

# The influence of physical exercise on College Students' negative emotions: the mediating and regulating role of psychological resilience

Guoqing Cui <sup>1\*</sup>, Lili Zhang<sup>2</sup>

## Abstract

This study investigates the detrimental effects of sports culture training on negative emotions in college students, focusing on the mediating and modifying role of mental toughness. According to the "Sports Culture Training Comment Scale," "Negative Emotion Scale," "Self-efficacy Evaluation scale," and "Psychological malleability scale," the hierarchical cluster convenient and quick sampling method was used to investigate 1500 college students, and spSS20.0 and AMOS20.0 were utilized to analyze the mediating effect and the moderating effect, respectively. Positively predicting and analyzing autonomy and stamina while adversely predicting and analyzing depression, anxiety, and stress. Independence and Physical Despair Predict and analyze anxiety, depression, and stress. Regarding the association between physical activity and negative emotions, the mediating effects of independence and psychological resilience contributed 26.78 percent and 31.33 percent, respectively, to the total benefits. Mental exercise's independence and adaptability are crucial in physical activity and unpleasant emotions. Training in sports culture increased college students' self-efficacy and mental toughness and effectively prevented and reduced negative feelings.

**Keywords:** Physical exercise; Negative emotion; Psychological resilience; college student

## Introduction

Most college students are between the ages of 19 and 23 and are in a crucial time of physical and mental growth. The research indicates that the worry and fear among college women are greater than that of men, as are their mental health issues. The emotional state is a significant indicator of an individual's mental health. Negative affect (NA) is a subjective sensation of depression and dissatisfaction that encompasses all negative emotional states, such as anxiety, depression, fear, and anger. Negative life situations (such as test failure, being misunderstood, etc.) may induce negative feelings and behaviors in college students, such as depression, anxiety, wrath, fear, and other negative emotions (Ginsburg et al., 2007). Some studies in the mental health field indicate that physical exercise as a method of control is more sensitive to the influence of individual mood; both short-term and long-term exercise can alleviate unpleasant emotional states resulting from psychological stress. In an experimental meta-analysis of the effects of stressors on mood, negative emotions also rose in response to stress.

Similarly, psychological flexibility may serve as a buffer between unfavorable life events and negative feelings. Individuals with a high level of psychological elasticity can utilize a variety of positive resources and coping strategies promptly to mitigate negative emotional experiences and improve their social adaptability. According to research Sedikides and Gregg (2008), college students utilize running and stepping exercises. The trial demonstrates that thirty minutes of aerobic

exercise reduces their negative sentiments. In a study on the effect of aerobic exercise on emotion (Washizu & Naito, 2015), it was discovered that negative emotion decreased between 6 and 20 minutes of exercise and 1 to 15 minutes after exercise when participants completed 30 minutes of self-regulated running or walking on a treadmill. Using the natural experiment approach (Wang et al., 2020), it was discovered that managing the intensity of physical exercise at a moderate level will lessen the psychological stress of college students. Based on the research mentioned above, this study is informed by scientific concepts; however, there are still some limitations in the research on the association between psychological stress, negative mood, and physical exercise: (1) From the standpoint of the environment, the majority of prior studies adopt the environmental atmosphere and laboratory study produced by researchers. However, there are few studies on how individuals change their daily environments. (2) Most studies employ the prescribed amount or method of physical activity, although in real life, most people exercise in their own way. There are still unanswered questions regarding whether or not exercise can alleviate stress and anxiety. (3) Numerous researchers employ experimental research and one-time measurements to evaluate individual stress and emotion (Table 1, Figure 1, Table 2, and Table 3); however, this type of research can only analyze cross-sectional data and cannot reflect how individual stress and emotion evolve. Daily psychological stress among college students has a longitudinal effect on the duration of negative

<sup>1</sup> Zhoukou Normal University, Zhoukou, Henan,466001, China  
Corresponding Author's Email: [zkcuiguqing@163.com](mailto:zkcuiguqing@163.com)

<sup>2</sup> Zhoukou vocational and Technical College, Zhoukou, Henan,466001, China

emotions. Medium-high MET moderates the connection between daily psychological stress and negative feelings among college students during the tracking procedure.

In conclusion, this study aims to investigate the impact of physical exercise on college students' negative emotions, as well as the role of self-efficacy and psychological resilience as mediators and regulators, to provide an empirical basis for physical exercise to improve college students' negative emotions. Based on the extensive research hypothesis, a model of regulated intermediaries is developed (see Figure 1). According to the "Sports Culture Training Comment Scale," "Negative Emotion Scale," "Self-efficacy Evaluation scale," and "Psychological malleability scale," the hierarchical cluster convenient and quick sampling method was used to investigate 1500 college students, and SPSS20.0 and AMOS20.0 were utilized to analyze the mediating effect and the moderating effect, respectively. Positively predicting and analyzing autonomy and

stamina while adversely predicting and analyzing depression, anxiety, and stress. Independence and Physical Despair Predict and analyze anxiety, depression, and stress.

Regarding the association between physical activity and negative emotions, the mediating effects of independence and psychological resilience contributed 26.78 percent and 31.33 percent, respectively, to the total benefits. Mental exercise's independence and adaptability are crucial in physical activity and unpleasant emotions. There are nevertheless variances in unpleasant feelings among college students who engage in identical physical activity, suggesting that some component governs the effect between the two. Given the high correlation between mental toughness and negative emotions in college students, it is reasonable to hypothesize that mental toughness (support) can significantly moderate the relationship between physical exercise and negative emotions in college students.

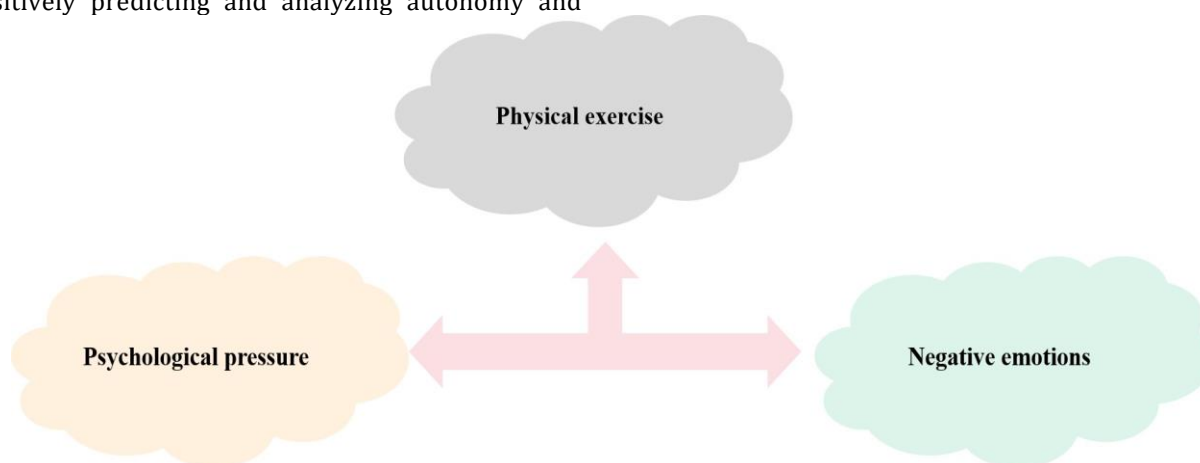


Figure 1 assumes a relational model

## Research objects and methods

### Research object

In May 2020, a questionnaire survey of first-year students through juniors from two universities in a province will be conducted using the hierarchical cluster method of easy sampling. The selection of 1592 undergraduates from 100 administrative classes per grade level. The questionnaire was administered twice, two weeks apart, to limit the influence of common method bias. After verification, 92 incorrect questionnaires were eliminated. This study's effective sample size was 1048 individuals, and the effective sample rate was 93.87 percent. 51.7 percent were male, and 48.3 percent were female; 54.1 percent were from metropolitan regions, and 45.9 percent were from rural areas; 47.2 percent were students of liberal arts, and 52.8 percent were science students, with a mean age of (20.12 ± 1.21). A questionnaire survey is one way to measure human behavior and psychology. It refers to the uniform, standardized design of questions in a questionnaire. In this questionnaire-based study, the

physical activity level, psychological stress, and negative emotional state of college students were evaluated.

### Research tools

#### (1) Physical exercise scale.

The physical activity appraisal scale is used for accurate and accurate measurement. The scale's key consists of three levels: exercise intensity, duration, and frequency of physical exercise. Likert5 scoring standard was selected, and the matching scores were 1-5 points, respectively. The score of sports exercise = the score of compressive strength × (time score - 1) × the score of times. The higher the score, the greater the amount of sports exercise. In this scientific study, the retest reliability of the scale was 0.82 (Kim & Lee, 2018; Kovalenko et al., 2020; Sears & Humiston, 2015).

#### (2) Negative emotion scale.

Depression, anxiety, and stress self-assessment scales (simplified Chinese) were used to measure accuracy. The schedule is divided into three dimensions: depression, anxiety, and stress, with seven questions

on each dimension. This scale uses the Likert4 scale and has a corresponding score of 0 to 3. The higher the good/good ratio, the higher the depression, anxiety, and stress level. In this study, the values of the internal consistency index for each scale ranged from 0.870 to 0.893.

### (3) Self-efficacy scale

It is accurately measured using a universal self-efficacy measure. The size is classified into 10 items. Excellent, good grades are standardized using the Likert4 scoring system and correspond to a score of 1 to 4. The higher the good performance, the higher the ability to be effective. According to this scientific study, the value of the internal compliance index of the scale was 0.892.

### (4) Psychological plasticity scale

An adolescent mental toughness scale was used. The scale has 5 dimensions and 21 items. The first three dimensions accurately measure human resource factors, while the last two measures measure support force factors. The overall goals include 5 overall dimensions, 6 psychological situation control dimensions, 4 positive thinking ability dimensions, 6 family application dimensions, and 6 social assistance dimensions. Likert4 was used in the scale, and the matching scores were 1-4 points, respectively. The higher the good rate, the better the plasticity of mental toughness. The internal consistency index values of each dimension in this scientific study ranged from 0.714 to 0.786.

### Statistical methods

Relevant independent variables were subjected to **Table 1**

Mean, standard deviation and correlation of variables

Variable	M	SD	1	2	3	4	5	6	7	8	9
Amount of Physical exercise	15.61	17.65									
Depressed	6.47	5.47	-0.347	0.891							
Anxious	8.53	5.92	-0.340	-0.742	0.870						
Pressure	8.71	6.18	-0.385	0.841	-0.841	0.881					
Self efficacy	26.66	5.84	0.443	-0.345	-0.412	-0.347	0.892				
Goal focus	16.68	3.76	0.284	-0.368	-0.314	-0.374	0.314	0.714			
Emotion control	20.50	3.98	0.274	-0.321	-0.364	-0.446	0.265	0.263	0.752		
Positive cognition	14.34	3.45	0.354	-0.366	-0.37	-0.344	0.156	0.645	0.314	0.768	
Family support	21.55	4.12	0.231	-0.478	-0.462	-0.251	0.374	0.432	0.156	0.541	0.750
Interpersonal assistance	19.58	4.47	0.364	-0.387	-0.352	-0.294	0.125	0.149	0.394	0.301	0.471

According to **Table 1**, exercise resistance intensity is connected with depression, anxiety, stress, mood, and mental health ( $P < 0.01$ ), and consciousness is associated with depression, anxiety, and stress ( $P < 0.01$ ); 5 Depression, anxiety, and stress were connected with mental health disorders. Significant correlation ( $P < 0.01$ ). By examining the mean values of the three negative emotional variables, we can see the adverse changes in negative emotions generated by outdoor activities among college students with greater

illustrative analysis, correlation analysis, standard deviation analysis, and grade return analysis using SPSS.20. Amos20 investigated the mediating influence of self-efficacy and mental toughness (personal strength) on the association between physical exercise and unpleasant emotions. In this manner, Amos20 was utilized to validate the study's structural model, which explains the relationship between different variables (Wu et al., 2017; Xia et al., 2020; Xiao et al., 2018).

Due to the importance of self-reporting in collecting essential data and information for this scientific investigation, it is feasible for major variations to arise similarly. As a result, there may be discrepancies in the aggregate and verification of Harman's single-factor assays after data collection. There were five common factors whose characteristic roots exceeded 1, and the variance of the first common factor was significantly less than 40 percent of the zero-bound norm. Consequently, this scientific study can't have the same major bias (Gramazio et al., 2021).

## Results and analysis

### Effects of physical exercise, self-efficacy, and psychological resilience on College Students' negative emotions

To examine the direct influence of physical exercise, self-efficacy, and psychological resilience on the negative emotions of College Students, a bivariate Pearson correlation analysis was undertaken on each of the four variables separately. **Table 1** demonstrates the correlation coefficients.

precision. **Figure 2** demonstrates that increased physical activity makes college students less likely to have unpleasant emotional symptoms. Depression, anxiety, and stress levels were considerably reduced in the medium and large training groups compared to the small training group ( $P < 0.001$ ) (Zhen et al., 2018).

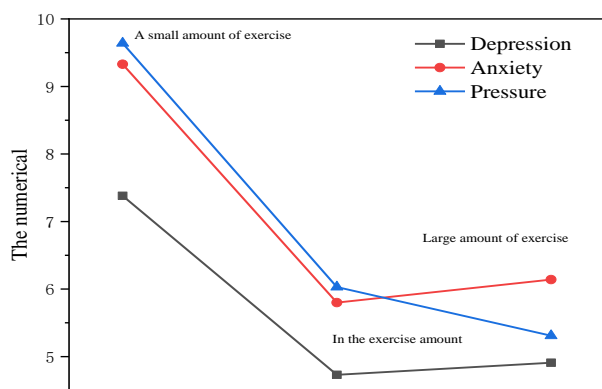


Figure 2 Analysis of results of the impact of physical exercise on College Students' negative emotions

### Regression analysis of physical exercise, psychological resilience, and negative emotion

As shown in Table 2, exercise can significantly predict negative emotions. In particular, stress ( $\beta = -0.373$ ,  $P < 0.001$ )

Table 2

Regression analysis results of physical exercise, psychological resilience (personal strength), and negative emotion

Variable	$\beta$	t	R2	$\beta$	t	R2	$\beta$	t	R2	$\beta$	t	R2
Psychological efficacy	-0.336	-9.571	0.134	-0.355	-9.264	0.126	-0.413	-10.74	0.162	0.387	10.25	0.150
Goal focus	-0.435	-11.78	0.189	-0.367	-9.513	0.135	-0.405	-10.79	0.164			
Emotion control	-0.270	-7.065	0.078	-0.220	-5.944	0.048	-0.514	-5.332	0.046			
Positive cognition	-0.383	-10.84	0.187	-0.361	-9.442	0.121	-0.413	-11.62	0.171			
Variable	0.257	-6.472	0.066	-0.199	-4.688	0.036	-0.223	-5.652	0.050			

### Mediating effect of self-efficacy and psychological resilience

The association between exercise compression strength, independence, spirituality, muscle stiffness (personal strength), and unpleasant emotions was statistically significant ( $P < 0.01$ ) and satisfied the criteria for the validity of the agreement. Appropriate software to verify typical operating modes. SPSS mobile program analyses data about sports culture, sports compression force, negative emotions, independence, psychological tensile force (my strength), and the relationship between outdoor activities and low factors and its psychological condition (my strength). Force) expansion. Validation is under discussion. All procedures 1 Examine the overall amount of damage caused by the independent variable C to itself. Check the database index value of the independent variable on the intermediate variable to determine the SQL database index value if you have mastered step 2. a dependent variable and an

$<0.001>$  anxiety ( $\beta = -0.347$ ,  $P < 0.001$ )> depression ( $\beta = -0.423$ ,  $P < 0.001$ ), and exercise and fitness activities predict psychological conditions. Ability to manipulate flexibility ( $\beta = 0.390$ ,  $P < 0.001$ ). Specific functional flexibility (personal kinetic energy) plays a key role in predicting negative emotions (see Table 2). In particular, mental flexibility (my ability) was associated with depression ( $\beta = -0.368$ ,  $P < 0.001$ )> work stress ( $\beta = -0.369$ ,  $P < 0.001$ )> anxiety ( $\beta = -0.367$ ,  $P < 0.001$ ).Adjustable mental state. ( $\beta = -0.383$ ,  $P < 0.001$ )> General understanding of the overall goal ( $\beta = -0.280$ ,  $P < 0.001$ )> Positive cognitive ability ( $\beta = -0.257$ ,  $P < 0.001$ ), psychological state ( $\beta = -0.257$ ,  $P < 0.001$ ) = -0.361,  $P < 0.001$ )> Total value of target concentration ( $\beta = -0.220$ ,  $P < 0.001$ )> Adequate cognitive ability to predict anxiety ( $\beta = -0.189$ ,  $P < 0.001$ ) (mental state) ); stress response level adjustment ( $\beta = -0.189$ ,  $P < 0.001$ ) = -0.423,  $P < 0.001$ )> positive cognitive ability ( $\beta = -0.267$ ,  $P < 0.001$ )> Overall value of the target concentration ( $\beta = -0.214$ ,  $P < 0.001$ ).

independent variable on an intermediate variable. Included in the business plan of the corporation. The mediation variable, if established, indicates the existence of a specific mediation effect, and the value of the intermediate company's losses is assessed as  $AB / C$ . In other words, psychological independence and adaptability (my strength) are the primary mediators between physical movement and bad feelings. Fully operational Simultaneously, the correlation coefficient  $r$  of viability's thematic activity was established (Raza et al., 2020). Therefore, mental practice independence and adaptability (personal strength) mediate physical movement and unpleasant emotions. Health Independence and Negative Emotional Mediation  $26.78 [AB / C = (0.471 \times 0.224) / 0.394] \approx$  The role of mediating psychological resilience (my strength) between health and negative emotions. It accounts for 31.33% of total demand  $[AB / C = (0.387 \times 0.319) / 0.394] \approx 0.3133$ ].



**Table 3**

*Results of stepwise hierarchical regression analysis of self-efficacy and psychological resilience (personal strength)*

Model	Step	Standardized equation	SE	t
Self efficacy	1	Negative emotion = $-0.394 \times$ physical exercise	0.038	-10.346
	2	Self efficacy = $0.471 \times$ physical exercise	0.036	13.101
	3	Negative emotion = $-0.224 \times$ self efficacy $-0.288 \times$ physical exercise	0.042	-5.134 -6.874
Psychological resilience (personal strength)	1	Negative emotion = $-0.394 \times$ physical exercise heart	0.036	-10.658
	2	Physical toughness (personal strength) = $0.387 \times$ sports	0.036	10.657
	3	Exercise negative emotion = $-0.319 \times$ psychological resilience (personal strength) $-0.270 \times$ physical exercise	0.037	-8.671 -6.982

To further improve H2 and H3 proposed by previous civilizations, amos20 was analyzed for compliance with the predicted model. Self-reliance is a one-dimensional evaluation measure that includes many questions so that it can be packaged and obtained by any packaging method. The 10 test questions are arbitrarily divided into two sets, with 5 questions in each set as their efficiency observation index values. Physical activity was an independent variable, and negative emotions were dependent, independent, and psychologically flexible (personal strength). The results show that  $\chi^2 = 125.424$ ,  $\chi^2 / DF = 3.216$ , CFI = 0.953, NFI = 0.941, RFI = 0.934, IFI = 0.922, AGFI = 0.917, RMSEA = 0.065. In SEM,  $\chi^2 / DF \leq 5.00$ ,  $RMSEA \leq 0.08$ , CFI, NFI, RFI, IFI,  $AGFI \geq 0.90$  indicate compliance with the model.

#### **Moderating effect of psychological resilience**

Mental health issues such as health promotion, negative emotions, family use, and social development collaboration are addressed in the SPSS under standard procedures and procedures that address injury control. Subsequently, a scientific study was conducted using the hierarchical regression method to study the harmful effects of psychological tensile forces (external forces) and the negative adaptability of emotions in sports production practice. The first step is the interaction between the independent variable of the constant variable and the independent variable of the regulatory variable. The second step is the interaction between the independent variables, such as the constant independent variable, the regulatory variable, its independent variable, and the regulatory variable. The regulatory variable has a real adjustment effect if the interaction terms are unique. The  $R^2$  variation of the interaction between physical exercise and family support ( $\Delta R^2 = 0.005$ ,  $F = 0.041$ ) in psychological resilience (support) reached a significant level, indicating a moderating effect. However, the interaction between interpersonal assistance and physical exercise was insignificant ( $\Delta R^2 = 0.002$ ,  $F = 0.218$ ), so interpersonal assistance in psychological resilience (support) could not significantly regulate the correlation between physical exercise and negative emotions. Specifically, for every one sd increase in family support, the slope of physical exercise on negative emotions increased by 0.075 sd.

## **Discussion**

Scientific research results indicate that sports participation can accurately analyze and predict depression, anxiety, stress, and other negative emotions among college students. This confirms the theory of H1 and is consistent with the findings of previous scientific research. Based on the results of existing scientific studies, its functional system concludes that exercise increases the generation and release of -endorphins in the human body, reduces adrenaline and aldosterone levels, and stimulates the ability to think, think and think logically and reason. Emotional thinking minimizes negative feelings such as depression, anxiety, and work stress among college students. The value of actively managing negative emotions through exercise has been established as a practical necessity. Timing, intensity, and frequency of physical activity are significant determinants of the anticipated negative emotional impact. Basic research indicates that moderate to vigorous aerobic exercise at least three times per week substantially impacts depression, anxiety, and stress (Poon, 2022). Studying the link between physical activity and depression, anxiety, and stress was central to this analysis. Low levels of melancholy, anxiety and stress among college students who engage in moderate to vigorous physical activity are consistent with the initial scientific findings and the concept of long-term, intermittent aerobic flexibility, and flexibility, according to several studies. perform exercises (Yang & D'Arcy, 2022). Negative emotions have a greater economic value for moderate compressive strength. According to research, college students pay significant attention to their workout capacity, compressive strength, and frequency. Large-scale instruction in sports culture can significantly reduce college students' negative feelings and clarify their overall aims. Long-standing scientific research has proven a correlation between college students' independence from outdoor activities and their bad emotions, suggesting that exercise not only quickly helps the negative emotions of college students but also increases its efficacy. Enhancing the autonomy of college students (Zhao, 2022). Improve college students' negative emotions and then generate H2-confirmed thoughts that are congruent with existing

scientific research. This indicates that increasing the physical efficiency of college students is an excellent method for reducing negative emotions among college students. First, independence is an independent variable associated with individual behavior. It has a favorable influence on self-efficacy independent of the intensity or duration of physical activity. Second, independence is detrimental to the human mind and intellect. Self-reliant college students are more autonomous and assured in facing adversity and failure (Zhang & Velez, 2022). During training and resistance, their control and ability to work will be enhanced, thereby preventing and reducing the emergence of negative feelings. According to the findings, independence is the primary link between physical activity and mental health. Exercise helps college students avoid unpleasant emotions and improves their physical and mental health. This study investigated the role of psychological expansion as a mediator and regulator in the association between physical activity and unpleasant emotions in college students. According to the study's findings and predictive analysis, physical activity positively affects college students' psychological development. Periodically, college students' negative emotions are diminished based on their ability to work. H3 Fundamental Concepts and Infrastructure. First, the intended purposes of exercise and fitness are distinct. Fitness is beneficial for college students' physical and mental health and is also an excellent technique to enhance their self-control. Exercise helps college students concentrate on the fundamentals, enhances cognitive function, and raises their psychological level in terms of psychological well-being and operational flexibility, according to da Cruz et al. (2020). Second, college students are more susceptible to negative emotions and encounter numerous challenges, including cultural education, work, social media, and mental health. Students with great mental resilience have superior self-control, are less susceptible to despair, and experience less unpleasant feelings.

Overall, the moderated mediation model provided in this study demonstrates the mechanism of physical activity on negative feelings in college students: Physical activity influences negative emotions in college students via self-efficacy and mental toughness (per person); The effect of physical activity on negative emotions was negatively mitigated by the family support feature of psychological resilience (Taniguchi et al., 2022). Therefore, the link between physical activity and negative emotions involves mediating and moderating effects. It is encouraged that college students pay close attention to the selection of physical exercise items, intensity, duration, and regularity when engaging in physical activity. Not only can they continue completing the physical activity, but they can also overcome certain obstacles. To prevent and lessen negative emotions more effectively, they should develop their feeling of self-efficacy and mental toughness through physical

activity.

## Conclusion

According to the "Sports Culture Training Comment Scale," "Negative Emotion Scale," "Self-efficacy Evaluation scale," and "Psychological malleability scale," the hierarchical cluster convenient and quick sampling method was used to investigate 1500 college students, and spSS20.0 and AMOS20.0 were utilized to analyze the mediating effect and the moderating effect, respectively.

Exercise minimizes negative emotions in college students by strengthening their independence and intelligence. Families employ endurance to combat the adverse psychological effects of physical exertion. Therefore, unpleasant emotions and physical activity have a mediating and regulatory influence. Physical activity is essential in enhancing the psychological resilience of college students experiencing unpleasant emotions. On the one hand, physical activity increases college students' endurance and decreases negative moods. Physical education and extracurricular physical exercise are required to improve the psychological health of college students, while physical education programs are utilized to alleviate their negative emotions. Parents have a significant impact on the psychological and behavioral traits of teenagers. In addition to regular exercise, college students must also consider shift selection, energy, and the time and frequency of physical activity to increase their independence. The study indicated that those with high mental resilience were cognitively more optimistic and able to deal with more difficult problems more efficiently than those with low mental resilience. Therefore, the greater an individual's mental resilience following a traumatic life event, the smaller the impact of the event on their negative feelings.

## Theoretical Implications

This study gives substantial theoretical implications for teachers and administrators to consider decreasing negative feelings among kids by fostering positivity. It is essential to give college students the necessary resources to enhance their psychological learning without impairing their cerebral capacity. As psychological pressure has a significant impact on the cognitive abilities of pupils, it was not addressed in previous research. Indeed, management must provide students with dependable and intelligible training to improve their well-being by addressing their mental stress difficulties. Similarly, there is a need to enhance the policy governing sports training methods. With the assistance of effective management, players can develop their self-efficacy and mental toughness, enhancing their performance. In this perspective, the study's factors are noteworthy and contribute to knowledge, as they are highly influential and

significant.

### **Practical Implications**

This study has substantial practical implications for reducing student pressure and stress. This study begins by emphasizing that college students must be educated on effectively improving their long-term health. The second role of the administration is to establish a better learning environment for the pupils, which will aid in their development and comprehension. The administration is also responsible for offering adequate training to the teachers so that they may best assist the students and provide them with more effective and realistic results to improve their well-being by providing them with greater physical activity to alleviate mental stress. Therefore, the management must effectively examine these variables and strive to improve and advance the kids

and other individuals. Because the consequences of this study are not confined to school-aged adolescents, the relevant measures can be administered to other athletes to increase their self-efficacy and mental toughness. Thus, it is the role of sports administration to evaluate all of these aspects to enhance athletes' performance.

### **Future Directions**

This study aimed to determine the connection between physical activity and unpleasant feelings. Future research must focus on effective teaching methods' function in lowering negative feelings among pupils. Second, future research must focus on the role of a negative emotion-reduction curriculum. Future research must focus on the cognitive behavior of pupils to lessen their negative feelings.

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