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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

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Abstract

Background Fitness to maintain an ideal body shape is becoming increasingly popular among college students. However, it also leads to many mental health issues. This study explores the pathways through which negative body image affects depression in college students. It also examines possible means of implementing depression interventions in college populations through the mediating roles of self-efficacy and physical activity, and the moderating role of social support.

Method The present study employed a convenience sampling method to collect data from 600 university students using the Body Image Scale, Self-Efficacy Scale, Physical Activity Scale, General Social Support Scale and Depression Self-Rating Scale. Data analysis and structural equation modeling were conducted using SPSS, M-plus and R software.

Result The result indicate that negative body image is positively correlated with depression. Self-efficacy and physical exercise play a chain mediating role between body image and depression. Additionally, social support moderates the effects of self-efficacy by predicting the pathway through which physical activity effects depression.

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Conclusion The study suggest that individuals with a negative body image are more prone to depression and that physical exercise can help alleviate their depressive symptoms. Self-efficacy is an important mediator, and social support moderates adherence to physical exercise. Therefore, attention should be paid to the mental health issues of college students with negative body images.

Keywords Body image, Depression, Physical activity, Self-efficacy, Social support

Background

Body image, referring to an individual's perception, thoughts, and feelings about their physical appearance, has become an increasingly critical issue in contemporary society, particularly among young adults. College students, navigating the dual pressures of academic achievement and social adaptation, are particularly susceptible to body image dissatisfaction. Recent surveys indicate that approximately 41.6% of individuals aged 15–25 are dissatisfied with their physical appearance, a dissatisfaction that can lead to emotional challenges such as anxiety, depression, and low self-esteem [1]. The proliferation of idealized body standards on social media platforms has intensified these concerns [2], especially during the COVID-19 pandemic, which restricted physical activities, altered eating habits, and heightened social isolation [3, 4]. These compounding factors highlight the urgent need to understand how body image concerns contribute to mental health issues like depression.

Body image dissatisfaction has been consistently linked to depressive symptoms in young adults. Theories such as Social Comparison Theory and Hopelessness Theory provide a framework for understanding this relationship [5]. Social Comparison Theory posits that individuals evaluate their appearance by comparing themselves to societal standards of beauty, often perpetuated by media and peer influences [6]. When individuals perceive a significant gap between their own appearance and these ideals, they may experience dissatisfaction, which can erode self-esteem and contribute to depressive symptoms. Hopelessness Theory adds that individuals with a negative cognitive style are more likely to interpret body image dissatisfaction as a global, stable, and unchangeable failure, further deepening feelings of despair and vulnerability to depression [7].

While the link between body image and depression is well-documented, the mechanisms mediating this relationship remain a critical area of exploration. Among these mechanisms, self-efficacy—a concept rooted in Bandura's Social Cognitive Theory—emerges as a pivotal factor. Self-efficacy refers to an individual's belief in their ability to successfully execute behaviors necessary to achieve desired outcomes [8, 9]. It influences how individuals interpret challenges, regulate emotions, and engage in coping behaviors. In the context of body image,

individuals with low self-efficacy may feel less capable of adopting behaviors such as physical activity that could improve their mental health [10, 11]. Conversely, higher self-efficacy is associated with greater resilience and engagement in health-promoting behaviors, which can mitigate depressive symptoms.

However, self-efficacy does not operate in isolation. Contemporary behavioral change frameworks, such as the Integrated Change Model (ICM), emphasize that behavior is shaped by a constellation of factors, including attitudes, perceived social influences, risk perceptions, and knowledge [12, 13]. For instance, an individual's motivation to engage in physical activity may depend not only on their confidence in their abilities but also on their perceptions of social support, their attitudes toward exercise, and their awareness of its health benefits [10]. Recognizing the interplay among these factors is essential for understanding the complex pathways linking body image to depression.

Physical activity, widely regarded as a cornerstone of mental and physical health, plays a dual role in this process. On the one hand, regular physical activity improves psychological well-being by releasing mood-enhancing neurochemicals such as endorphins, improving sleep quality, and reducing stress [9, 14]. On the other hand, it positively influences body image by enhancing physical aesthetics and boosting self-esteem. Yet, the relationship between physical activity and mental health is dynamic and influenced by individual-level factors such as self-efficacy and external influences like social support [11, 15]. For example, individuals with high self-efficacy are more likely to initiate and sustain physical activity, while those with low self-efficacy may struggle to overcome barriers to participation.

Social support, defined as the material, emotional, and informational assistance provided by one's social network, further moderates these relationships [16, 17]. According to the Buffering Hypothesis, social support reduces the adverse effects of stress by providing resources that enhance coping abilities [18, 19]. In the context of body image, social support may bolster self-efficacy, encourage adherence to physical activity, and provide emotional reinforcement, thereby mitigating depressive symptoms. Empirical evidence suggests that individuals with strong social support networks

are better equipped to navigate the challenges associated with body dissatisfaction, as they are more likely to engage in positive health behaviors and experience less psychological distress [20].

Building on these theoretical insights, this study proposes a chain mediation model to examine the pathways through which negative body image influences depression in college students. Specifically, it investigates how self-efficacy and physical activity mediate this relationship and how social support moderates these pathways. By situating self-efficacy within the broader behavioral change literature, this study addresses critical gaps in the understanding of how cognitive, behavioral, and social factors interact to influence mental health outcomes.

The contributions of this study are threefold. First, it integrates key elements of behavior change theories, including self-efficacy, physical activity, and social support, into a comprehensive framework for understanding the body image–depression relationship. Second, it situates self-efficacy within a broader context by acknowledging its interactions with other determinants such as attitudes and perceived social influences. Third, it highlights the moderating role of social support, offering practical insights for designing interventions that address body image concerns and promote mental health.

Based on these considerations, the following hypotheses are proposed:

- (1) Negative body image is positively correlated with depression.
- (2) Self-efficacy and physical activity act as chain mediators between negative body image and depression.
- (3) Social support plays a moderating role in the pathways of physical activity and depression, self-efficacy, and physical activity with the interaction of high support and self-efficacy having a stronger effect on depression.

Based on the three theoretical assumptions outlined above, this study constructs the theoretical hypothesis model illustrated in Fig. 1.

Methods

Participants

Simple random sampling was used to select 623 college students from three universities in Wenzhou City and Harbin City as a questionnaire survey in 2022, after deleting 23 invalid questionnaires due to incomplete or undifferentiated data, 600 valid questionnaires were recovered, yielding a valid response rate of 96.3%. All participants were aged 18–24 years old. The study included 320 males and 280 females. In terms of majors, 186 participants were in science and technology (31%), 201 in arts (33.5%), 160 in medical fields (26.7%), and 53 in art majors (8.8%). Of the participants, 320 were an only child (53.3%), and 280 had siblings (46.7%).

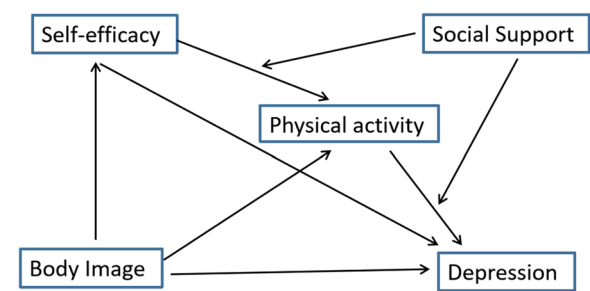


Fig. 1 Theoretical model diagram

Measures

2.2.1 Body image: The Body Image States Scale (BISS) was developed by Cash in 1977 [21], often used to measure body shape. The BISS consists of 26 items divided into five subscales: health evaluation, appearance evaluation, physical fitness evaluation, appearance concern, and physical fitness concern. The scale is scored on a 5-point scale, where higher scores indicate a more positive body image. The Cronbach's α for this scale in this study was 0.869.

General Self-Efficacy Scale (GSES)

The scale was developed by Schwarzer in 1995, with 20-item instrument scored on a 4-point scale, with scores of 1, 2, 3, and 4 corresponding to “completely incorrect,” “somewhat correct,” “mostly correct,” and “completely correct,” respectively. Higher scores indicate higher self-efficacy. The Cronbach's α for this study was 0.91.

Physical Activity Scale (PARS)

The scale was developed by the Japanese scholar Hashimoto in 2008 [22]. The PARS-3 measures subjects' physical activity using three indicators: intensity, time (duration of one exercise session), and frequency (number of exercise sessions in a month). The formula for calculating exercise volume is $\text{intensity} \times (\text{time} - 1) \times \text{frequency}$. The scale rates exercise volume as follows: ≤ 19 points indicate a small amount of exercise; 20–42 points, a medium amount; and ≥ 43 points, a large amount. The Cronbach's α for this scale was 0.82 in this study.

Social support scale

The Social Support Rating Scale (SSRS) was designed by Xiao Shuiyuan from in 1994. The Social Support Rating Scale (SSRS) measures the social support status of college students [23]. It consists of 10 items and includes three dimensions: objective support, subjective support, and utilization of support. Higher scores on each dimension indicate higher levels of social support received.

Some items in the scale were revised for college students according to the method of Wu Qinglan. and the Cronbach's α for the revised scale in this study was 0.88.

Self-Rating Depression Scale (SDS)

The SDS quantity was compiled by Zung et al. in 1965 [24]. This scale consists of 20 items. The total raw score is multiplied by 1.25, and the integer part is taken as the standardized total score. Classification criteria are as follows: an SDS score less than 50 indicates no depression, 50–59 indicates mild depression, 60–69 moderate depression, and 70 or more severe depression. The Cronbach's α for this scale in this study was 0.94.

Procedure

Data were primarily collected via online We-Chat Star questionnaires. Subjects were informed of the questionnaires' purpose and content during class sessions. Instructions for each item were explained in detail, and written consent was obtained from the subjects. The survey adhered to principles of anonymity, voluntariness, and confidentiality, allowing subjects to fill in the questionnaire by scanning a QR code on their cell phones. The survey content complied with the Helsinki Declaration and was approved by the Ethics Committee of [review for blind], with all subjects consenting to participate in the survey and the study.

The correlation analysis of each variable was conducted by SPSS, the Harman's single-factor test method and bias-corrected percentile Bootstrap method were conducted by R, and the mediating effects and moderating effects were conducted by M-plus. A p -value $p < 0.05$ was considered statistically significance.

Results

Common Method Variance Test (CMV)

Since the data were collected from the subjects' self-reports, there is a possibility of common method bias. Harman's single-factor test method was used to check the common method bias in the data. All items were loaded into an exploratory factor analysis to examine the unrotated factor structure. The results showed that the

variance explained by the first factor without rotation was 16.6%, which is less than the critical value of 40%. Therefore, the data in this study do not exhibit common method variance.

Descriptive Statistical Analysis

Correlation analysis of each variable indicated that negative body image and depression were positively correlated, while self-efficacy and physical activity were negatively correlated with depression. Table 1 displays the results of each correlation index.

Mediating effects

The chain-mediated effects of self-efficacy and physical activity between body image and depression were first tested, followed by a moderated mediation model using Mplus 7.0 to examine social support as a moderator of the two pathways: self-efficacy and physical activity, physical activity and depression. The mediation model demonstrated ideal fit indices with $\chi^2/df = 2.140$, CFI = 0.995, TLI = 0.984, SRMR = 0.017, RMSEA = 0.030.

Confidence intervals for the mediating and moderating effects were estimated by drawing 5000 samples using the bias-corrected percentile Bootstrap method. Statistically significant results were indicated when the confidence intervals did not contain zero. Table 2 and Table 3 display the results of the multiple mediation effects. Negative body image was a positive predictor of depression, as well as a positive predictor of self-efficacy and physical activity. Self-efficacy and physical activity were negatively predictive of depression. Furthermore, self-efficacy was a positive predictor of physical activity, suggesting that self-efficacy and physical activity act as chain mediators between body image and depression. The results of this study also indicate that although gender was included as a covariate, its direct influence on each pathway was not significant. This suggests that the relationship between body image, self-efficacy, physical exercise, and depression is consistent across genders. Regardless of whether participants were male or female, the indirect effects of

Table 1 Means, standard deviations, and correlations among key variables

	M \pm SD	Body image	Self-efficacy	Physical exercise	Depression	Social support
1. Body image	32.39 \pm 8.77	1				
2. Self-efficacy	26.15 \pm 7.15	-0.26**	1			
3. Physical exercise	29.99 \pm 3.13	-0.21**	0.45**	1		
4. Depression	43.84 \pm 8.11	0.31**	-0.31**	-0.48**	1	
5. Social support	35.65 \pm 7.69	-0.38**	0.33**	0.32**	-0.31**	1

Note: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. the same below

body image on depression through self-efficacy and physical exercise remained significant.

Moderating effects

We also examined the paths of social support moderating the relationship between self-efficacy and physical activity and moderating the relationship between physical activity and depression. We found that social support was a significant predictor of physical activity and depression. The interaction of social support and self-efficacy was a significant positive predictor of physical activity, and the interaction term of social support and physical

activity was a significant negative predictor of depression. This suggests that social support plays a moderating role between self-efficacy and physical activity and between physical activity and depression. Table 4 shows the results.

To understand the moderating role of social support better, we also differentiated subjects into high and low social support groups based on social support plus and minus one standard deviation and found that the mediating effect in the path of self-efficacy in predicting physical activity was significant in the high social support group, with a total indirect effect value of 0.267 ($p < 0.001$).

Table 2 Regression examining the mediating effect of self-efficacy and physical exercise

The regression equation		Overall fitting index			Significance of regression coefficient			
Outcome variable	Predictors	R	R ²	F	β	LLCI	ULI	t
Self-efficacy	Negative body image	0.25	0.06	40.33***	-0.25	-0.33	-0.18	-6.35***
	Sex				-0.06	-0.16	0.04	-1.49
Physical exercise	Self-efficacy	0.46	0.21	77.05***	0.42	0.35	0.50	11.01***
	Negative body image				-0.10	-0.18	-0.03	-2.74**
	Sex				-0.05	-0.15	0.07	-0.61
Depression	Physical exercise	0.53	0.28	74.65***	-0.40	-0.48	-0.32	-10.13***
	Self-efficacy				-0.08	-0.21	-0.1	-3.4**
	Negative body image				0.20	0.13	0.27	5.51***
	Sex				-0.04	-0.15	0.06	-0.72

Table 3 The bootstrap 95% CI for the mediating effect test and deviation correction

Effect	Paths	Std. Estimate	Boot std	Bootstrap 95% CI	Estimate
Direct effect	Negative body image → Depression	-0.202	0.037	[-0.27, -0.13]	65.80%
Indirect effect 1	Negative body image → Self-efficacy → Depression	-0.020	0.012	[-0.15, -0.01]	6.51%
Indirect effect 2	Negative body image → Physical exercise → Depression	-0.042	0.022	[-0.09, -0.01]	13.68%
Indirect effect 3	Negative body image → Self-efficacy → Physical exercise → Depression	-0.043	0.012	[-0.07, -0.02]	14.01%
Total Indirect effect	/	-0.105	0.025	[-0.16, -0.06]	34.20%
Total effect	/	-0.307	0.040	[-0.38, -0.23]	100%

Table 4 The moderating role analysis of social support

Regression equation		Overall fitting index			Significance of regression coefficient			
Outcome variable	Predictors	R	R ²	F	β	LLCI	ULCI	t
Physical exercise	Self-efficacy	0.49	0.24	61.65***	0.38	0.30	0.45	9.86***
	Social support				0.18	0.10	0.26	4.66***
	Self-efficacy × social support				0.29	0.02	0.14	2.60**
depression	Self-efficacy	0.51	0.27	52.13***	-0.11	-0.21	-0.07	-2.48**
	Physical exercise				-0.38	-0.47	-0.30	-9.35***
	Social support				-0.16	-0.23	-0.08	-4.03***
	Physical exercise × Social support				-0.1	-0.10	-0.01	-2.68**

The mediation effect was as significant in the low social support group, with a total indirect effect value of 0.12 ($p < 0.05$), and the difference in the amount of mediation effect between the two groups was significant ($p < 0.001$). Similarly, in the pathway of physical activity predicting depression, the mediation effect was significant in the high social support group, with a total indirect effect value of 0.233 ($p < 0.001$), and it was just as significant in the low social support group, with a total indirect effect value of 0.15 ($p < 0.05$). The difference in the magnitude of the mediation effect between the two groups was significant ($p < 0.001$). Figure 2 shows the corresponding simple slope plot. For the low social support group, self-efficacy was a significant positive predictor of physical activity ($b_{\text{simple}} = 0.18$, $t = 5.34$, $p < 0.05$) and physical activity was a significant negative predictor of depression ($b_{\text{simple}} = 0.20$, $t = 6.19$, $p < 0.05$), and for the high social support group, self-efficacy was a stronger positive predictor of physical activity ($b_{\text{simple}} = 0.29$, $t = 7.04$, $p < 0.05$) and physical activity was a stronger predictor of depression ($b_{\text{simple}} = 0.34$, $t = 9.76$, $p < 0.05$).

Discussion

In this study, we explored the relationship between body image dissatisfaction and depression among college students, examining how self-efficacy and physical activity mediate this relationship, and the moderating role of social support. Our findings confirm that (1) negative body image is positively correlated with depression, (2) self-efficacy and physical activity mediate this relationship, and (3) social support moderates the pathways between self-efficacy and physical activity, as well as between physical activity and depression. The results not only contribute to our understanding of the mechanisms linking body image to depression but also offer insights into the potential intervention strategies for alleviating depressive symptoms in college students with body image concerns.

Body image and depression

Our study revealed a significant positive correlation and predictive relationship between negative body image and depression, aligning with prior research indicating that poorer body image correlates with higher levels of depression and increased susceptibility to negative emotions [25, 26]. Social Comparison Theory posits that individuals evaluate their own appearance by comparing themselves to others, particularly those who embody societal ideals of beauty. In the context of our study, college students may compare their body image to the idealized standards often portrayed on social media or in popular culture. When students perceive a discrepancy between their own body and these ideals, they may experience body dissatisfaction, which contributes to negative emotional outcomes like depression. This aligns with our findings, which show a positive correlation between negative body image and depression. Similarly, Hopelessness Theory suggests that individuals with a negative cognitive style are more likely to interpret undesirable events as personal failures that are global, stable, and unchangeable [27]. In the case of body image dissatisfaction, students may view their inability to meet certain body ideals as a reflection of their worth, which leads to feelings of hopelessness. This sense of hopelessness is a significant predictor of depression, as our study indicates.

By integrating these theories, we provide a more comprehensive understanding of how negative body image can lead to depressive symptoms, further supporting the chain-mediation model proposed in our study. Notably, a study reported significant disparities in body image perceptions among males and females with normal BMI [28], which may contribute to the negative emotions experienced during physical changes in puberty. These findings emphasize that dissatisfaction with body image can trigger negative emotions leading to depression [29, 30].

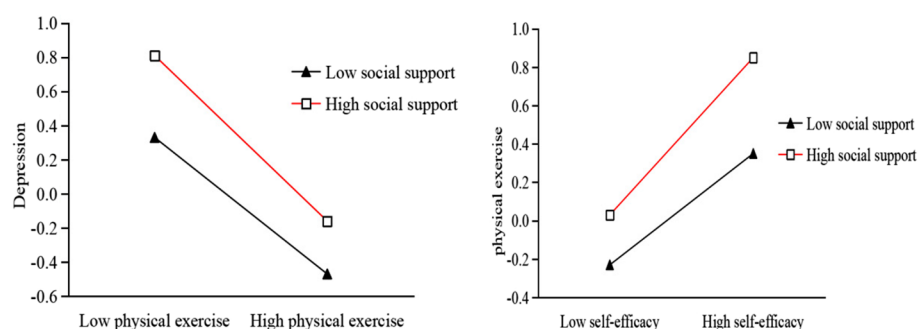


Fig. 2 Depression as a function of physical and social support (left). Physical exercise as a function of self-efficacy and social support (right)

The Mediating Role of Self-Efficacy

Self-efficacy emerged as a critical mediator in the pathway from body image dissatisfaction to depression, reinforcing Bandura's concept of self-efficacy as a determinant of behavior and emotional regulation [9, 31]. Self-efficacy influences how individuals perceive their ability to cope with stressors, engage in behaviors that improve health, and maintain positive emotions. Our study found that individuals with negative body image tended to have lower self-efficacy, which subsequently reduced their likelihood of engaging in physical activity—a key factor in preventing and alleviating depressive symptoms. This finding aligns with previous studies showing that individuals with high self-efficacy are more likely to engage in behaviors that enhance their physical and mental well-being [32].

However, the reliance on a generalized self-efficacy scale in this study has some limitations. Self-efficacy is typically context-specific, and its effects can vary depending on the specific behavior in question. For example, self-efficacy related to physical activity may differ from self-efficacy regarding other aspects of well-being, such as academic achievement or social engagement. Future research should consider using domain-specific self-efficacy measures to better capture the nuanced role of self-efficacy in different behavioral domains. Moreover, integrating self-efficacy with other cognitive factors, such as motivation and goal-setting, could enhance our understanding of how self-efficacy influences body image and mental health.

The mediating role of physical activity

In our study, physical activity also played a significant mediating role between body image dissatisfaction and depression. This finding aligns with existing research that has shown that physical activity not only improves physical health but also has profound psychological benefits, including mood enhancement, stress reduction, and improved self-esteem [33, 34]. College students who maintain regular physical activity are likely to experience greater satisfaction with their body image, which in turn contributes to better mental health. Regular exercise has been shown to release neurochemicals such as endorphins, which promote a sense of well-being and reduce feelings of depression [35, 36].

However, the relationship between physical activity and depression is complex and influenced by several factors. Attitudes towards exercise, social norms, and external support systems play important roles in determining whether individuals with negative body image are likely to engage in physical activity. For instance, individuals with low self-efficacy or negative perceptions of their ability to exercise may be less motivated to initiate or

maintain a regular exercise routine. Our findings suggest that interventions targeting body image improvement should include components that boost self-efficacy and promote positive attitudes towards physical activity.

The Moderating Role of Social Support

The moderating role of social support was another key finding of this study. Social support not only enhances self-efficacy but also encourages adherence to physical activity and buffers against the negative effects of stress. Our results suggest that social support strengthens the relationship between self-efficacy and physical activity, as well as between physical activity and depression. This aligns with the Buffering Hypothesis, which posits that social support mitigates the adverse effects of stress by providing resources that improve coping skills [37–39]. Our findings suggest that individuals with higher levels of social support are more likely to maintain self-efficacy and engage in physical activity, which, in turn, reduces their risk of depression.

This finding has important implications for intervention design. Interventions that aim to alleviate depression among college students with body image concerns should not only focus on individual-level factors such as self-efficacy and physical activity but also incorporate strategies to enhance social support. Peer support groups, family involvement, and counseling services can provide the necessary emotional and informational resources to help individuals navigate body image concerns and engage in behaviors that promote mental health.

Integrating broader theoretical frameworks

While this study contributes to the literature by highlighting the roles of self-efficacy, physical activity, and social support in the body image-depression relationship, it is important to recognize that these factors do not operate in isolation. Behavior change models such as the I-Change Model suggest that other determinants, including attitudes, knowledge, and perceived social influences, also play critical roles in shaping behavior [40, 41]. The I-Change Model emphasizes that behavior change is a complex process involving cognitive (e.g., self-efficacy), emotional (e.g., attitudes towards physical activity), and social (e.g., support from peers and family) factors. These elements align with the findings of our study, which show that individuals with a negative body image often have lower self-efficacy, leading to reduced engagement in physical activity—behavioral change that is facilitated by supportive social environments.

For instance, our study found that social support moderates the relationship between self-efficacy, physical activity, and depression. This aligns with the I-Change Model's focus on social support as an essential

component of behavior change, where social networks buffer against negative emotional outcomes and enhance the likelihood of engaging in health-promoting behaviors. The I-Change Model's framework suggests that interventions targeting both cognitive and social factors are more effective than those targeting behavior alone, which reinforces the need for holistic approaches in addressing body image dissatisfaction and depression.

In conclusion, our study demonstrates the interplay between negative body image, self-efficacy, physical activity, and social support in predicting depression among college students. By embedding these findings in the context of the I-Change Model, we offer a more comprehensive understanding of the relationships between these variables. The model highlights the importance of addressing both cognitive (self-efficacy) and behavioral (physical activity) factors in mitigating the negative emotional outcomes associated with body dissatisfaction. Specifically, individuals with a negative body image are more likely to have lower self-efficacy, which in turn reduces their motivation to engage in physical activity—a known protective factor against depression. The addition of social support as a moderator emphasizes the importance of social networks in maintaining self-efficacy and promoting engagement in physical activity, thereby buffering against depression.

These insights suggest that health interventions should focus not only on promoting positive body image but also on enhancing self-efficacy, encouraging regular physical activity, and fostering supportive social networks. By integrating these components, interventions can more effectively address the complex relationship between body image and mental health. Future research should further explore the integration of the I-Change Model in intervention design to improve outcomes for college students with body image concerns.

Limitations and prospects

This study has some limitations. First, regarding data collection, we relied on self-assessments in the questionnaire. Although the data passed the common method bias test, the absence of other forms of assessment could affect the survey's objectivity. Future studies should incorporate data from multiple sources, such as parents, peers, and teachers, to enhance objectivity. Second, One significant limitation of our study is its cross-sectional design, which prevents us from making causal inferences between negative body image and depression. While we found significant associations, the temporal sequence of these variables cannot be determined in this type of study. As such, it remains unclear whether negative body image leads to depression or if depression exacerbates negative body image perceptions. Future research

utilizing longitudinal designs would be essential to investigate the causal relationships more definitively [38, 42]. Moreover, experimental designs or interventions could help further clarify the directionality of these relationships. Third, This study's sample was drawn from college students in specific regions of China (Wenzhou and Harbin), and thus, the findings may not be representative of the wider population or applicable to different demographic groups [43, 44]. The cultural and regional characteristics of these participants could influence the relationship between body image and depression, potentially limiting the generalizability of our results to other populations.

To address this, future research should aim to include a more diverse sample in terms of geographic regions, academic disciplines, and socioeconomic backgrounds. This will help in determining whether the observed associations hold true across various groups and cultural contexts. Additionally, expanding research to different age groups and non-college populations could provide a more comprehensive understanding of the relationship between body image and depression. At last, While the Body Image States Scale (BISS) and General Self-Efficacy Scale (GSES) are well-validated measures, their application in different cultural settings may present limitations. The BISS primarily captures short-term emotional responses to body image, which may not fully represent long-term body dissatisfaction, particularly in non-Western populations like the Chinese college students in this study. Similarly, the GSES, though widely used, may not account for cultural nuances affecting self-efficacy in relation to body image and physical activity. Future research should consider validating or adapting these scales for broader cultural applicability. A key limitation of this study is its cross-sectional design, which prevents us from observing how body image and depression evolve over time. While our findings highlight significant associations between these variables, longitudinal studies are necessary to determine the long-term effects of body image concerns on mental health. Future research should adopt a longitudinal approach to better understand the temporal sequence of these relationships and explore the potential causal pathways between negative body image, self-efficacy, physical activity, and depression.

Conclusion

This study established a moderated mediation model to examine the influencing factors and mechanisms of depression in college students. The research analysis result showed that:

(1) College students' dissatisfaction with their physical appearance may induce depression. (2) Physical activity can change the association between body image

and depression, with self-efficacy being an important mediator. (3) Social support can modulate adherence to exercise, thus providing an intervention for depression.

These findings suggest that attempting to adjust individual self-efficacy and physical activity to alleviate depression may provide new perspectives and recommendations for clinical intervention in mental health, which may yield the greatest benefits by making physical activity regulation strategies more accessible to patients.

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Authors' contributions

Ye Yuan and Yuqi Su: Conceptualization, Methodology, Software, Data collection, Data analysis, Writing-Original Draft. Ke Yang and Yanling Tu: Data collection, Conceptualization. Leijin and Yu Tian: Conceptualization and English Translation. Xuesong Chang and Junyi Zheng supervised the whole research process and revised the draft. Daili wu and Haiyun Xu: Designed the research, revised the manuscript and fund the research. All authors have approved the final version of the submission.

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Data availability

Data will be available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate

In accordance with the Helsinki Declaration, the study was conducted and revised under the approval of the ethics committees of Wenzhou Medical University. Informed Consent was obtained from all subjects. The participants were required to follow instructions, and the data recorded were alphanumerically coded to ensure anonymity following the law on the protection of personal data.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.²⁴

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