

MASSIFICATION OF WOMEN'S ARTISTIC GYMNASTICS IN BRAZIL: AN ANALYSIS OF PARTICIPATIONS IN THE NATIONAL TOURNAMENT

MASSIFICAÇÃO DA GINÁSTICA ARTÍSTICA FEMININA NO BRASIL: UMA ANÁLISE DAS PARTICIPAÇÕES NO TORNEIO NACIONAL

Lucas Machado de Oliveira¹, Allana Alencar^{1,2}, Juliana Pizani¹

¹Federal University of Santa Catarina, Florianópolis-SC, Brazil.

²State University of Santa Catarina, Florianópolis-SC, Brazil.

RESUMO

O estudo objetivou analisar as participações no Torneio Nacional de Ginástica Artística Feminina, considerando a presença das diferentes regiões e unidades da federação, o quantitativo de ginastas e faixa etária das participantes. Recorremos à pesquisa documental, tomando como base as listagens de inscrições e resultados das edições de 2019 a 2024. Os resultados da pesquisa demonstram um crescimento contínuo no evento, liderado pela região Sudeste e Centro-Oeste, enquanto as regiões Norte e Nordeste apresentaram os menores percentuais de participação. Ainda assim, a análise da participação ao longo dos anos mostra um acentuado crescimento dessas regiões. Os dados apontam menores taxas de participação nas categorias juvenil e adulta. Por fim, novos direcionamentos de pesquisa são traçados para superar os desafios e otimizar as oportunidades no desenvolvimento da modalidade no Brasil.

Palavras-chave: ginástica. educação física e treinamento. competição. políticas públicas.

ABSTRACT

The study aimed to analyze participation in the National Women's Artistic Gymnastics Tournament, considering the presence of different regions and federative units, the number of gymnasts, and the age groups of the participants. We employed a documentary research approach, based on registration lists and competition results from the 2019 to 2024 editions. The results indicate a continuous growth in the event, led by the Southeast and Midwest regions, while the North and Northeast regions showed the lowest participation rates. Nonetheless, the analysis of participation over the years reveals a marked increase in these regions. The data also point to lower participation rates in the junior and senior categories. Finally, new research directions are proposed to address challenges and optimize opportunities for the development of the sport in Brazil.

Keywords: gymnastics. physical education and training. competition. public policies.

Introduction

The significant results of Brazilian athletes in international women's artistic gymnastics (WAG) competitions, such as the Pan American Games, Olympic Games, and World Championships, have increasingly highlighted Brazil's success. This path, pioneered by prominent figures such as Daniele Hypólito, Daiane dos Santos, Jade Barbosa, and Laís Souza, has seen a peak in international individual and team results in recent years, with the team composed of Rebeca Andrade, Flávia Saraiva, Lorrane Oliveira, Julia Soares, Carlyne Pedro, and Jade Barbosa^{1,2}. With the media visibility gained through this performance, a phenomenon called by media outlets the "Rebeca Andrade effect" became evident, named after the athlete currently with the most Olympic medals in Brazil³. News published in prestigious newspapers in the country describe this effect, through reports from sports managers and coaches, as a significant increase in demand for WAG in various regions of the country³⁻⁸.

When reflecting on the development of gymnasts in the national context and recognizing the advances that WAG has experienced, it is necessary to firstly state that the institutionalization of gymnastics in Brazil began in the South region, specifically in Rio Grande do Sul, with the dissemination attributed to German immigration and later with the creation of the first state gymnastics federation^{2,9-11}. Subsequently, the practice also spread to the Southeast region with the formation of state federations in São Paulo and Rio de Janeiro⁹. These data

appear to have lasting repercussions, with a notable predominance of gymnasts from these regions among the participants and medalists of various editions of the Brazilian WAG Championship. This competitive event represents the highest level of performance in the country^{9,12}, and among Brazil's representatives at the Olympic Games^{2,11,13}. To overcome the centralization of these regions and strengthen the development of WAG throughout Brazil, there is a need to consider several factors such as the professional development of coaches, the quality of training, and the expansion of discussions about the sports training of gymnasts, especially in aspects related to the sports preparation system and the organization of the sport in the country.^{2,10} In addition to this scenario of concentration of gymnasts in these regions, the WAG requires its practitioners to specialize in sports at a young age, which can lead to early abandonment of high-performance sports¹⁴, and often contribute to problems in renewing the selections that represent the country^{2,10}.

In view of this, the scientific agenda of sports pedagogy has guided debates on the need for youth sports competitions to be designed with distinct goals, based on the pedagogical character to overcome problems such as early specialization, which generates high emotional and physical overload and leads to sports dropout^{15,16}. Additionally, it is suggested to implement diverse competitive formats, including tournaments and festivals that have easier access for sports clubs with fewer financial and structural resources, allowing for a greater number of participants¹⁷.

In Brazil, the National Women's Artistic Gymnastics Tournament (NWAGT), an event organized by the Brazilian Gymnastics Confederation (BGC), has stood out as an alternative competitive format, playing an essential role in the massification of the sport and enabling the participation of athletes who, for different reasons, do not participate in the Brazilian Championships¹⁸⁻²⁰. Several factors explain the more inclusive and democratic nature of the NWAGT, such as: (a) adaptation of the regulations to accommodate beginners through to the most advanced levels; (b) implementation of the "base" level for gymnastics clubs with limited equipment, allowing participation in only two apparatus; (c) the presence of teams from diverse backgrounds, from traditional Brazilian clubs to social projects, gyms, schools, and city halls; and (d) a high-level organizational structure, including official apparatus, an efficient counting system, and live broadcasting on the BGC YouTube channel¹⁸⁻²¹. By combining a competitive environment accessible to different levels and profiles of gymnasts, NWAGT expands the reach of the sport, contributes to sports development, increases the number of participants, and promotes the democratization of the sport¹⁸⁻²¹.

In addition to these organizational efforts and adaptations of competitive structures, we understand that for WAG to fully develop in Brazil and reach its maximum potential, the scientific field must align with observed demands, bringing reflections and proposals to the practical field. This is why several authors have analyzed and provided insights into WAG and its progress in Brazil through different research areas, such as historical factors^{10,11}, the biodynamic aspects^{22,23}, the professional development of coaches^{24,25}, the sports training of athletes^{14,26,27}, or even the management of sports policies^{28,29}. This last area is still considered little explored in the national scientific literature regarding competitive gymnastics^{30,31}. However, providing data on sports participation, for example, is essential for strategic decision-making, policy formulation and continuous evaluation, and progress on management issues.

We understand the importance of expanding the analyses already conducted beyond high-performance championships in Brazil and proposing a mapping of the representation of different regions of Brazil in the NWAGT, considering the event's potential for promoting and expanding the sport nationwide. Through analyses of this type, we believe it is possible to advance debates on public policy development, strategic planning, and sustainable growth of the WAG, based on data on regional disparities and challenges in the sport's development. Therefore, the objective of this study was to analyze participation in the NWAGT, considering

the presence of different Brazilian regions and federative units, as well as the number and age range of gymnasts. Based on this, we intend to deepen the discussion on the development and democratization of the sport in the country.

Methods

This descriptive and quantitative study was conducted through documentary research in primary and public sources, based on registration lists and results from the 2019, 2021, 2022, 2023, and 2024 editions of the NWAGT, available on the official BGC website. Understood as a detailed examination of a body of data composed of different documents, documentary research allows for additional and/or complementary interpretations³², through the analytical treatment of primary data, in this case, the lists published by the BGC, making it possible to foster the understanding and maturation of the object studied³³.

The collection was therefore developed based on criteria proposed in the scientific literature³⁴, namely: authenticity, related to respect for original documents; credibility, expressed in references free or not from distortions; representativeness, indicating whether the collected sample corresponds to the reality investigated; and comprehensibility, which refers to the comprehensibility of the sources used. To ensure authenticity and credibility, all listings were taken from the official BGC website³⁵⁻³⁸ and the data was maintained as published. To ensure representativeness and comprehension, the inclusion and exclusion criteria defined below were applied.

The choice of the timeframe between the 2019 and 2024 editions considered the relevance of the current analysis and the period in which the Brazilian WAG achieved unprecedented results on the international stage, such as the Olympic medals in Tokyo (2021) and Paris (2024), as well as the World Championships held in Belgium (2023). The year 2020 was disregarded, given that the NWAGT was not held due to the COVID-19 pandemic.

To collect the data, the information for each gymnast enrolled in the NWAGT editions analysed in this study was extracted from the BGC website and stored in a spreadsheet using Microsoft Excel software. Finally, the data set was organized according to the year of the NWAGT, the name of the participating gymnast, the year of birth, the entity they were representing, and the federative units of origin, considering the following aspects for analysis: (a) characterization of each edition according to year, location, and number of participants; (b) percentage of participation in each federative unit and region of the country in the five editions; (c) regional participation according to the number of gymnasts and year of edition; (d) regional participation according to the number of sports clubs and year of edition; (e) participation of the federative units according to the number of gymnasts and clubs in each edition; (f) characterization of the federative units according to the age group of the gymnasts in each edition.

During data processing, we use descriptive statistics, which consist of organizing and describing data through synthetic indicators³⁹, allowing us to summarize a set of values of the same nature⁴⁰. Data analysis was performed using descriptive statistics of mean, absolute frequency (n) and relative frequency (%). We used the Statistical Package for the Social Sciences software (SPSS®), version 20.0.

Results and discussion

In the timeframe investigated, it is possible to verify that the NWAGT has expanded its national representation, considering the increase in the number of participating federative units, sports clubs, and gymnasts (Table 1). In the last five editions, we observed a predominance of cities in the Central-West region as host cities, with the state of Goiás hosting two of these

editions.

Table 1. Federative units, clubs, and participating gymnasts in each edition of the NWAGT

Year	Host city	Region	Federative units	Clubs	Gymnasts
2019	Rio de Janeiro (RJ)	Sudeste	13	39	316
2020	-	-	-	-	-
2021	Campo Grande (MS)	Centro-Oeste	12	42	322
2022	Goiânia (GO)	Centro-Oeste	16	55	578
2023	Anápolis (GO)	Centro-Oeste	19	61	764
2024	Palmas (TO)	Norte	19	66	898

Source: Authors

The growth in the number of participating gymnasts over the years demonstrates the potential for expansion of the WAG in Brazil, as well as the event's importance in implementing this process. It is important to note that in 2021, sports activities were returning from the isolation period caused by the COVID-19 pandemic, which may have affected the number of gymnasts at the event. We also believe that the increase in the number of participants, more significant from 2022 onwards, may be related to the inclusion of the Base Level in the NWAGT, which introduces adaptations to the regulations and competition format aimed at gymnasts at more beginner technical levels²⁰. Such adaptations are in line with scientific evidence that discusses the importance of modifying competitive regulations and competition formats with a view to democratizing the sport¹⁷, including, for example, reducing the number of apparatus on which gymnasts perform, reducing the space used on the floor, and adjusting the difficulty and execution of gymnastic elements.

We understand that one of the challenges for more federative units, organizations, and gymnasts to participate in the event lies in the continental dimension of Brazil. The movement of athletes, coaches, and support teams requires significant logistical planning and financial investment, a fact that can affect participation in different regions. Therefore, we understand the need to alternate the federative units and cities hosting the event, allowing places with less tradition in WAG to have equal access to national-level competitions and encourage the development of the sport. In response to these investments, it is possible to foster the creation of opportunities for new talent to be discovered throughout the country. In this sense, specialized literature highlights that countries that achieve international success in sport, especially at a high performance level, have centrally structured national action plans implemented nationwide⁴¹. In other words, the union of public policies in the provision of financial resources together with the systematization of the organizational structure reflects good sporting results in different countries⁴². However, it is important to emphasize that this perspective should not only serve to identify high-performance athletes, but also as part of a broader process of democratizing access, civic education, and valuing the diversity of sporting experiences.

Analyzing the representation of each federative unit between 2019 and 2024 (Figure 1), we identified the highest percentage of participation of gymnasts from São Paulo (29.29%), followed by Goiás (12.47%), Distrito Federal (10.42%), Rio Grande do Sul (9.31%), and Minas Gerais (7.68%). Five federative units had no representatives in the event during this period, all located in the North and Northeast regions: Acre, Amapá, Piauí, Rondônia, and Roraima.

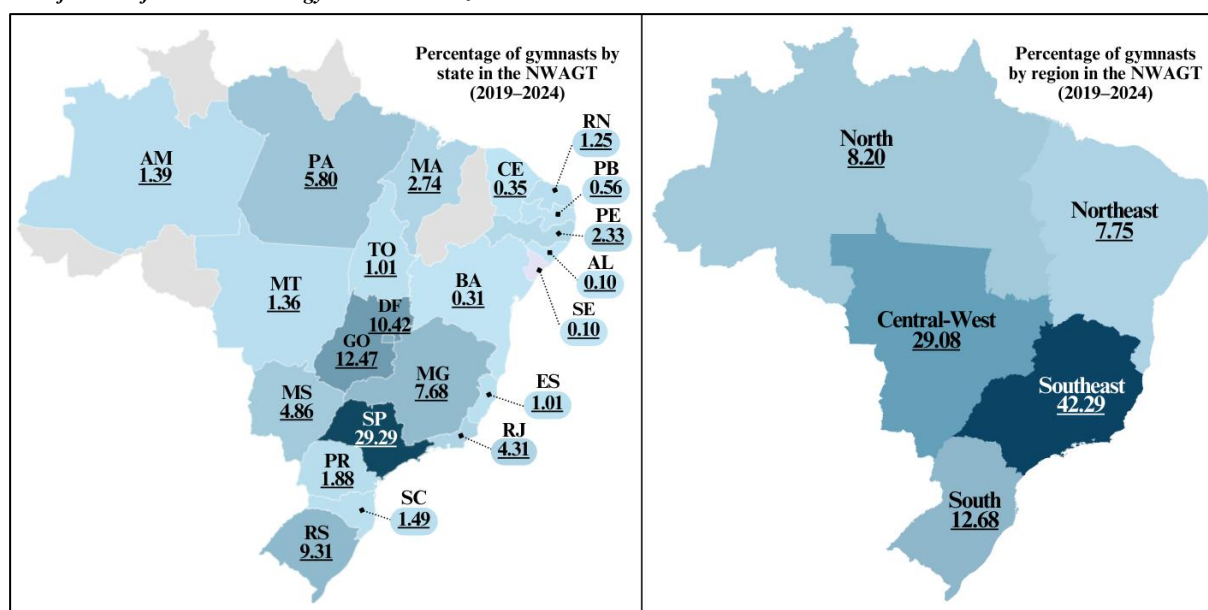


Figure 1. Percentage of gymnasts participating in the NWAGT from 2019 to 2024 by federative unit and region

Source: Authors

Contrary to the evidence from studies that highlight the reduced participation, mostly in the South and Southeast regions, in the Brazilian WAG Championships^{10,12}, the analysis of the NWAGT in this study indicated that even though the Southeast region's massive participation remains (42.29%), the Central-West region stands out in the sequence, representing 29.08% of the gymnasts present in the editions investigated. This phenomenon may reflect the fact that the Central-West region hosted three of the last five editions, reinforcing the importance of choosing host regions to expand the sport in nearby locations. Furthermore, unlike the predominance of the federative units of São Paulo, Rio de Janeiro, and Paraná in the Brazilian WAG Championships¹², NWAGT has been a more diverse event, considering the number of federative units present. This data reinforces the initial understanding of the importance of a competitive format that is an alternative to that presented for high performance¹⁷, as a way to decentralize gymnastics and break the boundaries of the South and Southeast axis

Despite this, it is crucial to consider that, even though the NWAGT presents a more inclusive competitive approach regarding technical requirements and includes more federative units, the regional distribution of participants remains unbalanced. Furthermore, the North and Northeast regions did not have all their federative units present at the event, with four federative units from the North and one from the Northeast missing. A study that investigated the management of the Ceará Gymnastics Federation indicates that the state's low representation on the national stage may be linked to a lack of financial support in pillars such as: athlete detection and development systems, career and retirement support, infrastructure, research, and innovation⁴³. This scenario reinforces that without proper government intervention and support, financial investment, adequate facilities, training adapted to the demands of athletes, and the support of science and sports medicine, it becomes unfeasible to achieve a systematic and strategic approach to athlete development, especially in nations that aspire to international sporting scenarios⁴². In accordance with the discussion proposed by authors who focused on the development of WAG in Brazil, in the North and Northeast regions, investments are still needed, such as the training of professionals who can strengthen the modality, in addition to adequate locations and equipment for practice that favor the development of base categories in different locations in the federative units and not just concentrated in one city²³.

At this point, we must not ignore social indicators and their potential impacts on sports

development. For example, cities in the North and Northeast have the lowest Municipal Human Development Indexes, according to the Atlas of Human Development in Brazil⁴⁴. In addition, there is a greater tendency to promote sports activities when municipalities have a higher Municipal Human Development Index⁴⁵. In the words of these authors^{45,966}, “more developed municipalities have more instruments, hold more events, have more structure” and, therefore, “it is not audacious to federative units that the full socioeconomic and cultural development of a people depends on the full development of sport”.

The Southeast region's massive presence is particularly influenced by the state of São Paulo, which accounts for 29.29% of the event's participants. Some studies offer insights into the factors that explain this scenario. Beyond the historical and cultural context, studies point to the economic importance of the Southeast region and the state of São Paulo in the country⁴⁶, as well as the large number of affiliated clubs in the state, the promotion of numerous championships and competitions, such as Regional Games and Inland Open Games⁴⁷, can explain the scenario that moves the cities of São Paulo and drives their athletes to compete, resulting in big names from WAG being highlighted, such as Daniele Hypólito and Laís Souza^{46,47}. São Paulo is also home to the largest national manufacturers of devices and equipment for sports⁴⁸, making these items more accessible to clubs and schools in the state. Furthermore, it is important to highlight the impact of traditional public universities such as the University of São Paulo (USP), the State University of Campinas (UNICAMP), and the São Paulo State University (UNESP), which are heavily involved in scientific promotion and development, making São Paulo the Brazilian state with the highest number of scientific productions on gymnastics at the stricto sensu graduate level^{30,49}.

To visualize the distribution of regional representation over recent years, the number of gymnasts participating in each edition is presented (Figure 2).

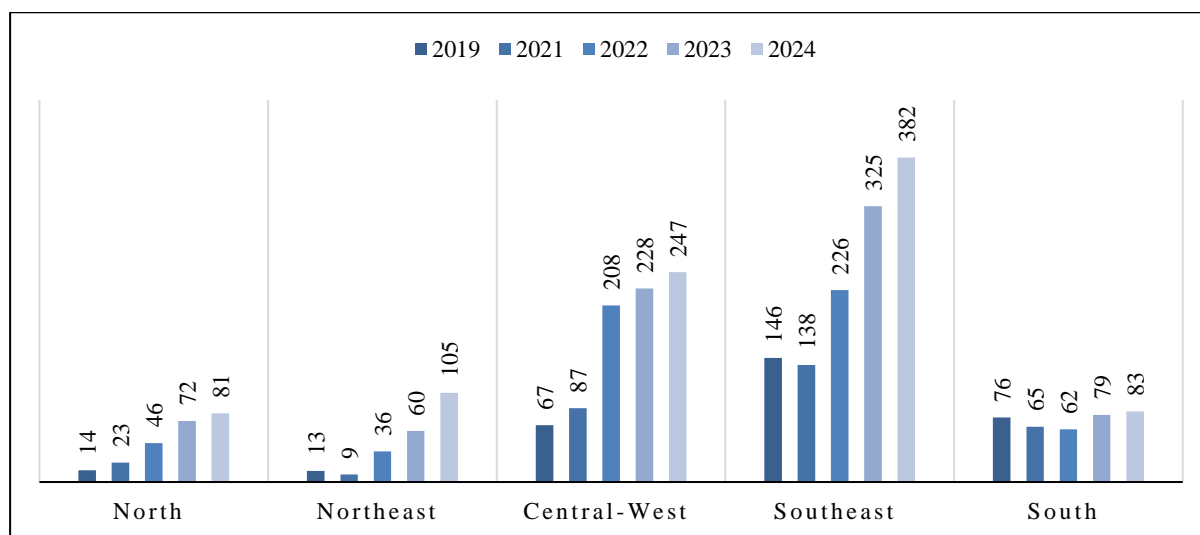


Figure 2. Number of gymnasts in each edition of the NWAGT by region

Source: Authors

Overall, the data demonstrates an increase in the number of participating gymnasts in all regions of the country over the past few years. Although the North and Northeast regions had the lowest overall attendance percentages in the NWAGT editions investigated, the analysis of participation over the years shows continued growth, surpassing the South of the country (in the case of the Northeast) or approaching it (in the case of the North) in the 2024 edition.

These records are especially relevant if we consider the historical representation that the South region has in the context of WAG, given the pioneering role of the state of Rio Grande do Sul in the modality and the emergence of important names such as Daiane dos Santos¹¹. On

the one hand, it is striking that the increase in gymnasts in the South is lower than in the other regions. On the other hand, it is positive looking from the perspective of occupying regions with less tradition. We infer the need for this continuous monitoring so that organizations that manage the WAG in the country and in the federative units, such as the BGC and state federations, can develop strategies to promote balanced growth of the sport throughout Brazil. Furthermore, regarding the participation of the South region, it is important to note that the state of Rio Grande do Sul suffered severe flooding in 2024, a factor that may have also impacted the local sporting context and participation figures in the region.

Regarding the number of gymnastics clubs participating in the NWAGT (Figure 3), the Southeast region showed the largest increase from 2019 to 2024 ($n=11$), followed by the Northeast ($n=9$) and Central-West ($n=5$) regions.

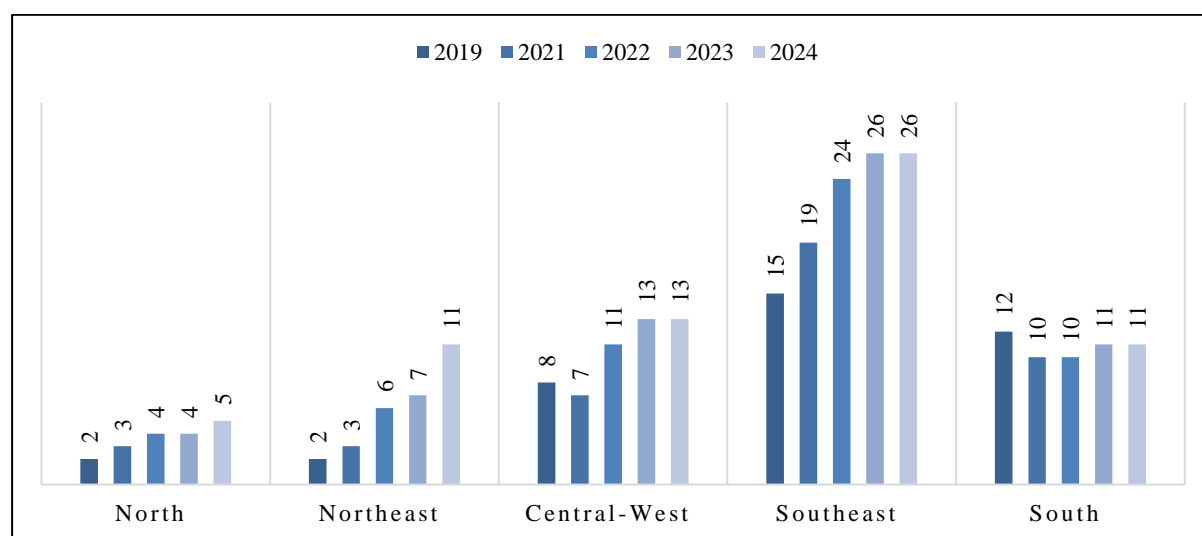


Figure 3. Number of clubs in each edition of the NWAGT by region

Source: Authors

The significant increase in participating gymnastics clubs in the Southeast, Northeast, and Central-West regions is positive, as it implies more locations offering WAG in these regions. One factor that helps understand this movement is the intentionality of the sports governing bodies. For example, the BGC's efforts to improve WAG in different locations in Brazil, which enabled the distribution of official WAG equipment in 2015 to existing training centers or the creation of new centers in the Federal District, Pará, Paraná, Rio Grande do Norte, Rio Grande do Sul, Rio de Janeiro, and Sergipe²⁸. However, intentionality should not be tied exclusively to the physical structure for practicing the sport. As discussed in the scientific literature in the field, WAG still requires multifactorial advancement, encompassing structural and organizational aspects such as governance, infrastructure, training and development of coaches, media support, strengthening of clubs at the local and state levels, and greater transparency in management, all of which are indispensable factors for consolidating a sustainable sporting trajectory².

However, we also hypothesize that the growth of these regions may be associated with the increase in private gymnastics schools in these areas. Some authors point out that, although WAG is widely represented by public institutions, it is necessary to consider the presence and influence of the private sector in the development of the sport^{28,46,50}. Therefore, we believe that WAG's visibility, generated by its impressive international results, may have contributed to its recognition as a profitable product for sports entrepreneurs. However, further research is required to understand this scenario.

Table 2 presents data on each federative federative unit's participation in the NWAGT,

considering the number of gymnasts and sports organizations in each year. Federative units in the North and Northeast regions gained greater representation over the period under investigation. For example, Pará (North region), Pernambuco, and Maranhão (Northeast region) saw a significant increase in the number of participating gymnasts. Furthermore, Alagoas and Bahia (Northeast region) broke their cycle of absence from the NWAGT with their participation in the 2024 edition. This scenario highlights the potential for growth of the sport in these regions. From 2011 to 2019, the only federative units in these regions that participated in Brazilian WAG Championships, for example, were Amazonas (1 gymnast), Pará (3 gymnasts), Pernambuco (10 gymnasts), Sergipe (1 gymnast), and Ceará (1 gymnast)²⁸. The comparison between these two events once again reinforces the democratic potential of the NWAGT, which, in addition to enabling the participation of more federative units, presents a substantially larger number of gymnasts in these federative units.

We also found that the federative units of the Central-West region stand out for their increased number of participating gymnasts, especially Goiás and the Federal District. Although research on these regions is still in its infancy, we understand that WAG in these locations has gained notoriety due to private sector support, as is the case with a network of private WAG schools that began in the state of Goiás and later spread throughout Brazil^{51,52}. Although there is a lack of theoretical support to further explore these findings, news reports suggest that this group invested heavily in training professionals, hiring a renowned former coach of the Brazilian national team to develop new coaches for the sport in the region⁵³. This entire process goes back to professional training along the lines of “coach developer”, widely discussed in international literature as a professional responsible for training and supporting sports coaches and helping to improve their practices, acting as a facilitator of continuous learning, promoting reflections on sports pedagogy, especially in communication skills, leadership and athlete development⁵⁴. Therefore, we infer that the private sector of the WAG has expanded in Brazil with a new configuration, presenting a fertile context for the scientific field to explore relevant topics such as sports management in the WAG, the professional development of coaches and sports managers, public-private partnerships, the facilitators and barriers faced in this context, among others.

Table 2. Number of clubs and gymnasts participating in NWAGT according to the federative units

Federative Unit (grouped by region)	2019		2021		2022		2023		2024	
	Clubs n (%)	Gymnasts n (%)	Clubs n (%)	Gymnasts n (%)	Clubs n (%)	Gymnasts n (%)	Clubs n (%)	Gymnasts n (%)	Clubs n (%)	Gymnasts n (%)
Amazonas	-	-	1 (2.38)	10 (3.11)	1 (1.82)	10 (1.73)	1 (1.64)	11 (1.44)	1 (1.52)	9 (1.00)
Pará	2 (5.13)	14 (4.43)	2 (4.76)	13 (4.04)	2 (3.64)	30 (5.19)	2 (3.28)	50 (6.54)	3 (4.55)	60 (6.68)
Tocantins	-	-	-	-	1 (1.82)	6 (1.04)	1 (1.64)	11 (1.44)	1 (1.52)	12 (1.34)
Alagoas	-	-	-	-	-	-	-	-	1 (1.52)	3 (0.33)
Bahia	-	-	-	-	-	-	-	-	3 (4.55)	9 (1.00)
Ceará	-	-	-	-	1 (1.82)	2 (0.35)	1 (1.64)	4 (0.52)	1 (1.52)	4 (0.45)
Maranhão	-	-	-	-	2 (3.64)	16 (2.77)	2 (3.28)	22 (2.88)	2 (3.03)	41 (4.57)
Paraíba	-	-	-	-	-	-	1 (1.64)	16 (2.09)	-	-
Pernambuco	1 (2.56)	10 (3.16)	3 (7.14)	9 (2.80)	2 (3.64)	9 (1.56)	1 (1.64)	7 (0.92)	3 (4.55)	32 (3.56)
Rio Grande do Norte	-	-	-	-	1 (1.82)	9 (1.56)	2 (3.28)	11 (1.44)	1 (1.52)	16 (1.78)
Segipe	1 (2.56)	3 (0.95)	-	-	-	-	-	-	-	-
Distrito Federal	4 (10.26)	46 (14.56)	3 (7.14)	24 (7.45)	4 (7.27)	68 (11.80)	5 (8.20)	81 (10.60)	4 (6.06)	81 (9.02)
Goiás	1 (2.56)	6 (1.90)	1 (2.38)	35 (10.9)	5 (5.45)	114 (19.70)	4 (6.56)	96 (12.60)	4 (6.06)	107 (11.90)
Mato Grosso do Sul	2 (5.13)	11 (3.48)	3 (7.14)	28 (8.70)	2 (3.64)	26 (4.50)	3 (4.92)	31 (4.06)	4 (6.06)	44 (4.90)
Mato Grosso	1 (2.56)	4 (1.27)	-	-	-	-	1 (1.64)	20 (2.62)	1 (1.52)	15 (1.67)
Espírito Santo	-	-	1 (2.38)	9 (2.80)	1 (1.82)	9 (1.56)	1 (1.64)	11 (1.44)	-	-
Minas Gerais	2 (5.13)	19 (6.01)	4 (9.52)	25 (7.76)	4 (7.27)	55 (9.52)	6 (9.84)	79 (10.30)	4 (6.06)	43 (4.79)
Rio de Janeiro	5 (12.82)	39 (12.34)	3 (7.14)	14 (4.35)	3 (5.45)	12 (2.08)	2 (3.28)	25 (3.27)	2 (3.03)	34 (3.79)
São Paulo	8 (20.51)	88 (27.85)	11 (20.60)	90 (28.00)	16 (29.10)	150 (26.00)	17 (27.90)	210 (27.50)	20 (30.30)	305 (34.00)
Paraná	3 (7.69)	12 (3.80)	2 (4.76)	14 (4.35)	3 (5.45)	11 (1.90)	2 (3.28)	10 (1.31)	1 (1.52)	7 (0.78)
Rio Grande do Sul	7 (17.95)	53 (16.77)	8 (19.00)	51 (15.80)	7 (12.17)	51 (8.82)	8 (13.10)	57 (7.46)	8 (12.10)	56 (6.24)
Santa Catarina	2 (5.13)	11 (3.48)	-	-	-	-	1 (1.64)	12 (1.57)	2 (3.03)	20 (2.23)
Total	39 (100)	316 (100)	42 (100)	322 (100)	55 (100)	578 (100)	61 (100)	764 (100)	66 (100)	898 (100)

Source: Authors

The profile of the participating gymnasts, considering their age groups (Table 3) shows a marked dropout after 12 years of age, since the pre-child (9 to 10 years old) and child (11 to 12 years old) categories account for 65.28% of the gymnasts in the last five editions of the event.

Table 3. Participation of each federative unit by age group from 2019 to 2024

Federative Unit (grouped by region)	9–10 years (pre-child)	11–12 years (child)	13–15 years (junior)	16+ years (senior)
	n (%)	n (%)	n (%)	n (%)
Amazonas	10 (1.07)	16 (1.70)	14 (1.86)	-
Pará	65 (6.94)	40 (4.25)	41 (5.45)	21 (8.50)
Tocantins	6 (0.64)	18 (1.91)	5 (0.66)	-
Alagoas	3 (0.32)	-	-	-
Bahia	2 (0.21)	3 (0.32)	2 (0.27)	2 (0.81)
Ceará	5 (0.53)	2 (0.21)	3 (0.40)	-
Maranhão	39 (4.16)	23 (2.44)	14 (1.86)	3 (1.21)
Paraíba	7 (0.75)	5 (0.53)	4 (0.53)	-
Pernambuco	24 (2.56)	28 (2.97)	11 (1.46)	4 (1.62)
Rio Grande do Norte	18 (1.92)	12 (1.27)	5 (0.66)	1 (0.40)
Sergipe	1 (0.11)	1 (0.11)	1 (0.13)	-
Distrito Federal	95 (10.14)	102 (10.83)	78 (10.37)	25 (10.12)
Goiás	112 (11.95)	113 (12.00)	105 (13.96)	28 (11.34)
Mato Grosso do Sul	41 (4.38)	47 (4.99)	44 (5.85)	8 (3.24)
Mato Grosso	18 (1.92)	11 (1.17)	9 (1.20)	1 (0.40)
Espírito Santo	12 (1.28)	9 (0.96)	6 (0.80)	2 (0.81)
Minas Gerais	87 (9.28)	72 (7.64)	50 (6.65)	12 (4.86)
Rio de Janeiro	58 (6.19)	44 (4.67)	20 (2.66)	2 (0.81)
São Paulo	265 (28.27)	285 (30.25)	212 (28.19)	81 (32.79)
Paraná	4 (0.43)	12 (1.27)	27 (3.59)	11 (4.45)
Rio Grande do Sul	48 (5.13)	87 (9.24)	88 (11.70)	45 (18.22)
Santa Catarina	17 (1.82)	12 (1.27)	13 (1.73)	1 (0.40)
Total	937 (100)	942 (100)	752 (100)	247 (100)

Source: Authors

The decline in gymnast participation in the youth and adult categories may indicate challenges in retaining these athletes even in the context of mass participation, considering that the NWAGT regulations already include adaptations to technical requirements to attract a larger number of participants. These data suggest that even in the context of mass participation, problems typical of high-performance sports may exist. It is common to see training in the early stages of sports development modeled after adult athletes, reproducing the logic of high performance and achieving significant results as quickly as possible, leading to negative impacts on their continued participation in sports^{14,55,56}. Generally, WAG coaches in the performance context claim that the requirements set out in the sport's technical regulations, proposed by state federations and the BGC, induce the process of early specialization, which often contradicts their concept of sports training¹⁴. Although the WAG scenario has historically favored early specialization processes, recent initiatives, such as the Brazilian Olympic Committee's Sports Development Model, point to alternative paths for organizing sports training. However, specific documents for the sport are needed, as well as research focused on understanding how such proposals have impacted the culture and specificities of the sport.

Furthermore, another aspect discussed by researchers that should be considered is the

lack of incentives for dual sports careers in Brazil, which requires athletes to leave as they age to enter the job market or dedicate themselves to studies, due to the lack of resources that allow them to reconcile different careers^{57,58}. This phenomenon is even more critical when considering female athletes, since expectations regarding women's sports are lower when compared to men's sports, increasing economic disparity and favoring discontinuity in the sport⁵⁹.

The findings of a systematic review highlight factors that influence the retention of elite athletes in artistic gymnastics over time and indicate that adequate infrastructure, access to quality training centers, financial support and parental involvement are central elements in ensuring the continuity of sports practice⁶⁰. On the other hand, the absence of structured policies and the organization of sport according to a predominantly commercial logic seem to favor early dropout⁶⁰. This raises some questions that require future research in the specific context of massification, such as: What are the challenges faced by gymnasts participating in the NWAGT that result in their dropping out of the sport? To what extent do the NWAGT regulations propose adaptations that favor the participation of gymnasts in older age categories? How can the sports community discuss and encourage the participation of these gymnasts?

It can be observed that, in general, the federative units with the largest number of participants in the youth categories (pre-child and children) are also those that manage to obtain the largest number of gymnasts in the youth and adult categories. These findings reinforce the importance of promoting youth sports, ensuring the retention of more athletes in the future. Furthermore, we highlight the importance of the NWAGT, especially for these larger categories (pre-child and children), as a gateway to the competitive scene, being part of the development process for gymnasts who can later be directed to competitions with greater technical demands, such as the Brazilian Championship²¹.

Conclusion

This study analyzed participation in the NWAGT from 2019 to 2024, based on the presence of the different regions and federative units in Brazil, the number of gymnasts, and the ages of participants. This overview allows us to identify trends, challenges, and opportunities for strengthening the WAG, contributing to the democratization of access to sport. The survey results demonstrate continued growth in the event, led by the Southeast and Central-West regions. The North and Northeast regions still have the lowest participation rates, but they are particularly notable for the increase in federative units, clubs, and gymnasts with each edition of the event. Overall, we observed a movement toward WAG representation in the context of mass participation, directed toward the Southeast and Central-West regions, unlike the performance context, which is directed toward the South and Southeast. In addition, the age range of the gymnasts taking part in the event shows a sharp drop in participation in the youth and adult categories.

Given these findings, we outline potential issues for future research, with a view to providing insights to guide the strategic planning of sports organizations responsible for developing the WAG. Therefore, we suggest evaluating the transfer of gymnasts participating in the NWAGT to performance competitions as a way to understand the event's impact on the process of massification and sports development. In the meantime, encouraging research and establishing dialogue with the private sector, sports managers, and coaches from regions underrepresented in the NWAGT are essential for understanding new scenarios, as well as overcoming the challenges and barriers to effective participation at the national level. Finally, we highlight the urgent need to interpret the factors that may explain the reduced number of gymnasts participating in the youth and adult categories in this event, which prioritizes sports massification.

It is undeniable that WAG is experiencing an unprecedented moment in Brazil, given recent international results. However, we understand that the growth and strengthening of the sport requires continuous monitoring. This study is part of an initial effort limited to the analysis of NWAGT reports made available by the BGC within a specific timeframe (2019 to 2024), which limits triangulation with other data sources and in-depth exploration of other qualitative dimensions of the phenomenon under investigation. Certainly, the advancement of WAG in Brazil requires more than just data organization and analysis. Measurement tools with more robust indicators are needed to assess the impact of public policies, the influence of competitive regulations, and practitioner engagement, among other aspects.

References

1. Estadão [Internet]. Como a ginástica brasileira deu um salto rumo à glória nos últimos 20 anos [cited 2025 Feb 16]. Available from: <https://www.estadao.com.br/esportes/como-a-ginastica-brasileira-deu-um-salto-rumo-a-gloria-nos-ultimos-20-anos/>
2. Lima LBQ, Bortoleto MAC, Oliveira MS, Schiavon LM. Women's artistic gymnastics in Brazil: paths taken from 1966 to 2021. *Sci Gym J*. 2024;16(2):225–53. DOI: <https://doi.org/10.52165/sgj.16.2.225-253>
3. G1 [Internet]. Efeito Rebeca Andrade: academia do interior de SP vê aumento na procura por aulas de ginástica artística após ouro olímpico [cited 2025 Feb 16]. Available from: <https://g1.globo.com/sp/sorocaba-jundiai/noticia/2024/08/16/efeito-rebeca-andrade-academia-do-interior-de-sp-ve-aumento-na-procura-por-aulas-de-ginastica-artistica-apos-ouro-olimpico.ghtml>
4. Metrôpoles [Internet]. Efeito Rebeca: 2 mil famílias buscam vagas em escola de ginástica [cited 2025 Feb 16]. Available from: <https://www.metropoles.com/esportes/olimpiadas-2024/efeito-rebeca-2-mil-familias-buscam-vagas-em-escola-de-ginastica>
5. Bahia Esportes [Internet]. Efeito Rebeca Andrade: procura pela prática da ginástica artística aumenta em Salvador [cited 2025 Feb 16]. Available from: <https://www.bahianoticias.com.br/esportes/noticia/70523-efeito-rebeca-andrade-procura-pela-pratica-da-ginastica-artistica-aumenta-em-salvador>
6. UOL [Internet]. Efeito Rebeca faz lista de espera travar em Instituto Hypólito de ginástica [cited 2025 Feb 16]. Available from: <https://www.uol.com.br/esporte/olimpiadas/ultimas-noticias/2024/08/07/efeito-rebeca-faz-lista-de-espera-travar-em-instituto-hypolito-de-ginastica.htm>
7. Estado de Minas [Internet]. Efeito Rebeca aumenta procura por ginástica artística em BH [cited 2025 Feb 16]. Available from: <https://www.em.com.br/gerais/2024/08/6918451-efeito-rebeca-aumenta-procura-por-ginastica-artistica-em-bh.html>
8. Campo Grande News [Internet]. Efeito Rebeca: projeto de ginástica tem fila de espera que pode demorar um ano [cited 2025 Feb 16]. Available from: <https://www.campograndenews.com.br/esportes/efeito-rebeca-projeto-de-ginastica-tem-fila-de-espera-que-pode-demorar-um-ano>
9. Públio NS. Ginástica artística. In: DaCosta L, organizadora. *Atlas do Esporte no Brasil*. Rio de Janeiro: Conselho de Educação Física; 2004. p. 224–5.
10. Schiavon LM, Paes RR, Toledo E, Deutsch S. Panorama da ginástica artística feminina brasileira de alto rendimento esportivo: progressão, realidade e necessidades. *Rev Bras Educ Fís Esporte*. 2013;27(3):423–59. DOI: <https://doi.org/10.1590/S1807-55092013005000018>
11. Bender N, Goellner SV. A participação de ginastas do Rio Grande do Sul nos Jogos Olímpicos: trajetórias, narrativas e memórias. *Motrivivência*. 2019;31(59):1–22. DOI: <https://doi.org/10.5007/2175-8042.2019e58016>
12. Lima LBQ, Bortoleto MAC, Nunomura M, Schiavon LM. A representatividade da ginástica artística feminina no contexto brasileiro (2011–2019). *Rev Bras Ciênc Mov*. 2022;30(3):1–19. DOI: <https://doi.org/10.31501/rbcm.v30i3.13083>
13. Oliveira MH, Bueno BL, Lima LBQ. Local de nascimento como fator de influência para o sucesso esportivo de ginastas olímpicos brasileiros. *Rev Int Ges Desp*. 2023;13(3):e110063. DOI: <https://doi.org/10.51995/2237-3373.v13i3e110063>
14. Nunomura M, Carrara PDS, Tsukamoto MHC. Ginástica artística e especialização precoce: cedo demais para especializar, tarde demais para ser campeão! *Rev Bras Educ Fís Esporte*. 2010;24(3):305–14. DOI: <https://doi.org/10.1590/S1807-55092010000300001>
15. Choi HS, Johnson B, Kim YK. Children's development through sports competition: derivative, adjustive, generative, and maladaptive approaches. *Quest*. 2014;66(2):191–202. DOI: <https://doi.org/10.1080/00336297.2013.861757>
16. Lloyd RS, Oliver JL. The youth physical development model: a new approach to long-term athletic development. *Strength Cond J*. 2012;34(3):61–72. DOI: <https://doi.org/10.1519/SSC.0b013e31825760ea>

17. Reis-Furtado LN, Carbinatto MV. Competição esportiva na infância: análise dos regulamentos de ginástica rítmica. *Motrivivência*. 2020;32(63):1–22. DOI: <https://doi.org/10.5007/2175-8042.2020.e72097>
18. Confederação Brasileira de Ginástica [Internet]. Efeito Rebeca Andrade repercute no Torneio Nacional de Ginástica Artística [cited 2025 Feb 16]. Available from: <https://cbginastica.com.br/noticia/1714/efeito-rebeca-andrade-repercute-no-torneio-nacional-de-ginastica-artistica>
19. Confederação Brasileira de Ginástica [Internet]. Organização do Torneio Nacional de GA comemora sucesso do evento [cited 2025 Feb 16]. Available from: <https://cbginastica.com.br/noticia/1716/organizacao-do-torneio-nacional-de-ga-comemora-sucesso-do-evento>
20. Confederação Brasileira de Ginástica [Internet]. Formato inclusivo e dinâmico foram diferenciais do Torneio Nacional de Ginástica Artística deste ano [cited 2025 Feb 16]. Available from: <https://cbginastica.com.br/noticia/1883/formato-inclusivo-e-dinamico-foram-diferenciais-do-torneio-nacional-de-ginastica-artistica-deste-ano>
21. Kumakura RS. O sistema competitivo da ginástica artística feminina (2013–2016): a competição como instrumento de educação e formação para atletas até 12 anos de idade [tese]. Porto Alegre: Universidade Federal do Rio Grande do Sul, Programa de Pós-Graduação em Ciências do Movimento Humano; 2018.
22. Carrara P, Mochizuki L. Análise biomecânica do crucifixo nas argolas. *Rev Bras Ciênc Mov*. 2008;16(2):83–9. DOI: <https://doi.org/10.18511/rbcm.v16i2.825>
23. Bacciotti S, Gaya A, Pereira S, Gomes T, Bacciotti F, Baxter-Jones A, et al. Seleção em ginástica artística feminina no Brasil. *Rev Bras Ciênc Esporte*. 2019;41(1):51–8. DOI: <https://doi.org/10.1016/j.rbce.2018.04.016>
24. Nunomura M, Carbinatto MV, Carrara PDS. Reflexão sobre um programa de formação profissional na ginástica artística. *Pensar Prát*. 2013;16(2):469–83. DOI: <https://doi.org/10.5216/rpp.v16i2.17345>
25. Oliveira LM, Ciampolini V, Milisteti M, Pizani J. Percepções de treinadores de ginástica artística sobre a formação inicial em Educação Física em instituições privadas de ensino superior. *Rev Bras Psi Esporte*. 2022;12(3):238–57. DOI: <https://doi.org/10.31501/rbpe.v12i3.13049>
26. Nunomura M, Oliveira MS. Centro de excelência e ginástica artística feminina: a perspectiva dos técnicos brasileiros. *Motriz*. 2012;18(2):378–92. DOI: <https://doi.org/10.1590/S1980-65742012000200018>
27. Nunomura M, Carrara PDS, Carbinatto M. Ginástica artística competitiva: considerações sobre o desenvolvimento dos ginastas. *Motriz*. 2009;15(3):503–14. DOI: <https://doi.org/10.5016/2222>
28. Lima LBQ, Schiavon LM. Instalações e equipamentos esportivos para treinamentos e competições em ginástica artística feminina no Brasil. *Rev Bras Educ Fís Esporte*. 2023;37(Esp):e37nesp215375. DOI: <https://doi.org/10.11606/issn.1981-4690.2023e37nesp215375>
29. Santos LCA, Capraro AM, Vargas PPI, Mezzadri FM. Panorama dos esportes ginásticos olímpicos nos municípios paranaenses. *J Phys Educ*. 2024;35(1):e3504. DOI: <https://doi.org/10.4025/jphyseduc.v35i1.3504>
30. Oliveira LM, Maidana NRD, Pires AF, Vinholes L, Barbosa-Rinaldi IP, Pizani J. Panorama das ginásticas de competição na pós-graduação stricto sensu em Educação Física no Brasil. *Movimento*. 2024;30:e30011. DOI: <https://doi.org/10.22456/1982-8918.139298>
31. Barros TES, Ramos V, Brasil VZ, Souza JR, Goda C, Conti BC. Análise das publicações científicas sobre ginástica artística. *Motrivivência*. 2016;28(47):67–81. DOI: <https://doi.org/10.5007/2175-8042.2016v28n47p67>
32. Godoy AS. Pesquisa qualitativa: tipos fundamentais. *Rev Adm Empresas*. 1995;35(3):20–9. DOI: <https://doi.org/10.1590/S0034-75901995000300004>
33. Sá-Silva JR, Almeida CD, Guindani JF. Pesquisa documental: pistas teóricas e metodológicas. *Rev Bras Hist Ciênc Soc*. 2009;1(1):1–15. Available from: <https://periodicos.furg.br/rbhcs/article/view/10351>
34. Mogalakwe M. The use of documentary research methods in social research. *Afr Sociol Rev*. 2006;10(1):221–30. Available from: <https://www.jstor.org/stable/afrisocirevi.10.1.221>
35. Confederação Brasileira de Ginástica [Internet]. XL Torneio Nacional de Ginástica Artística Feminina - Categoria: Todas [cited 2025 Feb 16]. Available from: <https://cbginastica.com.br/evento/13/xl-torneio-nacional-de-ginastica-artistica-feminina-categoria-todas?tab=atletas>
36. Confederação Brasileira de Ginástica [Internet]. XLI Torneio Nacional de Ginástica Artística Feminina [cited 2025 Feb 16]. Available from: <https://cbginastica.com.br/evento/34/xli-torneio-nacional-de-ginastica-artistica-feminina?tab=atletas>
37. Confederação Brasileira de Ginástica [Internet]. XLII Torneio Nacional de Ginástica Artística Feminina [cited 2025 Feb 16]. Available from: <https://cbginastica.com.br/evento/56/xlii-torneio-nacional-de-ginastica-artistica-feminina?tab=atletas>
38. Confederação Brasileira de Ginástica [Internet]. XLIII Torneio Nacional de Ginástica Artística Feminina [cited 2025 Feb 16]. Available from: <https://cbginastica.com.br/evento/93/xliii-torneio-nacional-neutrox-de-ginastica-artistica-feminina?tab=atletas>
39. Silvestre A. Análise de dados e estatística descritiva. Lisboa: Escolar Editora; 2007.

40. Appolinário F. As dimensões da pesquisa. In: Appolinário F. Metodologia científica: filosofia e prática da pesquisa. São Paulo: Thompson Learning; 2006. p. 59–72.
41. Mees GK. Políticas públicas do esporte de alto rendimento no Brasil: fatores político-esportivos que influenciam e contribuem para o sucesso [dissertação]. Porto Alegre: Universidade Federal do Rio Grande do Sul, Programa de Pós-Graduação em Ciências do Movimento Humano; 2014.
42. Grix J, Brannagan PM, Houlihan B. Comparative elite sport development: systems, structures and public policy. 2. ed. Londres: Routledge; 2024. DOI: <https://doi.org/10.4324/9781003213529>
43. Dantas CR, Lima LBQ, Reis LN, Bastos FC. Gestão da Federação Cearense das Ginásticas: um estudo de caso baseado no modelo SPLISS. Rev Gest Neg Esporte. 2018;3(1):35–49. Available from: <http://revistagestaodoesporte.com.br/mod/page/view.php?id=113>
44. Atlas Brasil [Internet]. Atlas do Desenvolvimento Humano no Brasil [cited 2025 Feb 16]. Available from: <http://www.atlasbrasil.org.br/ranking>
45. Micaliski EL, Radtke Junior CH, Hertes A, Ordonhes MT, Figuerôa KM, Cavichioli FR. A influência do índice de desenvolvimento humano municipal sobre o desenvolvimento de políticas esportivas educacionais, de rendimento ou de lazer no Brasil. Retos. 2024;51:962–9. DOI: <https://doi.org/10.47197/retos.v51.101375>
46. Lima LBQ. Representatividade da ginástica artística feminina paulista no cenário brasileiro (2011–2014) [dissertação]. Rio Claro: Universidade Estadual Paulista, Programa de Pós-Graduação em Ciências da Motricidade; 2016.
47. Schiavon LM, Lima LBQ, Ferreira MDTO, Silva YM. Análise da formação e atualização dos técnicos de ginástica artística do estado de São Paulo. Pensar Prát. 2014;17(3):618–35. DOI: <https://doi.org/10.5216/rpp.v17i3.29749>
48. Bortoleto MAC. Tecnologia e esporte: o desenvolvimento dos aparelhos da ginástica artística e sua influência no Brasil. Rev Bras Educ Fís Esporte. 2023;37(Esp):e37nesp215373. DOI: <https://doi.org/10.11606/issn.1981-4690.2023e37nesp215373>
49. Oliveira LM, Pires AF, Barbosa-Rinaldi IP, Pizani J. A ginástica como tema de investigação nos programas de pós-graduação em Educação Física no Brasil (1980–2020). Rev Bras Ciênc Esporte. 2021;43:e009321. DOI: <https://doi.org/10.1590/rbce.43.e009321>
50. Bortoleto MAC, Schiavon LM. Pequena notável: ensaio sociológico sobre a ginástica artística brasileira. In: Giglio SS, Amaral SCF, Ribeiro OCF, Bortoleto MAC, organizadores. Múltiplos olhares sobre os Jogos Olímpicos. São Paulo: Intermeios/Fapesp; 2018. p. 81–104.
51. Esporte Goiano [Internet]. Com inédita participação no adulto, MS representa Goiás no Brasileiro de Ginástica Artística [cited 2025 Feb 16]. Available from: <https://esportegoiano.com.br/inedita-participacao-adulto-ms-representa-goias-brasileiro-ginastica-artistica/>
52. Esporte Goiano [Internet]. Com quatro equipes do estado, Goiânia recebe Torneio Nacional de Ginástica Artística [cited 2025 Feb 16]. Available from: <https://esportegoiano.com.br/com-quatro-equipes-do-estado-goiania-recebe-torneio-nacional-de-ginastica-artistica/>
53. Esporte Goiano [Internet]. Após 13 anos na seleção, Roger Medina alavanca MS Ginástica e almeja capacitação de treinadores [cited 2025 Feb 16]. Available from: <https://esportegoiano.com.br/com-quatro-equipes-do-estado-goiania-recebe-torneio-nacional-de-ginastica-artistica/>
54. McQuade S, Nash C. The role of the coach developer in supporting and guiding coach learning. Int Sport Coach J. 2015;2(3):339–46. DOI: <https://doi.org/10.1123/iscj.2015-0059>
55. Brito N, Fonseca AM, Rolim R. Os melhores atletas nos escalões de formação serão igualmente os melhores atletas no escalão sénior? Análise centrada nos rankings femininos das diferentes disciplinas do atletismo ao longo das últimas duas décadas em Portugal. Rev Port Ciên Desp. 2004;4(1):17–28. DOI: <https://doi.org/10.5628/rpcd.04.01.17>
56. Reis-Furtado LN, Carbinatto MV. Formação competitiva na ginástica rítmica: a experiência da participação na infância. Rev Bras Educ Fís Esporte. 2023;37(Esp):e37nesp215796. DOI: <https://doi.org/10.11606/issn.1981-4690.2023e37nesp215796>
57. Rocha HPA, Souza CAM, Melo LBS, Soares AJG. Dupla carreira no Brasil de 2018 a 2023: um panorama dos estudos recentes. Rev Bras Ciênc Esporte. 2023;45:e20220045. DOI: <https://doi.org/10.1590/rbce.45.e20220045>
58. Rocha HPA, Miranda IS, Silva ALC, Costa FR. A dupla carreira esportiva no Brasil: um panorama na agenda das políticas públicas. Rev Com Censo. 2020;7(2):52–9. Available from: <https://periodicos.se.df.gov.br/index.php/comcenso/article/view/848>
59. Martins MZ, Silva BS, Souza ACF. Dupla carreira e mobilidade social no futsal brasileiro: diferenças entre homens e mulheres. J Phys Educ. 2021;32(1):e3249. DOI: <https://doi.org/10.4025/jphyseduc.v32i1.3249>
60. Vargas PI, Reis F, Leite N. The sporting trajectory of elite athletes in artistic gymnastics: a systematic review. Sci Gym J. 2021;13(3):337–55. DOI: <https://doi.org/10.52165/sgj.13.3.337-355>

CRediT author statement

Lucas Machado de Oliveira: Conceptualization, Data Curation, Formal Analysis, Methodology, Validation, Visualization, Writing – Original Draft, Writing – Review & Editing; Allana Alexandre Cardoso Alencar: Data Curation, Formal Analysis, Methodology, Supervision, Validation, Visualization, Writing – Original Draft, Writing – Review & Editing; Juliana Pizani: Data Curation, Formal Analysis, Methodology, Supervision, Validation, Writing – Review & Editing.

ORCID

Lucas Machado de Oliveira: <https://orcid.org/0000-0001-9229-1033>

Allana Alencar: <https://orcid.org/0000-0002-0280-7567>

Juliana Pizani: <https://orcid.org/0000-0001-5489-1468>

Editor: Carlos Herold Junior

Received Feb 19, 2025.

Revised on Aug 22, 2025.

Accepted on Aug 22, 2025.

Corresponding author: Lucas Machado de Oliveira. E-mail: lucasmachado.edf@gmail.com