

A Study on the Mediating Effect of Psychological Resilience in the Relationship between Physical Exercise and Subjective Well-being among Chinese University Students

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Abstract: This study investigates the impact of physical exercise on subjective well-being among Chinese university students, with a focus on the mediating role of psychological resilience. Utilizing quantitative methodologies, statistical analyses were conducted through SPSS 26.0 and AMOS 26.0 to process empirical data. Key findings revealed demographic disparities in subjective well-being across gender, geographical origin, and academic year. A significant positive association was identified between physical exercise engagement and both psychological resilience and subjective well-being. Mediation analysis confirmed the partial mediating effect of psychological resilience in the physical exercise-subjective well-being pathway. These findings underscore the importance of prioritizing physical exercise interventions to enhance psychological resilience and subjective well-being among college populations. Policy implications suggest integrating structured exercise programs into campus wellness initiatives to foster holistic student development.

Keywords: Chinese College Students; Physical Exercise; Psychological Resilience; Subjective Well-Being; Mediating Effect

1. Introduction

1.1 Research Necessity

With the accelerated construction of a global community of shared future for humanity, the pursuit of individual subjective well-being has become increasingly intense. In China, there are nearly 50 million college students who are the main force and the primary reserve for social development. Therefore, paying attention to their subjective well-being has

become an important task in the field of educational psychology. Subjective well-being, defined as an individual's holistic evaluation of life quality based on self-referenced criteria Diener,^[1] has been extensively operationalized in psychological research. Suh et al. further conceptualized subjective well-being as a tripartite construct comprising life satisfaction, positive affect, and negative affect, establishing it as a multidimensional metric for personal quality-of-life assessment.^[2] This theoretical framework has catalyzed empirical advancements across disciplines, with subsequent studies validating its predictive validity in health psychology, educational outcomes, and organizational behavior research.

This study situates itself within positive psychology's emphasis on subjective well-being as a critical determinant of holistic development. Empirical investigations reveal multidirectional associations between physical exercise and subjective well-being in collegiate populations. Xie and Li established significant correlations among exercise adherence, physical self-esteem, and self-efficacy in predicting subjective well-being.^[3] A finding corroborated by Chen and Yu's meta-analytic evidence demonstrating robust exercise-subjective well-being correlations.^[4] Ding suggested that engaging in physical exercise not only enhances college students' physical fitness but also alleviates individual stress, fosters positive qualities, and improves interpersonal skills, thereby increasing their subjective well-being.^[5] Notably, exercise-induced neurocognitive improvements warrant attention. Zhou's psychophysiological model posits optimal exercise intensity enhances neural processing efficiency through increased synaptic plasticity.^[6] These neuroadaptive changes mediate cognitive performance gains that

subsequently influence subjective well-being metrics. Xi argued that contemporary scholarship thus reconceptualizes exercise not merely as biopsychosocial intervention,^[7] but as multifactorial subjective well-being determinant operating through physiological (HPA axis regulation), psychological (stress buffering), and social (peer bonding) mediating mechanisms. This theoretical integration underscores the imperative for targeted exercise prescriptions in campus health initiatives.

Contemporary research elucidates a robust interconnection between psychological resilience and subjective well-being, particularly salient in Chinese collegiate populations. Resilience, operationalized as the dynamic capacity to adaptively recover from adversity (Newman),^[8] constitutes a multidimensional construct encompassing stress inoculation and post-traumatic growth (Hu & Gan).^[9] Empirical evidence demonstrates resilience's dose-response relationship with subjective well-being indices, with high-resilience students exhibiting 32% greater life satisfaction scores than low-resilience counterparts. Longitudinal analyses indicate concerning resilience declines across academic years, with gender disparities manifesting in resilience trajectories. Male students higher resilience scores than females throughout undergraduate studies (Shi et al.),^[10] though this gap narrowed in stress-intensive senior years.

The findings reveal that collegiate physical exercise and psychological resilience exert differential impacts on various dimensions of subjective well-being. As a crucial indicator of mental health status, students' subjective well-being significantly mediates academic performance, emotional regulation, life satisfaction, and future orientation. Physical exercise, serving as a manifestation of socialized individual behavior, demonstrates multidimensional correlations with psychosocial adaptation mechanisms. Investigating these interactions not only provides operational pathways for optimizing college sports programs but also contributes practical solutions to critical issues requiring urgent attention in higher education institutions under the national health promotion campaign. This dual-focused approach aligns with the strategic objectives of cultivating well-rounded

talents through physical literacy enhancement. The distinctive contribution of this study lies in its holistic analytical framework for examining subjective well-being among Chinese university students. Methodologically, it pioneers the incorporation of psychological resilience as an intermediary mechanism to systematically investigate the multidimensional interactions between physical exercise participation, personal affective states, and perceived social support in shaping subjective well-being outcomes. Theoretically, this tripartite model advances current understanding by bridging psychosocial adaptation processes with contextual behavioral factors. Practically, the empirical findings offer evidence-based implications for optimizing campus sports initiatives and enriching mental health promotion strategies. Notably, the research paradigm establishes a novel conceptual foundation for subsequent investigations into the sociocognitive determinants of student well-being in China's evolving educational landscape.

1.2 Purpose and Questions

The aim of this study is to empirically investigate the direct impact of physical exercise on the subjective well-being of Chinese university students and to explore the mediating role of psychological resilience in this relationship. Through analysis, the study seeks to identify effective strategies for enhancing the subjective well-being of Chinese college students. From both practical and theoretical perspectives, this research aims to provide actionable guidance for physical exercise among Chinese university students, broaden the understanding of the relationship between physical exercise and subjective well-being, and enrich the research framework on subjective well-being among university students. To achieve these objectives, the study will address the following research questions:

1. Does physical exercise influence the subjective well-being of Chinese university students?
2. Does psychological resilience effect the subjective well-being of Chinese university students?
3. Does physical exercise influence psychological resilience among Chinese university students?

4. Does psychological resilience moderate the relationship between physical exercise and subjective well-being among Chinese university students?

2. Theoretical Background

2.1 Definition of Terminology

2.1.1 Physical exercise

The term "physical exercise" is sometimes translated as "physical activity," "bodily exercise," or "sports activity," given that "physical" conveys the meaning of "pertaining to the body" or "bodily." Caspersen et al. defined physical exercise as a planned, structured, and repetitive bodily activity aimed at improving physical fitness.^[11] Research on physical exercise among college students includes both participation in sports-related physical education classes and voluntary physical exercise activities outside of class time. These activities are characterized by being planned, regular, and having a certain intensity, frequency, and duration. Given the characteristics of this research subjects, this study adopts Fan Wen's definition of physical exercise among university students.

2.1.2 Subjective well-being

Subjective well-being is characterized by an individual's affirmative perception of their life circumstances, representing a congruence between their actual lifestyle and their envisioned ideal state of well-being. Diener and Lucas defined subjective well-being as an overall subjective evaluation and judgment of one's quality of life based on personal standards, characterized by subjectivity, stability, and self-identification.^[12] It can be observed that research on subjective well-being has primarily focused on cognitive perspectives, psychological development, subjective emotional experiences, and self-evaluation. Given the characteristics of the subjects in this study and integrating the existing definitions of subjective well-being, this study adopts the definition provided by Diener.

2.1.3 Psychological resilience

Psychological resilience refers to the process by which an individual, when facing stressful events or being in disadvantaged situations, adopts more proactive coping strategies to adapt well and rapidly re-establish a state of equilibrium. Newman described psychological

resilience as a dynamic process by which an individual demonstrates good adaptability in the face of various life stressors and adversities.^[8] Hu and Gan adopted the definition from the American Psychological Association Help Center, which defines psychological resilience as the good adaptation of an individual to life adversities, trauma, tragedy, threats, or other significant life stressors.^[9] It implies the ability to "bounce back" from life stress and setbacks. A review of the definitions of psychological resilience reveals that it encompasses various aspects, ranging from personality traits and capabilities to the process of overcoming difficulties and the resulting outcomes. Thus, it is evident that psychological resilience is a complex and multifaceted construct. Given the characteristics of the research subjects, this study adopts the definition of psychological resilience provided by Hu and Gan.

2.2 Previous Studies

2.2.1 Research on physical exercise

Physical exercise refers to the process of engaging in bodily activities aimed at enhancing physical fitness, developing the body, improving health, and enriching cultural life through the use of various sports means, equipment, and natural forces. White's et al. research indicates that frequent engagement in physical exercise can foster more intimate connections with others and boost individual subjective well-being.^[13] According to Wang's research, correlation analysis reveals a positive relationship between college students' physical exercise and subjective well-being. Specifically, a higher level of exercise engagement is associated with greater subjective well-being among individuals.^[14] Significant differences in physical exercise among college students were observed across gender, grade, and major, but no differences were found based on place of origin. For instance, male students engaged in physical exercise more frequently, with greater intensity and duration compared to female students. Liu argued that students majoring in humanities participated in physical exercise more frequently and for longer durations than those majoring in science. Additionally, first- and second-year students exhibited higher levels of physical exercise compared to third- and fourth-year students.^[15] These findings suggest

that physical exercise varies across demographic factors and is also significantly influenced by numerous factors in educational psychology.

2.2.2 Research on subjective well-being

Subjective well-being represents a unique conceptualization of happiness from the perspective of psychologists, in which individuals conduct a holistic assessment of their quality of life based on self-determined criteria. Chen and Yu argued significant gender differences have been observed in physical exercise, peer relationships, and subjective well-being, with male students exhibiting higher levels in these aspects compared to female students.^[4] Zhou et al. conducted a survey among 1,348 college students from eight universities in Jiangxi Province and found that the subjective well-being of college students was at a moderate level.^[16] Notably, significant differences were observed across grades, with first-year students reporting the highest level of well-being and third-year students the lowest. In summary, subjective well-being among college students is influenced by various factors, and the outcomes differ accordingly. These differences are related to the research subjects, methods, and indicators employed. As subsequent research progresses, the issue of subjective well-being among college students will

become clearer and more definitive.

2.2.3 Research on resilience

Psychological resilience can help reduce negative emotions and promote the generation of positive emotions when facing adversity. Lan's research shows that significant variations exist in college students' psychological resilience across demographic variables such as gender, grade, major, place of origin, and whether they are an only child.^[17] Wang found that psychological resilience and motivation for physical exercise among college students also show significant differences based on gender, being an only child, family residence, educational level, major category, and grade.^[18] These studies have yielded diverse results, which are expected to become more comprehensive and clear as research progresses.

3. Research Methods

3.1 Research Model

Building on previous research and theoretical background, this study constructs a theoretical research model based on the relationships among variables. The model aims to explore the impact of physical exercise on subjective well-being among Chinese college students. The research model is shown in [Figure 1].

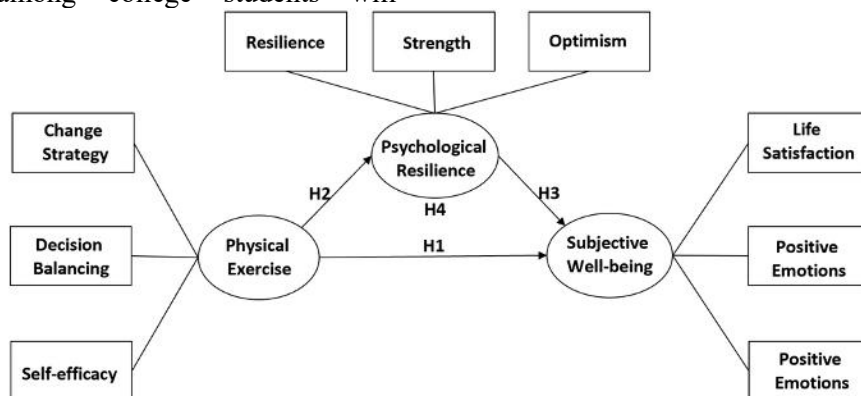


Figure 1. Model of Influencing Factors

3.2 Research Hypothesis

Drawing from theoretical foundations and existing research, and guided by the research model and objectives, the following hypotheses are formulated.

H1: The physical exercise of Chinese university students has a significant impact on their subjective well-being.

H2: The physical exercise of Chinese

university students has a significant impact on their psychological resilience.

H3: The psychological resilience of Chinese university students significantly affects their subjective well-being.

Additionally, considering that physical exercise may also indirectly influence subjective well-being through psychological resilience, the following hypothesis is proposed:

H4: There is a mediating effect between psychological resilience and subjective well-being in physical exercise among Chinese university students.

3.3 Participants

This study targets undergraduate students in Chinese universities. To ensure comprehensiveness and diversity, a questionnaire survey was conducted among students from six different types of universities in Shandong Province. The selected universities include two comprehensive universities, two normal universities, one science and engineering university. The chosen institutions and majors meet the requirements of this study. A total of 735 undergraduate students were selected from these six universities to participate in the questionnaire survey. After excluding invalid questionnaires, 673 valid responses were collected, resulting in a response rate of 91.56%.

The demographic variables selected for this study include gender, place of origin, whether the respondent is an only child, grade level, and major. Among the respondents, 321 were male and 352 were female; 261 were from urban areas and 412 from rural areas; 382 were only children and 291 were not; there were 209 freshman, 235 sophomore, 142 junior, and 87 senior. The specific distribution of demographic variables is shown in <Table 1>.

Table 1. Demographic Characteristics of the Participants (N=632)

Variables	Project	Frequency(N)	Percentage (%)
Gender	Male	301	47.63%
	Female	331	52.37%
Place of Birth	Urban	233	36.87%
	Rural	399	63.18%
Grade	Freshman	204	32.28%
	Sophomore	199	31.49%
	Junior	142	22.47%
	Senior	87	13.77%

3.4 Research Tools

3.4.1 Physical exercise scale

Zhang et al. [19] The Cronbach's coefficient for the Chinese version of the Youth Physical Exercise Behavior Psychological Assessment Scale (2013) is .888, the Cronbach's α coefficients for changing strategies, decision balance, and self-efficacy across three dimensions are .880, .706, and .839.

After testing, the strategies for changing the dimension of physical exercise, decision-making balance, self-efficacy, and the Cronbach α coefficient for physical exercise (total score) were respectively. 954, .953, .909 and 963, as shown in <Table 2>.

Table 2. Reliability Coefficient of Physical Exercise among University Students

Scale	Variables	Cronbach's α	N
Physical Exercise	Overall Subjective Well-being Scale	.963	30
	Change Strategy	.954	14
	Decision Balancing	.953	10
	Self-efficacy	.909	6

3.4.2 Psychological resilience scale

The psychological resilience questionnaire was revised in Chinese using Yu and Zhang. [20] The scale consists of three dimensions: resilience, self-strengthening, and optimism, comprising a total of 25 questions. The scale has a total coefficient of Cronbach α , respectively. 910. resilience. 880. strength. 880. optimism. 600, with good reliability.

Table 3. Reliability Coefficient of Psychological Resilience among University Students

Scale	Variables	Cronbach's α	N
Psychological Resilience	Overall Psychological Resilience Scale	.956	25
	Resilience	.954	13
	Strength	.926	8
	Optimism	.824	4

After testing, the Cronbach α coefficients for resilience, strength, optimism, and psychological resilience (total score) in the psychological resilience dimension were respectively. 954, .926, .824 and 956, as shown in <Table 3>.

3.4.3 Subjective well-being scale

The Subjective Well-being Scale was compiled by Diener, and Lucas. [21] This scale includes 9 positive emotions and 9 negative emotions, totaling 18 emotional words. The total coefficients of this scale are Kronbach α . 910. Life satisfaction. 880. Positive emotions. 880. Negative emotions. 600, with good reliability. After testing, the Cronbach α coefficients for life satisfaction, positive emotions, negative emotions, and total subjective well-being in the dimension of subjective happiness were respectively. 844, .931, 948 and 947, as shown

in <Table 4>.

Table 4. Reliability Coefficient of Subjective Well-being among University Students

Scale	Variables	Cronbach's α	N
Subjective Well-being	Overall Subjective Well-being Scale	.947	23
	Life Satisfaction	.844	5
	Positive Emotions	.931	9
	Negative Emotions	.948	9

3.5 Data Analysis

Descriptive statistics, one-way ANOVA, correlation analysis, and multiple regression analysis were conducted using SPSS 26.0. Additionally, AMOS 26.0 was employed to assess path coefficients and mediating effects.

4. Research Results

4.1 Analysis of Demographic Variable

Table 5. The *t*-test Results at Gender and Place of Birthplace

Dimension	Gender		<i>t</i>	Place of birthplace		<i>t</i>
	Male (n=301)	Female (n=331)		Rural (n=178)	Town (n=311)	
PE.	3.75±.77	3.12±.98	8.991***	3.00±.95	3.66±.85	-8.716***
PR.	3.73±.86	3.35±.95	5.157***	3.41±.95	3.60±.91	-2.444*
SW.	3.59±.66	3.29±.86	4.918***	3.27±.87	3.53±.71	-3.796***

Note. PE.: Physical Exercise, PR.: Psychological Resilience, SW.: Subjective Well-being.

Significant differences in physical exercise, psychological resilience, and subjective well-being were observed among Chinese college students across different grades, as shown in <Table 6>. The results indicated that there were significant differences in physical exercise, psychological resilience, and subjective well-being among students of

Differences in Physical Exercise, Psychological Resilience, and Subjective Well-being

Significant differences in physical exercise, psychological resilience, and subjective well-being were observed among Chinese university students based on gender and place of origin, as shown in <Table 5>. The results indicated that male students had significantly higher levels of physical exercise, psychological resilience, and subjective well-being compared to female students ($t = 8.991, p < .001$; $t = 5.157, p < .001$; and $t = 4.918, p < .001$, respectively). Additionally, students from rural areas exhibited significantly higher levels of physical exercise, psychological resilience, and subjective well-being compared to those from urban areas ($t = -8.716, p < .001$; $t = -2.444, p < .05$; and $t = -3.796, p < .001$, respectively).

different grades ($F = 30.469, P < .001$; $F = 13.892, P < .001$; and $F = 6.774, P < .001$, respectively). Specifically, first- and second-year students exhibited significantly higher levels of physical exercise, psychological resilience, and subjective well-being compared to third- and fourth-year students.

Table 6. The ANOVA Test Results at Grade

Dimension	Grade				<i>F</i>
	Freshman (n=204)	Sophomore (n=199)	Junior (n=142)	Senior (n=87)	
PE.	3.61±.83	3.67±.84	3.23±.96	2.69±.94	30.469***
PR.	3.64±.95	3.73±.88	3.41±.86	3.02±.90	13.892***
SW.	3.53±.70	3.52±.77	3.35±.80	3.14±.88	6.774***

Note. PE.: Physical Exercise, PR.: Psychological Resilience, SW.: Subjective Well-being.

4.2 Correlation Analysis

To examine the correlations among the sub-dimensions of the main variables, <Table 7> presents the Pearson correlation coefficients among these sub-dimensions.

4.3 Regression Analysis

Regression analysis is a process that examines

the influence of independent variables on a dependent variable. Based on the results of the tests on the relationships among physical exercise, psychological resilience, and subjective well-being, this study further investigates the effect of physical exercise on subjective well-being through psychological resilience.

Table 7. Correlations between the Sub-Dimensions of Main Variables

	1	2	3	4	5	6	7	8	9
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1. CS	1								
2. DB	.569**	1							
3. SE	.598**	.538**	1						
4. Res	.187**	.175**	.202**	.1					
5. Str	.172**	.200**	.180**	.586**	1				
6. Opt	.176**	.137**	.192**	.567**	.570**	1			
7. LS	.232**	.291**	.228**	.214**	.177**	.165**	1		
8. PE	.158**	.180**	.140**	.178**	.147**	.199**	.531**	1	
9. NE	.250**	.283**	.233**	.244**	.211**	.220**	.854**	.854**	1

NOTE. CS: Change Strategy, DB: Decision Balancing, SE: Self-efficacy, Res: Resilience, Str: Strength, Opt: Optimism, LS: Life Satisfaction, PE: Positive Emotions, NE: Negative Emotions.

4.3.1 The effect of physical exercise on subjective well-being

Table 8. The Statistical Significance of How Physical Exercise Predicts Subjective Well-being

	Unstandardized Coefficients		Standardized Coefficients	<i>t</i>	<i>p</i>	VIF	<i>F</i>
	B	Std. Error	Beta				
Constant	2.575	.112		22.989***	.000		
PE	.251	.032	.302	7.954***	.000	1.000	33.117

Note: Dependent variable: Subjective Well-being, PE: Physical Exercise.

As shown in <Table 8>, physical exercise is a significant predictor of subjective well-being ($F = 33.117$, $p < .001$). Moreover, the β coefficient of .251 indicates that physical

exercise exerts a significantly positive influence on subjective well-being.

4.3.2 The effect of physical exercise on physical resilience

Table 9. The statistical significance of how Physical Exercise predicts Psychological Resilience

	Unstandardized Coefficients		Standardized Coefficients	<i>t</i>	<i>p</i>	VIF	<i>F</i>
	B	Std. Error	Beta				
Constant	2.699	.135		19.944***	.000	1.000	
PE	.244	.038	.247	6.385***	.000	1.000	40.774

Note: Dependent variable: Psychological Resilience, PE: Physical Exercise

As shown in <Table 9>, physical exercise is also a significant predictor of psychological resilience ($F = 40.774$, $p < .001$). Additionally,

exercise exerts a significantly positive influence on psychological resilience.

4.3.3 The effect of physical resilience on subjective well-being

Table 10. The Statistical Significance of how Psychological Resilience Predicts Subjective Well-being

	Unstandardized Coefficients		Standardized Coefficients	<i>t</i>	<i>p</i>	VIF	<i>F</i>
	B	Std. Error	Beta				
Constant	2.643	.118		22.393***	.000	1.000	
PR	.224	.032	.266	6.928***	.000	1.000	48.003

Note: Dependent variable: Subjective Well-being, PR: Psychological Resilience.

As shown in <Table 10>, psychological resilience is a significant predictor of subjective well-being ($F = 48.003$, $p < .001$). Furthermore, the β coefficient of .224 indicates that psychological resilience has a significant positive effect on subjective well-being.

subjective well-being. Specifically, the structural model includes not only the direct effects of independent variables on dependent variables but also the indirect effects. In other words, the model incorporates the mediating role of psychological resilience in the relationship between physical exercise and subjective well-being.

4.4 Research Model Analysis

4.4.1 Model construction and model fit

Based on the research model and hypotheses of this study, the structural equation model was ultimately determined, as shown in [Figure 2]. The model illustrates the relationships among physical exercise, psychological resilience, and

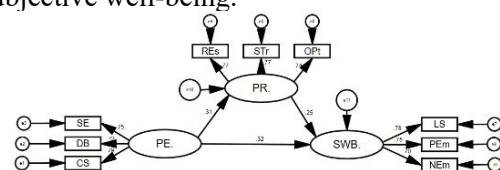


Figure 2. Structural Equation Model

Note. CS: Change Strategy, DB: Decision Balancing, SE: Self-efficacy, PE.: Physical Exercise, Res: Resilience, Str: Strength, Opt: Optimism, PR.: Psychological Resilience, LS:

Life Satisfaction, PE: Positive Emotions, NE: Negative Emotions, SWB.: Subjective Well-being.

Table 11. Results of Model Fitting Index

Index	X2/df	RMSEA	IFI	TLI	CFI	PGFI	PNFI
Standard	<5	<.08	>.90	>.90	>.90	>.50	>.50
Models fitness	1.305	.022	.996	.994	.996	.664	.656

The model in [Figure 2] was fitted using Amos 25.0 software. The specific fit indices are presented in <Table 11>. For the absolute fit indices, the χ^2/df value was 1.305, which is less than 5, and the *RMSEA* value was .022, which is less than .08. These absolute fit indices are considered ideal. Regarding the incremental fit indices, the *IFI* value was 0.996, which is greater than 0.9; the *TLI* value was 0.994, which is greater than 0.9; and the *CFI* value was 0.996, which is greater than 0.9. These incremental fit indices are also considered ideal. For the parsimony fit indices, the *PGFI* value was .664, and the *PNFI* value was .656, both of which are greater than 0.5. These parsimony fit indices are deemed ideal as well. In summary, the external quality of the model is satisfactory. Therefore, the structural model fits the empirical research data well at an acceptable level.

4.4.2 Model path test results

Table 12. Path Analysis

Path	Estimate	S.E.	C.R.	P
SWB <--- PE	.302	.050	6.033	.000
PR <--- PE	.309	.050	6.199	.000
SWB <--- PR	.238	.050	4.770	.000

Note. PE: Physical Exercise, PR: Psychological Resilience, Str: Strength, SWB: Subjective Well-being.

The path analysis results of the model are presented in <Table 12>. Physical exercise has a significant positive effect on subjective well-being ($\beta = .302, p < .001$). This finding is consistent with the results of previous studies by (Ding Ying, 2021) and (Wang Zeren, 2023). Physical exercise also has a significant positive impact on psychological resilience ($\beta = .309, p < .001$), which aligns with the findings of (Guo Hong, 2023). Furthermore, psychological resilience has a significant positive effect on subjective well-being ($\beta = .238, p < .001$), corroborating the results of (Jiang Yuxian and Chen Yi, 2020).

4.4.3 Mediating effect test results

In AMOS 26.0, the bootstrapping procedure

was employed to assess whether the mediating effect of psychological resilience in the relationship between physical exercise and subjective well-being was significant. If the 95% confidence interval of the indirect effect does not include zero, the mediating effect is considered statistically significant. If the 95% confidence interval of the direct effect does not include zero, this indicates partial mediation. The results of the mediation effect test are presented in <Table 13>.

Table 13. Mediation Effect Test

Parameter	Estimate	S.E.	95%CI		
			LLCI	ULCI	P
Total effect	.251	.032	.000	.189	.000
Direct effect	.210	.032	.000	.147	.000
Total indirect effect	.419	.011	.023	.064	.000
Indirect effect of PR	.050	.013	.027	.077	.000

Note. PR: Psychological Resilience.

As shown in the table, the total effect of physical exercise on subjective well-being is .251, with a confidence interval of [.000, .189], which does not include zero, indicating the presence of a total effect. The direct effect is .210, with a confidence interval of [.000, .147], which also does not include zero, indicating the presence of a direct effect. The total indirect effect is .419, with a confidence interval of [.023, .064], which does not include zero, confirming the existence of a total indirect effect. The indirect effect of psychological resilience is .050, with a confidence interval of [.027, .077], which does not include zero, indicating the presence of an indirect effect of psychological resilience.

5. Conclusions

5.1 Summary of Research

This study aims to empirically investigate the direct and indirect effects of physical exercise on the subjective well-being of Chinese university students, while examining the

mediating role of psychological resilience in this relationship. Through a theoretical examination of these variables, a research model was developed to reveal the relationships and mediating effects among these factors, followed by empirical validation. This research empirically validates the dual-pathway influence of physical exercise on subjective well-being through multifactorial analysis, encompassing both direct and mediating mechanisms. Key findings demonstrate: Physical exercise significantly enhances subjective well-being, providing robust support for Hypothesis 1. Psychological Resilience as a Predictor: Psychological resilience, a core component of psychological capital, positively predicts subjective well-being, confirming Hypothesis 2. Exercise-Induced Resilience: Regular physical activity elevates psychological resilience capacity, validating Hypothesis 3. A significant mediating effect of psychological resilience, thereby substantiating Hypothesis 4. Collectively, the study establishes that physical exercise augments subjective well-being not only directly but also through resilience-mediated pathways. All four theoretical hypotheses (H1–H4) receive comprehensive empirical validation.

5.2 Discussion and Conclusion

This study primarily explores the relationship between physical exercise and subjective well-being among university students in China, and constructs a theoretical model using psychological resilience as an intermediary variable. Empirical analysis was conducted on the data collected through the questionnaire to verify the relationships between variables. From the research results, the following is evident.

First, emerging empirical evidence substantiates the beneficial role of structured physical activity in enhancing perceived life satisfaction among Chinese undergraduates. This aligns with prior investigations by Wang^[14], who established exercise-mediated emotional regulation mechanisms. Diverging from conventional macro-level explorations of subjective well-being determinants—such as institutional support frameworks, academic burnout trajectories, and familial dynamics—this research pioneers a microanalytic perspective on subjective

experiential dimensions. The data reveal that systematic engagement in physical activities and social reciprocity enables undergraduates to mitigate psychological distress, optimize neurophysiological functioning, and ultimately elevate subjective well-being indices. Methodologically, this study advocates a paradigm shift toward granular, phenomenologically-grounded inquiries into students' embodied wellness experiences, moving beyond standardized psychometric inventories. Such an approach not only illuminates understudied intrapersonal mediators but also establishes a novel theoretical scaffold for interpreting SWB through biopsychosocial lenses. These conceptual and methodological advancements constitute the scholarly innovation of this work, providing actionable insights for designing campus well-being interventions rooted in students' lived realities.

Secondly, the study establishes a robust predictive association between resilience capacity and subjective well-being in Chinese undergraduates, corroborating psychosocial models proposed by Jiang and Chen^[22]. Resilience is operationalized as a dual-dimensional construct encompassing both innate trait-like attributes and acquired competencies, supported by contextual supports and intrapersonal assets. When confronting adversities, students demonstrating adaptive resilience synthesize metacognitive strategies—goal prioritization, contingency planning, and locus-of-control reinforcement—to transform stressors into developmental opportunities. This dynamic process facilitates post-traumatic growth trajectories, culminating in stabilized well-being metrics despite environmental challenges.

Thirdly, the analysis further corroborates the psychophysiological benefits of structured physical activity in fortifying resilience capacities among Chinese undergraduates, a finding consonant with the neurobehavioral frameworks advanced by Secer^[23]. Beyond its somatic benefits, systematic exercise regimens activate dopaminergic reward pathways, thereby amplifying intrinsic motivation and volitional persistence. This adaptive process cultivates stress inoculation—training individuals to reinterpret adversities as mastery opportunities through repeated exposure to

controlled physical challenges. Consequently, exercise-induced resilience manifests as heightened self-efficacy in navigating complex tasks, substantiating its role as a behavioral catalyst for psychological robustness.

Fourthly, the empirical findings reveal a significant mediational pathway linking physical exercise engagement, psychological resilience, and subjective well-being among Chinese university students. This investigation substantiates previous scholarly conclusions by Qi^[24] regarding psychosocial mechanisms in exercise-wellbeing associations. Notably, a dose-response relationship was observed between exercise engagement and both psychological resilience and hedonic outcomes suggesting behavioral frequency moderates this psychophysiological cascade. These results position collegiate physical activity not merely as a direct enhancer of hedonic well-being, but as a behavioral catalyst that amplifies subjective wellness through resilience development.

Therefore, this study aims to fill the gap in the existing research. Through empirical analysis and hypothesis testing, this study explores how physical exercise among university students affects subjective well-being and the role of interpersonal skills, perceived social support, and psychological resilience in this process. The goal of this study is to identify effective strategies to promote the subjective well-being of university students.

5.3 Limitations and Suggestions

This study theoretically investigates the impact of physical exercise on subjective well-being among Chinese university students and examines the mediating effect of psychological resilience. However, certain limitations were encountered during the research process. Therefore, the following suggestions are proposed for future studies.

Firstly, the study sample was limited to university students in Shandong Province, China, which restricts the geographical scope and results in insufficient sample diversity. To address this, future research should expand the survey coverage to include students from other regions of China, thereby increasing the representativeness of the sample. Additionally, future studies should consider incorporating other demographic factors, such as students' major fields (e.g., medical, agricultural, or

forestry), family income, and leadership roles (e.g., class officer status), into the analysis to provide a more comprehensive examination of the research topic.

Secondly, although the model developed in this study drew on previous research findings, there may be other variables that could enhance subjective well-being. These factors should be considered in future research. This study analyzed the subjective well-being of Chinese university students from the perspective of physical exercise and psychological resilience. While this investigation leveraged existing theoretical frameworks in model construction, it should be acknowledged that potential covariates influencing subjective well-being determinants may require further exploration. The current study specifically examined psychological resilience in physical exercise as a predictor of subjective well-being among Chinese university students. Although these identified variables represent significant contributors to well-being formation, the complexity of this psychological construct suggests possible interactions with individual demographic characteristics and contextual factors within physical activity environments. Subsequent empirical investigations should therefore incorporate multidimensional analyses to verify these associations and elucidate potential mediating mechanisms.

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