Research Square

Preprints are preliminary reports that have not undergone peer review.
They should not be considered conclusive, used to inform clinical practice,
or referenced by the media as validated information.

Gender Differences in the Mechanisms Linking Appearance Anxiety to Exercise Participation Among Chinese College Students: A Multi-Group Structural Equation Modeling Study

yifan zhang
Wuhan Sports University
Jiaqi Hao
Wuhan Sports University
Qian Huang
1485570510@qq.com
Wuhan Sports University

Article

Keywords: appearance anxiety, exercise participation, negative body image, exercise self-efficacy, multi-group structural equation modeling, gender differences

Posted Date: July 17th, 2026

DOI: https://doi.org/10.21203/rs.3.rs-9835823/v1

License: This work is licensed under a Creative Commons Attribution 4.0 International License. Read Full License

Additional Declarations: No competing interests reported.

Abstract

To explore the mechanisms underlying the effects of appearance anxiety on exercise participation among Chinese college students and the associated gender differences, this study constructed a chained mediation model based on the Stimulus-Organism-Response (SOR) framework. Using survey data from 1,052 Chinese college students, we employed a multi-group structural equation model to examine the mechanisms through which appearance anxiety influences exercise participation and the associated gender differences. The results indicate that body image anxiety significantly and positively influences negative body image, and significantly and negatively influences exercise self-efficacy and exercise participation; negative body image significantly and negatively influences exercise self-efficacy and exercise participation, while exercise self-efficacy significantly and positively influences exercise participation. Gender differences were primarily concentrated in the upstream psychological mechanisms, manifested as stronger effects of appearance anxiety on negative body image and exercise self-efficacy among female participants, while differences in the remaining pathways were not significant. Further effect decomposition indicated that the influence of appearance anxiety on exercise participation among male college students manifested through both direct and indirect effects, whereas its influence on female college students was primarily mediated by negative body image and exercise self-efficacy. The study indicates that the impact of appearance anxiety on exercise participation among college students exhibits distinct gender heterogeneity. When promoting exercise participation and implementing psychological interventions, universities should focus on the upstream psychological transmission mechanisms of appearance anxiety and implement gender-specific interventions tailored to different groups.

1 Introduction

In recent years, appearance anxiety has gradually emerged as a major concern affecting people's physical and mental health as well as their social development. The college years are a critical period for the formation of self-identity and the intensification of social comparison. Compared to other groups, college students are more susceptible to the influence of peer evaluations, online beauty standards, and body image expectations, leading to persistent preoccupation and anxiety regarding their own appearance, body shape, and physical characteristics. Consequently, college students constitute a high-prevalence group among those experiencing appearance anxiety and are also the group most significantly affected by its negative consequences (Pan, 2023).

From a theoretical perspective, negative body image and exercise self-efficacy may serve as important mediating variables in explaining how appearance anxiety influences exercise participation(Ouyang et al., 2020). Negative physical self (NPS) refers to an individual's negative cognitive evaluations of their own body, negative emotional experiences, and the resulting behavioral regulatory responses (Song and zhu, 2019). When individuals are chronically troubled by appearance anxiety, this anxiety negatively impacts their cognitive perception of body image(Bizman et al., 2001), leading to the development and entrenchment of a negative physical self-image(Papapanou et al., 2023). Negative body image leads individuals to form persistent negative perceptions of their own appearance, causing them to feel ashamed to expose their bodies in public spaces, and is thus associated with lower exercise self-efficacy(Gattario and Frisén, 2019). Physical exercise self-efficacy refers to an individual's perception of their ability to overcome exercise barriers, as well as their tendency to judge whether their own behavior can achieve predetermined goals(McAuley, 1992). Individuals with low physical exercise self-efficacy require additional external motivation to help them develop regular exercise habits. The lower an individual's physical exercise self-efficacy, the lower their level of exercise participation (Huang and Ren, 2020)

From a gender-differentiated perspective, women often face stricter appearance norms and greater pressure regarding body image than men, and are more likely to internalize external mainstream aesthetic standards as the core basis for self-evaluation(Fredrickson and Roberts, 1997; Mahon and Hevey, 2021). Consequently, the same level of appearance anxiety may more readily translate into negative body image among women, whereas although men also experience appearance anxiety, its mechanisms and pathways of influence may not be entirely consistent with those observed in women(Liu et al., 2022). Although current research addresses the relationships among appearance anxiety, negative body image, exercise self-efficacy, and exercise participation among college students, most studies focus on the linear effects of appearance anxiety on exercise participation or on mediational analyses. However, questions regarding whether gender differences exist in the pathways linking appearance anxiety to exercise participation—and, if so, in which specific pathways these differences manifest—remain to be clarified.

Based on this, this study takes Chinese college students as the research subjects. Building upon existing research that has validated the overall chain mediation relationship, it further focuses on the issue of gender heterogeneity in the process by which appearance anxiety influences exercise participation. Unlike studies that primarily examine the general mechanisms of "appearance anxiety, negative body image, exercise self-efficacy, and exercise participation," this study utilizes the same dataset to introduce measurement invariance tests and multi-group structural equation modeling, focusing on examining differences among gender groups across various pathways and their specific transmission characteristics. The contributions of this study are primarily reflected in three aspects: (1) It advances the research focus from testing general mechanisms to identifying heterogeneous mechanisms, addressing the questions of "whether gender differences exist and where they occur." (2) It enhances the interpretability and rigor of path comparisons across groups through measurement invariance testing. (3) It provides more concrete practical guidance for universities to implement exercise promotion and psychological interventions tailored to different genders.

2 Literature Review and Research Hypotheses

2.1 Mechanisms and Theoretical Framework of the Role of Appearance Anxiety in University Students' Exercise Participation

Appearance anxiety is a widespread psychological phenomenon in contemporary society. It refers to an individual's negative perceptions of their own appearance and the negative emotional reactions—such as tension, anxiety, and low self-esteem—arising from the fear that others may judge their

appearance negatively(Ayhan et al., 2022). Against the backdrop of an increasingly media-saturated environment and an intensifying culture of aesthetics, physical appearance is no longer merely an accessory to identity; rather, it has transcended traditional dimensions of identity such as occupation and social status to become a core component of identity itself(Negrin, 2008). Existing research confirms that high levels of body image anxiety not only impair an individual's mental health and subjective well-being but also influence their social interactions, eating habits, consumption behaviors, and approaches to body management(Liao et al., 2023; Xiao et al., 2024; Hu et al., 2025). As an activity that combines both social and physical presentation attributes, physical exercise is similarly susceptible to the influence of body image anxiety.

Negative body image is defined as low body self-esteem, dissatisfaction with one's own body, or body shame. Because it is closely associated with low overall well-being, low self-esteem, eating disorders, and depression, it has a significant impact on the lives of many young people (Brechan and Kvalem, 2015). Negative body image is considered a crucial upstream psychological mechanism in the process by which appearance anxiety influences exercise participation. Although both appearance anxiety and negative body image involve negative cognitive and emotional experiences regarding one's own appearance, and both can trigger reactions such as inferiority, shame, tension, and dissatisfaction, negative body image represents a more stable state of dissatisfaction and rejection toward the body, whereas appearance anxiety is an emotional experience more focused on facial features and evaluations of physical appearance. Existing research indicates that when individuals continuously compare themselves to idealized body standards and appearances, appearance anxiety tends to solidify into dissatisfaction with and rejection of their overall body image(Putri et al., 2025).In physical activity settings, individuals with higher negative body image often tend to avoid places such as playgrounds, gyms, and ball sports—where they must display their bodies and be subject to others' gaze(Cowley and Schneider, 2025). Therefore, appearance anxiety may not directly inhibit exercise participation but rather indirectly reduce participation levels by increasing an individual's negative body image.

Furthermore, exercise self-efficacy is a key variable in how body image anxiety influences college students' exercise participation. Exercise self-efficacy moderates an individual's emotional state during physical activity, enabling them to complete exercise tasks with a positive attitude even when facing challenges(Zhao et al., 2023). Consequently, the higher an individual's exercise self-efficacy, the stronger their motivation to exercise and the higher their level of exercise participation(Depenbusch et al., 2022); Conversely, when an individual's exercise self-efficacy is low, their level of exercise participation is also low. Body image anxiety intensifies an individual's focus on their own physical flaws and perceived inadequacies, leading to concerns such as "my body does not meet aesthetic standards" or "I will be negatively evaluated by others," thereby reducing their confidence in their ability to complete physical activities(Hart et al., 1989).

From a mechanistic perspective, negative body image and exercise self-efficacy do not exist in isolation but function as a chain of mediators in the mechanism by which body image anxiety influences exercise participation(Yuan et al., 2025). College students with high levels of appearance anxiety may develop a negative body image due to concerns about others' negative evaluations of their bodies. This negative body image reduces their confidence in sports settings and weakens their exercise self-efficacy. In turn, low exercise self-efficacy reduces their level of exercise participation, making it difficult for them to improve their physique through exercise. This further deepens their negative emotions toward their own bodies, thereby creating a vicious cycle.

From a theoretical perspective, the influence of body image anxiety on exercise participation is not a simple direct effect but is mediated through changes in the individual's internal psychological processes. This theoretical logic aligns well with the Stimulus–Organism–Response (SOR) framework. According to the SOR model, external stimuli do not directly elicit behavioral responses in individuals; rather, they first act upon an individual's cognition and emotions, and then influence behavioral outcomes through changes in internal psychological states(Zhang et al., 2021). In this study, body image anxiety can be understood as a "front-end stimulus" that triggers physical and psychological changes in individuals due to college students' excessive preoccupation with their own appearance and societal aesthetic pressures; negative body image and exercise self-efficacy, as chained mediating variables, reflect the internal psychological processing states generated in individuals under the influence of this stimulus. Exercise participation, meanwhile, can be viewed as the "response" ultimately exhibited by the individual. Based on this theoretical framework, it is evident that the key influence of appearance anxiety on college students' exercise participation lies not merely in its negative attributes, but rather in its ability to alter individuals' evaluations of their own bodies and their judgments regarding their capacity to perform physical activities.

2.2 The Theoretical Logic of Gender Differences in the Pathways Through Which Appearance Anxiety Influences College Students' Exercise Participation

Gender is a crucial lens for understanding the causes of body image anxiety and its behavioral consequences. Research indicates that men and women face different appearance norms and body evaluation standards during socialization; these differences may result in significant heterogeneity between men and women in the formation, expression, and behavioral impact of body image anxiety (Sobrino-Bazaga and Rabito-Alcón, 2018). Specifically, because the ideal body type conveyed by society to women is essentially limited to being slim, young, and attractive, the appearance norms they face in daily life are more stringent and homogenized than those faced by men(Buote et al., 2011). Consequently, women often need to invest more effort in managing their appearance, and when confronted with appearance anxiety, they may be more likely to translate it into negative evaluations of their overall body image.

Based on the mechanisms underlying the formation of negative body image, women are more likely than men to internalize societal aesthetic standards as their own internal criteria for evaluating their bodies, and to continuously magnify their perceived physical flaws during subsequent comparisons(Fries et al., 2025). This leads to higher levels of appearance anxiety, which further translates into dissatisfaction with their own bodies, thereby forming a negative body image. While men also experience appearance anxiety, their anxiety primarily stems from concerns regarding muscle tone and body proportions(Lennon and Johnson, 2021). Therefore, this study hypothesizes that the positive influence of appearance anxiety on negative body image may be stronger among women.

Furthermore, gender differences may also manifest in the impact of appearance anxiety on an individual's exercise self-efficacy. Since physical activities involve elements such as physical display, performance, and peer comparison, they inherently carry a strong evaluative nature(Vani et al., 2020). Women are more likely than men to feel a sense of bodily exposure during exercise and are more prone to worrying that their physique and attire may elicit negative

evaluations from others(Driediger et al., 2018). Consequently, appearance anxiety reinforces women's negative emotions toward their bodies and further undermines their confidence in their ability to perform physical activities, thereby creating a cognitive chain of reasoning: "Because my body is not ideal, I cannot perform the exercise." In contrast, the reduction in exercise self-efficacy among men in sports settings due to appearance or body image pressure is more closely linked to competitive pressure or comparisons of physical functionality. Based on this, this study infers that the negative impact of body image anxiety on exercise self-efficacy may be stronger among women.

At the same time, gender differences in the pathways through which appearance anxiety influences college students' exercise participation are not necessarily uniformly distributed(Fries et al., 2025). Specifically, gender differences may be more pronounced in the upstream pathway where appearance anxiety acts on internal psychological mechanisms—that is, in the stage where appearance anxiety influences negative body image and exercise self-efficacy—while gender differences may be smaller in the downstream pathway where psychological mechanisms influence exercise participation. Therefore, if gender is treated solely as a control variable or if studies rely solely on mean comparisons, it is difficult to truly reveal the differences between men and women at the mechanistic level. In contrast, a multi-group structural equation model, under the assumption of measurement equivalence, allows for a systematic comparison of path coefficients across different gender groups, thereby more accurately identifying the differences present in each pathway.

2.3 Research Hypotheses and Research Model

Based on the theoretical analysis presented earlier, it is evident that the mechanism through which appearance anxiety influences college students' exercise participation is not a simple direct effect, but rather is mediated indirectly through internal psychological mechanisms such as negative body image and exercise self-efficacy. In this process, gender differences between men and women are not evenly distributed across all pathways, but are likely concentrated at the initial stage of the mechanism through which appearance anxiety influences college students' exercise participation. Both existing research and the theoretical inferences of this study indicate that women are more susceptible to the influence of appearance and aesthetic standards during the socialization process. That is, when faced with appearance anxiety, women are more likely to form negative evaluations of their own bodies, which in turn weakens their exercise self-efficacy. In contrast, although men may also be troubled by appearance anxiety, the mechanisms of action and the intensity of its impact may differ from those observed in women. Based on this, this study does not propose repetitive hypotheses regarding the general relationships among appearance anxiety, negative body image, exercise self-efficacy, and exercise participation. Instead, building upon existing theoretical relationships, it focuses on examining the differences in the mechanisms of action across gender groups.

Accordingly, this study proposes the following hypotheses:

H1: The pathways through which appearance anxiety influences exercise participation among college students differ across gender groups, and these differences are primarily concentrated in the early stages of the pathway

H2: The positive effect of appearance anxiety on negative body image is stronger among female college students than among male college students.

H3: The negative effect of appearance anxiety on exercise self-efficacy is stronger among female college students than among male college students.

Based on the above analysis, this study constructed the research model shown in Fig. 1. First, the measurement model was tested, and assuming measurement invariance held, the differences in coefficients across structural paths between the male and female groups were further compared.

3 Research Methods

3.1 Sample Selection and Data Sources

This study utilizes survey data on Chinese college students collected in the author's previous research (Zhang et al., 2026). Unlike the previous study, which focused on the overall mediating mechanism in the full sample, the present study further examines gender-based heterogeneity by incorporating measurement invariance testing and multi-group structural equation modeling. The sampling process employed a combination of stratified random sampling and convenience sampling. Specifically, universities nationwide were first divided into two categories: "985/211" universities and "non-985/211" universities. Six universities were randomly selected from each category, and each selected university included students from the following disciplines: science and engineering; humanities, history, and law; business and management; medicine; arts and physical education; and other disciplines. Next, questionnaires were distributed to undergraduate students in these disciplines using convenience sampling, combining online platforms (such as WeChat and QQ) with offline methods (such as paper-based distribution and collection). The entire survey process was divided into two main phases: during the pilot phase, 80 eligible respondents were selected to test the questionnaire's reliability, validity, and the clarity of item wording; during the formal survey phase, a total of 1,145 questionnaires were distributed, and 1,052 valid responses were ultimately collected, resulting in a valid response rate of 91.88%.

In this survey, responses with missing data, anomalous data, or evident patterned answers were excluded on the basis of the following criteria: (1) If a substantial proportion of core variable items were left unanswered (e.g., exceeding 10% of the core items in the respective questionnaire), the response was deemed invalid. (2) If the same option was selected consecutively for 15 or more items within the core scales and lacked reasonable content variation, the response was classified as patterned answering. (3) This study did not include standalone attention-check questions, nor did it exclude questionnaires based solely on a single response-duration threshold. Instead, exclusion decisions were made through a comprehensive assessment combining missing data patterns, extended strings of identical responses, and the logical consistency of the answers provided.

Given the complexity of the planned analyses—including confirmatory factor analysis, measurement invariance testing, multi-group structural equation modeling, and bootstrap estimation—a relatively large sample size was required to ensure the stability of parameter estimates and sufficient statistical power. The final analysis sample comprised 1,052 participants, providing the necessary data support for subsequent multi-group comparative analyses.

Detailed sample information is presented in Table 1. While this sample information is consistent with the original study, the present study represents a secondary analysis of a previously collected dataset. Whereas the prior study examined the overall chained mediation mechanism in the full sample, the present study specifically focuses on gender-based heterogeneity in structural pathways by incorporating measurement invariance testing and multi-group structural equation modeling. Thus, the research questions, analytic strategy, and theoretical contribution of the present study differ from those of the previous work.

Table 1
Descriptive statistics of the sample.

Item	Categories	Frequency	Percentage(%)
Gender	Male	550	52.3
	Female	502	47.7
Grade	Freshman	195	18.5
	Sophomore	219	20.8
	Junior	158	15
	Senior	255	24.2
	Postgraduate and above	225	21.4
Place of Origin	Urban Area	586	55.7
	Rural Area	466	44.3
Major	Science and Engineering	296	28.1
	Literature, History, Philosophy, Law	235	22.3
	Economics and Management	241	22.9
	Medicine	191	18.2
	Art and Physical Education	68	6.5
	Other	21	2
University Type	“985”/“211”Universities	401	38.1
	Non-“Double First-Class” Universities	651	61.9
Relationship Status	Yes(In a relationship)	401	38.1
	No(Not in a relationship)	651	61.9
Monthly Disposable Income	Below 1000 Yuan	183	17.4
	1001–1500 Yuan	256	24.3
	1501–2000 Yuan	415	39.4
	2001–3000 Yuan	134	12.7
	Above 3000 Yuan	64	6.1
Height (cm)	157–161	205	19.5
	162–166	199	18.9
	167–171	220	20.9
	172–176	198	18.9
	177–182	230	21.9
Weight (kg)	46–51	192	18.3
	52–57	216	20.5
	58–63	212	20.2
	64–69	203	19.3
	70–76	229	21.8

3.2 Measurement of Variables

This study measured four core variables: appearance anxiety, negative body image, exercise self-efficacy, and exercise participation. For each variable, we employed well-established scales that have been widely used in relevant domestic and international studies and possess a solid foundation of reliability and validity.

Appearance anxiety was measured using the Appearance Anxiety Scale-Brief Version developed by Dion et al. (1990). The scale consists of 14 items and employs a 5-point Likert scale; higher scores indicate higher levels of appearance anxiety.

Negative body image was primarily measured using the Negative Physical Self Scale—General Appearance Subscale (NPSS-G) developed by Chen et al. (2006), which is designed to assess adolescents' levels of dissatisfaction with their body image. Each item is scored on a 5-point scale, with higher scores indicating a stronger negative body image. Given that the original wording of these items reflects positive body evaluations, they were reverse-coded during data processing so that higher scores indicate a higher degree of negative body image.

Exercise self-efficacy was measured using the Self-efficacy for Exercise (SEE) scale developed by Resnick and Jenkins (2000). This scale is primarily used to assess an individual's confidence in continuing to participate in exercise despite obstacles such as fatigue, stress, lack of time, or lack of companionship. The scale consists of 9 items; a higher score indicates a higher level of exercise self-efficacy.

Drawing on the findings of Zhang and Li (2021), physical activity participation was measured using the Physical Activity Rating Scale (PARS-3). This scale assesses an individual's level of physical activity participation across three dimensions: exercise intensity, exercise duration, and exercise frequency. The total score is calculated using the standard formula: Level of physical activity participation = Exercise intensity×(Exercise duration−1)×Exercise frequency. A higher score indicates a higher level of physical activity participation. In this study, exercise participation is treated as an observed variable, and the total score calculated using the above formula is incorporated into subsequent analyses.

3.3 Data Analysis Methods

This study began by testing the data for normality. Univariate normality was assessed through the skewness and kurtosis of each observed variable, whereas multivariate normality was evaluated using the multivariate kurtosis coefficient and its critical ratio obtained from the AMOS output. The results indicated that the skewness and kurtosis values of all the observed variables fell within acceptable ranges, suggesting that the data largely met the assumption of normality. The multivariate normality test revealed a degree of deviation. Considering the relatively large sample size of this study and the Likert-scale nature of the questionnaire data, which are distributional characteristics commonly encountered in related research, this deviation was deemed unlikely to substantially influence subsequent analyses. This study primarily employed four methods to analyze the raw data.

First, descriptive statistical methods were used to organize the basic characteristics of the sample and the overall distribution of each core variable. Furthermore, the mean differences between male and female college students in appearance anxiety, negative body image, exercise self-efficacy, and exercise participation were compared to obtain preliminary statistical characteristics of the main variables across different gender groups.

Second, confirmatory factor analysis was used to test the measurement model, evaluating the fit between latent variables and their observed indicators. Using metrics such as standardized factor loadings, composite reliability, and average variance extracted, the scale's convergent validity, discriminant validity, and internal consistency were examined. Based on the validity of the measurement model, a baseline structural model for the overall sample was constructed to serve as a reference for subsequent group comparison analyses.

Third, given that the core research objective of this study is to compare differences in structural paths between male and female college students, multi-group invariance tests were conducted prior to formal path comparisons. These tests specifically included configural invariance, metric invariance, and intercept invariance to confirm that the measurement meanings of the scale are consistent across different gender groups, thereby ensuring the interpretability and statistical rigor of the group comparison results.

Fourth, after measurement invariance met acceptable standards, a multi-group structural equation model was employed to examine differences in structural paths across gender groups. Specifically, we first established a freely estimated model, then progressively imposed equality constraints on the target paths, and assessed the significance of path differences by analyzing changes in model fit and parameter comparison results. Concurrently, to more clearly elucidate the mechanism through which appearance anxiety influences exercise participation, this study decomposed the direct, indirect, and total effects across gender groups and employed Bootstrap methods for robustness testing to enhance the reliability of assessments regarding mediating effects and path differences.

While the original study used structural equation modeling and Bootstrap analysis to examine mediation effects in the overall sample, this study builds upon the same dataset by incorporating measurement invariance and multi-group comparison procedures, shifting the analytical focus from "testing general mechanisms" to "identifying path differences."

4 Results and Discussion

4.1 Descriptive Statistics, Gender Differences, and Correlation Analysis

Prior to testing the structural model, this study first conducted descriptive statistics, independent samples t-tests, and correlation analyses on the four core variables: appearance anxiety, negative body image, exercise self-efficacy, and exercise participation. The results are presented in Table 2.

Table 2
Descriptive statistics, gender differences, and correlations among study variables

Variable	Total Sample(N = 1052)M ± SD	Male Group (n = 550) M ± SD	Female Group (n = 502) M ± SD	t	p	Cohen's d	1	2	3	4
Appearance Anxiety (AA)	32.87 ± 12.65	33.43 ± 12.97	32.26 ± 12.28	1.50	0.134	0.09	—			
Negative Body Image (NBI)	11.85 ± 4.69	11.76 ± 4.58	11.96 ± 4.81	-0.68	0.498	-0.04	0.417***	—		
Exercise Self-Efficacy (ESE)	33.41 ± 8.26	33.98 ± 7.78	32.80 ± 8.78	2.31	0.021*	0.14	-0.386***	-0.377***	—	
Exercise Participation (EP)	44.45 ± 27.55	44.09 ± 27.33	44.85 ± 27.82	-0.45	0.651	-0.03	-0.326***	-0.306***	0.374***	—

Note: M = mean, SD = standard deviation; t = t-statistic for an independent samples t-test ; p = two-tailed significance; Cohen's d is the effect size; negative values indicate that girls scored higher than boys, while positive values indicate that boys scored higher than girls; *p < 0.05, **p < 0.01, ***p < 0.001; N = 1052.

For the overall sample, the means and standard deviations for appearance anxiety, negative body image, exercise self-efficacy, and exercise participation were 32.87 ± 12.65, 11.85 ± 4.69, 33.41 ± 8.26, and 44.45 ± 27.55, respectively. Results of the gender difference test showed that the differences between males and females in appearance anxiety and negative body image were not statistically significant. Specifically, the mean appearance anxiety score for male college students was 33.43 ± 12.97, while that for female college students was 32.26 ± 12.28, with no significant difference (t = 1.50, p = 0.134, Cohen's d = 0.09); The mean negative body image score for male college students was 11.76 ± 4.58, while that for female college students was 11.96 ± 4.81; this difference was also not significant (t = -0.68, p = 0.498, Cohen's d = -0.04). Regarding exercise self-efficacy, male college students scored significantly higher than female college students, with a mean of 33.98 ± 7.78 for the male group and 32.80 ± 8.78 for the female group; the difference reached statistical significance (t = 2.31, p = 0.021), but the effect size was small (Cohen's d = 0.14). Regarding exercise participation, no significant difference was observed between the male and female groups; the mean for the male group was 44.09 ± 27.33, and for the female group, 44.85 ± 27.82 (t = -0.45, p = 0.651, Cohen's d = -0.03).

Correlation analysis results showed that the directions of correlations among the core variables were consistent with theoretical expectations. Specifically, appearance anxiety was significantly positively correlated with negative body image (r = 0.417, p < 0.001) and significantly negatively correlated with exercise self-efficacy (r = -0.386, p < 0.001) and exercise participation (r = -0.326, p < 0.001). Negative body image was significantly negatively correlated with both exercise self-efficacy (r = -0.377, p < 0.001) and exercise participation (r = -0.306, p < 0.001), while exercise self-efficacy was significantly positively correlated with exercise participation (r = 0.374, p < 0.001). The above results indicate that the variables in this study exhibit good theoretical consistency, providing a foundation for subsequent structural equation modeling and multi-group comparative analyses.

4.2 Reliability, Convergent Validity, and Discriminant Validity of the Measurement Model

To assess the reliability and convergent validity of the measurement instrument, this study further examined the standardized factor loadings, Cronbach's α coefficients, composite reliability (CR), and average variance extracted (AVE) for each latent variable. The results are presented in Table 3.

Table 3
Standardized factor loadings, Cronbach's alpha, composite reliability, and average variance extracted for latent variable

Construct	Items	Standardized loadings	Cronbach's α	CR	AVE
AA	14	0.703–0.784	0.949	0.949	0.570
NBI	5	0.729–0.776	0.868	0.869	0.569
ESE	9	0.715–0.798	0.922	0.922	0.567

The results showed that the standardized factor loadings for the three latent variables—appearance anxiety, negative body image, and exercise self-efficacy—ranged from 0.703 to 0.784, 0.729 to 0.776, and 0.715 to 0.798, respectively, all of which were above 0.70, indicating that the items effectively reflected their respective latent variables. The Cronbach's α coefficients for the three latent variables were 0.949, 0.868, and 0.922, respectively, with composite reliabilities of 0.949, 0.869, and 0.922, all exceeding 0.70; the average variance extracted values were 0.570, 0.569, and 0.567, respectively, all exceeding 0.50. These results indicate that the three latent variables possess good internal consistency and convergent validity. Since exercise participation, calculated using the PARS-3 formula, is an observed variable, it was not included in the reliability and convergent validity tests for the latent variables.

To test the discriminant validity among the variables, this study constructed a three-factor model, a two-factor model, and a one-factor model for a comparative analysis of competing models. As shown in Table 4, the three-factor model exhibited the best fit, with $\chi^2/df = 2.015$, GFI = .954, AGFI = .946, NFI = .961, IFI = .980, TLI = .978, CFI = .980, RMSEA = .031, and AIC = 817.187, with all indices reaching a satisfactory level. The fit indices for the two-factor and one-factor models were significantly worse, and their AIC values were notably higher than those of the three-factor model. Thus, the three-factor model demonstrates superior fit, indicating good discriminant validity among the three latent variables.

Table 4
Comparison of competing measurement models

Model	χ^2	df	χ^2/df	RMR	GFI	AGFI	NFI	IFI	TLI	CFI	RMSEA	AIC
Three-factor model	699.187	347	2.015	0.03	0.954	0.946	0.961	0.98	0.978	0.98	0.031	817.187
Two-factor model	2530.227	349	7.25	0.107	0.802	0.77	0.86	0.877	0.866	0.876	0.077	2644.227
One-factor model	6884.462	350	19.67	0.226	0.513	0.435	0.618	0.63	0.6	0.63	0.133	6996.462

4.3 Test of Measurement Invariance

Before conducting path comparisons across multiple groups, this study first tested the measurement invariance of each scale across male and female samples; the results are shown in Table 5. Given that the chi-square test of differences is sensitive to sample size, this study comprehensively considered both the results of the $\Delta\chi^2$ test and changes in the approximate fit indices when assessing measurement invariance, with a particular focus on the magnitude of changes in ΔCFI and ΔRMSEA.

Table 5
Measurement invariance across gender groups

Model	Constraints	χ^2	df	χ^2/df	CFI	TLI	RMSEA	RMSEA 90% CI	$\Delta\chi^2$	Δdf	p	ΔCFI	ΔRMSEA	Deci
Unconstrained	Configural invariance	1053.147	694	1.518	0.98	0.978	0.022	[0.019, 0.025]	—	—	—	—	—	Sup
Metric	Metric invariance	1081.157	719	1.504	0.979	0.978	0.022	[0.019, 0.025]	28.01	25	0.307	-0.001	0	Sup
Scalar	Scalar invariance	1133.22	747	1.517	0.978	0.978	0.022	[0.020, 0.025]	52.063	28	0.004	-0.001	0	App sup
Strict	Strict invariance	1162.355	776	1.498	0.978	0.979	0.022	[0.019, 0.024]	29.135	29	0.458	0	0	Acc

Each constrained model was compared with the immediately preceding model. CFI = comparative fit index; TLI = Tucker-Lewis index; RMSEA = root mean square error of approximation.

The results of the multi-group measurement invariance test indicate that the unconstrained model fits well (χ^2 = 1053.147, df = 694, χ^2/df = 1.518, CFI = 0.980, TLI = 0.978, RMSEA = 0.022, 90% CI = [0.019, 0.025]). After further imposing equal factor loadings constraints, model fit did not significantly decline ($\Delta\chi^2$ = 28.010, Δdf = 25, p = 0.307; ΔCFI = -0.001, ΔRMSEA = 0.000), indicating that load invariance holds. Subsequently, after imposing an isovalence constraint on measurement intercepts, the chi-square difference test reached statistical significance ($\Delta\chi^2$ = 52.063, Δdf = 28, p = 0.004), suggesting that full intercept invariance was not fully supported; however, since the changes in ΔCFI and ΔRMSEA were both minimal (ΔCFI = -0.001, ΔRMSEA = 0.000), intercept invariance can be considered generally acceptable. Finally, after further imposing measurement residual isovariation constraints, model fit did not deteriorate significantly ($\Delta\chi^2$ = 29.135, Δdf = 29, p = 0.458; ΔCFI = 0.000, ΔRMSEA = 0.000), indicating that the strict invariance model is also acceptable under practical fit criteria. Overall, this study obtained acceptable evidence of measurement equivalence across different gender groups. In particular, configural invariance and load invariance were supported, and intercept invariance was also acceptable under approximate fit criteria. Therefore, further multi-group structural path comparisons can be conducted based on these findings.

4.4 Testing for Differences in Structural Paths by Gender

Assuming measurement invariance holds, this study further employs a multi-group structural equation model to test for differences between male and female college students across various structural paths. Specifically, a freely estimated model was used as the baseline model. Subsequently, equal-variance constraints were applied to each path, and chi-square tests were conducted to determine whether there were significant differences in the coefficients across paths between the two gender groups. The results are presented in Table 6.

Table 6
Structural path differences across gender groups

Model	Constrained path	χ^2	df	$\Delta\chi^2$	Δdf	p	Conclusion
Baseline	None	1098.842	744	—	—	—	Baseline
S1	AA→NBI	1105.871	745	7.029	1	0.008	Significant difference
S2	AA→ESE	1102.752	745	3.91	1	0.048	Significant difference
S3	AA→EP	1102.135	745	3.293	1	0.07	Marginal difference
S4	NBI→ESE	1099.136	745	0.294	1	0.588	No difference
S5	NBI→EP	1099.8	745	0.958	1	0.328	No difference
S6	ESE→EP	1100.216	745	1.374	1	0.241	No difference

The results indicate that there is a significant difference between the male and female groups in the path through which appearance anxiety influences negative body image. When the path coefficient was set to be equal across groups, the model fit deteriorated significantly ($\Delta\chi^2 = 7.029$, $\Delta df = 1$, $p = 0.008$), suggesting that this path exhibits significant gender heterogeneity. At the same time, the effect path of appearance anxiety on exercise self-efficacy also showed significant differences ($\Delta\chi^2 = 3.91$, $\Delta df = 1$, $p = 0.048$), indicating that the strength of the effect on this path differs significantly between the two gender groups. In contrast, although the direct effect path of body image anxiety on exercise participation did not reach the conventional level of significance, it showed a marginally significant difference ($\Delta\chi^2 = 3.293$, $\Delta df = 1$, $p = 0.070$), suggesting that there may be some degree of gender difference in this path. However, the path differences for negative body image to exercise self-efficacy, negative body image to exercise participation, and exercise self-efficacy to exercise participation did not reach the level of significance (p-values of 0.588, 0.328, and 0.241, respectively).

The above findings indicate that gender differences among college students are primarily concentrated in the psychological mechanism pathway through which appearance anxiety influences negative body image and exercise self-efficacy. Additionally, the direct pathway of appearance anxiety to exercise participation also showed marginal differences. There is heterogeneity in the mechanism through which appearance anxiety influences exercise participation across genders within the student population; therefore, Hypothesis H1 is supported.

4.5 Comparison of Standardized Path Coefficients Between Men and Women

To further clarify the specific directional effects of each path in the male and female groups, this study compared the standardized path coefficients in the multi-group structural model. The results are shown in Table 7.

Table 7
Standardized path coefficients for male and female groups

Path	Male β	Female β	Group difference
AA→NBI	0.400***	0.526***	Significant
AA→ESE	-0.253***	-0.325***	Significant
AA→EP	-0.218***	-0.079	Marginal
NBI→ESE	-0.277***	-0.285***	No significant difference
NBI→EP	-0.181***	-0.118*	No significant difference
ESE→EP	0.207***	0.334***	No significant difference
Note. p < 0 .05, ** p < 0 .01, *** p < 0.001.			

Group difference was determined based on the chi-square difference tests reported in Table 6.

Looking at the specific path coefficients for the male and female groups, the positive effect of appearance anxiety on negative body image was significantly stronger among women than among men. In the male group, the standardized coefficient for this path was 0.400 ($p < 0.001$); in the female group, it was 0.526 ($p < 0.001$). Combined with the results of the aforementioned between-group difference tests, it can be seen that female college students are more likely to translate appearance anxiety into a negative evaluation of their overall body image, a finding that supports Hypothesis H2.

The negative effect of appearance anxiety on exercise self-efficacy reached a significant level in both the male and female groups, with the negative effect being stronger in the female group. In the male group, the standardized coefficient for this path was − 0.253 ($p < 0.001$); in the female group, it was − 0.325 ($p < 0.001$). This result indicates a significant difference in this path between the groups, supporting Hypothesis H3, which suggests that appearance anxiety is more likely to undermine female college students' confidence in their ability to complete exercise tasks.

Regarding the remaining pathways, the direct negative effect of appearance anxiety on exercise participation was significant in the male group, with a standardized coefficient of -0.218 ($p < 0.001$); in the female group, however, the coefficient for this pathway was − 0.079 ($p = 0.135$), which did not reach statistical significance. This suggests that the inhibitory effect of appearance anxiety on male college students' exercise participation is primarily manifested as a direct effect, whereas for female college students, the effect is more likely mediated through an intermediary mechanism. However, given that the results of the between-group difference test showed only marginal significance, these findings should be interpreted with caution. Negative body image had a significant negative predictive effect on exercise self-efficacy in both the male and female groups, with a standardized coefficient of -0.277 ($p < 0.001$) for the male group and − 0.285 ($p < 0.001$) for the female group; no significant difference was observed between the two groups. Negative body image also had a significant negative effect on exercise participation, with a standardized coefficient of -0.181 ($p < 0.001$) for the male group and − 0.118 ($p < 0.05$) for the female group; however, the difference between the groups was not significant. Exercise self-efficacy had a significant positive effect on exercise participation in both the male and female groups, with a standardized coefficient of 0.207 ($p < 0.001$) for the male group and 0.334 ($p < 0.001$) for the female group; similarly, no significant difference was observed between the two groups.

Overall, the directions of the pathways in the baseline model were largely consistent between male and female college students, but the differences were primarily reflected in the upstream pathways through which appearance anxiety influences exercise participation. In particular, the positive effect of appearance anxiety on negative body image was stronger among female students, while the direct effect of appearance anxiety on exercise participation was significant only in the male group. This suggests that appearance anxiety among female college students is more likely to further influence their exercise participation through mediating mechanisms such as negative body image and exercise self-efficacy.

4.6 Analysis of the Total, Direct, and Indirect Effects of Appearance Anxiety on Exercise Participation

Building on the comparison of structural path differences, this study further employed the Bootstrap method to decompose and test the direct effects, total indirect effects, and total effects of appearance anxiety on exercise participation in the male and female groups. The results are shown in Table 8.

Table 8
Bootstrap Tests of the Direct, Total Indirect, and Total Effects of Appearance Anxiety on Physical Activity Participation Across Gender Groups

Gender	Direct Effect β	95% Bootstrap CI	Total Indirect Effect β	95% Bootstrap CI	Total Effect β	95% Bootstrap CI	Mediation Type
Male	-0.218	[-0.311, -0.125]	-0.148	[-0.205, -0.098]	-0.366	[-0.450, -0.281]	Partial mediation
Female	-0.079	[-0.196, 0.035]	-0.22	[-0.298, -0.150]	-0.299	[-0.397, -0.196]	Full mediation
Note: Direct, total indirect, and total effects were estimated using bootstrap resampling (5000 samples), and 95% confidence intervals were calculated using the percentile method. Effects were considered significant when the 95% confidence interval did not include zero.							

In the male group, the direct effect of appearance anxiety on exercise participation was significant (β = −0.218, 95% CI [− 0.311, − 0.125]), and the total indirect effect was also significant (β = −0.148, 95% CI [− 0.205, -0.098]), and the total effect was significant (β = -0.366, 95% CI [-0.450, -0.281]). This indicates that appearance anxiety not only directly and negatively predicts exercise participation among male college students but also exerts an indirect influence through negative body image and exercise self-efficacy; thus, the male group exhibited partial mediation.

In the female group, the direct effect of body image anxiety on exercise participation was not significant (β = -0.079, 95% CI [-0.196, 0.035]), but its total indirect effect was significant (β = -0.220, 95% CI [− 0.298, − 0.150]), and the total effect was also significant (β = −0.299, 95% CI [− 0.397, − 0.196]). This suggests that the effect of body image anxiety on female college students' exercise participation is primarily mediated through intermediary variables, specifically negative body image and exercise self-efficacy, which fully mediate this relationship.

Overall, appearance anxiety has a significant negative overall effect on exercise participation among both male and female college students, but the mechanism of action differs by gender: among males, appearance anxiety exerts both direct and indirect effects; whereas among females, its influence is primarily mediated through these mechanisms.

5 Discussion

5.1 Key Findings and Theoretical Explanations

Based on a sample of Chinese college students, this study constructed a structural model comprising "appearance anxiety, negative body image, exercise self-efficacy, and exercise participation." Assuming that measurement invariance was generally acceptable, the study systematically compared path differences across gender groups. The results indicate that the influence of appearance anxiety on college students' exercise participation is not a simple direct effect, but rather operates through internal psychological mechanisms such as negative body image and exercise self-efficacy. This finding aligns with the theoretical logic proposed earlier in this paper, namely that appearance anxiety, as the initial stimulus in this mechanism, influences an individual's body evaluation and judgment of behavioral capabilities, thereby further affecting their exercise participation behavior. This also corresponds with the theoretical inferences made in this paper based on the SOR framework.

Regarding the pathways through which appearance anxiety influences college students' exercise participation, this study found that gender differences across these pathways were not uniformly distributed; rather, the differences were primarily concentrated in the initial stages where appearance anxiety influences internal psychological mechanisms. Specifically, the positive effect of appearance anxiety on negative body image was significantly stronger among female college students than among male college students, and the negative effect of appearance anxiety on exercise self-efficacy was also significantly stronger among female students than among male students. This suggests that when faced with appearance anxiety, female college students are more likely to transform appearance-related pressure into negative perceptions of their own body image, which further undermines their confidence in completing exercise tasks. In contrast, no significant differences were observed across gender groups regarding the effects of negative body image on exercise self-efficacy and exercise participation, nor regarding the effects of exercise self-efficacy on exercise participation. This suggests that once negative body image and exercise self-efficacy are established, the mechanisms through which they influence exercise participation show a high degree of consistency between male and female college students.

Furthermore, Bootstrap effect decomposition results revealed that in the male group, both the direct effect and the total indirect effect of appearance anxiety on exercise participation reached statistical significance, indicating partial mediation; whereas in the female group, the direct effect of appearance anxiety on exercise participation did not reach statistical significance, but both the total indirect effect and the total effect reached statistical significance, indicating full mediation. These results indicate that body image anxiety exerts a significant negative overall effect on exercise participation among both male and female college students, but the two groups differ in the pattern of these effects: the male group exhibits both significant direct and indirect effects, whereas the female group primarily demonstrates an indirect effect on exercise participation through negative body image and exercise self-efficacy. Thus, this study not only confirms the negative association between appearance anxiety and exercise participation but also further reveals differences in the structural mechanisms of this association across gender dimensions.

5.2 Gender Differences in the Role of Appearance Anxiety in Upstream Psychological Mechanisms

This study found that gender differences in the influence of appearance anxiety on college students' exercise participation are not uniformly distributed across all pathways, but are primarily concentrated in the upstream psychological mechanisms through which appearance anxiety affects negative body image and exercise self-efficacy. At the same time, the direct pathway of appearance anxiety to exercise participation showed only marginally significant differences between groups. Specifically, the positive effect of appearance anxiety on negative body image was significantly stronger among female college students than among male college students, while its negative effect on exercise self-efficacy was also significantly stronger in the female group than in the male group. This suggests that gender differences are more evident in the process of "how appearance anxiety influences internal psychological mechanisms" rather than in the subsequent stage of "how these internal mechanisms influence exercise participation." These findings are consistent with fundamental perspectives on gender socialization. Existing research indicates that the sociocultural environment shapes a set of physical attractiveness standards that women must conform to—namely, being young, tall, and slender—and thus women are more likely to internalize external aesthetic standards as criteria for self-evaluation(Szymanski et al., 2011; Avery et al., 2021). Under the influence of this sociocultural context, the appearance anxiety experienced by women is more likely to further translate into dissatisfaction, shame, and self-denial regarding their overall self-image, thereby reinforcing their negative body image(Moya-Garófano and Moya, 2019). Therefore, the stronger path coefficient for appearance anxiety influencing negative body image in the female group in this study is not merely a statistical difference; rather, it reflects women's greater sensitivity in the process of internalizing appearance pressure.

At the same time, this study also found that the negative effect of body image anxiety on exercise self-efficacy is stronger among women. This result may stem from the fact that women are more likely to feel evaluative pressure in sports settings due to physical exposure, peer scrutiny, and comparisons of appearance, and are more prone to worrying that their body shape, posture, or athletic attire will elicit negative evaluations from others(Haug et al., 2023). In this context, body image anxiety not only heightens women's focus on perceived physical flaws but also undermines their assessment of their ability to perform physical tasks, thereby reducing their exercise self-efficacy(Hu et al., 2025). This further illustrates that exercise self-efficacy is not merely a variable reflecting ability; to a certain extent, it is also related to an individual's comprehensive perception of body image, social evaluation, and behavioral competence(Peng et al., 2025). In contrast, this study found no significant between-group differences in the downstream pathways, such as the effects of negative body image on exercise self-efficacy, the effects of negative body image on exercise participation, and the effects of exercise self-efficacy on exercise participation. This result suggests that once negative body image and exercise self-efficacy are established, their subsequent mechanisms influencing exercise participation remain relatively stable across different gender groups. Thus, when investigating the effects of body image anxiety on exercise participation, treating gender solely as a control variable without conducting path-level comparisons is likely to obscure the true differences occurring in these upstream psychological mechanisms(Navas-León et al., 2025).

The findings of this study expand, to some extent, the existing research perspective on the relationship between body image anxiety and exercise participation. Previous studies have primarily focused on linear relationships or mediating mechanisms among variables in general samples(Christiansen, 2015; Sicilia et al., 2023), with few further discussions on whether such mechanisms exhibit heterogeneity across different stages based on gender. Through a multi-group structural equation model, this study demonstrates that gender differences are not universally present across all pathways but primarily emerge in the initial stages of the mechanism. This finding allows for a more nuanced understanding of the psychological processes through which body image anxiety influences exercise participation and provides a basis for exploring specific differences in subsequent research.

5.3 Differences in the Transmission of the Effects of Appearance Anxiety on Exercise Participation

After comparing the path coefficients across different gender groups, this study further analyzed and tested the direct effects, total indirect effects, and total effects of appearance anxiety on exercise participation. The results show that appearance anxiety has a significant negative total effect on exercise participation among both male and female college students; however, the two groups exhibit different patterns in the transmission of these effects: in the male group, appearance anxiety exhibits both a significant direct effect and a significant total indirect effect; whereas in the female group, the direct effect of appearance anxiety did not reach statistical significance, but both the total indirect effect and the total effect were significant. This suggests that the inhibitory effect of appearance anxiety on male college students' exercise participation manifests both as relatively direct behavioral suppression and as indirect influences mediated by psychological mechanisms; whereas among female students, this effect is primarily achieved through gradual mediation via internal psychological mechanisms such as negative body image and exercise self-efficacy.

The significant direct effect in the male group indicates that the impact of appearance anxiety on male exercise participation is more likely to manifest directly as a decrease in exercise motivation, increased avoidance behavior, or reduced exercise engagement. Previous research has shown that although men also experience appearance anxiety, their focus is often more related to body shape, muscularity, physical functionality, and competitive performance(Pomichter et al., 2025). Therefore, when men experience appearance anxiety, this anxiety does not first translate into negative self-perceptions of their bodies, but may instead directly influence their judgments regarding athletic performance and actual behavior, leading to more pronounced inhibition in exercise participation (Brunet and Sabiston, 2009). The pattern of results for the female group, however, was characterized by a more prominent indirect effect pathway. Although the total effect of appearance anxiety on women's exercise participation was significantly negative, its direct effect was not significant, while the total indirect effect was significant. This suggests that women do not directly reduce their exercise participation simply because they "have appearance anxiety," but are more likely to first internalize this anxiety as a persistent negative evaluation of their bodies, which further undermines their confidence in completing exercise tasks and ultimately affects their level of exercise participation. This process aligns with the theoretical logic previously mentioned regarding women's greater tendency to internalize external aesthetic norms and transform appearance-related pressures into negative body image (Fries et al., 2025). Therefore, the pattern observed in the female group does not represent simple behavioral inhibition but rather a chain reaction mechanism.

This finding is of significant importance for understanding the relationship between appearance anxiety and exercise participation. It suggests that when comparing different gender groups, one should not merely focus on mean differences, overall effect sizes, or the presence of significant effects, but should further examine the structural pathways through which these effects occur. For men, the negative effects of appearance anxiety are partly manifested as relatively direct behavioral inhibition; for women, however, appearance anxiety is more often expressed through cumulative effects mediated by negative body image and exercise self-efficacy. This further illustrates that when explaining the mechanisms by which appearance anxiety influences exercise participation, it is insufficient to report mediation results for the overall sample alone; a more detailed analysis of the pathways of effect transmission based on gender subgroups is also necessary.

5.4 Implications for Practice

The findings of this study offer practical insights for physical education promotion and mental health interventions in higher education institutions.

First, when seeking to increase students' participation in physical exercise, universities should not attribute low participation rates solely to external factors such as course offerings, facilities, or exercise habits; they should also give due consideration to the mechanisms underlying psychological factors such as body image anxiety, negative body image, and exercise self-efficacy. Since body image anxiety further inhibits exercise participation through internal psychological mechanisms such as negative body image and exercise self-efficacy, universities can incorporate content on body acceptance, media aesthetic literacy, and the cultivation of exercise confidence into physical education courses, mental health education courses, and orientation programs for new students. This will help students reduce their excessive sensitivity to evaluations of their appearance, enhance their positive perceptions of physical activity, and increase their confidence in continuing to participate in sports.

Second, universities should implement more targeted intervention strategies based on gender differences. Given that female college students are more likely to transform appearance-related pressure into negative body image when facing appearance anxiety, which further undermines their exercise self-efficacy, institutional interventions for this group should focus on reducing the pressure of appearance-based social norms, mitigating the internalization of singular aesthetic standards, and creating a low-exposure, low-judgment exercise environment. For example, by offering body-positive education programs, non-competitive group exercise classes, and peer support initiatives, institutions can reduce students' feelings of body shame and the fear of being judged during exercise, thereby increasing the likelihood of sustained participation. For male students, interventions should focus more on enhancing the experience of exercise competence, reinforcing functional body perceptions, and boosting confidence in maintaining exercise habits. This approach avoids framing exercise participation solely as a means to improve physical appearance, thereby reducing the direct inhibitory effect of appearance anxiety on their physical activity.

Finally, university sports governance and campus health communication should undergo value-oriented adjustments. Universities should minimize the use of singular appearance-based goals—such as "weight loss" or "enhancing physical attractiveness"—to guide student exercise participation, and instead emphasize the comprehensive value of physical activity in health promotion, emotional regulation, social interaction, and personal growth. In particular, campus media campaigns, social media content, and physical education course evaluations should minimize one-sided assessments of body shape and appearance, preventing students from perceiving sports settings as spaces for displaying their bodies and being scrutinized. Only when exercise participation is framed as a safe, reliable, and multifaceted aspect of daily life will the negative impact of body image anxiety on college students' exercise participation be effectively mitigated.

6 Limitations of the Study

Although this study has made some progress in exploring the mechanisms through which appearance anxiety influences college students' exercise participation and the associated gender differences, several limitations remain that require further refinement in future research.

First, this study utilized cross-sectional survey data. While this approach effectively reveals the structural relationships among variables and their underlying pathways, it still has certain limitations regarding causal inference. There may be bidirectional influences or dynamic relationships among appearance anxiety, negative body image, exercise self-efficacy, and exercise participation. For example, a long-term lack of exercise participation may, in turn, exacerbate an individual's body dissatisfaction and appearance anxiety. Therefore, future research should employ longitudinal tracking designs or experimental methods to conduct more rigorous tests of the causal relationships among these variables.

Second, the data in this study primarily come from self-report questionnaires. While this method is feasible for large-scale surveys, it is inevitably subject to common method bias and social desirability bias. Particularly when dealing with socially sensitive variables such as appearance evaluation and physical activity, respondents may tend to answer in accordance with social expectations, thereby affecting the objectivity and accuracy of the measurement results to some extent. Although this study has made every effort to minimize the impact of such biases in questionnaire design and data processing, it remains difficult to completely avoid them.

Third, regarding sample selection, this study focuses on college students in China. While the sample is representative to a certain extent, it remains confined to a specific cultural and educational context. There may be significant differences in body image perceptions, social aesthetic standards, and exercise participation habits across different cultural contexts, and these factors may influence the mechanisms underlying the development of body image anxiety and its behavioral consequences. Therefore, caution is warranted when generalizing the findings of this study to other countries or different populations, and future research should validate these findings within broader cultural and social contexts.

Fourth, regarding variable measurement, this study employed relatively generalized measures of negative body image and exercise participation, failing to further distinguish between different dimensions or specific contexts. For example, different types of physical activities vary in terms of the degree of bodily exposure, the intensity of social interaction, and the pressure to be evaluated on one's appearance; these differences may moderate the pathways through

which appearance anxiety influences exercise participation. Additionally, exercise self-efficacy may manifest at different levels across various exercise tasks or environments. These factors have not been sufficiently distinguished in this study, which to some extent limits the detailed characterization of the underlying mechanisms.

Fifth, during model construction, this study primarily focused on individual psychological variables such as appearance anxiety, negative body image, and exercise self-efficacy, while failing to incorporate additional situational factors, such as peer evaluation, social media use, family environment, and campus culture. These factors may play a significant role in the development of appearance anxiety and its impact on exercise participation. Future research should integrate individual and situational factors to construct a more comprehensive explanatory framework.

7 Future Directions

Based on the findings and limitations of this study, there remains significant scope for future research on the impact of body image anxiety on exercise participation among college students.

First, in terms of research design, future studies could employ longitudinal tracking, intervention experiments, or quasi-experimental methods to continuously observe the dynamic relationships among body image anxiety, negative body image, exercise self-efficacy, and exercise participation. This would allow for a more accurate identification of the causal directions and phasic changes among these variables. In particular, given the ever-changing context of college students' physical and mental development and social comparisons, the impact of appearance anxiety on exercise participation is likely to fluctuate with age, changes in social environments, and the accumulation of physical experiences. Therefore, future research should adopt a dynamic process perspective to further elucidate its evolutionary mechanisms.

Second, regarding variable measurement and model construction, future research could provide a more detailed dimensional differentiation of negative body image, exercise participation, and exercise self-efficacy. For example, body image could be further differentiated into distinct dimensions such as appearance satisfaction, body shame, and evaluations of physical function. By integrating various types of physical activities—including aerobic exercise, strength training, team sports, and fitness check-ins—researchers could analyze whether the pathways through which appearance anxiety influences exercise participation differ under varying degrees of physical exposure, social interaction intensity, and evaluative pressure. Additionally, positive psychological variables such as body appreciation, exercise motivation, social support, and psychological resilience could be introduced to explore their buffering effects within the negative causal chain, thereby constructing a more comprehensive explanatory framework.

Furthermore, future research could incorporate social contextual factors. Body image anxiety is not a psychological state generated solely by the individual but rather a result shaped by the combined effects of social media dissemination, peer comparison, family expectations, campus culture, and mainstream aesthetic norms. Therefore, subsequent research could integrate individual psychological variables with social environmental variables to construct a multilevel analytical model, further examining the mechanisms through which social media usage, experiences of appearance evaluation, peer support environments, and campus sports culture influence college students' exercise participation.

Finally, future research could further expand the scope of the sample and the comparative perspective. On the one hand, the research population could be extended from undergraduate students at general universities to include students at vocational colleges, graduate students, physical education majors, and young people at different developmental stages, thereby examining differences in how appearance anxiety influences exercise participation across varying educational backgrounds, bodily experiences, and social roles. On the other hand, cross-regional and cross-cultural comparative studies could be conducted within broader cultural contexts to test whether the causal pathways and gender-specific differences revealed in this study possess greater universality. In particular, since aesthetic standards, gender role expectations, and patterns of exercise participation vary significantly across cultures, these factors may alter the logic underlying the development of body image anxiety and its behavioral consequences.

Declarations

Ethical Approval and consent to participate

This research protocol has been submitted to and approved by the Medical Ethics Committee of Wuhan Sports University (Approval Number: 2026073; Approval Date:2026.5.25). This study is a cross-sectional anonymous questionnaire survey classified as low-risk/very low-risk research. The research process adheres to the Declaration of Helsinki and relevant ethical guidelines. Participants may withdraw at any time without incurring any adverse consequences.

Informed Consent

All participants voluntarily agreed to participate after reading the informed consent statement prior to involvement. This statement outlined the study objectives, survey content, completion timeframe, potential risks and subject rights, anonymity and confidentiality measures, and data usage. For online questionnaires, an electronic informed consent form appeared on the homepage; participants clicked "Agree and Continue" to proceed to the formal survey. For offline paper surveys, written informed consent was obtained from participants before distribution.

Author Contribution

Yifan Zhang, Jiaqi Hao designed the study. Yifan Zhang ,Jiaqi Hao conducted the questionnaire distribution and data collection. Yifan Zhang performed the statistical analyses.Qian Huang supervised the study. All authors participated in writing and reviewing the manuscript. All authors read and approved the final manuscript.

Acknowledgement

We extend our gratitude to all university students who participated in this study's questionnaire survey for their support and cooperation. We also thank the faculty and students who assisted in the pre-testing of the questionnaire, its distribution and collection, as well as data organization and entry. Additionally, we acknowledge the anonymous reviewers and editors for their constructive feedback on this paper.

Data Availability

The de-identified questionnaire dataset supporting the conclusions of this article will be made available by the authors, without undue reservation. Data (and analysis code, if applicable) are available from the corresponding author upon reasonable request. Requesters should state the research purpose and agree not to attempt to re-identify any participant.This research protocol has been submitted to and approved by the Medical Ethics Committee of Wuhan Sport University (Approval Number: 2026073; Approval Date:2026.5.25). This study is a cross-sectional anonymous questionnaire survey classified as low-risk/very low-risk research. The research process adheres to the Declaration of Helsinki and relevant ethical guidelines. Participants may withdraw at any time without incurring any adverse consequences.

References

1. Avery LR, Stanton AG, Ward LM, Cole ER, Trinh SL, Jerald MC (2021) Pretty hurts: acceptance of hegemonic feminine beauty ideals and reduced sexual well-being among black women. Body Image 38:181–190. 10.1016/j.bodyim.2021.04.004
2. Ayhan H, Savsar A, Yilmaz Sahin S, Iyigun E (2022) Investigation of the relationship between social appearance anxiety and perceived social support in patients with burns. Burns 48:816–823. 10.1016/j.burns.2021.08.020
3. Bizman A, Yinon Y, Krotman S (2001) Group-based emotional distress: an extension of self-discrepancy theory. Personal Soc Psychol Bull 27:1291–1300. 10.1177/01461672012710005
4. Brechan I, Kvalem IL (2015) Relationship between body dissatisfaction and disordered eating: mediating role of self-esteem and depression. Eat Behav 17:49–58. 10.1016/j.eatbeh.2014.12.008
5. Brunet J, Sabiston CM (2009) Social physique anxiety and physical activity: a self-determination theory perspective. Psychol Sport Exerc 10:329–335. 10.1016/j.psychsport.2008.11.002
6. Buote VM, Wilson AE, Strahan EJ, Gazzola SB, Papps F (2011) Setting the bar: divergent sociocultural norms for women's and men's ideal appearance in real-world contexts. Body Image 8:322–334. 10.1016/j.bodyim.2011.06.002
7. Chen H, Jackson T, Huang X (2006) The negative physical self scale: initial development and validation in samples of chinese adolescents and young adults. Body Image 3:401–412. 10.1016/j.bodyim.2006.07.005
8. Christiansen DM (2015) Sex differences in PTSD: mediation and moderation effects. In: Martin CR, Preedy VR, Patel VB (eds) Comprehensive guide to post-traumatic stress disorder. Springer. doi: 10.1007/978-3-319-08613-2_4-1
9. Cowley ES, Schneider J (2025) I sometimes feel like I can't win! an exploratory mixed-methods study of women's body image and experiences of exercising in gym settings. PLoS ONE 20:e0316756. 10.1371/journal.pone.0316756
10. Depenbusch J, Haussmann A, Wiskemann J, Tsiouris A, Schmidt L, Sieverding M et al (2022) The relationship between exercise self-efficacy, intention, and structural barriers for physical activity after a cancer diagnosis. Cancers 14. 10.3390/cancers14102480
11. Dion KL, Dion KK, Keelan JP (1990) Appearance anxiety as a dimension of social-evaluative anxiety: exploring the ugly duckling syndrome. Contemp Soc Psychol 14:220–224
12. Driediger MV, Hall CR, McKay CD (2018) A qualitative examination of women's self-presentation and social physique anxiety during injury rehabilitation. Physiotherapy 104:355. 10.1016/j.physio.2017.05.003
13. Fredrickson BL, Roberts T-A (1997) Objectification theory. Psychol Women Q 21:173–206. 10.1111/j.1471-6402.1997.tb00108.x
14. Fries D, Gregory T, Whipple L, Victory K, Alan J, Featherstone C et al (2025) A qualitative study of gender-specific pathways to body dissatisfaction. Gend Issues 43:7. 10.1007/s12147-025-09390-8
15. Gattario KH, Frisén A (2019) From negative to positive body image: men's and women's journeys from early adolescence to emerging adulthood. Body Image 28:53–65. 10.1016/j.bodyim.2018.12.002
16. Hart EA, Leary MR, Rejeski WJ (1989) Tie measurement of social physique anxiety. J Sport Exerc Psychol 11:94–104. 10.1123/jsep.11.1.94
17. Haug E, Castillo I, Samdal O, Smith ORF (2023) Body-related concerns and participation in physical education among adolescent students: the mediating role of motivation. Front Psychol 14. 10.3389/fpsyg.2023.1266740
18. Hu C, Zhang W, Huang W (2025) The role of self-objectification and physical exercise in social appearance anxiety and restrained eating among female college students. Behav Sci 15. 10.3390/bs15101300
19. Huang G, Ren Y (2020) Linking technological functions of fitness mobile apps with continuance usage among chinese users: moderating role of exercise self-efficacy. Comput Hum Behav 103:151–160. 10.1016/j.chb.2019.09.013

20. Lennon SJ, Johnson KKP (2021) Men and muscularity research: a review. Fashion Text 8:20. 10.1186/s40691-021-00245-w
21. Liao J, Xia T, Xu X, Pan L (2023) The effect of appearance anxiety on social anxiety among college students: sequential mediating effects of self-efficacy and self-esteem. Behav Sci 13:692. 10.3390/bs13080692
22. Liu Z-H, Cai H, Bai W, Liu S, Liu H, Chen X et al (2022) Gender differences in body appreciation and its associations with psychiatric symptoms among chinese college students: a nationwide survey. Front Psychiatry 13. 10.3389/fpsyt.2022.771398
23. Mahon C, Hevey D (2021) Processing body image on social media: gender differences in adolescent boys' and girls' agency and active coping. *Front. Psychol.* 12. 10.3389/fpsyg.2021.626763
24. McAuley E (1992) The role of efficacy cognitions in the prediction of exercise behavior in middle-aged adults | journal of behavioral medicine | springer nature link. J Behav Med 15:65–88. 10.1007/BF00848378
25. Moya-Garófano A, Moya M (2019) Focusing on one's own appearance leads to body shame in women but not men: the mediating role of body surveillance and appearance-contingent self-worth. Body Image 29:58–64. 10.1016/j.bodyim.2019.02.008
26. Navas-León S, Tajadura-Jiménez A, Morales L, Borda-Mas M, Avargues-Navarro ML, Sánchez-Martín M (2025) Exploring the mediating role of motivational regulations in the relationship between body image and physical activity by sex: a structural equation modelling approach. BMC Psychol 13:1189. 10.1186/s40359-025-03476-4
27. Negrin L (2008) Appearance and identity. in Appearance and identity. Palgrave Macmillan US), New York, pp 9–32. doi: 10.1057/9780230617186_2
28. Ouyang Y, Wang K, Zhang T, Peng L, Song G, Luo J (2020) The influence of sports participation on body image, self-efficacy, and self-esteem in college students. Front Psychol 10:3039. 10.3389/fpsyg.2019.03039
29. Pan Y (2023) Analysis of the causes of appearance anxiety of contemporary college students and its countermeasures. J Med HEALTH Stud 4:45–53. 10.32996/jmhs.2023.4.4.6
30. Papapanou TK, Darviri C, Kanaka-Gantenbein C, Tigani X, Michou M, Vlachakis D et al (2023) Strong correlations between social appearance anxiety, use of social media, and feelings of loneliness in adolescents and young adults. Int J Environ Res Public Health 20. 10.3390/ijerph20054296
31. Peng B, Chen W, Wang H, Yu T (2025) From physical self-esteem to sports participation: the mediating role of exercise motivation and social support in adolescents. PLoS ONE 20:e0324588. 10.1371/journal.pone.0324588
32. Pomichter E, Cepeda-Benito A, Ahmadkaraji S, DePalma JP (2025) Exploring male body image: a scoping review of measurement approaches and mental health implications. Int J Environ Res Public Health 22. 10.3390/ijerph22060834
33. Putri BBK, Noer AH, Purba FD (2025) Psychological factors influencing appearance anxiety among adolescents: a systematic literature review. Psychol Res Behav Manag 18:487–503. 10.2147/PRBM.S501547
34. Resnick B, Jenkins LS (2000) Testing the reliability and validity of the self-efficacy for exercise scale. Nurs Res 49:154. 10.1097/00006199-200005000-00007
35. Sicilia Á, Alcaraz-Ibáñez M, Paterna A, Gallardo LO, Martín-Albo J (2023) Effects of pubertal timing and pubertal tempo on social physique anxiety, self-determined motivation, and exercise in early adolescent girls. J Adolesc Health 73:37–43. 10.1016/j.jadohealth.2023.01.025
36. Sobrino-Bazaga A, Rabito-Alcón MF (2018) Gender differences existing in the general population in relation to body dissatisfaction associated with the ideal of beauty: a systematic review. Estud Psicol 39:548–587. 10.1080/02109395.2018.1517860
37. Song SH, Zhu YQ (2019) The relationship between social media use and women's negative body image [in Chinese]. Contemporary Communication, pp 29–34
38. Szymanski DM, Moffitt LB, Carr ER (2011) Sexual objectification of women: advances to theory and research. Couns Psychol 39:6–38. 10.1177/0011000010378402
39. Vani MF, Pila E, Willson E, Sabiston CM (2020) Body-related embarrassment: the overlooked self-conscious emotion. Body Image 32:14–23. 10.1016/j.bodyim.2019.10.007
40. Xiao Y, Wu B, Deng Z, Liu M (2024) Can social appearance anxiety promote the online impulse buying of beauty products among young females? A moderated mediation model of sense of control and perceived coronavirus stress. Curr Psychol 43:18119–18132. 10.1007/s12144-024-05650-0
41. Yuan Y, Tu Y, Su Y, Jin L, Tian Y, Chang X et al (2025) The mediating effect of self-efficacy and physical activity with the moderating effect of social support on the relationship between negative body image and depression among chinese college students: a cross-sectional study | BMC public health | springer nature link. BMC Public Health 25:285. 10.1186/s12889-025-21350-1
42. Zhang G, Yue X, Ye Y, Peng MY-P (2021) Understanding the impact of the psychological cognitive process on student learning satisfaction: combination of the social cognitive career theory and SOR model. *Front. Psychol.* 12. 10.3389/fpsyg.2021.712323
43. Zhang, Y., Hao, J., Guo, K., Huang, Q., and Liu, L. (2026). Appearance anxiety and college students' exercise participation: a chain mediation model of negative body image and exercise self-efficacy. *Front. Psychol.* 17. doi: 10.3389/fpsyg.2026.1828308
44. Zhang Y, Li L (2021) The impact of sports participation on subjective well-being: evidence from sociological empirical research [in Chinese]. J Shenyang Sport Univ 40:92–102
45. Zhao YS, Ma QS, Li XY, Guo KL, Chao L (2023) The relationship between exercise motivation and exercise behavior in college students: the chain-mediated role of exercise climate and exercise self-efficacy. Front Psychol 14. 10.3389/fpsyg.2023.1130654

Figures

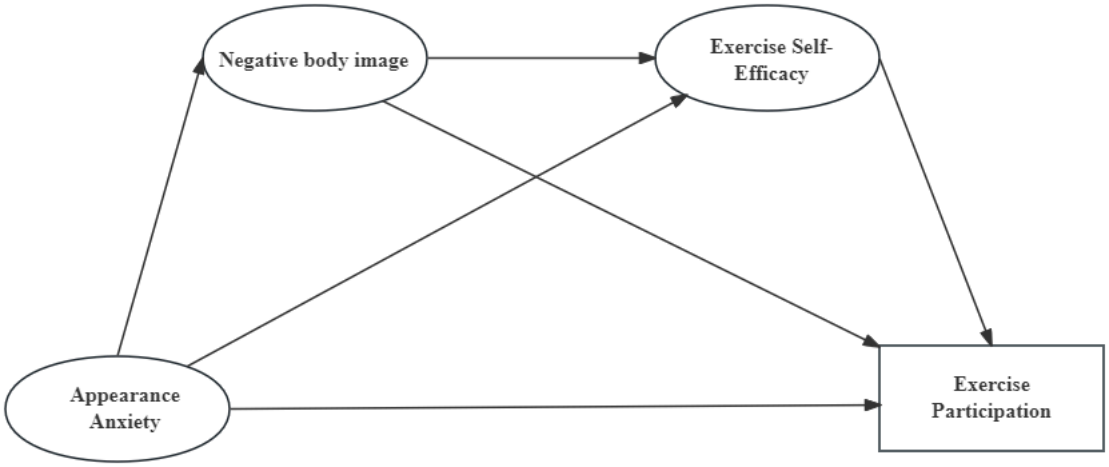


Figure 1

Baseline structural model and gender-group comparison framework

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- QuestionnaireandCodebookanonymous.docx.docx
- Anonymizedsurveydataset.xlsx