

REVIEW

Body image and dissatisfaction among rhythmic gymnastics practitioners: A systematic review and meta-analysis

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Abstract

Background: In aesthetic sports, including rhythmic gymnastics (RG), slimness is associated with sporting success. As a consequence, the pressure that RG athletes are under to achieve this type of figure can lead to problems with their body image, among them problems with self-perception of body image and body image dissatisfaction. These problems are usually associated with adolescents and the highest levels but are present at all ages and competitive levels. **Objective:** This study aimed to synthesize the scientific evidence on self-body perception inaccuracies and body dissatisfaction among both young and adult RG athletes. **Methods:** Three electronic databases were searched: Scopus, PubMed and PsycINFO until March 2025. The methodological quality of studies was assessed using a ten-item version of the Quality Assessment Tool for Observational Cohort and Cross-Sectional Studies. **Results:** A total of 13 comparative studies were included, showing a high ($n = 1$), moderate ($n = 9$) and poor ($n = 3$) methodological quality. Research shows that RG athletes do not exhibit an altered self-perception of body image. According to the meta-analysis, body dissatisfaction is generally not prevalent among RG practitioners. **Conclusions:** Practicing RG is not associated with body image or body dissatisfaction issues.

Keywords: body image, body dissatisfaction, mental health, sports, rhythmic gymnastics

Introduction

Body image refers to the perception an individual holds about their own body, encompassing its size, shape, weight, and overall appearance (Sabiston et al., 2019). This perception is comprised of a mental representation that includes a perceptual body schema, alongside the emotions, thoughts, and behaviors associated with it (Kling et al., 2019). While some individuals may have an accurate perception of their body, others may overestimate or underestimate its dimensions. When there is a discrepancy between the perceived body and the actual one, it is considered a distortion of body image (Jiménez-Flores et al., 2017). This distortion can lead to negative attitudes towards one's body due to dissatisfaction with the perceived versus desired image, resulting in what is known as body dissatisfaction (Heider et al., 2015).

Dissatisfaction with one's own body image is a prevalent issue, particularly during adolescence, and more commonly affecting females (Jiménez-Flores et al., 2017; Rohde et al., 2014). However, it is increasingly observed across all age groups, from early childhood (Jellinek et al., 2016; Lowes & Tiggeman, 2003) to adulthood (Ibáñez-Zacamona et al., 2020). The negative consequences associated with high levels of body dissatisfaction are becoming more apparent (Delgado-Floody et al., 2021). Indeed, excessive concern about appearance and weight gain lies at the core of eating

disorders psychology. Addressing body dissatisfaction is crucial in treating these disorders and preventing relapses (McLean & Paxton, 2019). Furthermore, body dissatisfaction correlates with low self-esteem, depression, and disruptions in the physical and psychological development of children and adolescents (Paxton et al., 2006). This is particularly evident in sports where aesthetics play a crucial role, such as rhythmic gymnastics (RG; Francisco, Alarcão, & Narciso, 2012).

In RG, body image holds significant importance for the psychological well-being of athletes (Salas-Morillas et al., 2022). The RG environment often intensifies sociocultural pressures for thinness (Sundgot-Borgen, 1996). Apart from aesthetic considerations, gymnasts strive to attain a specific body shape that optimizes their athletic performance (Ávila-Carvalho et al., 2012). Various studies indicate that gymnasts' body types and aesthetic capabilities are key determinants of their success in the sport (Bobo-Arce, 2002; Miteva et al., 2019). Consequently, many gymnasts exhibit a desire to maintain a slender physique, sometimes resorting to unhealthy weight loss practices (Klinkowski et al., 2008). In addition, it should be considered that while engagement in sports generally correlates with positive levels of body satisfaction (Sabiston et al., 2019), it is crucial to recognize that the expectations within specific sports can have divergent impacts on athletes. In the case of RG, the

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Article history: Received November 8 2024, Accepted April 15 2025, Published May 16 2025

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amalgamation of physical and aesthetic demands inherent to the discipline can jeopardize the health of gymnasts when pushed to extreme levels (Kovács et al., 2022).

Given the significant emphasis placed on aesthetics and specific performance standards in RG, it becomes imperative to identify the prevalence and factors associated with both body image and body dissatisfaction among these athletes. Conducting critical analyses of existing scientific evidence through systematic reviews will provide a comprehensive overview of the current knowledge and shed light on the extent to which these issues affect this specific population (Villasís-Keever, 2020).

To the best of the authors' knowledge, two systematic reviews on this topic have been published to date, both of which were written in Spanish and had certain limitations (Pelaez Barrios & Vernetta Santana, 2022; Salas-Morillas et al., 2022). Notably, both reviews focused on different gymnastic disciplines and included age restrictions in their search criteria. This is notable because body dissatisfaction is prevalent among RG practitioners across all age groups (Zaccagni & Gualdi-Russo, 2023). Furthermore, the authors did not provide information regarding significant differences in self-perceived body image and the prevalence of body dissatisfaction when comparing RG with other disciplines or gymnasts with other populations. Additionally, a meta-analysis was not conducted. Incorporating meta-analysis techniques enhances the precision of the findings by statistically analyzing data from multiple studies, thereby offering more reliable conclusions (Ferreira et al., 2011). Therefore, a more comprehensive review on this topic is warranted.

Under these circumstances, the aim of this systematic review and meta-analysis was to synthesize and critically evaluate the scientific evidence on self-body perception inaccuracies and body dissatisfaction among both young and adult RG athletes.

Methods

This systematic review was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (Page et al., 2021). The PRISMA checklist is shown in supplementary Table S2. This review was registered with the Open Science Framework.

Search strategy

A systematic search was conducted in three electronic databases (PubMed, Scopus, PsycINFO) from their inception until March 2025. The following search terms, Boolean operators, and combinations were used: ("Gymnastics") AND ("Body image" OR "Body dissatisfaction").

Eligibility criteria

Inclusion criteria were investigations published in peer-reviewed journals that provided data on self-perceived body image and/or body dissatisfaction in RG athletes. Exclusion criteria were: a) Studies that included mixed samples (i.e., RG and non-RG athletes), unless separate data were

available specifically for the RG subgroup; b) studies that did not use valid tools to assess self-perceived body image and/or body dissatisfaction; c) studies were systematic reviews or congress communications; d) studies not written in English, Spanish, or Portuguese; and e) studies for which the full-text was not available.

Study selection

Two authors independently screened the titles and abstracts of the identified studies to determine their eligibility. Following this initial screening, the selected studies were reviewed by both authors to assess their suitability for inclusion. Any discrepancies or disagreements were discussed and resolved through mutual consensus. Subsequently, full-text copies of potentially relevant studies were obtained. In cases where there was uncertainty regarding whether a study met the selection criteria, a third author was consulted and a consensus was reached. The reference lists of the selected articles, as well as studies that cited them in Google Scholar, were checked for eligibility.

Data extraction

Information on the participants' characteristics, inclusion and exclusion criteria of the sample, instruments employed for assessing self-perceived body image and body dissatisfaction, and main findings were extracted by one researcher from the original reports and then cross-checked by a second investigator. Missing data were obtained from the study authors, whenever possible.

Quality appraisal

The methodological quality of the selected studies was evaluated by one author and subsequently cross-checked by a second investigator by means of an adapted ten-item version of the Quality Assessment Tool for Observational Cohort and Cross-Sectional Studies developed by the National Institutes of Health (2014). The studies' quality was categorized based on the following cut-off points: high (score 7–10), average (4–6), or poor (≤ 3), see Nowicki et al. (2022).

Statistical analysis

We performed the meta-analysis calculations in Microsoft Excel with Meta-Essentials Workbooks (Suurmond et al., 2017). To calculate the effect size for quantitative dependent variables we used Hedges's g . We used the random effects model for all analyses to account for the anticipated sources of heterogeneity among different studies.

The I^2 was applied to assess statistical heterogeneity and inconsistency. An I^2 value of 0% indicates no observed heterogeneity and higher values indicate greater heterogeneity. In addition to 95% confidence intervals (CI) of the average correlation value, we calculated the prediction intervals, which provide a predicted range for the true correlation in an individual study, useful for the interpretation of a random effects meta-analysis (Riley et al., 2011). The forest plot was used to summarize the findings. Funnel plot and Egger's test were used to evaluate statistically the presence of any publication bias. The trim-and-fill analysis was also included for the adjustment of potentially missing studies.

Results

The initial search yielded a total of 225 records. After removing duplicates, titles and abstracts of 139 articles were screened for eligibility. The full-text of 45 studies that appeared relevant to the research was assessed, from which 10 were included in the review. In a complementary process, the references of the selected studies were reviewed, and Google Scholar was consulted to find studies citing the included ones. Additionally, we screened 380 additional studies from the reference lists or citing the included works, of which 377 were excluded and 3 met the inclusion criteria. As a result of the entire process, we included 13 studies in the review (Figure 1).

Sample characteristics

In total, the studies included 586 RG athletes. The sample sizes across studies ranged from 29 (Oliveira et al., 2017) to 88 participants (Nuñez et al., 2024). Participant characteristics varied among the samples, with ages ranging from 8 to 18 years. Most studies included girls only and adolescents. Only the study by Borrione et al. (2013) included gymnasts older than 18 years. The competitive level of RG practice was reported in nine studies, with three studies involving national and international elite gymnasts (Borrione et al., 2013; Salbach et al., 2007; Vernetta et al., 2018), and the remaining five studies involving recreational gymnasts (Camacho et al., 2006; Ferrand et al., 2009; Martins et al., 2024; Nuñez et al., 2024; Zaccagni et al., 2019). One study included both levels (Lopes et al., 2009).

The comparison groups consisted of athletes from other sports in four studies (Borrione et al., 2013; Camacho et al., 2006; Kosmidou et al., 2016; Oliveira et al., 2017) and of girls and adolescents who did not engage in any sports in another five works (Lopes et al., 2009; Nuñez et al., 2024; Rimmel et al., 2021; Salbach et al., 2007; Zaccagni et al., 2019). Two studies combined both groups, comparing gymnasts with athletes from another sports discipline and with adolescents or girls who did not participate in any sports (Ferrand et al., 2009; Martins et al., 2024). Only the study by Vernetta et al. (2018) encompassed acrobatics as another form of gymnastics, whereas the study by Kosmidou et al. (2018) included former RG practitioners.

Main results

The reviewed studies provided information on self-perception of body image and the degree of dissatisfaction related to it (Table 1).

Self-perception of body image

The way gymnasts perceived their own body image was explored in five studies (Borrione et al., 2013; Martins et al., 2024; Rimmel et al., 2021; Salbach et al., 2007; Zaccagni et al., 2019). The most common procedure involved contrasting anthropometric assessments of gymnasts with their subjective perception of body image. For this purpose, Borrione et al. (2013), Zaccagni et al. (2019) and Martins et al. (2024) relied on Stunkard's, Collins' and Kakeshita pictograms, respectively, while Salbach et al. (2007) used the Test for Detecting Body Image Distortion in Children

and Adolescents. Only the study by Rimmel et al. (2021) used a questionnaire to assess gymnasts' body image, the Body Attitude Test (BAT).

In general, the studies suggested that gymnasts accurately perceived their body image. Regarding inter-group comparisons, Borrione et al. (2013) indicated that international gymnasts perceived their body image significantly more appropriately compared to gymnasts of lower competitive levels and girls who practised other sports. In contrast, Zaccagni et al. (2019) did not observe significant differences in self-perception of body image among competitive gymnasts, amateur gymnasts, and girls who did not participate in aesthetically-oriented sports. Similarly, Rimmel et al. (2021) found no significant differences between gymnasts and girls who did not engage in sports. This study reported that 24.4% of gymnasts had a disturbance in their body image compared to 15% of non-sporting adolescents. Salbach et al. (2007) indicated that, in general, gymnasts showed a more realistic perception of body image compared to girls with anorexia. Finally, only the study of Martins et al. (2024) found that the RG group presents greater body distortion, showing that 62.1% of gymnasts overestimate their body image compared to 48.3% in the group practising dance and 41.4% in the group not practising sport.

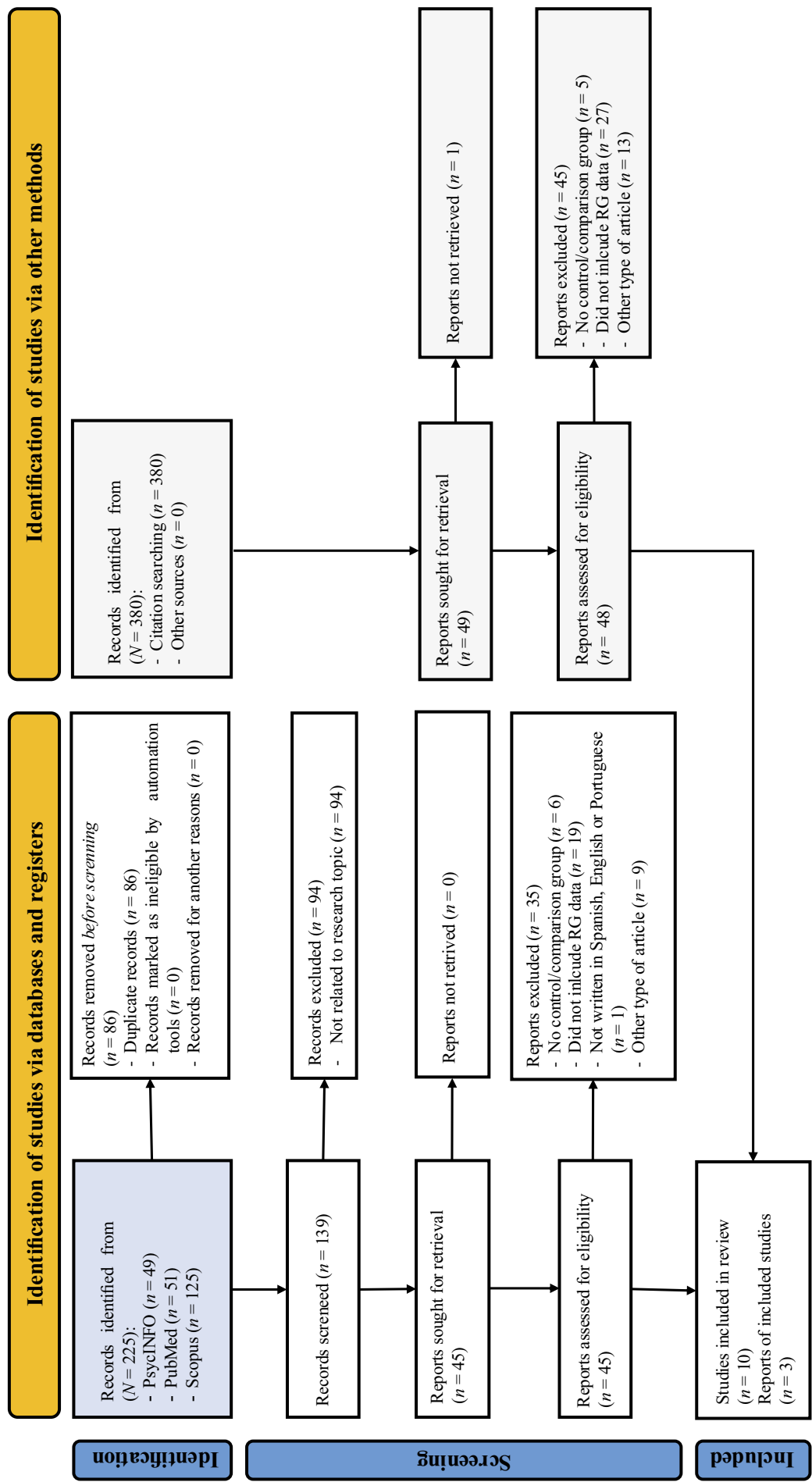
Body dissatisfaction

Twelve studies provided information on the level of body dissatisfaction among gymnasts (Borrione et al., 2013; Camacho et al., 2006; Ferrand et al., 2009; Kosmidou et al., 2016, 2018; Lopes et al., 2009; Martins et al., 2024; Nuñez et al., 2024; Oliveira et al., 2017; Salbach et al., 2007; Vernetta et al., 2018; Zaccagni et al., 2019). Seven studies assessed body dissatisfaction using scored-based tools such as the Body Shape Questionnaire (BSQ; Camacho et al., 2006; Lopes et al., 2009; Oliveira et al., 2017), the Body Esteem Scale (BES; Ferrand et al., 2009; Kosmidou et al., 2018; Vernetta et al., 2018), and the body dissatisfaction subscale of the Eating Disorder Inventory 2 (Salbach et al., 2007). Additionally, three studies analyzed the difference between the gymnasts' desired figure and their current image, four of them using Stunkard, Collins and Kakeshita pictograms (Borrione et al., 2013; Martins et al., 2024; Nuñez et al., 2024; Zaccagni et al., 2019), and one using the Body Image Scale (Kosmidou et al., 2016).

The results regarding the presence of body dissatisfaction were contradictory. Some studies concluded that gymnasts were generally not dissatisfied with their physique (Camacho et al., 2006; Salbach et al., 2007; Vernetta et al., 2018). On the contrary, Martins et al. (2024), Borrione et al. (2013), Oliveira et al. (2017) and Nuñez et al. (2024) clearly found dissatisfaction with the physique among gymnasts.

In terms of group comparisons, diverse results were found. On the one hand, some studies showed no differences between rhythmic gymnasts and comparison groups. For instance, Kosmidou et al. (2016) found no significant differences between gymnasts, ballet dancers, and synchronized swimmers. Similarly, Salbach et al. (2007) found no differences between gymnasts and a sedentary group;

Figure 1 Flow diagram of the systematic review process



Note. RG = rhythmic gymnastics.

Table 1 General characteristics of the included studies

Reference (first author, year)	RG characteristics	CG characteristics	Inclusion and exclusion criteria	Outcomes (test)	Results (score)	Results (prevalence descriptive)	Inter-group comparisons
Martins, 2024	RG: <i>Sample: n = 30 girls</i> <i>Mean age ± SD (years): 9.5 ± 1.4</i> <i>Mean BMI ± SD (kg/m²): NR</i> <i>Competition level: extracurricular activity</i> <i>Training age ± SD (years): NR</i>	CG 1: <i>Sample: n = 29 girls</i> <i>Mean age ± SD (years): 9.5 ± 1.4</i> <i>Mean BMI ± SD (kg/m²): NR</i> <i>Competition level: extracurricular activity</i> <i>Training age ± SD (years): NR</i> <i>Sport modality: dance</i> CG 2: <i>Sample: n = 31 girls</i> <i>Mean age ± SD (years): 9.5 ± 1.4</i> <i>Mean BMI ± SD (kg/m²): NR</i> <i>Training age ± SD (years): NR</i> <i>Sport modality: any sport modality</i>	- performance of other sports activities and the simultaneous participation of RG and dance	<i>Body dissatisfaction:</i> Kakeshita Silhouettes Scale <i>Body image:</i> Kakeshita Silhouettes Scale	NR	<i>Body dissatisfaction:</i> RG: 51.7% desired to decrease; 37.9% satisfied; 10.3% desired to increase CG 1: 72.4% desired to decrease; 13.8% satisfied; 13.8% desired to increase CG 2: 62.1% desired to increase; 21.1% satisfied; 13.8% desired to increase Body Image: RG: 62.1% overestimated their body image CG 1: 48.3% overestimated their body image CG 2: 41.4% overestimate their body image	There was no statistical difference between the variables.
	RG 1: <i>Sample: n = 20 adolescents</i> <i>Mean age ± SD (years): 18.1 ± 2.4</i> <i>Mean BMI ± SD (kg/m²): 17.4 ± 1.4</i> <i>Competition level: elite international</i> <i>Training time ± SD (hours per week): 48.1 ± 10.5</i> RG 2: <i>Sample: n = 20 adolescents</i> <i>Mean age ± SD (years): 16.0 ± 2.9</i> <i>Mean BMI ± SD (kg/m²): 16.7 ± 2.9</i> <i>Competition level: elite national</i> <i>Training time ± SD (hours per week): 24.1 ± 7.2</i>	CG: <i>Sample: n = 80 adolescents</i> <i>Mean age ± SD (years): 17.1 ± 3.2</i> <i>Mean BMI ± SD (kg/m²): 21.1 ± 2.2</i> <i>Training time ± SD (hours per week): 6.9 ± 3.8</i> <i>Sport modality: volleyball, basketball, fitness activities, Tae Kwondo</i>	NR	<i>Body image:</i> Figure Rating Scale (PBI (perceived body size) / BMI) <i>Body dissatisfaction:</i> Figure Rating Scale (ideal body size (IBI) – PBI)	<i>Body Image (mean ± SD)</i> RG 1: PBI: 2.5 ± 0.7 (underweight) BMI: 17.4 ± 1.4 (underweight) RG 2: PBI: 3.2 ± 0.9 (normal weight) BMI: 16.7 ± 1.8 (underweight) CG: PBI: 4.7 ± 1.5 (normal weight) BMI: 20.8 ± 1.1 (normal weight) RG1 and CG, but not RG2, showed an accurate self-perception of their body image <i>IBI-PBI (mean ± SD)</i> RG 1: −0.5 ± 0.8 RG 2: −0.8 ± 0.9 CG: −1.0 ± 1.1 The overall sample expressed a significant dissatisfaction with their own body image	<i>Body image</i> RG 1 showed a better self-perceived image than RG 2 and CG (<i>p</i> < .01).	

Table 1 (continued)

Reference (first author, year)	RG characteristics	CG characteristics	Inclusion and exclusion criteria	Outcomes (test)	Results (score)	Results (prevalence descriptive)	Inter-group comparisons
Camacho, 2006	RG: Sample: n = 33 Mean age ± SD (years): 13.91± 1.23 Mean BMI ± SD (kg/m²): 20.06 ± 2.34 Competition level: recreative competitive gymnasts Training age ± SD (years): 6.39 ± 2.86	CG 1: Sample: n = 35 Mean age ± SD (years): NR Mean BMI ± SD (kg/m²): NR Sport modality: bodybuilding	- practice regularly, for at least three hours a week, a specific type of sport, a particular sport	Body dissatisfaction: BSQ	BSQ (mean ± SD) RG: 65.85 ± 30.00 CG 1: 97.29 ± 36.34 CG 2: 93.52 ± 37.85 CG 3: 85.69 ± 37.05 CG 4: 75.37 ± NR CG 5: 69.59 ± 38.51 CG 6: 63.11 ± 29.71 RG exhibited the lowest score, with the exception of CG 6 also demonstrates notably positive standings.	NR	<i>Body dissatisfaction</i> RG, CG 4, CG 5, CG 6 < CG 1, CG 2, CG 3 (<i>p</i> < .05)
Ferrand, 2009	RG: Sample: n = 61 adolescents Mean age ± SD (years): 16.2 ± 1.5 Mean BMI ± SD (kg/m²): 18.3 ± 1.2 Competition level: recreative competitive gymnasts Training time (hours/week): 8	CG 1: Sample: n = 42 adolescents Mean age ± SD (years): 15.8 ± 1.2 Mean BMI ± SD (kg/m²): 19.2 ± 1.6 Competition level: national Training time (hours/week): 8 Sport modality: synchronized swimmers	NR	Body dissatisfaction: BES Appearance subscale BES Weight subscale BES Attribution subscale	Body dissatisfaction BES Appearance (mean ± SD) RG: 22.6 ± 7.0 CG 1: 12.1 ± 5.6 CG 2: 17.8 ± 7.0 BES Weight (mean ± SD) RG: 18.0 ± 7.5 CG 1: 16.6 ± 4.3 CG 2: 12.9 ± 5.9	NR	<i>Body dissatisfaction</i> BES Appearance RG > CG 1 (<i>p</i> < .001) BES Weight RG > CG 1 (<i>p</i> < .001) BES Attribution RG > CG 1 (<i>p</i> < .001)

Table 1 (continued)

Reference (first author, year)	RG characteristics	CG characteristics	Inclusion and exclusion criteria	Outcomes (test)	Results (score)	Results (prevalence descriptive)	Inter-group comparisons
Kosmidou, 2016	RG: Sample: n = 47 girls Mean age ± SD (years): 11.83 ± 1.36 Mean BMI ± SD (kg/m ²): 17.01 ± 2.37 Competition level: NR Training age ± SD (years): 5.24±2.49	CG 2: Sample: n = 49 adolescents Mean age ± SD (years): 16.3 ±0.86 Mean BMI ± SD (kg/m ²): 19.9 ± 2.0 Competition level: non competitive Training time (hours/week): 2 Sport modality: non athletic	NR	Body dissatisfaction: Body Image Scale (current body shape / desired body shape)	BES Attribution (mean ± SD) RG: 8.9 ± 2.3 CG 1: 4.4 ± 4.9 CG 2: 12.4 ± 6.2 Total (mean ± SD) RG: 49.4 ± 4.3 CG 1: 38.8 ± 13.2 CG 2: 47.3 ± 12.6 The RG group showed a lower body dissatisfaction in comparison with control groups, albeit for the attribution subscale in which CG 2 achieved higher values...	RG: 38.3% satisfied; 42.6% low satisfied; 19.1% not satisfied CG 1: 34.8% satisfied; 34.8% low satisfied; 30.4% not satisfied CG 2: 43.8% satisfied; 37.5% low satisfied; 18.8% not satisfied	Differences in rates between groups were not significant.
					NR		
Kosmidou, 2018	RG: Sample: n = 49 Mean age ± SD (years): 12.35 ± 1.67 Mean BMI ± SD (kg/m ²): 16.45 ± 1.65 Competition level: NR Training age ± SD (years): 6.45 ± 2.31	CG: Sample: n = 34 Mean age ± SD (years): 25.03 ± 4.45 Mean BMI ± SD (kg/m ²): 19.41 ± 1.65 Competition level: NR Training age ± SD (years): 9.70 ± 2.05 Sport modality: former rhythmic gymnasts	NR	Body dissatisfaction: BES	BES (mean ± SD) RG: 2.45 ± 0.53 CG: 2.67 ± 0.32 Body esteem was higher for former athletes than current athletes. The RG group presents more body dissatisfaction than CG.	NR	Body dissatisfaction BES CG > RG (p < .05)

Table 1 (continued)

Reference (first author, year)	RG characteristics	CG characteristics	Inclusion and exclusion criteria	Outcomes (test)	Results (score)	Results (prevalence descriptive)	Inter-group comparisons
Oliveira, 2017	RG: Sample: N = 29 adolescents Mean age ± SD (years): 14.8 ± 2.8 Mean weight ± SD (kg): 47.9 ± 9.8 Mean height ± SD (cm): 157.0 ± 9.8 Competition level: NR Training age ± SD (years): NR	CG 1: Sample: n = 17 adolescents Mean age ± SD (years): 15.0 ± 1.8 Mean weight ± SD (kg): 49.3 ± 5.2 Mean height ± SD (cm): 161.9 ± 0.1 Training age ± SD (years): NR Sport modality: running	NR	Body dissatisfaction: BSQ Body Weight Index (Ideal body weight – Perceived body weight)	NR	Body dissatisfaction RG: 6.8% severe; 13.7% moderate; 13.7% mild 52.3% desired a thinner figure; 4.3% desired a thicker figure CG 1: 11.8% mild; 6.3% desired a thinner figure; 12.5% desired a thicker figure CG 2: 6.3% severe; 31.2% mild; 60.0% desired a thinner figure; 13.0% desired a thicker figure. CG 3: 5.3% severe; 21.1% moderate; 5.3% mild; 58.9% desired a thinner figure; 5.9% desired a thicker figure CG 4: 62.5% mild 62.5% desired a thinner figure; 0% desired a thicker figure CG 5: 8.3% moderate; 25.0% mild; 33.4% desired a thinner figure; 8.3% desired a thicker figure	NR

Table 1 (continued)

Reference (first author, year)	RG characteristics	CG characteristics	Inclusion and exclusion criteria	Outcomes (test)	Results (score)	Results (prevalence descriptive)	Inter-group comparisons
Lopes, 2009	RG 1: Sample: n = 22 female athletes Age (years): 10–12 Mean weight ± SD (kg): 42.7 ± 13.14 Mean height ± SD (cm): 149 ± 0.11 Mean BMI ± SD (kg/m²): 19.23 ± 4.35 Competition level: state, national and international competitive gymnasts Training age ± SD (years): NR	CG 5: Sample: n = 12 adolescents Mean age ± SD (years): 20.4 ± 1.6 Mean weight ± SD (kg): 59.1 ± 8.6 Mean height ± SD (cm): 165.0±0.0 Training age ± SD (years): NR Sport modality: university athletes	RG: - practiced rhythmic gymnastics intensively for at least two consecutive years - taken part in at least two sporting competitions at state, national or international level, national or international level CG: - age - enrolled in public or private educational institutions in the same proportion as those athletes - not involved in a competitive sport programme	Body dissatisfaction: BSQ	BSQ (mean ± SD) RG 1: 61.1 ± 28.0 CG 1: 75.4 ± 34.0 RG 2: 89.6 ± 39.0 CG 2: 81.6 ± 18.1 RG 3: 95.2 ± 13.7 CG 3: 125.2 ± 15.5 The group of gymnasts and the group of non-athlete students with an age range of 10–12 years (RG 1 and CG 1) did not present a dissatisfaction with their body. The group of gymnasts and the group of non-athlete students with an age range of 13–14 years (RG 2 and CG 2) presented a slight dissatisfaction with their body, being higher in the group of gymnasts. The group of gymnasts and the group of non-athlete students older than 15 years (RG 3 and CG 3) presented dissatisfaction with their body, being moderate in the group of students and mild in the group of gymnasts.	RG 1: 91% satisfied; 4.5% moderate dissatisfaction; 4.5% severe dissatisfaction RG 2: 57.1% satisfied; 14.3% mild dissatisfaction; 9.5% moderate dissatisfaction; 19.1% severe dissatisfaction RG 3: 100% mild dissatisfaction Differences in rates between groups were not significant.	
	RG 2: Sample: n = 22 female athletes Age (years):13–14 Mean weight ± SD (kg): 40.6 ± 4.83 Mean height ± SD (cm): 155 ± 0.06 Mean BMI ± SD (kg/m²): 16.91 ± 1.53 Competition level: state, national and international competitive gymnasts Training age ± SD (years): NR	CG 3: Sample: n = 22 girls Age (years): 10–12 Mean weight ± SD (kg): 61.0 ± 6.08 Mean height ± SD (cm): 164 ± 0.07 Mean BMI ± SD (kg/m²): 22.66 ± 1.11 Sport modality: did not practice sport					
	RG 3: Sample: n = 5 female athletes Age (years): > 15 Mean weight ± SD (kg): 50.6 ± 3.43 Mean height ± SD (cm): 162 ± 0.02 Mean BMI ± SD (kg/m²): 19.29 ± 2.30						

Table 1 (continued)

Reference (first author, year)	RG characteristics	CG characteristics	Inclusion and exclusion criteria	Outcomes (test)	Results (score)	Results (prevalence descriptive)	Inter-group comparisons
Nuñez, 2024	Competition level: state, national and international competitive gymnasts Training age ± SD (years): NR	CG: Sample: n = 88 girls Mean age ± SD (years): 8.51 ± 1.52 Mean BMI ± SD (kg/m²): 17.96 ± 3.42 Sport modality: did not practice sport	RG: - excluded those competing at national or international levels	Body Dissatisfaction Stunkard Pictogram for young people Body Dissatisfaction Score (current body shape – ideal body shape)	Body Dissatisfaction Score RG: 0.94 ± 1.18 CG: 1.06 ± 1.29	RG: 63.6% desired a thinner figure; 29.5% were satisfied; 6.8% desired a heavier figure CG: 67% desired a thinner figure; 22.7% were satisfied; 10.2% desired a heavier figure	There was no significant difference in body dissatisfaction scores between the groups.
	Competition level: recreational gymnasts Training age ± SD (years): NR	CG: Sample: n = 22 girls Mean age ± SD (years): 16.5 ± 1.2 Mean BMI ± SD (kg/m²): 21.0 ± 2.2 Sport modality: untrained	NR	Body image: BAT	BAT (mean ± SD) RG: 29.6 ± 14.9 CG: 28.0 ± 13.1 In general, both groups presented an adequate body perception.	RG: 24.2% showed an impaired body image perception CG: 15% showed an impaired body image perception	Differences in rates between groups were not significant.
Remmel, 2021	Competition level: elite (national and international) Training time ± SD (hour per week): 20.9 ± 7.3	CG 1: Sample: n = 58 anorexia nervosa patients Mean age ± SD (years): 15.5 ± 1.5 Mean BMI ± SD (kg/m²): 15.6 ± 1.5 Sport modality: did not practice sport CG 2: Sample: n = 56 high school students Mean age ± SD (years): 14.9 ± 1.7 Mean BMI ± SD (kg/m²): 19.8 ± 1.9 Sport modality: did not practice sport	- to be included in the study, all participants had to be between 12 and 18 years old - the athletes had to be healthy without any kind of medication - subjects could only participate in the study if they and their parents gave written informed consent	Body dissatisfaction: EDI-2 BD subscale Body image: Test for Detecting Body Image Distortion in Children and Adolescents BFI (self-perceived / measured arm, abdomen and thigh body perimeter)	BD subscale (Mean ± SD) RG: 27.9 ± 10.7 CG 1: 39.0 ± 12.8 CG 2: 31.9 ± 12.6 RG obtained the lowest scores of body dissatisfaction CG 1 scored significantly higher BFI (mean ± SD) RG: BFlupper arm: 118.2 ± 17.4 BFthigh: 115.3 ± 16.2 BFwaist: 126.0 ± 16.8 BFmean: 119.8 ± 12.3 CG 1: BFlupper arm: 130.6 ± 32.2 BFthigh: 131.7 ± 23.6 BFwaist: 133.6 ± 19.3 BFmean: 132.0 ± 21.7 CG 2: BFlupper arm: 111.0 ± 17.2 BFthigh: 107.5 ± 12.9 BFwaist: 119.3 ± 13.9 BFmean: 112.6 ± 9.5	NR	Body Dissatisfaction BD subscale score RG > CG 1 (p < .001) Body Image: Body Feel Index RG showed a more correct perception of their thigh and arm, (p < .001, p = .027) and in general they perceived themselves better (p < .001).

Table 1 (continued)

Reference (first author, year)	RG characteristics	CG characteristics	Inclusion and exclusion criteria	Outcomes (test)	Results (score)	Results (prevalence descriptive)	Inter-group comparisons
Vernetta, 2018	RG: Sample: $n = 33$ Mean age $\pm$ SD (years): 11.81 ± 2.17 Mean BMI $\pm$ SD (kg/m^2): 16.79 ± 2.22 Competition level: elite national Training age $\pm$ SD (years): 4.92 ± 3.62	CG: Sample: $n = 34$ Mean age $\pm$ SD (years): 12.88 ± 2.53 Mean BMI $\pm$ SD (kg/m^2): 18.12 ± 2.34 Competition level: elite national Training age $\pm$ SD (years): 4.92 ± 3.62 Sport modality: acrobatic gymnastics	NR	Body dissatisfaction: BES-C	RG generally presents a correct body image. However, their abdomen body image is slightly distorted. Test scores were higher in CG 1. BES-C (mean $\pm$ SD) RG: 9.48 ± 1.95 CG: 10.64 ± 1.0	NR	Differences in rates between groups were not significant
Zaccagni, 2019	RG 1: Sample: $n = 36$ girls Mean age $\pm$ SD (years): 10.7 ± 1.6 Mean BMI $\pm$ SD (kg/m^2): 16.9 ± 1.8 ; overweight: 3% Competition level: recreative competitive gymnasts Weekly training $\pm$ SD (hours): 13.1 ± 4.9	CG: Sample: $n = 71$ girls Mean age $\pm$ SD (years): 11.4 ± 0.3 Mean BMI $\pm$ SD (kg/m^2): 19.5 ± 3.5 Sport modality: no aesthetic sport	RG: - being female - being in the sport categories foreseen under 13 years of age (up to the category "Allieve") - being apparently healthy and free from musculoskeletal diseases - continuous training in the past year - completed all the questions and all the anthropometric measurements CG: - female - within the same age range of RG - completed all the questions and all the anthropometric measurements - not practicing any aesthetic sport	Body image: Children's Body Silhouette Chart FAI score Body dissatisfaction: Children's Body Silhouette Chart FID score RG body dissatisfaction: Children's Body Silhouette Chart FIDSport score	FAI (mean $\pm$ SD) RG 1: -0.2 ± 0.6 RG 2: -0.3 ± 0.7 CG: -0.01 ± 0.52 FID (mean $\pm$ SD) RG 1: 0.4 ± 0.9 RG 2: 0.0 ± 1.1 CG: 0.6 ± 1.2 FIDSport (mean $\pm$ SD) RG 1: 1.1 ± 1.1 RG 2: 0.4 ± 0.9 RG 1 and RG 2 had a correct body image by obtaining a FAI score close to 0.	RG 1: 45% satisfied; 45% desired a thinner figure; 10% would have liked a thicker figure RG 2: 45% satisfied; 25% desired a thinner figure; 25% desired a thicker figure CG: 40% satisfied; 50% desired a thinner figure; 10% desired a thicker figure	Body image: ideal figure RG 2 > RG 1 ($p = .0023$)

Note. RG = rhythmic gymnastics; CG = control group. NR = not reported; BMI = body mass index. BAT = Body Attitude Test; BES = Body-Esteem Scale; BES-C = Body-Esteem Scale for Children; BFI = Body Feel Index; BSQ = Body Shape Questionnaire. EDI-2 = Eating Disorder Inventory 2; FAI = Feel weight status minus Actual weight status Inconsistency; FID = Feel-Ideal Difference.

however, the group with anorexia showed significantly more body dissatisfaction. Vernetta et al. (2018) observed slightly lower body dissatisfaction in acrobatic gymnasts, but the differences were not significant. Martins et al. (2024) found no significant differences between gymnasts, dancers and non-sporting students. Lopes et al. (2009) and Núñez et al. (2024) also found no statistically significant differences between gymnasts and non-sporting adolescents or girls. On the other hand, other studies reported significant differences when comparing gymnasts with other groups. Camacho et al. (2006) found that gymnasts had significantly lower dissatisfaction than teenagers engaged in bodybuilding, aerobic exercise, and dance.

Similarly, in the study by Kosmidou et al. (2018), the level of body dissatisfaction among gymnasts was significantly higher than that of non-practising rhythmic gymnasts. Oliveira et al. (2017) noted that compared to teenagers engaged in synchronized swimming, university athletes, and runners, gymnasts showed a significantly higher degree of dissatisfaction with their body image. This same study added a marker for dissatisfaction with body weight, indicating its presence in 60% of gymnasts. Ferrand et al. (2009) found significant differences between rhythmic gymnasts and synchronized swimmers. Overall, gymnasts showed significantly lower levels of body dissatisfaction. However, regarding how others perceived their appearance, they scored significantly lower than swimmers. Additionally, the results of Lopes et al. (2009) suggested that the degree of dissatisfaction increased with age, being more pronounced in adolescents. This study reported that the prevalence of dissatisfaction with body image reached 100% in the older age group versus 9% in younger ages.

Finally, two studies analyzed the relationship between body dissatisfaction and competitive level, with similar results. Borrión et al. (2013) showed a significantly higher level of body dissatisfaction in international-level gymnasts compared to national-level practitioners and practitioners of other sports. Zaccagni et al. (2019) found that both competitive and non-competitive gymnasts showed similar levels of dissatisfaction, with 55% and 50%, respectively. These percentages were comparable to those of other athletes practising non-aesthetic sports, who showed 60% of dissatisfaction. However, the desired thinness was significantly higher in competitive gymnasts.

Methodological quality

Nine studies showed moderate quality (Borrión et al., 2013; Ferrand et al., 2009; Kosmidou et al., 2018; Martins et al., 2024; Lopes et al., 2009; Rimmel et al., 2021; Salbach et al., 2007; Vernetta et al., 2018; Zaccagni et al., 2019). Only the study by Camacho et al. (2006) achieved high quality. However, three studies obtained poor quality (Kosmidou et al., 2016; Núñez et al., 2024; Oliveira et al., 2017). The results of the methodological quality assessment of the included studies are shown in supplementary Table S1.

Meta-analysis

The meta-analysis comparing body dissatisfaction between the RG group and non-athletes showed that RG athletes

were significantly more satisfied with their bodies than non-athletes (6 studies; $N = 676$ pooled participants; Hedges's $g = 0.31$, 95% CI [0.05, 0.56]; $p = .001$; $I^2 = 37\%$), see Figure 2. When comparing the RG group with the non-RG athletes controls there were no differences in body dissatisfaction, although a high degree of heterogeneity was observed (4 studies; $N = 406$ pooled participants; Hedges's $g = 0.30$, 95% CI [-0.78, 1.39]; $p = .377$; $I^2 = 8\%$), see Figure 3.

The results of the meta-analysis of the proportion (in percent) of body dissatisfaction in the RG group compared to the joint group consisting of non-RG athletes and non-athletes are shown in supplementary Figure S1. The results showed that approximately 48% of RG athletes were dissatisfied with their body image, compared to approximately 58% in non-RG athletes and non-athletes, with a low degree of heterogeneity (8 studies; $N = 943$ pooled participants; odds ratio [OR] = 0.60, 95% CI [0.43, 0.84]; $p < .001$; $I^2 = 3\%$). When dividing the control group into subgroups, the results varied. For non-athlete controls, RG athletes showed significantly lower body dissatisfaction (3 studies; $N = 407$; OR = 0.60, 95% CI [0.36, 0.99]; $p < .001$; $I^2 = 0\%$). For athlete controls, no significant differences were observed (4 studies; $N = 449$; OR = 0.65, 95% CI [0.26, 1.66]; $p = .147$; $I^2 = 47\%$). Significant differences were not found when stratifying this analysis by the severity of the dissatisfaction (mild OR = 0.66, 95% CI [0.37, 1.18]; severe OR = 0.81, 95% CI [0.20, 3.32]; $I^2 = 42\%$).

We did not find evidence of publication bias in the total of the included studies (8 studies, total $N = 806$ pooled participants; Egger's $p = .576$, Trim and Fill = 0), see Figure 4.

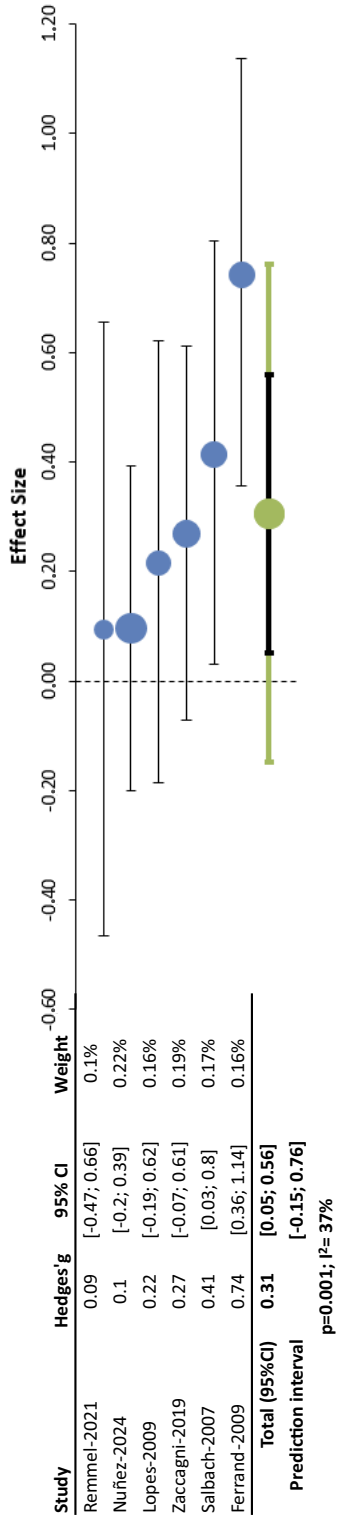
Discussion

This study aimed to identify how female RG athletes perceive their own body image and whether they experience dissatisfaction with it. The results obtained could prove useful for coaches, athletes, and parents or guardians of future RG practitioners seeking a healthy sports practice.

In the present review, a considerable number of studies with generally acceptable methodological quality were found. Therefore, the information extracted from them allows for the discussion of aspects of interest related to the study topic.

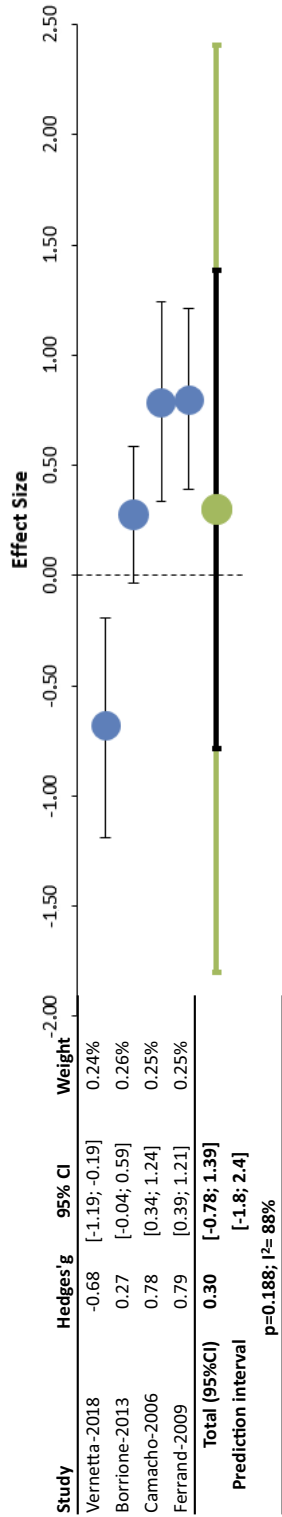
For instance, it is often assumed that gymnasts may be particularly prone to experiencing issues with body image distortion. On one hand, there is the notion that women tend to perceive themselves as heavier than they actually are (Anand et al., 2015; Gray, 1977; Cheung et al., 2007; Chung et al., 2019). On the other hand, gymnasts face pressure to attain thinness to enhance both their performance and physical appearance (Neves, Fernandes, et al., 2016). Additionally, some researchers have noted a susceptibility among gymnasts to developing eating disorders, with body distortion being identified as a significant associated risk factor (American Psychiatric Association, 2013; Martínez et al., 2020). However, the findings of this review suggest that RG athletes do not exhibit altered self-body perception. This contrasts with observations in other

Figure 2 Forest plot for the meta-analysis of the degree of body dissatisfaction between rhythmic gymnastics athletes and non-athlete controls



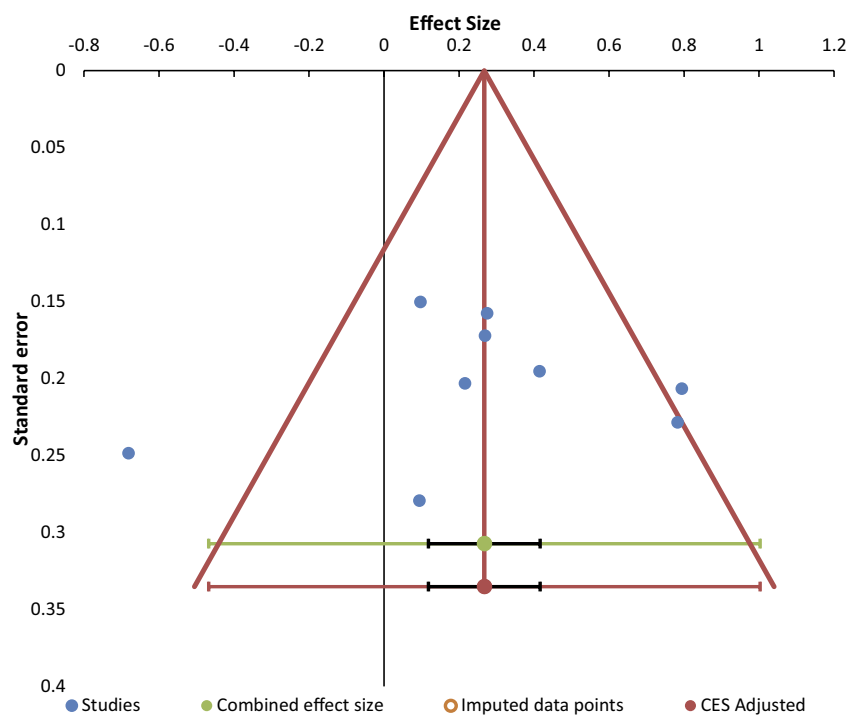
Note. Results to the right of the null dashed line (effect size = 0) indicate that rhythmic gymnastics athletes have lower body dissatisfaction. Green dot: overall pooled result across all studies. Black error bars: 95% confidence interval (CI). Green error bars: Prediction interval. I²: Inconsistency.

Figure 3 Forest plot for the meta-analysis of the degree of body dissatisfaction between RG athletes and non- RG athletes



Note. RG = rhythmic gymnastics. Results to the right of the null dashed line (effect size = 0) indicate that RG athletes have lower body dissatisfaction. Green dot: overall pooled result across all studies. Black error bars: 95% confidence interval (CI). Green error bars: Prediction interval. I²: Inconsistency.

Figure 4 Funnel plot for publication bias analysis of body dissatisfaction between rhythmic gymnastics athletes and controls



Note. Egger p -value: .576; Trim and Fill: 0.

sports disciplines. For instance, Urdapilleta et al. (2010) found that synchronized swimmers tend to have distorted body self-perception. In their study, both male and female synchronized swimmers displayed a tendency to overestimate their body image, with females showing a stronger tendency. Similarly, other sports disciplines have shown a tendency towards overestimating body image among young women (18–25 years old), such as dance (Urdapilleta et al., 2007) and horseback riding (Torres-McGehee, 2011). Even in aesthetic-based sports like bodybuilding, situations of both underestimation and overestimation of body image have been reported (Peters & Phelps, 2001). Additionally, overestimation of body image has been observed in non-aesthetic sports like volleyball (Toselli et al., 2022).

In this review, it was also observed that the way gymnasts perceive their body image was more positive compared to non-athletes, and not different compared to other non-RG athletes. This finding might seem unexpected, considering that in sports where there is a particular emphasis on weight and physical appearance, such as RG, athletes often face greater pressure to attain the ideal physique (Sundgot-Borgen & Larsen, 1993). Moreover, in other non-aesthetic sports, female athletes have been found to have a distorted self-perception of body image compared to non-athlete women of the same age (Toselli et al., 2022).

However, it is important to note that most of the studies on body self-perception reviewed here relied on silhouette scales as assessment tools, which have their limitations. For instance, Gardner and Brown (2010) questioned their utility, noting that they are subjectively designed to represent a range of weights rather than being based on anthropometric dimensions. This subjective design can lead to an

inaccurate representation of body size, potentially affecting the accuracy of body distortion assessments. In this line, Neves, Filgueiras Meireles, et al. (2016) argued that silhouette scales are only sensitive to evaluating one dimension of the attitudinal component, providing no useful information for the perceptual component.

The findings of this review also indicate that body dissatisfaction is generally not prevalent among RG practitioners. It is important to highlight that for the evaluation of dissatisfaction, three studies utilized pictograms. Some researchers argue that these tools may not provide a precise assessment of body dissatisfaction (Kling et al., 2019). Hence, recognizing this limitation, different meta-analyses were conducted to offer a more thorough and resilient perspective on this subject. The pooled data suggested that gymnasts tend to be more satisfied with their bodies than controls, irrespective of their competitive level. These findings contrast with those of Perini et al. (2009), who found that synchronized swimming adolescents (aged 15 years) exhibited significantly greater body dissatisfaction compared to their non-athlete peers.

Our results are consistent with those of Neves, Filgueiras Meireles, et al. (2016), who found that only 25% of adolescent girls (aged 10–16 years) participating in artistic gymnastics reported body dissatisfaction. Similarly, De Bruin et al. (2007), after analyzing a sample of young artistic gymnastics practitioners (aged 13–20 years), suggested that they were not dissatisfied with their physique, regardless of the level of practice.

The pooled data also indicated that RG athletes exhibited a similar level of body dissatisfaction compared to athletes in other sports. However, scientific evidence on this

topic remains contradictory. For instance, Bialek-Dratwa et al. (2022), reported that young female athletes (aged 19–29 years) practising bodybuilding exhibited lower levels of body dissatisfaction compared to those engaged in non-aesthetic sports like triathlon or volleyball. In contrast, Fortes and Ferreira (2011) found that adolescent girls (aged 12–16 years) involved in aesthetic sports such as synchronized swimming and artistic gymnastics had higher levels of body dissatisfaction compared to those participating in volleyball.

The fact that body dissatisfaction levels were similar among RG practitioners and other athletes, could be justified by the idea that the ideal physique for gymnasts in the sports context does not necessarily match the ideal physique in their personal lives (Zaccagni et al., 2023). In this aesthetic sport, the relationship between leanness and athletic success serves as motivation for gymnasts to want to achieve an even slimmer (De Bruin et al., 2007). In this line, the results of Francisco, Narciso, and Alarco (2012) reveal that the ideal sports physique of the dancers and gymnasts analyzed differs from the general ideal physique, showing themselves to be more dissatisfied with their image in the sports context than in their daily lives.

Indeed, the low prevalence of body dissatisfaction in RG may be attributed to athletes having a more positive body image overall (Hausenblas & Downs, 2001). Studies such as that conducted by Soulliard et al. (2019) indicate that higher levels of body satisfaction are observed among college athletes participating in diverse sports. Similarly, DiBartolo and Shaffer (2002) found comparable results in a cohort of female college athletes engaged in various sports) compared to a non-athlete cohort.

This study seems to be the first systematic review and meta-analysis examining self-perceived body image and body dissatisfaction in RG. Despite its pioneering nature, addressing encountered limitations is imperative. Foremost among these is the heterogeneity and scarcity of studies concerning body self-perception, which precluded meta-analytical synthesis. Similarly, the paucity of studies comparing different practice levels (elite, sub-elite, or amateur) hindered a clear understanding of how these distinctions influence dissatisfaction levels and associated factors within each subgroup. Lastly, search constraints, notably the restriction to certain languages and the omission of gray literature exploration may have led to relevant study oversight.

Conclusions

The descriptive data of this review indicate that practising RG is not associated with body self-perception issues. Gymnasts tend to have a more positive perception of their bodies compared to non-athletic controls, while no significant differences are found when compared to athletes from other sports. Overall, body dissatisfaction does not appear to be prevalent among RG practitioners, as they report greater body satisfaction than non-athletes and exhibit similar levels of body dissatisfaction to those engaged in other sports.

Conflict of interest

The authors report no conflict of interest.

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