prevalence of athletes born in the first quartiles. Likewise, a study of all male and female basketball players at the London Olympics showed no statistically significant results, except for French athletes[16].

Data from this study disagree with football athletes in Brazil, where a significant difference was found, with approximately half of athletes selected from the analyzed categories born in the 1st quartile and less than 10% born in the 4th quartile[8]. The lack of greater promotion and inclusion in the sport of late matured subjects may lead not only to less talent development, but also to the abandonment of sport by younger athletes[8,9,11,24].

The disagreements found with this study can be understood due to the heterogeneity in the participation of children and young people in the various sports, individual and team. According to Musch and Grondin[24], the more individuals practicing a sporting modality, the greater the chance of finding more athletes born in the first semester.

Regarding the regression and association between the sex of Olympic medalists, data presented significant results ($p \leq 0.05$), with greater number of male athletes. On the subject, studies have shown the low visibility of women in sports, in the media[25,26], and in clubs and sports associations, in school physical education and in public policies[26], which may influence the participatory culture and the development of women in sports, with the possible achievement of an Olympic medal. However, categorical variable sex was included as a control, since the authors of the present study consider this variable to be important for controlling the others variables analyzed. In addition, it can be seen in the present data that the variable elucidated better some allusions about the Olympic medal by the test of regression models.

Greater depth in data was not possible due to the study limitations associated to the small number of census to identify the real MHDI of cities and that can accurately correspond to the years of birth of athletes investigated. It was also considered the probability of the migration of athletes from their hometown. However, athletes' city changes are likely to be essentially the same and opposite, and the number of athletes who migrated from larger cities to smaller cities is probably equivalent to the number of athletes born in smaller cities and moved to larger cities[4,5].

Despite the limitations, the data found may elucidate further discussions about Olympic medalist athletes. Further studies should investigate the sports in an individual way, with greater number of participants considering women and men, because they present own characteristics. It is also suggested to consider social aspects, with studies focused on the quality of relationships among sports characters, opportunities for practice and the training context of elite athletes, which are indicated for a better understanding of factors such as MHDI and the process of preparation of athletes in the scenarios of sport development in the long term.

CONCLUSION

The present study pointed out that athletes born in cities with population of 100,000-499,999 inhabitants have higher odds ratio of becoming Olympic champions, as well as in the regression adjusted with variable male sex in relation to female sex and Olympic silver medalists ($p \leq 0.05$). In relation to categorical variable birth quartile referring to birthdate, no significant results were found. It was concluded that Olympic medalist athletes are mostly men, possibly because of the sports culture in the country of promoting and disseminating primarily men's sports. In addition, athletes are from places that present better living conditions, with intermediate MHDI, which appears only in cities with more than 100 thousand inhabitants.

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