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# Physical exercise and college students' mental health: Chain mediating effects of social–emotional competency and peer relationships

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Physical exercise plays an important role in promoting college students' mental health, but the mechanism of the effect of physical exercise on mental health is still under investigation. We conducted a survey with 1,168 Chinese college students using stratified cluster random sampling. Physical exercise, social–emotional competency, peer relationships, and mental health were assessed by using standard scales. Physical exercise was found to be positively correlated with mental health. Social–emotional competency and peer relationships had both independent and chain mediating effects on the link between physical exercise and mental health. These results reveal the mechanism of the relationship between physical exercise and mental health, and provide a preliminary basis for studying the causal relationship between them. Our findings also provide practical insights for intervention in and promotion of college students' mental health.

**Keywords**
physical exercise, mental health, social–emotional competency, peer relationships, college students

## Article Highlights

- Social–emotional competency was found to play a mediating role in the relationship between physical exercise and the mental health of college students.
- Peer relationships played a mediating role between physical exercise and mental health.
- Social–emotional competency and peer relationships had a chain mediating effect between physical exercise and mental health.

According to the World Health Organization (2005), mental health is a fundamental component of overall health. The mental aspect of health is particularly crucial for college students, as it significantly impacts their academic performance and life quality. College students face challenges and pressures related to academic studies, career prospects, emotional well-being, and social interactions (Zhong et al., 2021), making them susceptible in varying degrees to mental health problems. The *2022 China College Student Mental Health Survey Report* (Institute of Psychology, Chinese Academy of Sciences, 2022) highlighted this concern: 27% of students in China frequently experience problems with depression and anxiety, 66% encounter them occasionally, and a mere 2% report no such issues. Consequently, the mental health status of college students is a growing concern, drawing attention from families, educational institutions, and society at large (Auerbach et al., 2018). Therefore, understanding the factors and mechanisms influencing their mental health and implementing timely and effective interventions to prevent problems is vital for the well-being of college students.

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*Physical exercise*, defined as physical activity performed with a certain intensity, frequency, and duration, offers benefits beyond enhancing physical fitness; it also has a positive impact on mental health (Schuch & Vancampfort, 2021). Chekroud et al. (2018) observed a significant negative correlation between physical exercise and poor mental health in a large-scale study. Similarly, Grasdalsmoen et al. (2020) identified a negative association between physical exercise and various mental health issues, noting that women with low levels of physical activity had near threefold increased odds of scoring high on both psychological distress and self-reported depression, compared to women who exercised almost every day. Even stronger effect sizes were observed for men. Deslandes et al. (2009) further demonstrated that physical exercise reduced the harmful effects of stressors affecting mental health when performed at moderate intensities. However, the specific effects of physical exercise on mental health and the underlying mechanisms remain somewhat elusive. Consequently, in this study we explored the relationship between physical exercise and mental health, focusing on the mediating factors that influence this connection.

*Social–emotional competency* integrates aspects of both emotional and social competencies (Denham et al., 2009) and encompasses the ability to acquire and apply knowledge effectively, understand and manage emotions, set and achieve positive goals, and establish and maintain healthy relationships with peers (Y. Wang et al., 2019). Goh et al. (2022) indicated that physical exercise has a significant positive influence on social–emotional competency. Similarly, J. Liu et al. (2022) found a positive correlation between physical exercise and social–emotional competency. Yin et al. (2015) revealed that college students who engaged in regular physical exercise exhibited stronger social–emotional competency than their peers did. Furthermore, social–emotional competency is intricately linked to mental health. It is not only a critical component of competitive skills for future talent but also a fundamental factor in mitigating various psychological issues that can impair mental health (Saarni, 1999). Y. Wang et al. (2019) demonstrated that social–emotional competency positively influences interpersonal relationships, including peer and teacher–student interactions, which is one of the important factors to improve mental health. In summary, there appears to be a close relationship between physical exercise and social–emotional competency, which may, in turn, impact mental health. Therefore, in this study we examined the potential mediating role of social–emotional competency in the relationship between physical exercise and the mental health of Chinese college students.

*Peer relationships*, as defined by Xu et al. (2022), are interpersonal connections that develop through interactions among individuals of similar psychological maturity. Research has indicated that engaging in physical exercise can significantly enhance these relationships by expanding the scope of social interactions and increasing the number of friendships (Eime et al., 2013; Swanson et al., 2019). Additionally, it has been shown that physical exercise elevates levels of extraversion, agreeableness, and conscientiousness, thereby further improving individuals' peer relationships (Konu et al., 2002; Lehto et al., 2012). The link between peer relationships and mental health is well-documented. In an integrative review, Roach (2018) highlighted the positive impact of peer support on mental health. Strong peer relationships can bolster college students' self-confidence and self-esteem, enhance their sense of self-worth, alleviate negative emotions, and significantly contribute to their mental health (J. Wang et al., 2010). Feng and Zhang (2022) also observed that peer relationships positively predicted college students' mental health. Therefore, in this study we explored the potential mediating role of peer relationships in the relationship between physical exercise and the mental health of Chinese college students.

Huang et al. (2021) demonstrated that social–emotional competency positively influenced peer relationships. Strong social–emotional competency enables individuals to utilize effective interpersonal skills in managing interactions with their peers, thereby fostering the development of positive peer relationships (Goleman, 1995). College students who exhibit strong social–emotional competency tend to navigate interpersonal dynamics more adeptly than others do, and are often more readily accepted and welcomed by their peers (Chu et al., 2021). This, in turn, facilitates the establishment of healthier peer connections. Consequently, the stronger a college student's social-emotional competency, the more robust their peer relationships are likely to be. Given these insights, in this study we investigated the potential chain mediating role of social–emotional competency and peer relationships in the link between physical exercise and the mental health of Chinese college students.

# Method

## Participants and Procedure

We used stratified cluster random sampling to conduct a survey with students at Zhaoqing University, China. We distributed 1,328 survey forms; after discarding invalid surveys, such as those with regular answers, missing data, and reverse answers, we retained 1,168 valid forms for analysis, for an effective recovery rate of 95.70%. The students ranged in age between 17 and 25 years ($M$ = 19.51, $SD$ = 1.40). There were 304 freshmen, 291 sophomores, 289 juniors, and 284 seniors, accounting for 26.03%, 24.91%, 24.74%, and 24.31% of the group, respectively. There were 578 (49.49%) men and 590 women (50.51%).

In accordance with the Declaration of Helsinki, this study design passed the ethical review of the Human Research Ethics Committee of Zhaoqing University (2023-00312-01). All students participated voluntarily and were informed of the purpose of the research and the answer method, and instructed to respond truthfully, pay attention to distinguishing the positive and negative questions, and not leave incomplete answers. They each signed an informed consent form. Data confidentiality and anonymity of responding were emphasized.

## Measures

### *Physical Exercise*

We used the Physical Exercise Questionnaire compiled by Chen et al. (2006) and revised by Wu (2016) to investigate students' participation in physical exercise. The scale includes two dimensions: physical exercise commitment (e.g., "It was difficult for me to quit physical exercise") and physical exercise persistence (e.g., "I'd better stick to physical exercise"). Each dimension has four items. A 5-point Likert scale (1 = *strongly disagree*, 5 = *strongly agree*) is adopted for the scale, and total scores range between 8 and 40. The higher the score, the greater the amount of physical exercise. The scale has good reliability and validity among Chinese college students (Jiang et al., 2018). In this study Cronbach's alpha was .90.

### *Social–Emotional Competency*

Social–emotional competency was measured with the Chinese version (Zhu, 2016) of the Delaware Social–Emotional Competency Scale (Mantz et al., 2018). To facilitate the successful administration and completion of the test in most schools, the items for the self-awareness dimension were discarded in the Chinese version, leaving 12 items allocated evenly among each of four dimensions: social awareness (e.g., "I think about other people's feelings"), self-management (e.g., "I am in control of my actions"), peer relationships (e.g., "I get along well with others"), and responsible decision making (e.g., "I am good at distinguishing right from wrong"). Items are rated on a 4-point Likert scale ranging from 1 = *not like me at all* to 4 = *very like me.* One item, "I blame others when I am in trouble," in the dimension of responsible decision making is reverse scored. Total scores range between 12 and 48. The higher the score, the greater the respondent's social–emotional competency. The scale has good reliability and validity among Chinese college students (Chu et al., 2021). In this study Cronbach's alpha was .88.

### *Peer Relationships*

Peer relationships were measured with the Peer Relationships Scale compiled by Asher and Wheeler (1985) and revised by Y. L. Zhang (2008). The scale has 16 items divided across three dimensions: welcome (five items, e.g., "I make new friends easily at school"), exclusion (five items, e.g., "I get along well with other students"), and loneliness (six items, e.g., "I can't find anyone to talk to"). Respondents rate the items on a 4-point Likert scale (1 = *totally inconsistent for me*, 4 = *full compliance for me*). There are 10 reverse-scored items: one from the dimension of welcome ("I don't make friends easily"), four from the dimension of exclusion (e.g., "I don't have any friends"), and five from the dimension of loneliness (e.g., "I feel lonely"). Total scores are calculated; the higher the score, the better the peer relationships. The scale has good reliability and validity among Chinese college students (C. Ma et al., 2022). In this study Cronbach's alpha was .88.

### *Mental Health*

Mental health was measured with the Chinese version (Cheng et al., 1990) of the 12-item General Health Questionnaire compiled by Goldberg (1972). The scale has two dimensions: six positive items (e.g., "I feel like a useful person in life" and "I can concentrate when doing things"), and six negative items (e.g., "I don't think I can overcome the difficulty" and "I always feel stressed"). Total scores range between 0 and 36. The higher the score, the better the respondent's mental health. The scale has good reliability and validity among Chinese college students (Tang et al., 2021). In this study Cronbach's alpha was .81.

## Data Analysis

We used SPSS 26.0 to perform a descriptive statistical analysis and Pearson correlation analysis. We used Model 6 of the SPSS PROCESS macro (Hayes, 2018) to examine the mediating role of social–emotional competency and peer relationships.

# Results

## Common Method Deviation Test

Common method bias is generally assessed with Harman's single-factor test. The first factor in this study accounted for only 20.61% of the variance, which is less than the critical value of 40%. Therefore, there was no serious common method deviation in the data of this study.

## Descriptive Statistics and Correlation Analysis

As shown in Table 1, physical exercise was positively correlated with social–emotional competency, peer relationships, and mental health. Further, social–emotional competency was positively correlated with peer relationships. Finally, social–emotional competency and peer relationships were both positively correlated with mental health.

Table 1. *Means, Standard Deviations, and Correlations Among Variables*

| Variable | *M* | *SD* | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|---|
| 1. Physical exercise | 27.62 | 7.24 | 1 | | | |
| 2. Social–emotional competency | 34.79 | 7.51 | .332** | 1 | | |
| 3. Peer relationships | 40.08 | 7.93 | .238** | .325** | 1 | |
| 4. Mental health | 30.38 | 6.08 | .295** | .375** | .329** | 1 |

*Note.* $N = 1{,}168$.
** $p < .01$ (two-tailed).

We tested the chain mediation model by following the suggestions of Wen and Ye (2014). The results are shown in Table 2. First, the 95% confidence interval of the direct effect value of physical exercise on mental health did not contain zero, indicating a significant effect. Second, after incorporating social–emotional competency into the regression equation, it acted as a mediator between physical exercise and mental health. Third, after incorporating peer relationships into the regression equation, it played a partial mediating role between physical exercise and mental health. Last, after integrating social–emotional competency and peer relationships into the regression equation, both variables mediated the link between physical exercise and mental health. In addition, Table 2 shows that the 95% confidence intervals of the three indirect effects did not contain zero, indicating that all effects were significant. These results

suggest that physical exercise had a positive effect on mental health not only through the independent mediating effects of social–emotional competency and of peer relationships but also through the chain mediating effect of social–emotional competency and peer relationships. The independent mediating effect of social–emotional competency accounted for the highest ratio of the total indirect effect. The mediating effect of social–emotional competency and peer relationships between physical exercise and mental health is shown in Figure 1.

Table 2. *Mediating Effect of Social–Emotional Competency and Peer Relationships*

| | | Effect | Boot *SE* | 95% CI | | Ratio of indirect to total effect |
|---|---|---|---|---|---|---|
| | | | | *LL* | *UL* | |
| Total effect | | .248 | 0.029 | 0.190 | 0.303 | |
| Direct effect | | .135 | 0.028 | 0.079 | 0.188 | 54.44% |
| Indirect effect | Total indirect effect | .113 | 0.016 | 0.082 | 0.145 | 45.36% |
| | Physical exercise → Social–emotional competency → Mental health | .071 | 0.012 | 0.048 | 0.096 | 28.59% |
| | Physical exercise → Peer relationships → Mental health | .026 | 0.008 | 0.011 | 0.042 | 10.32% |
| | Physical exercise → Social–emotional competency → Peer relationships → Mental health | .016 | 0.004 | 0.010 | 0.024 | 6.45% |

*Note.* CI = confidence interval; *LL* = lower limit; *UL* = upper limit.

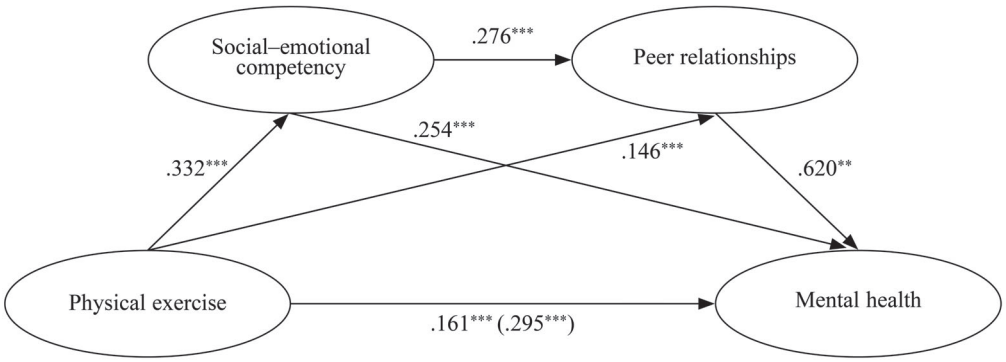


Figure 1. *Model of Chain Mediation of Social–Emotional Competency and Peer Relationships Between Physical Exercise and Mental Health*
*** $p < .001$.

## Discussion

### Physical Exercise and Mental Health

In this study we found a significant positive correlation between physical exercise and the mental health of Chinese college students, which aligns with prior research findings (S. H. Zhang et al., 2024). Pan (2015) observed a close and strong connection between physical exercise habits and mental health in college students. Lin (2019) expanded on this by discovering that the intensity, frequency, and duration of physical exercise each influenced the mental health of college students; specifically, exercise of high-to-medium intensity lasting for more than 60 minutes and engaged in more than three times a week, significantly enhanced college students' mental health. In a meta-analysis X. Ma and Chen (2020) further identified that a short cycle of exercise of up to 16 weeks was better than a long cycle of more than 16 weeks, and the intervention effect of exercise frequency of 1–2 times per week was less than the effect of exercising

3–4 times per week. Exercise of moderate intensity that lasted between 40 and 50 minutes per session, conducted over a period of less than 16 weeks, and with a frequency of 3–4 times per week, yielded the most beneficial effects on the mental health of college students. In summary, engaging in a certain amount of physical exercise can substantially improve the mental health of college students. It is therefore advisable to encourage college students to engage in regular physical exercise as a means to promote their mental health.

## Mediating Effect of Social–Emotional Competence

In this study we found that social–emotional competency served as a mediator between college students' physical exercise and their mental health. This finding aligns with prior research indicating there were significant positive correlations between physical exercise and social–emotional competency (Jiang et al., 2018; J. Liu et al., 2022), and between social–emotional competency and mental health (Godara et al., 2021).

On one hand, we found a positive association between physical exercise and social–emotional competency. J. Liu et al. (2022) found that physical exercise positively influenced emotional regulation, with regular exercising yielding even more substantial benefits. The results of their research also suggested that an exercise session lasting at least 30 minutes positively affected emotional regulation, with the intensity of the exercise being adaptable to individual physical conditions (J. Liu et al., 2022). For college students, regular physical exercise not only increases interpersonal interactions but also enhances perceived social support during these interactions, consequently improving their social–emotional competency (Chu et al., 2021).

On the other hand, in line with Godara et al. (2021), we found that social–emotional competency was closely linked to mental well-being. Enhancing social–emotional competency can lead to significant improvements in students' academic performance, the establishment of positive peer relationships, enhanced emotional health, reduced problematic behaviors, and the promotion of moral development (Durlak et al., 2011). Additionally, those college students who have greater social-emotional competency tend to possess stronger interpersonal and communication skills, exhibit greater social adaptability (Y. Liu et al., 2023), and experience higher levels of life satisfaction (Chu et al., 2021), which all contribute to better mental health.

## Mediating Effect of Peer Relationships

We also confirmed that peer relationships played a mediating role between college students' physical exercise and their mental health. This result aligns with previous findings showing that physical exercise had significant positive correlations with peer relationships (C. Ma et al., 2022) and with mental health (Feng & Zhang, 2022).

First, we found a positive correlation between physical exercise and peer relationships. Engaging in physical exercise provides college students with opportunities to broaden their interpersonal communication, expand their social networks, and deepen their acceptance and recognition within social circles, thereby improving their peer relationships (C. Ma et al., 2022). When college students engage in physical exercise alongside their peers, the support and collaboration inherent in such activities foster a harmonious coexistence in the group. The emotional and social support peers provide during these activities fulfills emotional and social needs, promotes a sense of belonging, and facilitates the experience of positive and pleasant emotions (C. Ma et al., 2022).

Second, we found that peer relationships were positively correlated with mental health. According to the social development model (Catalano & Hawkins, 1996) and Maslow's hierarchy of needs (Gambrel & Cianci, 2003), college students who experience peer acceptance and a sense of connection often exhibit positive social behaviors and are more likely than are those who do not have this acceptance and connection to perceive their interactions with peers as pleasurable and happy. These positive experiences can encourage students to repeatedly engage in physical exercise to further enhance their peer relationships and gain more happiness, thereby promoting their mental health (Hawkins et al., 2001). Conversely, those who do not engage in regular exercise tend to have lower quality social support and are more prone to mental health issues (Hefner & Eisenberg, 2009). Therefore, it is important to motivate and encourage college students to actively participate in physical exercise, not only to strengthen their peer relationships but also to improve their overall mental health.

### Chain Mediating Effect of Social–Emotional Competency and Peer Relationships

Our results revealed that a high level of social–emotional competency was an important factor for the improvement of peer relationships. This is consistent with previous research (Huang et al., 2021). College students with strong social–emotional competency possess stronger interpersonal and communication abilities, enabling them to engage more effectively with peers and establish stable, positive relationships. Furthermore, those who maintain good peer relationships tend to have better mental health (Feng & Zhang, 2022). We also found that social–emotional competency influenced the mental health of college students via their peer relationships. This effect may be attributed to the fact that students with robust social–emotional competency often have interpersonal and communication skills that are superior to the skills of those with less social–emotional competency, and these skills facilitate the formation of strong peer relationships. Once these positive peer relationships are established, college students receive more favorable responses from their peers when facing unfamiliar situations, making it easier for them to adapt to new environments and overcome challenges with the help of their peers, thus reducing psychological issues. Thus, physical exercise can impact the mental health of college students by enhancing both their social–emotional competency and their peer relationships.

In conclusion, in this study we revealed that engaging in physical exercise improved students' social–emotional competency and peer relationships, which then further promoted their mental health. College students who engage in a certain amount of regular physical exercise can improve their interpersonal skills, so their social–emotional competency is strengthened and their peer relationships are improved, which, in turn, is of great significance for promoting their mental health. Teachers, especially physical education teachers, should pay attention to encouraging college students to engage in a certain amount of regular physical exercise.

### Limitations and Directions for Future Research

First, because of spatial and temporal constraints, this study was conducted using a cross-sectional design. In future research, the incorporation of a longitudinal design or experimental interventions may be of benefit to deepen the insights gained. Second, we relied on self-reported data gathered through a survey. To enhance the robustness of findings in future studies, incorporating evaluations from others alongside self-assessments would be beneficial. Third, the participant selection was concentrated within one university. This approach aided in enhancing the internal validity of the study but potentially limited its external validity. Future researchers could include a more diverse sample, drawing participants from various regions and different types of universities to further validate and extend the findings of this study.

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Yanying Liu wrote and revised the manuscript. Qingkun Feng and Yao Tong collected and analyzed the data.

The data that support the findings of this study are available on request from the corresponding author.

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