

World Journal of *Psychiatry*

World J Psychiatry 2023 December 19; 13(12): 973-1144



REVIEW

- 973 Risk factors, preventive interventions, overlapping symptoms, and clinical measures of delirium in elderly patients
Mei X, Liu YH, Han YQ, Zheng CY

ORIGINAL ARTICLE

Case Control Study

- 985 Diagnostic and prognostic implications of non-high-density lipoprotein cholesterol and homocysteine levels for cognitive impairment in thalamic infarction
Zhu SY, Ge W, Zhang H
- 995 Brain-derived neurotrophic factor, sex hormones and cognitive decline in male patients with schizophrenia receiving continuous antipsychotic therapy
Li J, Xiao WH, Ye F, Tang XW, Jia QF, Zhang XB
- 1005 Haplotype analysis of long-chain non-coding RNA NONHSAT102891 promoter polymorphisms and depression in Chinese individuals: A case-control association study
Li Y, Wang YX, Tang XM, Liang P, Chen JJ, Jiang F, Yang Q, Liang YD

Retrospective Study

- 1016 Efficacy and risk factors for anxiety and depression after mini-incision hip arthroplasty for femoral head osteonecrosis
Yu WX, Hao YQ, Lu C, Li H, Cai YZ
- 1027 Efficacy of enhanced extracorporeal counterpulsation combined with atorvastatin in the treatment of cognitive impairment after stroke
Duan Y, Tang HX
- 1037 Value of Chuanjin Qinggan decoction in improving the depressive state of patients with herpes zoster combined with depression
Wang YN, Shi MM, Zhang JM
- 1046 Impact of an emergency department nursing intervention on continuity of care, self-care, and psychological symptoms
Xu S, Gu YF, Dong AH
- 1053 Effect of cognitive behavior therapy training and psychological nursing on the midwifery process in the delivery room
Shi Q, Wang J, Zhao D, Gu LY
- 1061 Meteorological factors, ambient air pollution, and daily hospital admissions for depressive disorder in Harbin: A time-series study
Hu T, Xu ZY, Wang J, Su Y, Guo BB

- 1079** Analysis of influencing factors and the construction of predictive models for postpartum depression in older pregnant women
Chen L, Shi Y
- Observational Study**
- 1087** Relationship between nightmare distress and depressive symptoms in Chinese emergency department nurses: A cross-sectional study
Gan QW, Yu R, Lian ZR, Yuan YL, Li YP, Zheng LL
- 1096** Mediating role of physical activity in the relationship between psychological distress and intimate relationships among stroke patients
Luo CY, Jiao P, Tu SM, Shen L, Sun YM
- 1106** Surviving the shift: College student satisfaction with emergency online learning during COVID-19 pandemic
Zhai XY, Lei DC, Zhao Y, Jing P, Zhang K, Han JT, Ni AH, Wang XY
- 1121** Influence of physical education on anxiety, depression, and self-esteem among college students
Fu HY, Wang J, Hu JX
- 1133** Influence of childhood trauma on adolescent internet addiction: The mediating roles of loneliness and negative coping styles
Dong WL, Li YY, Zhang YM, Peng QW, Lu GL, Chen CR

ABOUT COVER

Peer Reviewer of *World Journal of Psychiatry*, Qing-Zhong Wang, PhD, Associate Professor, Institute of Chinese Materia Medica, Shanghai University of Traditional Chinese Medicine, Shanghai 201203, China.
wangqingzhong3@gmail.com

AIMS AND SCOPE

The primary aim of *World Journal of Psychiatry* (*WJP*, *World J Psychiatry*) is to provide scholars and readers from various fields of psychiatry with a platform to publish high-quality basic and clinical research articles and communicate their research findings online.

WJP mainly publishes articles reporting research results and findings obtained in the field of psychiatry and covering a wide range of topics including adolescent psychiatry, biological psychiatry, child psychiatry, community psychiatry, ethnopsychology, psychoanalysis, psychosomatic medicine, etc.

INDEXING/ABSTRACTING

The *WJP* is now abstracted and indexed in Science Citation Index Expanded (SCIE, also known as SciSearch®), Current Contents/Clinical Medicine, Journal Citation Reports/Science Edition, PubMed, PubMed Central, Reference Citation Analysis, China Science and Technology Journal Database, and Superstar Journals Database. The 2023 Edition of Journal Citation Reports® cites the 2022 impact factor (IF) for *WJP* as 3.1; IF without journal self cites: 2.9; 5-year IF: 4.2; Journal Citation Indicator: 0.52; Ranking: 91 among 155 journals in psychiatry; and Quartile category: Q3.

RESPONSIBLE EDITORS FOR THIS ISSUE

Production Editor: *Yu-Xi Chen*; Production Department Director: *Xu Guo*; Editorial Office Director: *Jia-Ping Yan*.

NAME OF JOURNAL

World Journal of Psychiatry

ISSN

ISSN 2220-3206 (online)

LAUNCH DATE

December 31, 2011

FREQUENCY

Monthly

EDITORS-IN-CHIEF

Ting-Shao Zhu, Panteleimon Giannakopoulos

EDITORIAL BOARD MEMBERS

<https://www.wjgnet.com/2220-3206/editorialboard.htm>

PUBLICATION DATE

December 19, 2023

COPYRIGHT

© 2023 Baishideng Publishing Group Inc

INSTRUCTIONS TO AUTHORS

<https://www.wjgnet.com/bpg/gerinfo/204>

GUIDELINES FOR ETHICS DOCUMENTS

<https://www.wjgnet.com/bpg/GerInfo/287>

GUIDELINES FOR NON-NATIVE SPEAKERS OF ENGLISH

<https://www.wjgnet.com/bpg/gerinfo/240>

PUBLICATION ETHICS

<https://www.wjgnet.com/bpg/GerInfo/288>

PUBLICATION MISCONDUCT

<https://www.wjgnet.com/bpg/gerinfo/208>

ARTICLE PROCESSING CHARGE

<https://www.wjgnet.com/bpg/gerinfo/242>

STEPS FOR SUBMITTING MANUSCRIPTS

<https://www.wjgnet.com/bpg/GerInfo/239>

ONLINE SUBMISSION

<https://www.f6publishing.com>



Observational Study

Influence of physical education on anxiety, depression, and self-esteem among college students

Hai-Yan Fu, Jing Wang, Jia-Xi Hu

Specialty type: Psychiatry

Provenance and peer review:

Unsolicited article; Externally peer reviewed.

Peer-review model: Single blind

Peer-review report's scientific quality classification

Grade A (Excellent): 0
Grade B (Very good): 0
Grade C (Good): C, C
Grade D (Fair): 0
Grade E (Poor): 0

P-Reviewer: Dhakal S, Australia;
Mechili EA, Albania

Received: September 19, 2023

Peer-review started: September 19, 2023

First decision: October 8, 2023

Revised: October 20, 2023

Accepted: November 29, 2023

Article in press: November 29, 2023

Published online: December 19, 2023



Hai-Yan Fu, Jing Wang, Jia-Xi Hu, School of Physical Education, Guangzhou Sport University, Guangzhou 510500, Guangdong Province, China

Corresponding author: Hai-Yan Fu, PhD, Lecturer, School of Physical Education, Guangzhou Sport University, No. 1268 Guangzhou Avenue Central, Tianhe District, Guangzhou 510500, Guangdong Province, China. missfhy@163.com

Abstract

BACKGROUND

Physical education is pivotal in our country's education reform. Urban schools have notably enhanced the intensity of physical education in recent years. However, the effects of physical education on students' anxiety, depression, and self-esteem levels, as well as their interrelations, remain unexplored.

AIM

To analyze the influence of physical education on students' anxiety, depression, and self-esteem.

METHODS

This study employed a cross-sectional design. A stratified cluster sampling method was used to select 478 first-year university students. Self-administered questionnaires were used to investigate the physical education status and basic information of college students. We used the Physical Activity Rank Scale-3 (PARS-3), Self-Rating Anxiety Scale (SAS), Self-Rating Depression Scale (SDS), and Self-Esteem Scale (SES) to assess the level of exercise, anxiety, depression, and self-esteem. Multiple Logistic regression was used to analyze the factors influencing anxiety, depression, and low self-esteem. The receiver operating characteristic curve and area under the curve (AUC) were used to evaluate the predictive ability of PARS-3 scores for anxiety, depression, and low self-esteem. Spearman's correlation was used to analyze the correlations among the PARS-3, SAS, SDS, and SES.

RESULTS

Compared with the domestic norms, SAS and SDS scores were higher, and SES scores were lower ($P < 0.05$). Among the participants, 210 (43.93%) had PARS-3 scores below 20, 94 (19.67%) had scores of 20-42, and 174 (36.40%) had scores above 42. After adjusting for daily sleep time, gender, being an only child, major, father's educational background, mother's educational background, and family

residence, PARS-3 scores were independent influencing factors for anxiety, depression, and low self-esteem ($P < 0.05$). The AUC of PARS-3 scores predicting anxiety, depression, and low self-esteem were 0.805 (0.760-0.849), 0.799 (0.755-0.843), and 0.831 (0.788-0.874), respectively. The sensitivities were 0.799, 0.801, and 0.748, and the specificities were 0.743, 0.716, and 0.814, respectively. PARS-3 was negatively correlated with SAS and SDS scores ($r = -0.566$, -0.621 , both $P < 0.001$) and positively correlated with SES scores ($r = -0.621$, $P < 0.001$). SES scores were negatively correlated with SAS and SDS scores ($r = -0.508$, $r = -0.518$, both $P < 0.001$).

CONCLUSION

The amount of physical activity is negatively correlated with anxiety and depression degree and positively correlated with self-esteem degree.

Key Words: Physical education; Student; Anxiety; Depression; Self-esteem; Influence

©The Author(s) 2023. Published by Baishideng Publishing Group Inc. All rights reserved.

Core Tip: This study establishes a negative correlation between physical activity levels and the degree of anxiety and depression while demonstrating a positive correlation with self-esteem. This provides substantial evidence for the impact of physical education on anxiety, depression, and self-esteem of college students.

Citation: Fu HY, Wang J, Hu JX. Influence of physical education on anxiety, depression, and self-esteem among college students. *World J Psychiatry* 2023; 13(12): 1121-1132

URL: <https://www.wjgnet.com/2220-3206/full/v13/i12/1121.htm>

DOI: <https://dx.doi.org/10.5498/wjp.v13.i12.1121>

INTRODUCTION

University physical education aims to promote students' holistic development and cultivate students' comprehensive quality through sports activities[1]. Physical activity is a reliable way to develop healthy behaviors, sports abilities, morality, and other qualities among students[2]. College students are under pressure from various aspects, such as college entrance, interpersonal conflict, and job search competition. Moreover, they are prone to psychological problems, such as anxiety and depression, which may lead to violent injuries and even suicide[3]. Self-esteem refers to confidence in one's worth, abilities, and morals[4]. Self-esteem is a positive psychological quality and psychological capital for college students' growth and success[5]. College students are an important part of young people, and their physical and mental health have an important influence on personal development and long-term national planning. Research has shown that individuals with low self-esteem are prone to anxiety, depression, and other negative emotions[6]. However, individuals with high self-esteem have varying mental health levels[7]. Appropriate physical activity reduces anxiety and depression among college students[8] and effectively improves their self-esteem[9]. However, studies on the effects of physical education on anxiety, depression, and self-esteem are scant. Therefore, we used college students to analyze the influence of physical education on anxiety, depression, and self-esteem to provide a reference for improving their physical and mental health.

MATERIALS AND METHODS

Object of study

We conducted a cross-sectional survey. We selected university students using stratified cluster sampling. The participants were based on major, including humanities and social sciences, science and engineering, and medical sciences. Three majors were selected to obtain a sufficient sample size.

We determined the sample size using a formula (quantitative variable)[10] for cross-sectional studies: $n = \left(\frac{Z_{1-\alpha/2} \times \sigma}{\delta}\right)^2$, where: n represents the sample size of each group; $Z_{1-\alpha/2} = 1.96$; δ represents the allowable error, which is the half-width of the confidence interval; and σ is the standard deviation. Based on $\delta = 5$ and $\sigma = 30$, we calculated n to be 139. Considering a 10% withdrawal rate, we estimated that the study required 459 participants [$139 \times 3 \times (1 + 10\%)$].

The survey object recruitment methods were as follows: Buy some small gifts, such as carbon pens, cartoon erasers, post-it notes, and other small prizes, for each person willing to participate in the survey. The students included in the survey have the spirit, consciousness, ability, and a WeChat account to complete the questionnaire independently. They knowingly and voluntarily agree to participate in this study. We excluded the students who could not complete the questionnaire for any reason. To protect privacy, we ensure the questionnaire results and data are only known by the research team and destroy the questionnaire after obtaining the relevant data analysis conclusions. We established a WeChat group of survey participants and, after obtaining informed consent, sent questionnaire links to the group for the

questionnaire survey. Participation was voluntary. We sent 500 questionnaires, and 486 were returned (97.2% recovery rate). After excluding the invalid questionnaires such as missing or multiple pages, incomplete filling, respondents not meeting the requirements, obviously wrong or incorrect answers, or recalled deadlines, we included 478 effective questionnaires (95.6%) in the analysis.

Questionnaire survey and quality control

We used original questionnaires that were reviewed and tested by experts. The audit includes the completeness, standardization, consistency, authenticity, effectiveness, feasibility, and scientificity of the questionnaire. A test is a form of survey used to obtain preliminary information and understand respondents' opinion before conducting a formal survey. The questionnaire obtained information on the participants, their parents, and their peers. The survey included questions regarding sociodemographic factors, physical activity, anxiety, depression, and self-esteem. The survey was conducted from February to May 2023.

The investigators in this study were members of a research group that had undergone unified training and assessment. They managed the research data and survey results. Participants who were unable to participate in the survey during the set period were contacted by the investigators within two weeks and requested to complete the questionnaire using the same procedure as the set survey to reduce the number of invalid questionnaires.

Sociodemographic factors

Based on a review of the relevant literature, we designed a sociodemographic questionnaire under the guidance of epidemiologists. The questions included student number, gender, being an only child, major, parents' educational background, family residence, and average daily sleep time over the last month.

Sports activities

We employed the Physical Activity Rank Scale-3 (PARS-3)[11] to calculate the participants' physical activity in the past month. In previous studies, the scale's internal consistency and reliability were 0.86 and 0.82, respectively. The scale contains three dimensions: time, intensity, and frequency of exercise. Items were rated on a five-point Likert scale (1 = light exercise; 5 = competitive exercise). Among them, exercise time was rated 0 to 4 points, and exercise intensity and frequency grades were 1 to 5 points. Exercise was calculated as time $\times$ intensity $\times$ frequency; the score range was 0 to 100 points. Exercise classification criteria were as follows: ≤ 19 points = low exercise, 20-42 points = moderate exercise, ≥ 43 points = high exercise.

Anxiety and depression

We used the Self-Rating Anxiety Scale (SAS) and Self-Rating Depression Scale (SDS)[12] to detect anxiety and depression, respectively. The SAS contains 20 items (15 positive and 5 reverse scores). Similarly, the SDS contains 20 items (11 positive and nine reverse scores). Items were rated on a four-point Likert scale (1 = occasional; 4 = persistent). The sum of the scores for each item was the approximate score of anxiety or depression. The standard or final score of anxiety or depression was calculated as 1.25 times the score of anxiety or depression rounded to a whole number. The criteria for identifying anxiety were an SAS score of > 50 points while depression was an SDS score of > 53 points.

Self-esteem

We employed the Self-Esteem Scale (SES)[13] to evaluate college students' self-esteem. The scale's internal consistency was 0.87 in previous studies. This scale contains ten items (five positive and five negative). Items were rated on a four-point Likert scale (1 = strongly disagree; 4 = strongly agree). The total self-esteem score was the sum of all entries. Higher SES scores indicated higher self-esteem.

Statistical analysis

We used SPSS 20.0 to process the data and expressed the measurement data as mean $\pm$ SD. Comparisons between two sets of data were performed using the *t*-test, and comparisons between three sets of data were performed using a one-way analysis of variance (ANOVA) and Bonferroni. Count data are represented as *n*.

We classified low self-esteem by subtracting one standard deviation from the domestic norm average of SES[14]. Anxiety (anxious = 1, not anxious = 0), depression (depressed = 1, not depressed = 0), and self-esteem (low self-esteem = 1, regular/high self-esteem = 0) were the dependent variables, whereas PARS-3 scores and sociodemographic indicators were the independent variables. A multivariate logistic regression model was used for the analysis. The predictive ability of the receiver operator characteristic curve (ROC) and area under the curve (AUC). Spearman's correlation analysis was used to explore the correlation between PARS-3 scores and SAS, SDS, and SES scores. A *P* value less than 0.05 means that the difference is statistically significant.

RESULTS

SAS, SDS, and SES scores

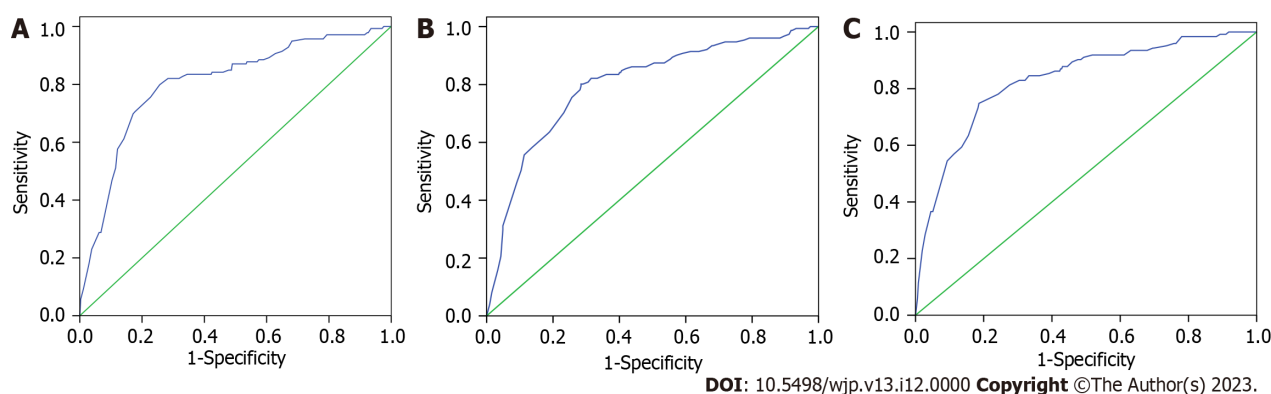
The participants' SAS and SDS scores were higher and SES scores were lower than the domestic norms [SAS: (29.78 $\pm$ 10.07) points, SDS: (33.46 $\pm$ 8.55) points][15,16] (*P* < 0.05; Table 1).

Table 1 Self-Rating Anxiety Scale, Self-Rating Depression Scale and the Self-Esteem Scale scores ($n = 478$)

Items	SAS	SDS	SES
Participants	46.39 $\pm$ 7.26	48.22 $\pm$ 10.24	26.35 $\pm$ 4.31
Domestic norm	29.78 $\pm$ 10.07	33.46 $\pm$ 8.55	28.75 $\pm$ 4.86
t^1	53.067	37.365	-12.184
P value	< 0.001	< 0.001	< 0.001

¹Single sample t -test.

SAS: Self-Rating Anxiety Scale; SDS: Self-Rating Depression Scale; SES: the Self-Esteem Scale.

**Figure 1 Receiver operating characteristic curve of Physical Activity Rank Scale-3 scores predicting anxiety, depression, and low self-esteem.** A: Physical Activity Rank Scale-3 (PARS-3) scores predicting anxiety; B: PARS-3 scores predicting depression; C: PARS-3 scores predicting low self-esteem.

Influence of sociodemographic factors on PARS-3 scores

Among the participants, 210 (43.93%) had PARS-3 scores ≤ 19 , 94 (19.67%) scored 20-42, and 174 (36.40%) scored ≥ 43 . Among the participants with PARS-3 scores ≤ 19 , the PARS-3 scores of only children were higher than those who were not only children. The PARS-3 scores of college students with an average daily sleep time > 8 h were higher than those with an average daily sleep time of 6-8 h and those with an average daily sleep time of < 6 h (all $P < 0.05$; Table 2).

Influence of sociodemographic factors on SAS, SDS, and SES scores

The SDS scores of college students whose fathers' education was at or above the graduate level were higher than those of those whose fathers' education was less than the graduate level, and their SES scores were lower than those of those whose fathers' education was below the graduate level ($P < 0.05$; Table 3).

Factors influencing anxiety, depression, and low self-esteem

Anxiety (anxious = 1, not anxious = 0), depression (depressed = 1, not depressed = 0), and self-esteem (low self-esteem = 1, regular/high self-esteem = 0) were the dependent variables, whereas PARS-3 scores and sociodemographic indicators were the independent variables. A multivariate logistic regression model was used for the analysis (Table 4). The results showed that after adjusting for daily sleep time, gender, being an only child, major, father's educational background, mother's educational background, and family residence, PARS-3 scores were independent influencing factors for anxiety, depression, and low self-esteem ($P < 0.05$; Table 5).

Predictive ability of PARS-3 scores

The AUC of the PARS-3 scores predicting anxiety, depression, and low self-esteem were 0.805 (0.760-0.849), 0.799 (0.755-0.843), and 0.831 (0.788-0.874), respectively. The sensitivities were 0.799, 0.801, and 0.748 and the specificities were 0.743, 0.716, and 0.814, respectively (Figure 1, Table 6).

Correlation analysis between PARS-3 scores and SAS, SDS, and SES scores

PARS-3 scores were negatively correlated with SAS and SDS scores ($r = -0.566, -0.621$, both $P < 0.001$) and positively correlated with SES scores ($r = -0.621, P < 0.001$). SES was negatively correlated with SAS and SDS scores ($r = -0.508, r = -0.518$, both $P < 0.001$; Figure 2, Table 7).

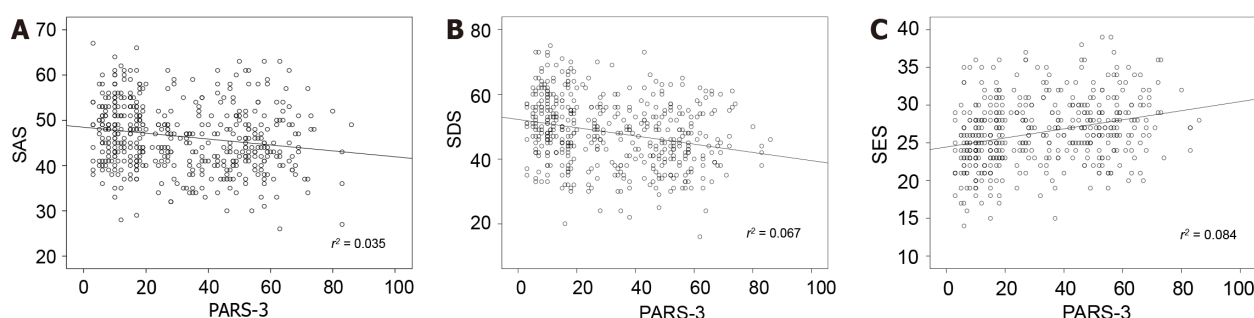
Table 2 The influence of sociodemographic factors on Physical Activity Rank Scale-3 scores

Index		Participant number	Statistic	PARS-3 scores		
				≤ 19	20-42	≥ 43
Gender	Male	221		11.60 ± 4.83	30.46 ± 5.77	56.50 ± 8.24
	Female	257		11.82 ± 4.41	32.27 ± 5.74	55.61 ± 9.62
			<i>t</i>	0.3446	1.544	0.637
			<i>P</i> value	0.731	0.126	0.525
Only child	Yes	212		12.42 ± 4.53	31.92 ± 6.01	56.59 ± 9.49
	No	266		11.14 ± 4.59	30.88 ± 5.65	55.49 ± 8.65
			<i>t</i>	2.023	0.866	0.792
			<i>P</i> value	0.044	0.388	0.429
Major	Humanities and social sciences	155		11.45 ± 4.64	30.34 ± 5.07	55.37 ± 8.62
	Science and engineering	135		12.04 ± 4.56	32.70 ± 5.92	57.49 ± 8.76
	Medicine	188		11.71 ± 4.60	31.20 ± 6.08	55.20 ± 9.61
			<i>F</i>	0.252	1.089	1.122
Father's educational background	High school or technical secondary school and below	210		11.58 ± 4.72	31.10 ± 5.63	55.63 ± 9.53
	College or undergraduate	205		11.96 ± 4.54	32.29 ± 5.28	55.33 ± 8.18
	Postgraduate and above	63		11.27 ± 4.06	30.14 ± 6.65	58.96 ± 9.89
			<i>F</i>	0.243	0.974	1.696
Mother's educational background	High school or technical secondary school and below	221		11.68 ± 4.76	31.07 ± 5.54	55.36 ± 9.92
	College or undergraduate	203		11.71 ± 4.53	31.67 ± 5.94	55.76 ± 7.75
	Postgraduate and above	54		12.08 ± 3.66	31.21 ± 6.21	58.70 ± 10.01
			<i>F</i>	0.041	0.104	1.240
Family domicile	Village	208		11.92 ± 5.18	30.07 ± 5.47	55.48 ± 9.30
	County	117		11.22 ± 4.27	33.60 ± 4.36	56.40 ± 9.26
	Downtown	153		11.86 ± 3.93	31.46 ± 6.51	56.39 ± 8.52
			<i>F</i>	0.442	2.642	0.215
Average sleep time	< 6 h	83		10.24 ± 4.71	29.87 ± 5.98	54.14 ± 9.41
	6-8 h	257		12.36 ± 4.43	31.29 ± 5.86	55.83 ± 8.60
			<i>F</i>	0.041	0.104	1.240
			<i>P</i> value	0.960	0.901	0.292

> 8 h	138 ^a	11.72 ± 4.57	32.15 ± 5.48	57.04 ± 9.55
F		3.512	0.740	0.845
P		0.032	0.480	0.431

^a $P < 0.05$, compared to the average daily sleep time of 6-8 h and < 6 h.

PARS-3: Physical Activity Rank Scale-3.



DOI: 10.5498/wjp.v13.i12.0000 Copyright ©The Author(s) 2023.

Figure 2 Scatter plot of correlation between Physical Activity Rank Scale-3 scores and Self-Rating Anxiety Scale, Self-Rating Depression Scale, and the Self-Esteem Scale scores. A: The correlation between Self-Rating Anxiety Scale and Physical Activity Rank Scale-3 (PARS-3); B: The correlation between Self-Rating Depression Scale and PARS-3; C: The correlation between the Self-Esteem Scale and PARS-3. SAS: Self-Rating Anxiety Scale; SDS: Self-Rating Depression Scale; SES: the Self-Esteem Scale; PARS-3: Physical Activity Rank Scale-3.

DISCUSSION

Self-esteem affects how individuals deal with stressful events; individuals with high self-esteem are more inclined to adopt positive coping strategies to deal with stress[17]. Understanding the link between physical education and anxiety, depression, and self-esteem helps guide and intervene to promote students' holistic physical and mental development.

The amount of exercise, also known as exercise load, refers to the physical load, psychological load, and calories consumed by the human body during physical activity. Exercise load determines the intensity, duration, accuracy, and characteristics of the exercises. This study revealed anxiety, depression, and low self-esteem among college students, which require attention. The proportion of students with low physical activity was lower than that reported by Sheng *et al* [18]. However, the overall situation is not positive, and the potential impact of low physical activity on the physical and mental health of college students should be monitored. This may be due to the wide use of electronic products, such as smartphones and tablet computers. Several college students are addicted to mobile phones and the internet, reducing their willingness to participate in sports activities[19]. Some researchers have proposed that the lack of exercise among college students is related to a lack of good exercise habits due to academic pressure in middle school[20]. Students in middle school did not develop good exercise habits, and their bad exercise habits after college cannot be corrected in time, resulting in less exercise. Moreover, our findings suggest that college students with high physical activity levels have a lower risk of anxiety, depression, and low self-esteem. Furthermore, our results indicate that higher amounts of exercise are associated with reduced anxiety and depression and improved self-esteem among college students. Participation in sports activities can affect anxiety and depression levels in many ways. Sports activities can increase communication between college students and their peers and release negative emotions, thereby reducing anxiety and depression. Additionally, regular participation in sports activities can improve college students' sense of self-efficacy, thus enhancing their subjective support levels, problem-solving ability, and positive evaluation of volitivity and self-confidence[21]. Therefore, college students who are more active and proactive in coping with pressure have fewer negative emotional experiences and more positive emotional experiences, thus reducing anxiety and depression levels [22]. Moreover, physical exercise increases the relative content of metabolites 4-hydroxyphenyl lactate and dihydro thymine and decreases the relative content of glutamine in the human body, thus affecting the regulatory pathways related to negative emotions, such as coenzyme Q biosynthesis, tyrosine metabolism, and pyrimidine metabolism[23]. In addition, physical exercise can change the composition of the human intestinal flora, affecting the secretion of a series of substances that regulate neural activity, such as serotonin, and improving the level of anxiety and depression in individuals[24]. Therefore, we suggest that schools encourage college students to participate actively in physical exercise. Psychological education departments should pay attention to the mental health status of college students with low daily physical activity and implement effective intervention measures to prevent anxiety and depression.

This study found that higher amounts of exercise are associated with higher self-esteem among college students, which was in line with Zayed's findings[25]. Previous research has shown that physical exercise can improve self-esteem by reducing loneliness. Moreover, physical activity enhances self-esteem[26]. Activity time, frequency, and intensity may be the key factors that produce positive psychological benefits for self-esteem. Our findings indicated that lower self-esteem

Table 3 Influence of sociodemographic factors on Self-Rating Anxiety Scale, Self-Rating Depression Scale and the Self-Esteem Scale scores

Index		Participant number	Statistic	SAS	SDS	SES
Gender	Male	221		46.63 ± 7.19	48.46 ± 9.50	26.36 ± 4.37
	Female	257		46.18 ± 7.31	48.01 ± 10.84	26.33 ± 4.26
			<i>t</i>	0.676	0.479	0.076
			<i>P</i> value	0.499	0.632	0.940
Only child	Yes	212		46.24 ± 6.74	48.58 ± 9.95	26.21 ± 4.21
	No	266		46.51 ± 7.65	47.93 ± 10.47	26.45 ± 4.39
			<i>t</i>	0.404	0.689	0.605
			<i>P</i> value	0.686	0.491	0.546
Major	Humanities and social sciences	155		45.95 ± 7.08	48.48 ± 9.47	26.62 ± 4.46
	Science and engineering	135		46.36 ± 6.97	48.33 ± 10.61	26.12 ± 4.13
	Medicine	188		46.76 ± 7.58	47.91 ± 10.58	26.28 ± 4.30
			<i>F</i>	0.531	0.144	0.522
Father's educational background	High school or technical secondary school and below	210		45.70 ± 6.10	44.09 ± 9.33 ^a	27.98 ± 3.88 ^a
	College or undergraduate	205		46.41 ± 7.43	47.44 ± 10.32 ^a	26.39 ± 4.47 ^a
	Postgraduate and above	63		46.17 ± 7.56	50.17 ± 10.84	25.57 ± 3.81
			<i>F</i>	0.558	11.250	11.890
Mother's educational background	High school or technical secondary school and below	221		46.26 ± 7.29	48.06 ± 10.09	26.54 ± 4.37
	College or undergraduate	203		46.76 ± 7.28	47.80 ± 10.04	26.44 ± 4.32
	Postgraduate and above	54		45.52 ± 6.94	50.39 ± 11.31	25.19 ± 3.85
			<i>F</i>	0.690	1.418	2.353
Family domicile	Village	208		46.40 ± 6.86	47.54 ± 9.75	26.72 ± 4.31
	County	117		46.25 ± 7.26	47.51 ± 10.67	26.34 ± 4.53
	Downtown	153		46.48 ± 7.76	49.67 ± 10.41	25.84 ± 4.07
			<i>F</i>	0.034	2.294	2.401
Average sleep time	< 6 h	83		48.02 ± 7.71	50.10 ± 9.63	25.46 ± 4.27
	6-8 h	257		46.02 ± 7.35	48.11 ± 10.21	26.54 ± 4.29
			<i>F</i>	0.967	0.102	0.092
			<i>P</i> value	0.967	0.102	0.092

	> 8 h	138	46.09 ± 6.65	47.28 ± 10.51	26.51 ± 4.31	
			<i>F</i>	2.572	2.972	2.131
			<i>P</i> value	0.078	0.053	0.120

^a*P* < 0.05, compared to the father's education level of postgraduate or above.

SAS: Self-Rating Anxiety Scale; SDS: Self-Rating Depression Scale; SES: the Self-Esteem Scale.

Table 4 Assignment table

Independent variables	Assignment
Gender	Male = 1; Female = 0
Only child	Yes = 1; No = 0
Major	Humanities and social sciences = 1; Science and engineering = 2; Medicine = 3
Father's educational background	High school or technical secondary school and below = 1; College or undergraduate = 2; Postgraduate and above = 3
Mother's educational background	High school or technical secondary school and below = 1; College or undergraduate = 2; Postgraduate and above = 3
Family domicile	Village = 1; County = 2; Downtown = 3
Average sleep time	Actual value
PARS-3 scores	Actual value

PARS-3: Physical Activity Rank Scale-3.

Table 5 Multivariate logistic regression for anxiety, depression, and low self-esteem

Model	Independent variables	Anxiety			Depression			Low self-esteem		
		B	<i>P</i> value	OR (95%CI)	B	<i>P</i> value	OR (95%CI)	B	<i>P</i> value	OR (95%CI)
1	PARS-3 scores	-0.065	< 0.001	0.937 (0.923-0.951)	-0.063	< 0.001	0.939 (0.926-0.952)	-0.077	< 0.001	0.926 (0.910-0.943)
	Constant	0.781	< 0.001	2.184	0.896	< 0.001	2.449	0.799	< 0.001	2.224
2	PARS-3 scores	-0.065	< 0.001	0.937 (0.923-0.951)	-0.063	< 0.001	0.939 (0.926-0.952)	-0.077	< 0.001	0.926 (0.910-0.943)
	Average sleep time	-0.064	0.236	0.938 (0.844-1.043)	-0.045	0.397	0.956 (0.862-1.061)	-0.005	0.931	0.995 (0.891-1.111)
	Constant	1.247	0.005	3.480	1.222	0.005	3.394	0.835	0.068	2.304
3	PARS-3 scores	-0.067	< 0.001	0.935 (0.921-0.949)	-0.064	< 0.001	0.938 (0.925-0.951)	-0.078	< 0.001	0.925 (0.908-0.942)
	Average sleep time	-0.083	0.134	0.921 (0.826-1.026)	-0.054	0.318	0.948 (0.853-1.053)	-0.012	0.835	0.988 (0.883-1.106)
	Gender	-0.145	0.540	0.865 (0.543-1.377)	-0.173	0.455	0.841 (0.535-1.324)	-0.055	0.825	0.947 (0.582-1.539)
	Only child	-0.360	0.132	0.698 (0.437-1.114)	-0.472	0.043	0.624 (0.395-0.986)	-0.136	0.585	0.873 (0.536-1.421)
	Major		0.020			0.132			0.174	
	Humanities and social sciences	0.137	0.631	1.147 (0.656-2.005)	0.382	0.164	1.465 (0.855-2.511)	0.397	0.182	1.488 (0.830-2.667)
	Science and engineering	0.769	0.007	2.158 (1.232-3.780)	0.542	0.055	1.719 (0.990-2.987)	0.533	0.076	1.704 (0.945-3.073)
	Father's educational background		0.454			0.924			0.669	
	High school or technical	-0.013	0.987	0.987 (0.202-	0.310	0.691	1.364 (0.296-	0.310	0.714	1.364 (0.260-

Secondary school and below			4.813)			6.284)			7.150)
College or undergraduate	0.440	0.555	1.553 (0.360-6.700)	0.255	0.722	1.291 (0.316-5.277)	0.557	0.476	1.745 (0.378-8.048)
Mother's educational background		0.685			0.776			0.325	
High school or technical secondary school and below	-0.165	0.830	0.848 (0.187-3.835)	-0.512	0.489	0.599 (0.140-2.559)	-1.175	0.141	0.309 (0.065-1.478)
College or undergraduate	0.176	0.833	1.193 (3.835-6.156)	-0.559	0.490	0.572 (0.117-2.797)	-1.002	0.250	0.367 (0.067-2.025)
Family domicile		0.448			0.939			0.613	
Village	0.036	0.915	1.037 (0.534-2.011)	-0.110	0.741	0.896 (0.467-1.719)	0.080	0.821	1.084 (0.541-2.173)
County	-0.330	0.360	0.719 (0.355-1.457)	-0.109	0.756	0.897 (0.451-1.782)	-0.230	0.543	0.795 (0.379-1.666)
Constant	1.263	0.031	3.538	1.627	0.005	5.087	1.322	0.029	3.753

Model 1 does not adjust for any variables; Model 2 adjusts the average daily sleep time; and Model 3 adjusts the average daily sleep time, gender, only child, major, father's educational background, mother's educational background, and family residence. PARS-3: Physical Activity Rank Scale-3.

Table 6 Receiver operating characteristic curve of Physical Activity Rank Scale-3 scores predicting anxiety, depression, and low self-esteem

Dependent variables	AUC	Sensitivity	Specificity	Standard error	P value
Anxiety	0.805 (0.760-0.849)	0.799	0.743	0.023	< 0.001
Depression	0.799 (0.755-0.843)	0.801	0.716	0.022	< 0.001
Self-esteem	0.831 (0.788-0.874)	0.748	0.814	0.022	< 0.001

PARS-3: Physical Activity Rank Scale-3; AUC: Area under the curve.

Table 7 Correlation matrix between Physical Activity Rank Scale-3 scores and Self-Rating Anxiety Scale, Self-Rating Depression Scale and the Self-Esteem Scale scores

Indexes		SAS	SDS	SES
PARS-3	<i>r</i>	-0.566	-0.621	0.621
	<i>P</i> value	< 0.001	< 0.001	< 0.001
SAS	<i>r</i>	-	0.511	-0.508
	<i>P</i> value	-	< 0.001	< 0.001
SDS	<i>r</i>	-	-	-0.518
	<i>P</i> value	-	-	< 0.001

PARS-3: Physical Activity Rank Scale-3; SAS: Self Rating Anxiety Scale; SDS: Self Rating Depression Scale; SES: the Self-Esteem Scale.

was associated with being more prone to depression, which was in line with extant studies[27]. College students with high self-esteem are confident, self-reliant, rational, and peaceful. Their self-evaluation is generally positive; they can rationally face the negative evaluation of others and effectively filter negative information. In addition, college students with high self-esteem have a better sense of control over their environment, can accept and adapt to the existing environment, and are willing to change themselves. When facing stressful events, they can effectively use their current social support to provide a buffer for themselves and reduce the negative impact of stressful events[28]. This effectively reduces the occurrence of anxiety and depression among college students. Therefore, individuals with high self-esteem can self-regulate their depression and solve general psychological problems under stressful conditions. The correlation scatter plot suggests that exercise significantly impacts anxiety, depression, and self-esteem. However, the goodness of fit

is low, indicating that exercise alone is not the sole factor affecting these aspects in college students. Ramón-Arbués *et al* [29] demonstrated that anxiety, depression, and self-esteem of college students were also related to Internet use, smoking, and insomnia.

Anxiety, depression, and low self-esteem are contemporary college students' main mental health problems. The detection rate of anxiety and depression in Chinese college students is rising. College students urgently need an intervention method that can effectively relieve their anxiety, depression, and low self-esteem. This study demonstrates that increasing physical activity decreases anxiety and depression thereby boosting self-esteem in college students. It indicates the value of incorporating appropriate physical activities for promoting college students' psychological well-being and development. Moreover, a significant correlation exists between anxiety, depression, and self-esteem. Low self-esteem can contribute to the development of anxiety and depression. Therefore, regardless of the specific psychological changes in anxiety, depression, and self-esteem, one must be vigilant to any abnormal psychological development. Due to the limited information collected in this study, it was impossible to investigate the correlation between the amount of physical activity and sedentary behavior, video time, and other behaviors, which needs to be supplemented by future studies with large samples. Moreover, this cross-sectional survey design introduces potential problems such as uncertain time sequencing, external factor interference, data quality impact, and potential factor uncertainty, making it challenging to establish causality. Therefore, other research methods such as randomized controlled studies should be employed in the future to verify the results of this study.

CONCLUSION

Physical activity decreases anxiety and depression and increases self-esteem among college students. Colleges and universities should promote active participation in sports and implement scientifically balanced exercise routines. This can alleviate anxiety and depression, improve self-esteem, and enhance the overall physical and mental well-being of college students, ultimately contributing to their holistic development.

ARTICLE HIGHLIGHTS

Research background

College students experience varying levels of anxiety, depression, and self-esteem. As this reflects the quality of education reform in China, the correlation between physical activity and students' anxiety, depression, and self-esteem must be explored.

Research motivation

This study aimed to identify the factors related to anxiety, depression, and self-esteem among college students, and provide guidelines for interventions. Considering the influence and adjustability of physical activity in students, we speculated that the amount of physical activity among college students may be related to anxiety, depression, and self-esteem.

Research objectives

To analyze the influence of physical activity on anxiety, depression, and self-esteem among college students.

Research methods

We investigated 478 first-year college students using the Physical Activity Rank Scale-3 (PARS-3), Self-Rating Anxiety Scale (SAS), Self-Rating Depression Scale (SDS), and Self-Esteem Scale (SES). A multivariate logistic regression model, receiver operating characteristic curve (ROC), area under the curve (AUC), and Spearman's correlation analysis were employed to determine the correlation between PARS-3 and SAS, SDS, and SES scores.

Research results

PARS-3 was negatively correlated with SAS and SDS scores ($r = -0.190, -0.267$, both $P < 0.001$) and positively correlated with SES scores ($r = 0.313, P < 0.001$). SES was negatively correlated with SAS and SDS scores ($r = -0.125, P = 0.016; r = -0.143, P = 0.002$).

Research conclusions

Physical activity was negatively correlated with anxiety and depression and positively correlated with self-esteem.

Research perspectives

Based on the multi-factor logistic regression model, ROC, AUC, and Spearman's correlation analysis, we comprehensively analyzed the correlation between college students' PARS-3 scores and SAS, SDS, and SES scores. We demonstrated that college students' PARS-3 scores were negatively correlated with SAS and SDS scores and positively correlated with SES scores. This could guide future interventions to reduce anxiety, depression, and low self-esteem among college students.

FOOTNOTES

Author contributions: Fu HY designed and conducted the research, and authored the paper; Wang J designed the research and supervised the report; Hu JX designed the research and contributed to the analysis.

Institutional review board statement: The study procedures were approved by the Ethics Committee of the School of Physical Education, Guangzhou Sport University (2023LCLL-23).

Informed consent statement: Written informed consent was obtained from all participants.

Conflict-of-interest statement: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Data sharing statement: The raw data supporting the conclusion of this article can be obtained from the corresponding author.

STROBE statement: The authors have read the STROBE Statement—a checklist of items, and the manuscript was prepared and revised according to the STROBE Statement—a checklist of items.

Open-Access: This article is an open-access article that was selected by an in-house editor and fully peer-reviewed by external reviewers. It is distributed in accordance with the Creative Commons Attribution NonCommercial (CC BY-NC 4.0) license, which permits others to distribute, remix, adapt, build upon this work non-commercially, and license their derivative works on different terms, provided the original work is properly cited and the use is non-commercial. See: <https://creativecommons.org/licenses/by-nc/4.0/>

Country/Territory of origin: China

ORCID number: Hai-Yan Fu 0009-0002-2169-6775; Jing Wang 0009-0000-1715-1145; Jia-Xi Hu 0009-0007-6564-9619.

S-Editor: Yan JP

L-Editor: A

P-Editor: Zhao S

REFERENCES

- Xia T. Evaluating College Students' Comprehensive Quality by the AHP Algorithm. *Comput Intell Neurosci* 2022; **2022**: 9606741 [PMID: 35615552 DOI: 10.1155/2022/9606741]
- Kljajević V, Stanković M, Đorđević D, Trkulja-Petković D, Jovanović R, Plazibat K, Oršolić M, Čurić M, Sporiš G. Physical Activity and Physical Fitness among University Students-A Systematic Review. *Int J Environ Res Public Health* 2021; **19** [PMID: 35010418 DOI: 10.3390/ijerph19010158]
- Wesonga S, Osingada C, Nabisere A, Nkemijika S, Olwit C. Suicidal tendencies and its association with psychoactive use predictors among university students in Uganda: a cross-sectional study. *Afr Health Sci* 2021; **21**: 1418-1427 [PMID: 35222607 DOI: 10.4314/ahs.v21i3.53]
- Vagka E, Gnardellis C, Lagiou A, Notara V. Nomophobia and Self-Esteem: A Cross Sectional Study in Greek University Students. *Int J Environ Res Public Health* 2023; **20** [PMID: 36833624 DOI: 10.3390/ijerph20042929]
- Wang X, Gao L, Yang J, Zhao F, Wang P. Parental Phubbing and Adolescents' Depressive Symptoms: Self-Esteem and Perceived Social Support as Moderators. *J Youth Adolesc* 2020; **49**: 427-437 [PMID: 31883099 DOI: 10.1007/s10964-019-01185-x]
- Weber SR, Winkelmann ZK, Monsma EV, Arent SM, Torres-McGehee TM. An Examination of Depression, Anxiety, and Self-Esteem in Collegiate Student-Athletes. *Int J Environ Res Public Health* 2023; **20** [PMID: 36673967 DOI: 10.3390/ijerph20021211]
- Kateri EV, Kalaitzaki A, Karademas EC. The role of self-esteem in the relationship between anxiety and depression of Albanian and Indian immigrants in Greece. *Psychiatriki* 2021; **32**: 26-33 [PMID: 33759806 DOI: 10.22365/jpsych.2021.002]
- Johnston SA, Roskowski C, He Z, Kong L, Chen W. Effects of team sports on anxiety, depression, perceived stress, and sleep quality in college students. *J Am Coll Health* 2021; **69**: 791-797 [PMID: 32149577 DOI: 10.1080/07448481.2019.1707836]
- Ouyang Y, Wang K, Zhang T, Peng L, Song G, Luo J. The Influence of Sports Participation on Body Image, Self-Efficacy, and Self-Esteem in College Students. *Front Psychol* 2019; **10**: 3039 [PMID: 32116869 DOI: 10.3389/fpsyg.2019.03039]
- Park S, Kim YH, Bang HI, Park Y. Sample size calculation in clinical trial using R. *J Minim Invasive Surg* 2023; **26**: 9-18 [PMID: 36936043 DOI: 10.7602/jmis.2023.26.1.9]
- Yuan S, You M. Effects of Physical Activity on College Students' Subjective Well-Being During COVID-19. *J Epidemiol Glob Health* 2022; **12**: 441-448 [PMID: 36197597 DOI: 10.1007/s44197-022-00062-4]
- Tu Z, He J, Wang Z, Wang C, Tian J, Tang Y. Development and validation of the while-in-bed-smartphone-use-induced sleep procrastination scale (WSPS) in Chinese undergraduates with/without problematic smartphone use. *Qual Life Res* 2023; **32**: 3085-3098 [PMID: 37347394 DOI: 10.1007/s11136-023-03457-3]
- Webster GD, Howell JL, Shepperd JA. Self-Esteem in 60 Seconds: The Six-Item State Self-Esteem Scale (SSES-6). *Assessment* 2022; **29**: 152-168 [PMID: 32929984 DOI: 10.1177/1073191120958059]
- Šagát P, Bartik P, Lazić A, Tohänean DI, Koronas V, Turcu I, Knjaz D, Alexe CI, Curițianu IM. Self-Esteem, Individual vs Team Sports. *Int J Environ Res Public Health* 2021; **18** [PMID: 34948525 DOI: 10.3390/ijerph182412915]
- Geng J, Lei L, Han L, Gao F. Shyness and depressive symptoms: a multiple mediation model involving core self-evaluations and sense of security. *J Affect Disord* 2021; **286**: 19-26 [PMID: 33662715 DOI: 10.1016/j.jad.2021.01.035]
- Böhler C, Lucht L, Göbel P, Ried R, Wülfing C, Seikowski K. [Sexual Self-esteem in Trans*People: Development of a New Questionnaire

- and Clinical Evaluation]. *Psychother Psychosom Med Psychol* 2022; **72**: 124-130 [PMID: [34781378](#) DOI: [10.1055/a-1658-0977](#)]
- 17 **Choi Y**, Choi SH, Yun JY, Lim JA, Kwon Y, Lee HY, Jang JH. The relationship between levels of self-esteem and the development of depression in young adults with mild depressive symptoms. *Medicine (Baltimore)* 2019; **98**: e17518 [PMID: [31626112](#) DOI: [10.1097/MD.00000000000017518](#)]
 - 18 **Sheng J**, Gong L, Zhou J. Exercise health belief model mediates the relationship between physical activity and peer support among Chinese college students: A cross-sectional survey. *Front Psychol* 2023; **14**: 1103109 [PMID: [36814667](#) DOI: [10.3389/fpsyg.2023.1103109](#)]
 - 19 **Zhang Y**, Li Y, Xia M, Han M, Yan L, Lian S. The relationship between loneliness and mobile phone addiction among Chinese college students: The mediating role of anthropomorphism and moderating role of family support. *PLoS One* 2023; **18**: e0285189 [PMID: [37115749](#) DOI: [10.1371/journal.pone.0285189](#)]
 - 20 **Lin X**, Liu H. A study on the effects of health behavior and sports participation on female college students' body mass index and healthy promoting lifestyle. *Front Public Health* 2022; **10**: 1069219 [PMID: [36684986](#) DOI: [10.3389/fpubh.2022.1069219](#)]
 - 21 **Wang K**, Li Y, Zhang T, Luo J. The Relationship among College Students' Physical Exercise, Self-Efficacy, Emotional Intelligence, and Subjective Well-Being. *Int J Environ Res Public Health* 2022; **19** [PMID: [36141869](#) DOI: [10.3390/ijerph191811596](#)]
 - 22 **Lin J**, Gao YF, Guo Y, Li M, Zhu Y, You R, Chen S, Wang S. Effects of qigong exercise on the physical and mental health of college students: a systematic review and Meta-analysis. *BMC Complement Med Ther* 2022; **22**: 287 [PMID: [36348349](#) DOI: [10.1186/s12906-022-03760-5](#)]
 - 23 **Dudzinska W**, Suska M, Lubkowska A, Jakubowska K, Olszewska M, Safranow K, Chlubek D. Comparison of human erythrocyte purine nucleotide metabolism and blood purine and pyrimidine degradation product concentrations before and after acute exercise in trained and sedentary subjects. *J Physiol Sci* 2018; **68**: 293-305 [PMID: [28432611](#) DOI: [10.1007/s12576-017-0536-x](#)]
 - 24 **Schneider E**, Doll JPK, Schweinfurth N, Kettelhack C, Schaub AC, Yamanbaeva G, Varghese N, Mählmann L, Brand S, Eckert A, Borgwardt S, Lang UE, Schmidt A. Effect of short-term, high-dose probiotic supplementation on cognition, related brain functions and BDNF in patients with depression: a secondary analysis of a randomized controlled trial. *J Psychiatry Neurosci* 2023; **48**: E23-E33 [PMID: [36653035](#) DOI: [10.1503/jpn.220117](#)]
 - 25 **Zayed MA**, Elshaer IA. Physical Activities and Learning Experience of Higher Education Students: Mediating Role of Quality of Life and Physical Self-Esteem. *Int J Environ Res Public Health* 2022; **19** [PMID: [36293998](#) DOI: [10.3390/ijerph192013417](#)]
 - 26 **Pop LM**, Iorga M, Iurcov R. Body-Esteem, Self-Esteem and Loneliness among Social Media Young Users. *Int J Environ Res Public Health* 2022; **19** [PMID: [35564458](#) DOI: [10.3390/ijerph19095064](#)]
 - 27 **Hasani S**, Aung E, Mirghafourvand M. Low self-esteem is related to depression and anxiety during recovery from an ectopic pregnancy. *BMC Womens Health* 2021; **21**: 326 [PMID: [34496785](#) DOI: [10.1186/s12905-021-01467-2](#)]
 - 28 **Wang C**, Cunningham-Erdogdu P, Steers MN, Weinstein AP, Neighbors C. Stressful life events and gambling: The roles of coping and impulsivity among college students. *Addict Behav* 2020; **107**: 106386 [PMID: [32272355](#) DOI: [10.1016/j.addbeh.2020.106386](#)]
 - 29 **Ramón-Arбуés E**, Gea-Caballero V, Granada-López JM, Juárez-Vela R, Pellicer-García B, Antón-Solanas I. The Prevalence of Depression, Anxiety and Stress and Their Associated Factors in College Students. *Int J Environ Res Public Health* 2020; **17** [PMID: [32987932](#) DOI: [10.3390/ijerph17197001](#)]



Published by **Baishideng Publishing Group Inc**
7041 Koll Center Parkway, Suite 160, Pleasanton, CA 94566, USA

Telephone: +1-925-3991568

E-mail: bpgoffice@wjgnet.com

Help Desk: <https://www.f6publishing.com/helpdesk>

<https://www.wjgnet.com>

