

THE SPORTING TRAJECTORY OF ELITE ATHLETES IN ARTISTIC GYMNASTICS: A SYSTEMATIC REVIEW

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Abstract

Sporting success may be influenced by several factors, the magnitudes of which are revealed throughout the athletes' training process. This study sought to systematically review research that deals qualitatively with the sporting trajectory of elite athletes in artistic gymnastics (AG). The searches were conducted in the Web of Science and Scopus databases, contemplating studies published before July 2020. Data extraction was organized according to the focus and location of the study (context), participants, and methodology used, whereby we analyzed the variables associated with the athletes' trajectory. We located 318 articles and, after applying the inclusion and exclusion criteria, 15 original studies were selected for the review. The articles used semi-structured interviews with athletes, former athletes, coaches, referees, and managers. In two studies, the authors used methodological assumptions of oral history: one of them documental analysis, and the other ethnography. The systematic review revealed that parental support is essential for insertion and retention in the sport, both for logistical (financing, transportation, organization of school activities) and emotional reasons. Financial support and good training facilities are factors that positively influence success in AG. A healthy relationship between the coach and the athlete is essential, but this relationship is often reported as authoritarian. The post-career phase must be planned and guided so that the transition happens gradually and the athlete is able to seek a new identity.

Keywords: *gymnastics, career, athletes, review.*

INTRODUCTION

It may prove challenging to objectively detect the aspects that lead to success in elite sports. De Bosscher, Shibli, Westerbeek, and van Bottenbur (2015) have classified various factors that influence this success into three different levels: macro, meso, and micro level. At the first level are the social and cultural factors such as geography, politics, urbanization, demography, economy, and the national culture. At the second level are the factors that influence the political

context, in this case, policies regulating talent detection, coach education, and fostering athletes. Finally, at the micro-level includes factors that influence athletes on an individual level, i.e. genetic predispositions, parental support, relationships with coaches, and engagement with colleagues (De Bosscher et al., 2015).

Several studies (Barreiros, Côté, & Fonseca, 2014; Diehl et al., 2014; Duffy, Lyons, Moran, Warrington, & MacManus,

2006; Hallmann, Breuer, Ilgner, Giel, & Rossi, 2018) have attempted to analyze sporting success based on other variables. Hallmann et al. (2018) emphasize the need to examine it from an individual's perspective, assuming that human capital, motivation, organizational characteristics, and socio-demographic data all play a role in sporting success.

Thus, it is clear that the sporting trajectory of elite athletes is a relevant topic of study; after all, they go through different stages of the formation process that will lead them to sporting success or otherwise (Peres & Lovisoló, 2006). Nevertheless, we are aware that there are differences between different sports that should not be overlooked. Considering such differences, we proceed to the analysis of a specific modality – artistic gymnastics (AG).

This Olympic sport has unique characteristics (Aleixio & Nunomura, 2018; Ferreira-Filho, Machado, Marques, & Nunomura, 2016; Lopes, Oliveira, Fátima, & Nunomura, 2016; Oliveira, Bortoleto, & Nunomura, 2018), namely, constant changes in the scoring code (Carrara, Amadio, Serrão, Irwin, & Mochizuki, 2016; Heorhiivna, Oleksandrivna, & Oleksandrovich, 2020; Nunomura, Kerr, Cervin, Schubring, & Barker-Ruchti, 2019; Rohleder & Vogt, 2019), early specialization (Nunomura, Carrara, & Tsukamoto, 2010; Pion, Lenoir, Vandorpe, & Segers, 2015), athletes' morphological characteristics (Atikovic, 2020; Barker-Ruchti, 2009; Carrara et al., 2016; Kaur & Koley, 2019; Silva, Silva, & Luemba, 2020), and the extensive training required to achieve high-level performance (Carrara et al., 2016; Ericsson, Krampe, & Tesch-Romer, 1993; Issurin, 2017).

However, up until 2021, no systematic review aiming to summarize the findings of different studies on the trajectory of AG athletes was available. Therefore, this study aims to systematically review studies that address the sporting trajectory of elite athletes in AG. For this purpose, we

looked at the focus of each study, the characteristics of the participants, the methodology employed, and the results obtained. This is possible due to online databases of articles which have become a useful tool for reference, intervention, and further research (Park, Lavalée, & Tod, 2013; Vissoc, Caruzzo, Nascimento Junior, & Moreira, 2020).

METHODS

To achieve our objective, we employed a qualitative systematic review method, that is, a rigorous summary and interpretation of research data relative to the study's objective (Gomes & De Oliveira Caminha, 2014; Vissoc et al., 2020). We will analyze the differences and similarities found in the literature, seeking to expand data interpretations and suggesting new readings about the topic. We took the following steps: 1) search of articles in the databases; 2) exclusion of duplicate articles; 3) analysis of titles, abstracts, and keywords; 4) exclusion of articles that did not satisfy the inclusion criteria; 5) description of the exclusion criteria; 6) full reading of selected articles; 7) analysis of eligibility criteria; 8) extraction and organization of research data, and 9) data interpretation.

We chose to search the *Web of Science* and *Scopus* databases due to the coverage and academic quality of the indexed articles (AlRyalat, Malkawi, & Momani, 2019; Harzing & Alakangas, 2016; Mongeon & Paul-Hus, 2016). We searched the titles, abstracts, and keywords for the English terms: “career”, “talent”, “support”, “development”, “performance”, “coach”, “financial” – each in combination with “artistic gymnastics”, using the Boolean operator AND. Our research included all original articles, without filter, available up until July 2020, that deal with the sporting trajectory of men's artistic gymnastics (MAG) and/or women artistic gymnastics (WAG) elite athletes. We

excluded all review and opinion articles, as well as abstracts for scientific conferences.

As for the quality of the studies, we focused on those that could help answer the question of this review (Higgins & Thomas, 2019). Ultimately, we understand that quality evaluation criteria in qualitative studies are related to the congruence between the object of research, the methodology employed, the interpretation of results, and attention to ethical research criteria (Peters et al., 2020). Therefore, all articles analyzed met the criteria.

Following the research method, two independent researchers searched for the articles and applied the inclusion and exclusion criteria. Upon any divergence among the researchers, we consulted a third specialist. The data extraction from

the articles was organized by the following items: the focus of the study (all articles analyzed met the criteria centered around men's artistic gymnastics (MAG) and/or women artistic gymnastics (WAG)), location of the study (context), participants, the methodology employed, and main results. In addition, we identified the variables associated with the sporting trajectory of AG athletes, the congruences and divergences between the studies, and possible interpretations of the proposed synthesis

RESULTS

715 studies were found with the search criteria. Figure 1 illustrates the selection process of the articles included in this review.

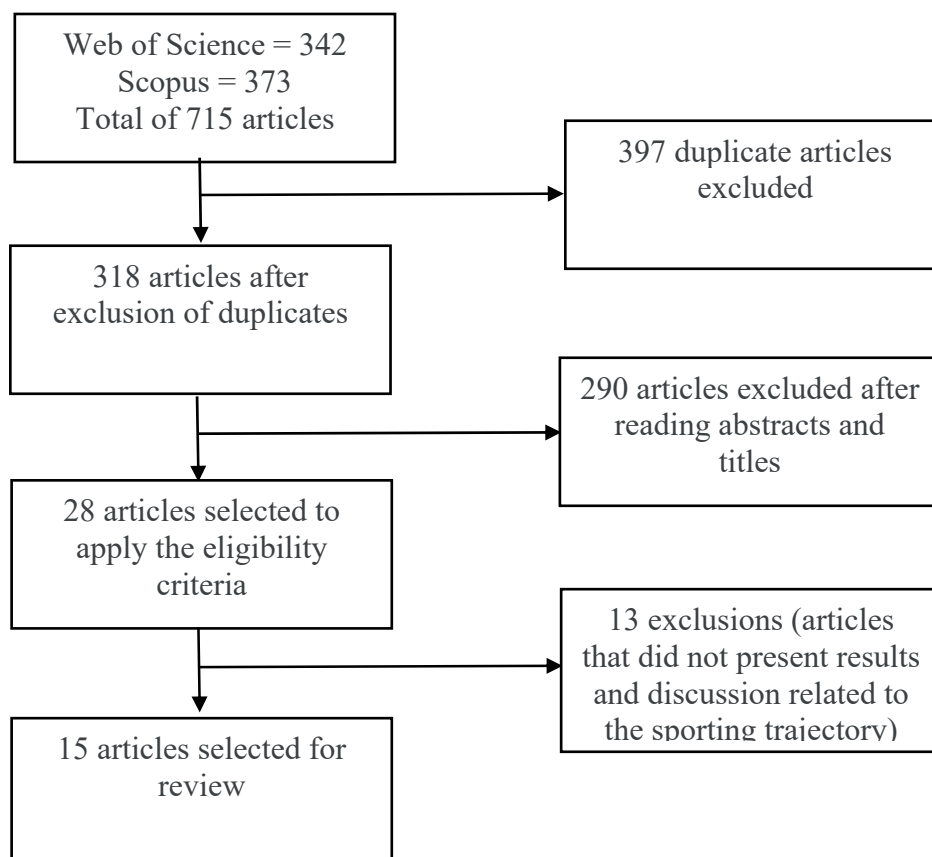


Figure 1. Flow diagram for the selection of studies included in the systematic review.

The first analysis excluded 397 duplicate studies. After reading the abstracts, titles, and keywords, 290 articles were excluded as they dealt with other topics, such as rhythmic or trampoline gymnastics, biomechanical analysis, instrument validation, experimental studies that measure the effects of training under different physical capacities, motor development, athletes' body composition or age, nutritional issues, as well as AG arbitration and support technologies. 28 studies were selected for full reading; however, 13 articles were excluded since they did not present results and discussion relevant to the topic of this review. Thus, we analyzed a total number of 15 articles. Among them, 13 were published in English and two in Portuguese, all of which used semi-structured interviews. In two studies, the authors used methodological assumptions of oral history: one of them documental analysis, and the other ethnography. As for the data analysis methodology, the articles were grouped into three categories: content analysis (Table 1), interpretive and phenomenological analysis (Table 2), and oral history and others (Table 3).

The studies interviewed athletes, former athletes, coaches, referees, and managers from different generations. They also addressed different contexts, namely the Brazilian (seven studies), Portuguese (two studies), Swedish, Slovenian, Australian, and English (one study each). Additionally, there was a comparative study between two nations – New Zealand and Australia (Kerr & Barker-Ruchti, 2015), as well as an international study with participants from different countries and continents (Barker-Ruchti, Kerr, Schubring, Cervin, & Nunomura, 2017). The combination of these diverse samples reveals the worldwide trend of sporting careers among nations that are seeking international representation. We say this because none of the countries mentioned were among the top three teams in the main international AG competitions

(women's and men's) during the 2016-2020 Olympic cycle. Still, it must be emphasized that there are differences in how AG is dealt with in these contexts, though the purpose of this review is simply to present the results of research on the topic.

Among the selected articles, we also found a greater number (12) of studies dealing specifically with WAG. As a result, some unique aspects of the sporting trajectory of female gymnasts were highlighted, such as the early age of entry (Barker-Ruchti & Schubring, 2016; Zurc, 2017), the impact of puberty on the continuity of athletes in the sport (Aleixio & Nunomura, 2018; Barker-Ruchti et al., 2017), and abusive relationships with coaches (Cervin, Kerr, Barker-Ruchti, Schubring, & Nunomura, 2017; Pinheiro, Pimenta, Resende, & Malcolm, 2014). Furthermore, in the articles' coverage of the sporting trajectory, we identified the following categories: infrastructure (Nunomura & Oliveira, 2012; Schiavon & Paes, 2012), financial support (Kerr & Barker-Ruchti, 2015; Oliveira & Bortoleto, 2012), parental support (Barker-Ruchti & Schubring, 2016; Duarte, Carbinatto, & Nunomura, 2015; Nunomura & Oliveira, 2013; Zurc, 2017), coach and athlete relationship (Barker-Ruchti, 2008; Barker-Ruchti & Schubring, 2016; Cervin et al., 2017; Duarte et al., 2015; Nunomura, Okade, & Carrara, 2012; Pinheiro et al., 2014; Stewart, Schiavon, & Bellotto, 2017), and adaptation for post-athletic career (Aleixio & Nunomura, 2018; Lavalley & Robinson, 2007). We will discuss these categories below.

Table 1

Articles that used content analysis.

| Authors and year of publication | Focus | Context | Participants | Method | Main results |
|-----------------------------------------------|-----------------------------------------------------------------------------|---------|----------------------------------------------------------------------------------------------|--------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Nunomura, M., Okade, Y., & Carrara, P. (2012) | Coach-athlete relationship and how coaches handle gymnasts' motivation. | Brazil | 46 participants from Brazil: 12 (MAG) and 34 (WAG) elite coaches from various categories. | Semi-structured interviews. Content analysis. | AG training requires a lot of motivation. Coaches use motivational strategies that are often inadequate. The authors observed that the infrastructure and funding may be detrimental to motivation in Brazilian gymnasts. |
| Nunomura, M., & Oliveira, M. S. (2012) | Gymnastics training center under a boarding school regime (infrastructure). | Brazil | 34 elite Brazilian coaches (WAG) from various categories. | Semi-structured interviews. Content analysis. | Positive aspects of the Training Center (TC): the Brazilian team improved their international results once the athletes got access to high-quality equipment, coaches with international experience, financial support, and a multidisciplinary staff. On the other hand, the centralization led to clubs downsizing, it devalued national coaches, and reduced the number of AG athletes in Brazil. |
| Nunomura, M., & Oliveira, M. S. (2013) | Parental support for WAG and MAG sporting careers. | Brazil | 163 participants from Brazil: 123 (WAG) and 40 elite athletes (MAG) from various categories. | Semi-structured interviews. Content analysis. | The results revealed different views on positive and negative parental support. Younger athletes appreciate parents' participation and interest in monitoring their sporting activity. The authors stress the need for a balanced amount of parental involvement, as the excess proved to be negative. |

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|-------------------------------------------------------------------------------|--------------------------------------------------------------------------|-----------|------------------------------------------------------------------------------------------------------------|--------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Pinheiro, M. C., Pimenta, N., Resende, R., & Malcolm, D. (2014) | The abuses experienced by former gymnasts during their sporting careers. | Portugal | 6 former WAG athletes from Portugal who have competed internationally (OG, WC, and European Championship) | Semi-structured interviews. Content analysis. | Weight control, injuries, and punishments have been identified as part of gymnastics culture, and are seen as "normal" by those who practice them. Families seem to accept and follow the coaches' instructions. |
| Duarte, L. H., Carbinatto, M. V., & Nunomura, M. (2015) | Fear in artistic gymnastics (training). | Brazil | 16 athletes (WAG), between 9 and 10 years old, who participated in a regional competition. | Semi-structured interviews. Content analysis. | The main sources of fear were as follows: injuries, errors, the equipment, and the coaches. As the strategies to manage fear, the authors suggest: social support (friends and family), instructional support, attention and concentration, positive thinking and self-confidence, mental practice, and relaxation techniques. |
| Cervin, G., Kerr, R., Barker-Ruchti, N., Schubring, A., & Nunomura, M. (2017) | Coach-athlete relationship and financial support | Australia | 18 participants: 6 athletes, 5 former athletes, 2 referees, and 5 coaches (WAG) at an international level. | Semi-structured interviews. Content analysis. | The authors exposed a new relationship between gymnasts and their bodies in line with the new coaching policies, which focused on the athletes' health. The changes in the coach-athlete relationship prolonged sporting careers, though the gymnasts had to stand up for their rights as adults. Financial support ensured the continued participation of some athletes, while others were excluded due to economic discrimination. |

Table 2

Articles that used interpretative phenomenological analysis or cultural perspective.

| Authors and year of publication | Focus | Context | Participants | Method | Main results |
|-------------------------------------------------------------------------------|----------------------------------------------|-------------------------------------------------------|-----------------------------------------------------------------------------------------------|--------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Lavallee, D., & Robinson, H. K. (2007) | Identity formation and post-career. | England | 5 former WAG elite athletes from England. | Semi-structured interviews. Phenomenological interpretative analysis. | The participants reported that they had dedicated their lives to gymnastics, which caused them to question their identities in their post-athletic careers. It is suggested that there should be a pre-retirement transition period so that gymnasts can gradually find a new identity. |
| Barker-Ruchti, N., Kerr, R., Schubring, A., Cervin, G., & Nunomura, M. (2016) | Gymnasts' career extension. | Australia, Asia, Europe, and North American countries | 10 "older" high-level WAG athletes (20 years or older). | Semi-structured interviews. Analysis from a cultural perspective. | Puberty is a key stage for WAG. The coach-gymnast relationship, the content of the training, and performance goals can prolong the gymnast's successful career. |
| Zurc, J. (2017) | Gymnasts' opinion about the sporting career. | Slovenia | 41 participants from Slovenia - 26 WAG athletes, 11 former WAG athletes, and 4 elite coaches. | Semi-structured interviews. Phenomenological interpretative analysis. | Gymnasts have a specific lifestyle that demands that they start training at a very early age, and thus age is a determining factor in their careers. The authors indicate that regardless of the lifestyle they had to adopt and the consequences for their physical and mental health, the athletes claimed that they would do it again. |
| Aleixio, I. M., & Nunomura, M. (2018) | Gymnasts' career extension. | Portugal | 7 "older" high-level WAG athletes (20 years or older). | Semi-structured interviews. Analysis from a cultural perspective. | The experience of older gymnasts shown to be positive, opposing the myth that WAG is only for young gymnasts. |

Table 3

Articles that used oral history and other analysis methods.

| Authors and year of publication | Focus | Context | Participants | Method | Main results |
|--------------------------------------------------------|------------------------------------------------------------------|---------------------------|------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Stewart, C., Schiavon, L. M., & Bellotto, M. L. (2017) | Development of the nutritional knowledge for gymnasts. | Brazil | 10 Brazilian WAG athletes that competed in the OG until 2004 (3 generations). | Semi-structured interviews. Oral History. | Coaches have been responsible for the nutritional knowledge of gymnasts and have held this control across all generations. Nutritionists have begun to play an important role as new approaches start to be implemented in the Brazilian gymnastics. |
| Barker-Ruchti, N., & Schubring, A. (2016) | The sporting life story of a former athlete. | Sweden | 1 former WAG athlete from Sweden. | Semi-structured interviews. Oral History. | The authors address the starting of a gymnastics career at an early age, moving to a new city, parental support, the relationship with coaches, and the adjustment to post-career life. |
| Schiavon, L. M., & Paes, R. R. (2012) | Conditions of high-performance TCs from the 1980s to 2008. | Brazil | 10 Brazilian WAF athletes that competed in the OG until 2004 (3 generations) | Semi-structured interviews. Oral History. | The authors pointed out that WAG has had two leaps of investment in equipment, in the early and late 1990s. However, the investments were focused on high-performance TCs, whereas in the basic TCs there were several infrastructure problems. |
| Kerr, R., & Barker-Ruchti, N. (2015) | Public policies on sports funding and their effects on AG clubs. | Australia and New Zealand | 1 WAG club from Australia and 4 WAG clubs from New Zealand. Players, coaches, referees, and managers were interviewed. | Two ethnographic surveys and semi-structured interviews. Analysis from a Foucauldian perspective. | In Australia, where the government provided funding for the sport and the gymnasts received scholarships, the pressure for results was higher. In New Zealand, where there was no government aid, it was the private clubs that invested in the gymnasts. As a result, the pressure was lower since the goal was to appeal to parents and gymnasts to remain in the club and continue paying monthly fees. |

| | | | | | |
|-----------------------------------------------|---------------------------------------------------------------|--------|-------------------------------------------------------------------------------------------------|-----------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Oliveira, M. S., & Bortoleto, M. A. C. (2012) | The <i>Bolsa-Atleta</i> program and its implications for MAG. | Brazil | 9 Brazilian participants - 2 MAG athletes, 3 MAG coaches, 2 MAG judges, and 2 federal managers. | Documental and semi-structured interviews. Content analysis. | The authors highlight the importance of the <i>Bolsa-Atleta</i> Program, as the success of athletes relies on government support and the effectiveness of funding for the sport. Furthermore, they suggest improvements to the Program, such as a higher number of scholarships, reduction of bureaucracy, and transparency in the rendering of accounts. |
|-----------------------------------------------|---------------------------------------------------------------|--------|-------------------------------------------------------------------------------------------------|-----------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

DISCUSSION

Infrastructure. De Bosscher et al. (2015) indicate that infrastructure is one of the pillars for a nation's sporting success. The authors highlight training centers (TCs) that offer training and housing facilities for athletes in the same place, as well as support services such as physicians and sports scientists. Some countries – like Spain – have chosen to distribute smaller TCs throughout the country; they are considered of great quality by athletes and coaches. On the other hand, countries like France and Australia have chosen a centralized approach, gathering athletes from various modalities in a single facility (De Bosscher et al., 2015).

In AG, particularly, the countries with the greatest tradition in the sport, such as Russia and Romania, offer boarding TCs specific to AG training. Athletes spend more than 250 days a year in these facilities, which comprise a gymnasium, rehabilitation area, sanitary facility, cafeteria, and dormitory (Nunomura & Oliveira, 2012).

Both articles that deal with infrastructure did so in the Brazilian context, focusing on the Center of Excellence in Gymnastics of Brazil, which was established in 1999 and shut down in 2008. The TC followed the permanent selection model, i.e, Brazilian gymnasts lived in the facilities (except for those who lived in the city where the TC was based) and trained daily with coaches from countries with a longer tradition in the sport (Nunomura & Oliveira, 2012; Schiavon & Paes, 2012).

The studies link the establishment of the TCs with the improvement in the international results of the Brazilian WAG team, since the facilities exclusively housed the women's gymnastics; although at the same time, the country also established a permanent selection of MAG. We identified several positive aspects of the TCs, including the gymnasts' technical improvement due to training on equipment

that provided greater safety, along with the experience contributed by foreign coaches.

Schiavon and Paes (2012) have investigated the training infrastructure aspects of three generations of Brazilian WAG. The pioneer gymnasts reported that they lacked basic training infrastructure even when they were in preparations for the Olympics, which in a way justifies the unsatisfactory results at that time. The second-generation noted that there were improvements in the training conditions, albeit sporadic. Finally, the generation with the best results is the one that benefited from the gymnastics TC structure. Nonetheless, Nunomura and Oliveira (2012) also identified negative aspects of TCs from the perspective of 34 Brazilian coaches. These include: they are monopolized by the best gymnasts; the devaluation of the clubs and coaches that first trained the gymnasts; the lack of opportunity for Brazilian coaches to train with foreigners (limited to those who worked in the TCs); excessive training, and other related problems, as well as poor adaptation of some gymnasts to the distance from their families and the city's weather conditions.

In the Brazilian context, it is clear that athletes' training is club-based, which means that training facilities are mostly found in clubs. Because of this, gymnasts participating in the studies reiterated the need to move to cities so as to train with better equipment and better coaches. Furthermore, this training model was identified by Nunomura and Oliveira (2012) as one of the reasons for the end of the permanent selection and, consequently, the termination of the activities in the Brazilian Gymnastics TCs.

The training infrastructure also proved to be fundamental for AG in other studies, despite not being the main topic of these articles. For instance, Barker-Ruchti and Schubring (2016) emphasized the need for athletes to change cities in order to train in better conditions in the Swedish context. It is worth noting that, since the equipment is

fixed, AG requires exclusive infrastructure for training, namely: floor, pommel horse, rings, vault, parallel and uneven bars, horizontal bar, and balance beam (Caine, Russell, & Lim, 2013). Moreover, the equipment must be reliable and modern so that gymnasts can train safely and perform the complex movements that are characteristic of the sport. In this regard, Nunomura et al. (2012) revealed that poor infrastructure, as well as the need to move from one city to another to train in better facilities, may be one of the discouraging factors for the continuity of athletes in gymnastics. Therefore, it becomes relevant to discuss the investment/funding for the sport.

Financial Support. Financial support is the key pillar, according to De Bosscher et al. (2015), for a country's sporting success. This means that, for the authors, financial support is crucial for the implementation of the other pillars (*Governance, organization and structure of (elite) sport policies; Sport participation; Talent identification and development; Athletic career and post-career support; Training facilities; Coach provision and coach development; National and international competition/events; Sport science support, scientific research and innovation in elite sport*). To do so, government funding for sport, lottery funds (a state-controlled service designed to complement funding for different areas, including sport), national Olympic Committee funding, and sponsorships are all indicators that contribute to the sporting success of different nations.

In this sense, Kerr and Barker-Ruchti (2015) compared the different kinds of financial incentives for gymnastics from the federal governments of Australia and New Zealand between 2004 and 2009. The authors found that the Australian government offered several benefits to athletes and teams; in return, the country demanded good results. This makes their training model quite rigid and excluding.

Although in the ranking presented by De Bosscher et al. (2015) Australia occupies a prominent position in summer sports performance (2009-2012), the country's results in AG are still modest. For example, in the 2019 AG World Championship, the men's team finished in 22nd place and the women's team in 13th place. Individually, however, some athletes are beginning to stand out¹.

On the other hand, there is no specific funding program for AG in New Zealand, therefore the incentive/funding is provided by private clubs. Thus, the logic that prevails (at least in WAG, over the assessed period) is commercial. Kerr and Barker-Ruchti (2015) observed that training in this country is less rigid; it is common to switch clubs to seek personal satisfaction rather than better performance. Houlihan and Green (2007) claim that despite recent efforts (post-2002) to make the country relevant in the international sports context, AG is not among the ten most favored sports. This of course impacts the international results in the sport; in the last AG World Championship, New Zealand was only represented in the individual events.

Brazil was identified by De Bosscher et al. (2015) as one of the countries that progressively increased investment in elite sport, driven by the hosting of the 2016 Olympic Games in Rio de Janeiro. In this sense, the main funding policy for Brazilian athletes, the *Bolsa-A atleta* Program, was the focus of the study by Oliveira and Bortoleto (2012). When analyzing the Program between 2005-2009, the authors identified the importance of this incentive for MAG athletes in training, as it enabled full dedication to training and prevented early withdrawal from the sport. Thus, it is possible to associate the increased investment in sports by the Brazilian government with

¹ To learn more, see:
<https://www.gymnastics.sport/site/events/searchresults.php#filter>

the rise of Brazilian gymnasts (Vargas & Capraro, 2020).

According to Oliveira and Bortoleto (2012), the amounts received by athletes through the *Bolsa-Atleta* Program are used to purchase world-class equipment, cover travel costs for training and competitions, and pay for the technical team. On the other hand, the interviewees in the study pointed out some of the Program's limitations, such as the need to increase the number of scholarships distributed and reduce the bureaucracy to obtain them. The interviewees also mentioned problems with the scholarship distribution criteria.

Given that in some countries the financial incentive programs are age-based and do not include young athletes, and that AG athletes enter the sport at an early age (Nunomura et al., 2010), there is a clear indication of the need for parental support during the specialization phase. Therefore, the relevance of parental support will be discussed in the next section.

Parental Support. Parental support in the sporting trajectory was the central theme of one of the articles analyzed (Nunomura & Oliveira, 2013) and has surfaced in others. For De Bosscher et al. (2015), this support is one of the factors at the micro-level that influence athlete's success from the individual perspective. For the authors, parents can have both positive and negative psychological influences on the athlete's development, and this is directly linked to emotional factors.

Barker-Ruchti and Schubring (2016), when describing the sporting trajectory of gymnast Marie, highlight the relationship with her parents as an important source of support throughout her sporting career. In that specific case, the parents' role stood out when the gymnast had to move to another city to train with the national team. At the time, Marie regularly phoned her parents in tears, but she still hid much of her suffering from them because she believed they would take her back home if she revealed it all. Once she quit

gymnastics, Marie's parents realized that she was not well psychologically and encouraged her to seek therapeutic help. This emotional support offered by parents was also a finding of Duarte, Carbinatto and Nunomura's (2015) research about young Brazilian gymnasts overcoming fear.

In the same sense, Zurc's (2017) study identified that it is common in AG for children/athletes to be "taken" from their families to seek more suitable training facilities. Also, their lives and that of their families are ultimately guided by gymnastics. Here, the authors highlight the positive influence of parents in the sporting trajectory of Slovenian gymnasts. Backer-Ruchti and Schubring (2016), Nunomura and Oliveira (2013), and Zurc (2017) agree that parents are primarily responsible for introducing their children to the sport environment; after all, they are the ones who enroll and take them to the gyms, although there may be contextual differences between the countries addressed in these studies. As children advance in gymnastics, parents strive to provide emotional support and opportunities for amenities such as transportation, nutrition, funding, and support in school tasks.

On the other hand, Nunomura and Oliveira (2013) also identified negative factors related to parental support, namely, discouragement to continue in the sport and pressure for results. It is known that excessive parental expectations can cause anxiety and excessive pressure on athletes (Harwood, Knight, Thrower, & Berrow, 2019; Knight, 2019; Knight, Berrow, & Harwood, 2017).

Therefore, when connecting the information present in the reviewed studies, parental support for AG athletes stands out as fundamental, especially regarding sports participation and aid during sports training. Parents are important sources of emotional support in overcoming fears and difficulties faced by athletes. Nevertheless, there is also the

possibility of a negative effect when the involvement of parents is perceived as a source of pressure by athletes. For this reason, Knight et al. (2017) reinforce that this relationship must take into account the young athletes' perception, since the parents' comments and reactions may be understood as either support or pressure. This leads us to another fundamental relationship, the one between athletes and coaches, which will be presented below.

Coach-Athlete Relationship. Among the 15 articles selected for analysis, eight dealt with the coach-athlete relationship at some level. This topic is widely discussed among researchers in the field as AG is known for its authoritarianism and troubled interactions between coaches and gymnasts (Kerr, Barker-Ruchti, Schubring, Cervin, & Nunomura, 2019). However, this training system has been undergoing several updates and modifications (Bortoleto & Schiavon, 2016). The reviewed studies suggest that the interaction with coaches may be positive or negative for the athlete's career, based on how it is managed. This is because both the professional skills and teaching pedagogy of coaches may affect their relationship with the athletes. Regarding the first aspect, Nunomura and Oliveira (2012) state that after the arrival of Russian coaches, Brazilian gymnasts began to achieve better results in competitions. Regarding the second aspect, it was identified that coaches who pursue a closer relationship with their athletes through positive interactions also achieve better results (Barker-Ruchti & Schubring, 2016).

Having a good relationship with coaches encourages gymnasts to remain in the sport (Barker-Ruchti & Schubring, 2016), and motivates them to improve (Nunomura et al., 2012) and achieve better results. In other words, coaches must strive to build trust with their athletes (Cervin et al., 2017). For this, Barker-Ruchti et al.

(2016) believe that coaches should not be so rigorous in their training hours.

Coaches should use those approaches: "have regular communication with athletes' parents, as they can be very informative; evaluate athletes' levels of satisfaction as a source of information regarding athletes' interests and needs, their reasons to participate, and objectives in the sport. Coaches and parental support are essential to maintain high levels of motivation and to avoid further emotional disturbances due to possible negative experiences as a result of a gap in interests" (Nunomura et al., 2012, p. 34).

Abuse is often mentioned as a type of negative interaction (Barker-Ruchti & Schubring, 2016; Cervin et al., 2017; Pinheiro et al., 2014; Zurc, 2017). This abuse may come in a "variety of forms of exploitation or abuse that can range from extreme diets and weight control, to verbal and emotional abuse, overtraining, corporal punishment, over-use injuries, and training and competing while in pain or injured" (Pinheiro et al., 2014, p. 436). Duarte et al. (2015) state that this relationship can generate fear in athletes. In the study, the authors identified the psychological and physical abuses that the participants experienced. According to the reports, the coaches would pull their hair and hit them whenever they made a mistake. In addition, yelling and cursing were common in training. As a result, the athletes experienced fear when performing the movements, especially in competitions (Duarte et al., 2015). Assuming that emotional control is an important skill for sporting success, the authors propose that coaches minimize gymnasts' fears and build mutual trust from a holistic and singular view of the athlete. Duarte et al. (2015) suggest that this feeling can be minimized with supportive and encouraging words instead of violent and authoritarian posturing.

In addition, such an authoritarian relationship can lead to eating disorders in athletes (Pinheiro et al., 2014; Stewart et

al., 2017). Stewart et al. (2017) state that coaches often do not have the necessary knowledge in nutrition and only focus on weight loss, jeopardizing the athletes' performance. Thus, the authors emphasize the importance of specialized nutritional support that gives necessary advice to gymnasts and coaches.

It is clear, thus, that the coach-athlete interaction is one of the main focuses of qualitative studies in AG. Furthermore, coaches' abusive behaviors are still a reality, and they have been questioned by researchers, parents, and sports entities. This is especially important because the results of the coach-athlete relationship can negatively interfere with the gymnasts' post-career, which will be discussed next.

Preparation for Post-Athletic Career. The post-career of high-performance athletes has been increasingly discussed in the literature. Lavalley and Robinson (2007) point out that great caution is needed in this transition phase, and for many authors transition to retirement is reported as a bad and often traumatic experience (Alfermann, Stambulova, & Zemaityte, 2004; Stambulova, Alfermann, Statler, & Côté, 2009). For this reason, some athletes seek other professional paths while still active in their professional sports careers in order to have a smoother transition to the post-athletic period. (Torregrosa, Ramis, Pallarés, Azócar, & Selva, 2015). This tends to get complicated since the formation of one's identity takes place during adolescence, i.e., the athletes' identity is built around the sport (Lavalley & Robinson, 2007).

This claim was confirmed by Lavalley and Robinson (2007) in a study that addresses the post-athletic career. The authors observed that, in England, as gymnastics requires early entry, the athletes felt lost in regards to their identities and plans for the future once they quit the sport. It is normal for them to go through a difficult period after this transition. For the respondents, this phase

lasted over five months. The gymnasts reported that they were left without any assistance after dedicating their entire lives to the sport, which led them to move away from the past to find a new identity beyond sport. To ensure that this process is not traumatic, it is advisable to reduce participation in training and competitions in a gradual manner. The authors emphasized the importance planning for retirement to minimize the impact of the transition. Corroborating with the authors, Martin, Fogarty e Albion (2014) state that a planned transition to retirement (not due to injury or involuntary reasons) facilitates this process. Thus, it is paramount to have a continuous and multidisciplinary approach so that high-performance athletes can be financially, physically, and psychologically prepared for this transition phase. Accordingly, it is essential to create public policies to support athletes in this process.

CONCLUSION

This systematic review of articles that addressed the trajectory of AG athletes selected 15 studies, all of which compiled their data through semi-structured interviews; among them, two studies used the methodological assumptions of oral history: one used documentary analysis and the other ethnography. Through various methods, the authors dealt with the necessary infrastructure for the development of AG. In this respect, we were able to identify that the development of AG requires a unique structure with high-quality equipment. It is often necessary for athletes to move from one city to another to find places that offer the best conditions (TCs). Financial support is also covered in the articles, focusing on public policies designed to support and encourage participation in sport. In our view, such incentives are essential for athletes to remain fully dedicated to sport. On the other hand, in countries where there

is no such incentive, the sport is organized based on a commercial logic to the detriment of the development of high-level athletes. Parental support is highlighted as essential for the entry and permanence of athletes in the sport, as they are the ones who provide the initial contact with the sport and who organize the logistics of transportation and nutrition. They also provide emotional support, even from afar (in cases where the gymnast lives in another city), helping the athletes overcome their fears, including of coaches. The coach-athlete relationship was one of the most debated topics in the articles, as it is essential not only for the development of high-level athletes but also for their personal development. In some cases, authoritarian conduct of coaches towards athletes was observed. Additionally, the transition to retirement has been identified as a phase that should be planned and oriented. After all, the athletes are faced with a break in their routine and have to seek a new identity.

At the end of the study, we note that there is scarce scientific research on the sporting trajectory of athletes in AG, especially in men's gymnastics. Another important aspect is the regionality of the reviewed studies. Brazil, Portugal, Sweden, Slovenia, England, New Zealand, and Australia are all developing countries in AG, but are still lagging behind countries like the United States, China, and Russia. However, studies of athletes from these nations were not included in this review. The choice of databases (Scopus and Web of Science) and the use of descriptors in English may have limited the search for Russian and Chinese studies. This indicates the need for new studies to include databases from these countries, especially by researchers who speak the language(s). We also noticed the absence of studies produced in the United States of America, despite it being one of the world leaders in the sport. This may indicate a lack of interest by North American researchers. In addition to alerting coaches,

gymnasts, and gymnasts' parents to important issues within AG, this study may aid national governments in the development of public policies as it points out the areas that need investment in order to successfully develop the sport. Nevertheless, we reiterate the need to expand the investigations about the sporting trajectory in AG from different perspectives and targeting different contexts, given the complexity surrounding the development of AG elite athletes and their needs.

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