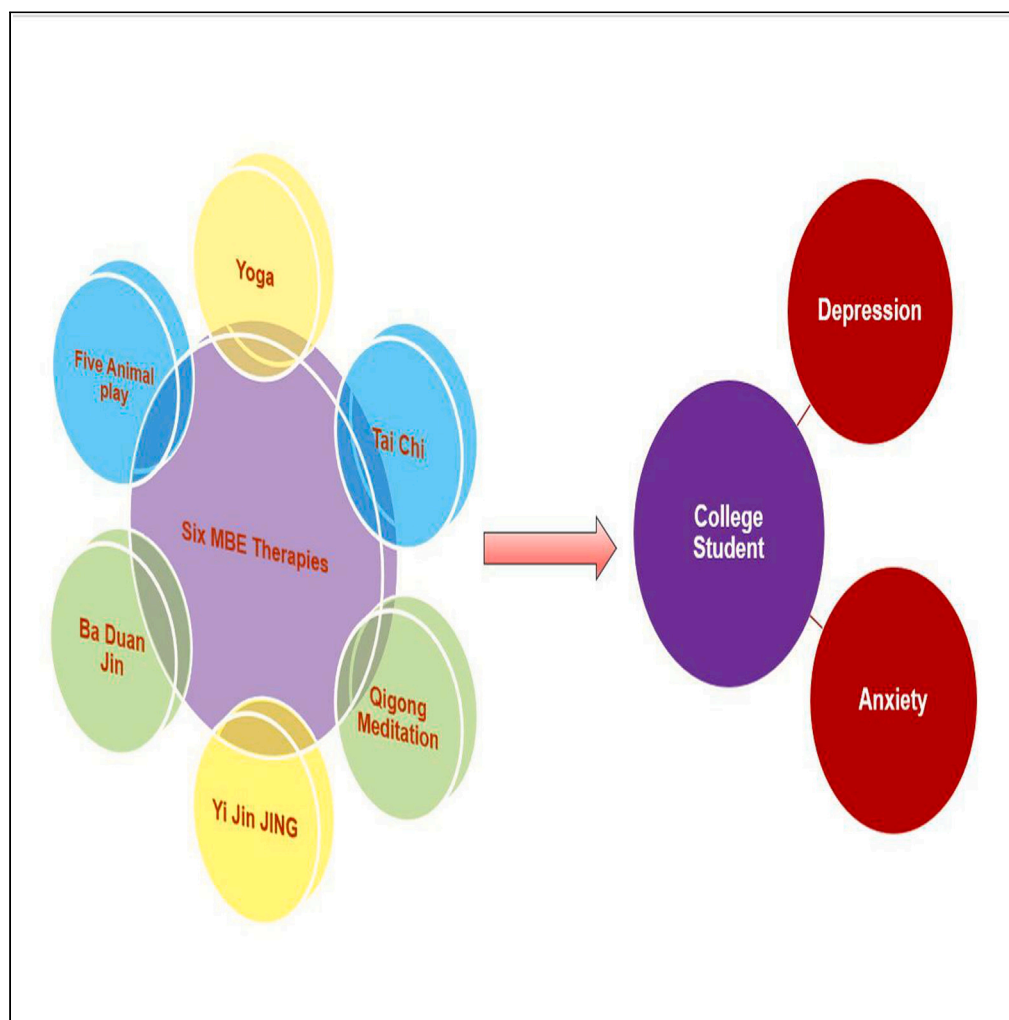


Article

An RCT-reticulated meta-analysis of six MBE therapies affecting college students' negative psychology



Haojie Li, Zhihao Du, Shunze Shen, Wenya Du, Junhao Kang, Deming Gong

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Highlights

This paper examines and analyzes the effects of six MBE

Article

An RCT-reticulated meta-analysis of six MBE therapies affecting college students' negative psychology

Haojie Li,^{1,6,7} Zhihao Du,^{2,6} Shunze Shen,³ Wenya Du,^{1,*} Junhao Kang,⁴ and Deming Gong⁵

SUMMARY

The positive impact of mind-body movement therapy on mental health has been confirmed, but the current effect of various mind-body movement-specific therapies on improving the negative psychology of college students is controversial. This study compared the effects of six mind-body exercise (MBE) therapies on improving negative psychological symptoms in college students. The study found that Tai Chi (standardized mean difference [SMD] = -0.87, 95% confidence interval [CI] (-1.59, -0.15), $p < 0.05$), yoga (SMD = -0.95, 95% CI (-1.74, -0.15), $p < 0.05$), Yi Jin Jing (SMD = -1.15, 95% CI (-2.36, -0.05), $p < 0.05$), Five Animal Play (SMD = -1.1, 95% CI (-2.09, -0.02), $p < 0.05$), and Qigong Meditation (SMD = -1.31, 95% CI (-2.2, -0.4), $p < 0.05$) improved depressive symptoms in college students ($p < 0.05$). Tai Chi (SMD = -7.18, 95% CI (-13.18, -1.17), $p = 0.019$), yoga (SMD = -6.8, 95% CI (-11.79, -1.81), $p = 0.008$), and Yi Jin Jing (SMD = -9.21, 95% CI (-17.55, -0.87), $p = 0.03$) improved college students' anxiety symptoms. It shows that the six MBE therapies are effective in improving anxiety and depression in college students.

INTRODUCTION

Mental health problems, mental illnesses, and other psychological disorders exist in 10%–30% of the college student population to varying degrees. These conditions are one of the important causes of the interruption of college students' studies, such as withdrawal and suspension, and may lead to suicidal tendencies among students.^{1,2} The General Office of the Ministry of Education in China issued the Notice on Strengthening the Management of Students' Mental Health,³ which focuses on the requirement of improving students' mental health literacy. It has become extremely necessary to prevent and intervene in the negative psychological symptoms of college students.

The usual treatments for patients with psychological disorders include pharmacological and non-pharmacological interventions, and non-pharmacological interventions are increasingly supported due to the side effects and contraindications of pharmacological interventions.⁴ The special role of physical activity in mental health has been gradually recognized.^{5,6} The National Institutes of Health's National Center for Complementary and Integrative Health defines mind-body exercise (MBE) as a category of alternative, complementary drug therapies⁷ that are characterized as multimodal exercises that combine aerobic and resistance exercise modalities.^{8,9} MBE is typically characterized by slow physical movement, whole-body stretching and relaxation, breathing control, concentration of mental intention, and other structured forms of movement represented by traditional Chinese sports, such as Tai Chi, fitness Qigong (Badaun Jin, Yi Jin Jing, and Five Animal Play), ancient Indian yoga, and Qigong Meditation,¹⁰ which combine physiological and psychological therapies.^{11,12} Compared to other aerobic or resistance exercises,^{13,14} MBEs have the advantages of a slow rhythm and stable intensity, which are conducive to long-term health development, do not require the use of exercise equipment,^{15,16} have low learning costs, and are safe, which support their promotion on a large scale in multiple populations.

Previous studies concluded that mind-body therapies, such as yoga and qigong, effectively improved negative psychological aspects, such as anxiety and depression, in college students.^{17,18} However, most current studies only compared two to two for efficacy analysis, and few evidence-based studies compared the effectiveness of multiple MBEs in improving depression and anxiety symptoms simultaneously. A review by Larun et al. suggested that current research lacks a focus on youth populations.¹⁹ In contrast to conventional meta-analysis, which allows only direct comparisons, reticulated meta-analysis allows for ranking

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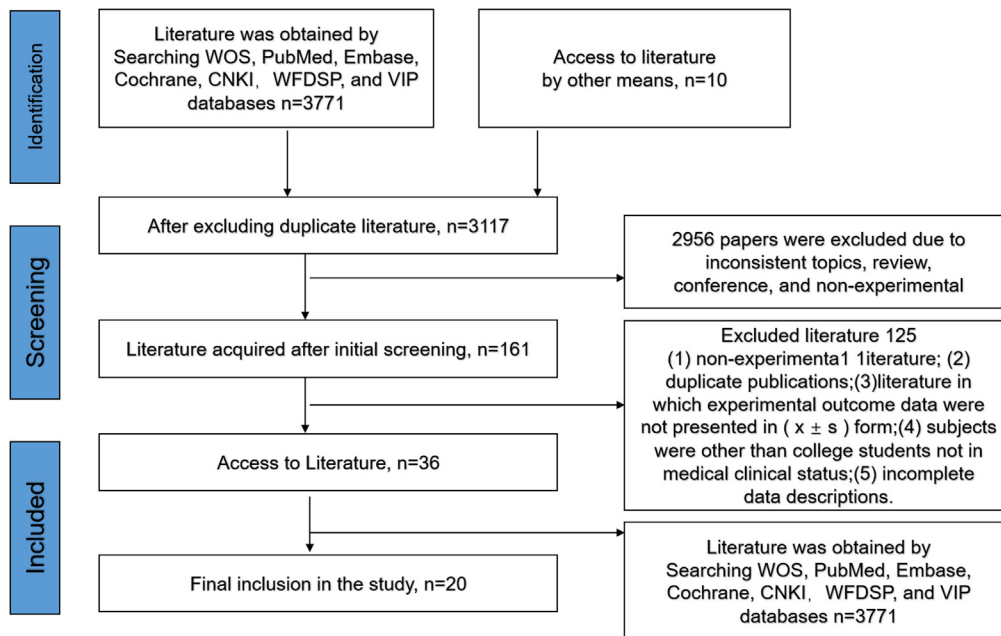


Figure 1. Flow chart of literature screening

the effects of interventions via direct or indirect comparisons. Therefore, the present study included randomized controlled trials (RCTs) of physical and psychomotor therapies for depression and anxiety symptoms in college students and used reticulated meta-analysis to integrate evidence of direct and indirect comparative relationships to examine the effects of different physical and psychomotor therapies on negative psychological symptoms. We also compared and ranked the efficacy of each therapy to provide a basis for intervention strategies and evidence-based support for improving negative psychological symptoms in college students.

The significance of this study is that by studying the intervention of 6 MBEs on college students' mental health, which is important for the treatment of college students' mental health, and as Chinese traditional sports are currently receiving more and more attention, this study is extremely important for both college students' mental health and the promotion of Chinese traditional sports. And it is important in terms of both clinical and alternative medical intervention practices.

RESULTS

A literature search and screening of the initial screening yielded 3,711 papers. After layers of screening, 20 studies were finally included. The screening process and results are detailed in [Figure 1](#).

Basic characteristics of the included studies and assessment of methodological quality: a total of 20 studies were included, and the basic characteristics of all included studies are detailed in [Table 1](#). Eighteen studies with 1,347 subjects were included for depression indicators, and 16 studies with 1,306 subjects were included for anxiety indicators. Due to the specificity of this exercise therapy and the need to sign an informed consent form, none of the experiments were double blinded, and only three^{35,37} articles were single blinded. The results of the quality evaluation of the literature are detailed in [Table 2](#).

Mesh diagram of the included studies: the seven dots in [Figures 2](#) and [3](#) represent the seven interventions. The straight lines between the dots represent the existence of direct comparisons between interventions, and the thickness of the lines represents the number of direct comparisons between the two interventions. Both indicators are 7 interventions (including blank control), and the same interventions were included. The interventions in the observation group included Tai Chi, Qigong Meditation, yoga, Ba Duan jin, Five Animal Play, and Yi Jin Jing. There was no regular physical activity in the control group, as shown in [Figure 2](#).

Table 1. Basic features of the included studies

Author & Year	Intervention method	Sample size (Male/Female)	T/C	Type of control group	Source	Ages (T/C) (mean ± SD)	Intervention cycle, frequency, and duration	Indicators	Measurement tools
Yang 2003 ²⁰	Tai Chi	102	51/51	IPA- non-active; Education	China	–	8 weeks, 3 times/week, 60 min/time	Depression, anxiety	SCL-90
Cheng 2016 ²¹	Five animal play	30(15/15)	15/15	IPA- non-active; Education	China	21.1 ± 1.4	12 weeks, 1 time/week, 40–60 min/time	Depression	BDI, HAMD
Gong 2019 ²²	yoga	70(0/70)	34/36	IPA- non-active; Education	China	22.85 ± 1.26	8 weeks, 3 times/week, 40 min/time	Anxiety	SAS
Liao 2006 ²³	yoga	120(60/60)	60/60	IPA- non-active; Education	China	–	16 weeks, 60 min/week	Depression, anxiety	SCL-90
Liu 2008 ²⁴	Baduan jin	100	50/50	IPA- non-active; Education	China	–	12 weeks, 5 times/week, 90 min/time	Depression, anxiety	SCL-90
Shen 2018 ²⁵	Tai Chi	25	–	IPA- non-active; Education	China	20.75 ± 1.77	8 weeks, 5 times/week, 40 min/time	Depression, anxiety	SDS,SAS
	Five animal play	22	–	IPA- non-active; Education	China	20.29 ± 1.21	8 weeks, 5 times/week, 40 min/time	Depression, anxiety	SDS,SAS
	Baduan jin	25	–	IPA- non-active; Education	China	21.00 ± 2.06	8 weeks, 5 times/week, 40 min/time	Depression, anxiety	SDS,SAS
	Yi Jin Jing	26	–	IPA- non-active; Education	China	20.53 ± 1.60	8 weeks, 5 times/week, 40 min/time	Depression, anxiety	SDS,SAS
Wang 2011 ²⁶	Yi Jin Jing	60	60/60	IPA- non-active; Education	China	18–24	12 weeks, 5 times/week, 30 min/time	Depression, anxiety	SDS,SAS
Xiong 2014 ²⁷	yoga	66	39/27	IPA- non-active; Education	China	21.5 ± 1.1	8 weeks, 3 times/week, 70 min/time	Depression, anxiety	BDI,BAI
Li 2008 ²⁸	Tai Chi	38	20/18	IPA- non-active; Education	China	20.35 ± 0.88	8 weeks, 3 times/week, 60 min/time	Depression	POMS
Chen 2019 ²⁹	Tai Chi	36	18/18	IPA- non-active; Education	China	–	16 weeks, 3–4 times/week, 60 min/time	Depression	CES-D
Jiao 2021 ³⁰	Five animal play	80	40/40	IPA- non-active; Education	China	20.0 ± 1.3	16 weeks, 5 times/week, 80 min/time	Depression, anxiety	SCL-90
Wang 2016 ³¹	Qigong Meditation	52(17/35)		IPA- non-active; Education	China	22.48 ± 2.85	2 weeks, 1 time/day, 10 min/time	Depression	BDI, BAI
Wu 2020 ³²	Qigong Meditation	60(17/43)	30/30	IPA- non-active; Education	China	19.0 ± 1.0	4 weeks, 2 times/day, 20 min/time	Depression	SDS

(Continued on next page)

Table 1. Continued

Author & Year	Intervention method	Sample size (Male/Female)	T/C	Type of control group	Source	Ages (T/C) (mean \pm SD)	Intervention cycle, frequency, and duration	Indicators	Measurement tools
Nasrin 2016 ³³	yoga	46	23/23	IPA- non-active; Education	USA	>18	8 weeks, 75 min/week	Depression, anxiety	BDI,HAMA
Tao Xiao 2021 ³⁴	Baduan jin	68(48/17)	31/34	IPA- non-active; Education	China	19.21 \pm 1.02	12 weeks, 3 times/week, 90 min/time	Anxiety	SAS
Yu Chen 2013 ³⁵	Qigong Meditation	60(8/52)	30/30	IPA- non-active; Education	China	19.5 \pm 0.87/ 19.4 \pm 0.85/ 19.7 \pm 0.88	1 week, 1 time/day, 40 min/time	Depression, anxiety	SDS,SAS
Sanford 2009 ³⁶	Qigong Meditation	207(85/122)	93/114	IPA- non-active; Education	USA	25.4 \pm 9.2/26.2 \pm 9.9	13 weeks, 1 time/week, 90 min/time	Depression, anxiety	POMS
Park 2016 ³⁷	Tai Chi	50(4/46)	24/26	IPA- non-active; Education	Korea	22.75 \pm 1.91/ 22.27 \pm 2.05	7 weeks, 3 times/week, 60 min/time	Anxiety	S-AI
Zhang J 2018(38)	Tai Chi	64(23/41)	32/32	IPA- non-active; Education	China	18.41 \pm 2.01	8 weeks, 2 times/week, 90 min/time	Depression	PHQ-9
Mohsen 2014 ³⁹	yoga	38(38/0)	19/19	IPA- non-active; Education	Iran	–	4 weeks, 2 times/week, 60 min/time	Depression, anxiety	GHQ-12

T: experimental group; C: control group; SCL-90: symptom self-rating scale; SAS: anxiety self-rating scale; SDS: depression self-rating scale; PHQ-9: depression self-assessment scale; BDI: BECK depression self-rating questionnaire; HAMA: Hamilton Anxiety Inventory; HAMD: Hamilton Depression Inventory; CES-D: depression self-rating scale; POMS: state of mind scale; BAI: Beck Anxiety Inventory; SARS: anxiety self-rating scale; S-AI: state anxiety scale; GHQ-12: general health questionnaire; -: indicates not reflected in the literature.

Table 2. Evaluation results of literature quality risk bias of included studies

Inclusion of literature (author)	Generation of random sequences	Assign hidden	Blinding of Subjects and Experimenters	Blinding of measurers	Data Integrity	Selective reporting	Other risk sources
Yang 2003 ²⁰	U	U	U	U	L	L	L
Cheng 2016 ²¹	L (Random wording)	U	U	U	L	L	L
Gong 2019 ²²	L (Random wording)	U	U	U	L	L	L
Liao 2006 ²³	L (Random wording)	U	U	U	L	L	L
Liu 2008 ²⁴	L (Random wording)	U	U	U	L	L	L
Shen 2018 ²⁵	U	U	U	U	L	L	L
Wang 2011 ²⁶	L (Random wording)	U	U	U	L	L	L
Xiong 2014 ²⁷	L (Random wording)	U	U	U	L	L	L
Li 2008 ²⁸	U	U	U	U	L	L	L
Chen 2019 ²⁹	U	U	U	U	L	L	L
Jiao 2021 ³⁰	L (Random wording)	U	U	U	L	L	L
Wang 2016 ³¹	L (computer sampling)	U	U	U	L	L	L
Wu 2020 ³²	L (Random number table method)	U	U	U	L	L	L
Nasrin 2016 ³³	L (computer sampling)	L	U	U	L	L	L
Tao Xiao 2021 ³⁴	L (computer sampling)	L	U	U	L	L	L
Yu Chen 2013 ³⁵	L (computer sampling)	L	U	U	L	L	L
Sanford 2009 ³⁶	L (computer sampling)	L	L (single-blind)	U	L	L	L
Park 2016 ³⁷	L (computer sampling)	L	U	U	L	L	L
Zhang J 2018 ³⁸	L (computer sampling)	L	L (single-blind)	U	L	L	L
Mohsen 2014 ³⁹	L (computer sampling)	L	L (single-blind)	U	L	L	L

L, low risk of bias; U, unclear risk of bias; H, high risk of bias.

Reticulated meta-analysis

Inconsistency test: where there is a closed loop in the evidence network for the effect of different physical and mental exercises on negative mood symptoms of depression and anxiety in college students, global inconsistency tests using nodal models showed that depression ($p = 0.9093$) and anxiety ($p = 0.6735$) were greater than 0.05, which indicated that direct and indirect comparisons of the two indicators were consistent.

Depression indicators: 18 papers were included for depression indicators. The results of the consistency analysis showed that Tai Chi (standardized mean difference [SMD] = -0.87 , 95% confidence interval [CI] $(-1.59, -0.15)$, $p < 0.05$), yoga (SMD = -0.95 , 95% CI $(-1.74, -0.15)$, $p < 0.05$), Yi Jin Jing (SMD = -1.15 ,

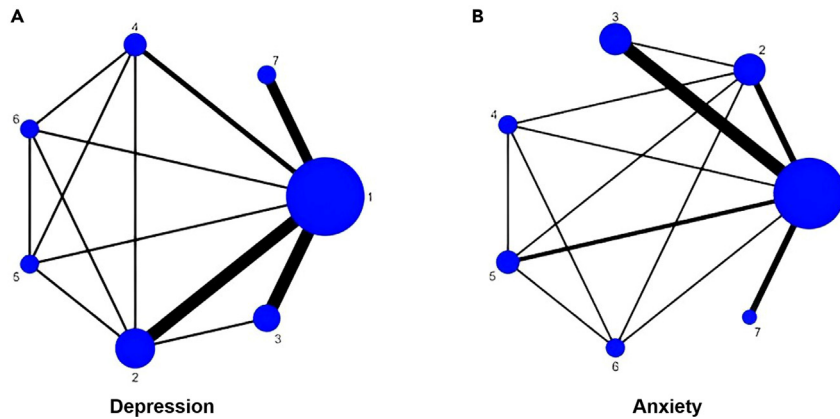


Figure 2. Reticular evidence diagram

(A) is depression, (B) is anxiety. 1 = Non-active control groups; 2 = Tai Chi; 3 = yoga; 4 = Five animal play; 5 = Baduan Jin; 6 = Yi Jin Jing; 7 = Qigong Meditation.

95% CI $(-2.36, -0.05)$, $p < 0.05$, and Qigong Meditation (SMD = -1.31 , 95% CI $(-2.2, -0.4)$, $p < 0.05$) were significantly more effective than non-active control groups in improving depressive symptoms in college students, and the differences were statistically significant (all p values < 0.05). There was no evidence that Five Animal Play (SMD = -1.1 , 95% CI $(-2.09, 0.02)$, $p > 0.05$) and Baduanjin (SMD = -0.63 , 95% CI $(-1.84, 0.57)$, $p = 0.303 > 0.05$) were better than non-active control groups in improving depressive states of college students. In addition, a two-by-two comparison showed no significant difference between the six MBE therapies ($p > 0.05$), as shown in [Figure 3](#) and [Table 3](#).

Anxiety indicators: 16 papers were included for anxiety indicators. The results of the consistency analysis showed that Tai Chi (SMD = -7.18 , 95% CI $(-13.18, -1.17)$, $p < 0.05$), yoga (SMD = -6.8 , 95% CI $(-11.79, -1.81)$, $p < 0.05$), and Yi Jin Jing (SMD = -9.21 , 95% CI $(-17.55, -0.87)$, $p < 0.05$) were more effective than non-active control groups in improving anxiety states in college students, with statistically significant differences (p values < 0.05). There was no evidence that Qigong Meditation (SMD = -3.48 , 95% CI $(-10.76, 3.8)$, $p = 0.349 > 0.05$), Five Animal Play (SMD = -2.66 , 95% CI $(-10.94, 5.62)$, $p = 0.53 > 0.05$), and Baduanjin (SMD = -4.24 , 95% CI $(-11.15, 2.67)$, $p = 0.229 > 0.05$) were more effective than non-active control groups in improving anxiety states of college students. In addition, a two-by-two comparison showed no significant difference between the six MBE therapies ($p > 0.05$) as shown in [Figure 3](#) and [Table 3](#).

Local inconsistency test: the local inconsistency test was performed using the nodal split method to analyze the two indicators, and the results showed no difference between all physical and mental

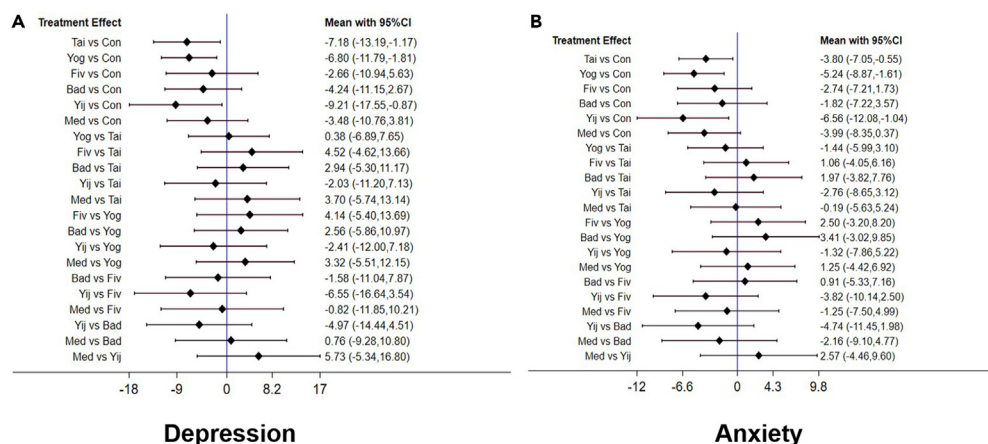


Figure 3. Forest map

(A) is depression, (B) is anxiety.

Table 3. Cross-comparison results of the effects of various psychosomatic motor therapies

Relative effects						
Depression						
Tai Chi	Yoga					
ES = -1.44,95% CI(-5.99,3.10)						
ES = 1.06,95% CI(-4.05,6.16)	ES = 2.50,95% CI(-3.02,8.20)		Five animal play			
ES = 1.97,95% CI(-3.82,7.76)	ES = 3.41,95% CI(-3.02,9.85)		ES = 0.91,95% CI(-5.33,7.16)		Baduan jin	
ES = -2.76,95% CI(-8.65,3.12)	ES = -1.32,95% CI(-7.86,5.22)		ES = -3.82,95% CI(-10.14,2.50)		ES = -4.74,95% CI(-11.45,1.98) Yi Jin Jing	
ES = -0.91,95% CI(-5.63,5.24)	ES = 1.25,95% CI(-4.42,6.92)		ES = -1.25,95% CI(-7.50,4.99)		ES = -2.16,95% CI(-9.10,4.77) ES = 2.57,95% CI(-4.46,9.60) Qigong Meditation	
Anxiety						
Tai Chi	Yoga					
ES = 0.38,95% CI(-6.89,7.65)						
ES = 4.52,95% CI(-4.62,13.66)	ES = 4.14,95% CI(-5.40,13.69)		Five animal play			
ES = 2.94,95% CI(-5.30,11.17)	ES = 2.56,95% CI(-5.86,10.97)		ES = -1.58,95% CI(-11.04,7.87)		Baduan jin	
ES = -2.03,95% CI(-11.20,7.13)	ES = -2.41,95% CI(-12.00,7.87)		ES = -6.55,95% CI(-16.64,3.54)		ES = -4.79,95% CI(-14.44,4.51) Yi Jin Jing	
ES = 3.7,95% CI(-5.74,13.14)	ES = 3.32,95% CI(-5.51,12.15)		ES = -0.82,95% CI(-11.85,10.21)		ES = 0.76,95% CI(-9.28,10.80) ES = 5.73,95% CI(-5.34,16.80) Qigong Meditation	

Comparison of the results of the six MBE therapies.

exercise therapies ($p > 0.05$). None of the inconsistencies were statistically significant, which indicated good consistency.

Ranking the effectiveness of the six MBE therapy interventions

Depression indicators: the ranking of the effectiveness of physical and mental exercise on depressive symptoms in college students was Yi Jin Jing (surface under the cumulative ranking [SUCRA] = 83.6), yoga (SUCRA = 73.6), Qigong Meditation (SUCRA = 57.3), Tai Chi (SUCRA = 55.2), Five Animal Play (SUCRA = 42.1), and BaDuan Jin (SUCRA = 31.3), and all interventions were better than the control group without regular physical activity (SUCRA = 6.9); see [Figure 4](#) and [Table 4](#) for details.

Anxiety indicators: the physical and mental exercises on the anxiety symptoms of college students ranked in the following order: Yi Jin Jing (SUCRA = 82.2), Tai Chi (SUCRA = 70.7), yoga (SUCRA = 67.7), Ba Duan Jin (SUCRA = 45.8), Qigong Meditation (SUCRA = 40.5), and Five Animal Play (SUCRA = 33.2). All interventions were better than the control group without regular physical activity (SUCRA = 9.9) (SUCRA = 9.9), as detailed in [Figure 4](#) and [Table 4](#).

Small sample effect or publication bias test: small sample effect estimates and publication bias tests were performed using corrected-comparison funnel plots for the studies included in the reticulated meta-analysis. The included studies were largely symmetrical, which suggests that the current study had a small sample effect possibility, and no significant publication bias was found ([Figure 5](#)).

DISCUSSION

The present study used six physical and mental exercise therapies as the observation group, and no regular physical activity was used as the control group. Only RCT studies were included. The risk of bias of the included RCTs was evaluated using the Cochrane version 5.1 systematic assessment manual, and a reticulated meta-analysis was used to investigate the physical and mental exercise therapies with the best effects via direct and indirect comparisons for each physical and mental exercise therapy. The results of direct and

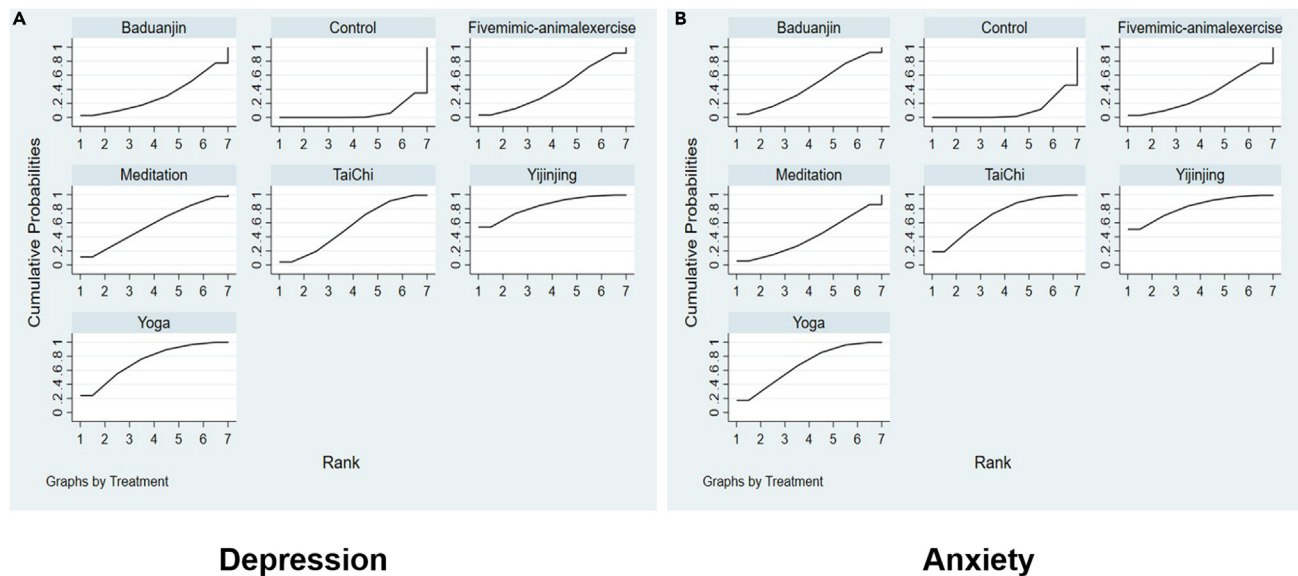


Figure 4. Ranking chart of intervention effect
(A) is depression, (B) is anxiety.

indirect comparisons of mind-body movement therapies were consistent. According to the SUCRA ranking, Yi Jin Jing, yoga, and Qigong Meditation were the most effective in improving depression, and Yi Jin Jing, Tai Chi, and yoga were the most effective in improving anxiety. Clustering and stratification showed that Yi Jin Jing was the best ranked, followed by yoga and Tai Chi.

There is no shortage of domestic and international scholars who compared MBE forms as interventions in college students' psychology. Zhang's meta-analysis compared four traditional Chinese fitness programs in MBE, and the results of this study support the hypothesis that Tai Chi and Yi Jin Jing significantly improve depression and anxiety symptoms in college students.⁴⁰ However, the ranking of SUCRA values is inconsistent with this paper. The reason for the difference in results may be that not all of the studies included in the meta-analysis by Jingyi Zhang were RCT experiments and multiple before-and-after control experiments were included. They included clinically ill patients, and their statistical analysis did not mention adjustment for baseline. Therefore, their conclusions may not be reliable. The studies included in the present study were all RCT trials of non-clinically ill college students as study subjects. This paper used difference comparisons to compare the amount of net change in individual studies, and the conclusions were relatively more reliable.

Fitness Qigong and Tai Chi, as traditional Chinese medicine fitness methods, have been widely used in the treatment of various diseases and verified.⁴¹ The results of the present study showed that fitness Qigong (Yi Jin Jing, Ba Duan Jin, and Five Animal Play) and Tai Chi were effective in improving the negative psychological symptoms of college students. Traditional Chinese medicine is a theory of mind-body monism that emphasizes "adjusting the form, adjusting the breath, and adjusting the spirit," i.e., the essence is the comprehensive exercise and control of the "form, qi, and spirit" of the human body and they are interrelated and inseparable. The regulation of body is the basis and premise of the regulation of breath and mind. The regulation of breath is an important part of the regulation of body and mind, and the regulation of mind is the core part of the "three regulation" and the purpose of the regulation of body and breath.^{42,43} The similarity between yoga and Qigong Meditation is that both practices focus on the control of "form, qi, and spirit." The breath is also referred to as the regulation of the breath. The form of yoga movement practice is more focused on softness and stillness and the practice of qi (breath control method and the coordination of breath and asana) and the requirement of intentional convergence (i.e., consciousness should be focused on the body somewhere), which is an acceptable and safe intervention to achieve mind-body integration.⁴⁴ Qigong Meditation "is a comprehensive process that includes three stages of physical relaxation, breath regulation, and attentional focus."⁴⁵ However, we found that most intervention studies combined Qigong Meditation with other interventions, such as positive thinking and music, and their results

Table 4. Probability ranking of different psychosomatic motor therapies to improve the negative psychological symptoms of college students

Indicators	Interventions	SUCRA (%)	PrBest	MeanRank	Sorting
Depression	Yi Jin Jing	83.6	53.9	2.0	1
	Yoga	73.6	24.2	2.6	2
	Qigong Meditation	57.3	11.6	3.6	3
	Tai Chi	55.2	4.3	3.7	4
	Five animal play	42.1	3.5	4.5	5
	Baduan jin	31.3	2.7	5.1	6
	Control group	6.9	0.0	6.6	7
Anxiety	Yi Jin Jing	82.2	50.8	2.1	1
	Tai Chi	70.7	18.7	2.8	2
	Yoga	67.7	17.2	2.9	3
	Baduan jin	45.8	4.7	4.3	4
	Qigong Meditation	40.5	5.7	4.6	5
	Five animal play	33.2	2.8	5.0	6
	Control group	9.9	0.0	6.4	7

Ranking the effects of the six MBE therapies.

may be affected. To reduce publication bias and strictly control the quality of the literature and intervention methods, only a single Qigong Meditation intervention was included. Therefore, the results were less subject to interference factors. In addition, the traditional Chinese Qigong Meditation approach used in this study can provide a means of mind-body therapy, but the results are not representative of a broad range of meditation approaches.

This paper examines the effects of the first 6 mind-body therapies on negative emotions in college students. MBE is used as a medical alternative therapy to provide positive exercise for psychological intervention exercises for college students and for the current phenomenon of increasing psychological problems in college students. This paper is very meaningful for future clinical research and experimental interventions.

Limitations of the study

This paper has some limitations. As traditional Chinese physical and mental exercise began to be more concerned and studied in the 21st century, only the literature from 2000 to 2022 was included, and only RCT experiments and literature in Chinese and English languages were included; the scope of literature inclusion needs to be enhanced in the future. In addition, the content of the literature appears to be not clearly defined, so some of the literature included in this paper is not clear enough in the assessment of

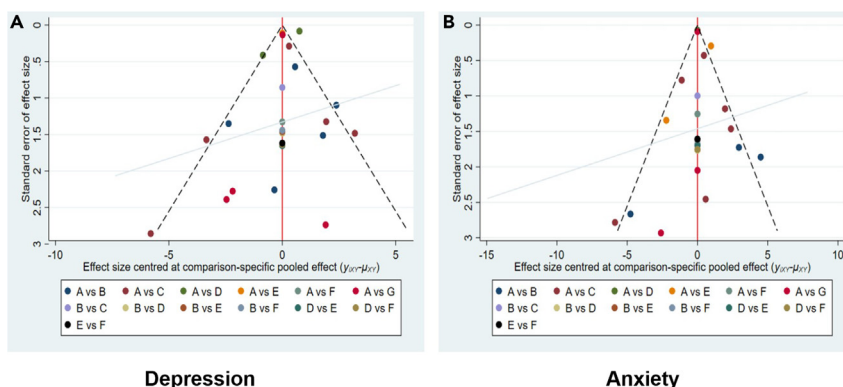


Figure 5. Correction comparison funnel plot
(A) is depression, (B) is anxiety.

risk bias, which may lead to high risk bias; in future studies there is a need to strengthen the clarity of the content of the literature.

STAR★METHODS

Detailed methods are provided in the online version of this paper and include the following:

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 - Sources and methods
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 - Literature search
- QUANTIFICATION AND STATISTICAL ANALYSIS

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AUTHOR CONTRIBUTIONS

Haojie Li and Zhihao Du designed the project and the first hypothesis; Shunze Shen, Junhao Kang, and Deming Gong performed the systematic search, reviewed the literature, and extracted the data; Haojie Li and Zhihao Du analyzed data and wrote the first draft of the paper. Wenya Du was involved in article revision. All of the authors reviewed and approved the final article proof for submission. All authors read and approved the final manuscript.

DECLARATION OF INTERESTS

The authors declare that there is no conflict of interest regarding the publication of this paper.

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STAR★METHODS

KEY RESOURCES TABLE

REAGENT or RESOURCE	SOURCE	IDENTIFIER
Deposited data		
Literature summary statistics	Figshare: https://doi.org/10.6084/m9.figshare.22283347.v5	Li, Haojie (2023): Original data. figshare. Dataset. https://doi.org/10.6084/m9.figshare.22283347.v5
Software and algorithms		
Cochrane 5.1	Higgins JPT, Thomas J, Chandler J, Cumpston M, Li T, Page MJ, Welch VA (editors). Cochrane Handbook for Systematic Reviews of Interventions version 6.3 (updated February 2022). Cochrane, 2022. Available from www.training.cochrane.org/handbook	https://handbook-5-1.cochrane.org/
Stata17.0	StataCorp LLC	https://www.stata.com/
Endnote X9.1	Thomson Scientific	https://endnote.com/downloads

RESOURCE AVAILABILITY

Lead contact

Further information and requests for resources should be directed to and will be fulfilled by the lead contact, Haojie Li (lihaojiebnu@foxmail.com).

Materials availability

This study did not generate new unique reagents.

Data and code availability

Any additional information required to reanalyze the data reported in this paper is available from the [lead contact](#) upon request.

METHOD DETAILS

Graded levels of anxiety and depression

Degree grading statistics for different depression and anxiety measurement tools

Testing tools	Indicators	Scoring method	Rating level	Measurement degree grading (score)			
				No symptoms	Mild	Moderate	Serious
SCL-90	Anxiety, depression	Factor scores	Level 4	<2	2–2.9	3–3.8	>3.9
BDI	Depression	Total Score	Level 4	0–4	5–7	8–15	16–39
HAMD	Depression	Total Score	Level 3	<7	7–17		>24
SAS	Anxiety	Total Score	Level 4	<50	50–59	60–69	>70
SDS	Depression	Total Score	Level 3	<50	50–60	60–70	
BAI	Anxiety	Total Score	Level 4	<15	15–25	26–35	>36
POMS	Depression	Factor scores	Level 4	0–1	2	3	4
CES-D	Depression	Total Score	Level 3	<15	16–19		≥20
HAMA	Anxiety	Total Score	Level 4	<6	7–14	14–29	>29

(Continued on next page)

Continued

Testing tools	Indicators	Scoring method	Rating level	Measurement degree grading (score)			
				No symptoms	Mild	Moderate	Serious
S-AI	Anxiety	Total Score	Level 4	<50	50–59	60–69	>69
PHQ-9	Depression	Total Score	Level 4	0–4	5–9	10–14	>15
GHQ-12	Anxiety, depression	Total Score	Level 2	0–2	3–12		

Statistics on the grading of different emotion scales.

Detailed methods include the following:

Sources and methods

This study is registered in the PROSPERO platform with the registration ID CRD42022314522.

Six types of MBE therapy

In this paper, six MBE therapies, namely Tai Chi, Baduan Jin, Yi jin jing, Five Animal Play, Yoga, and Qigong meditation, were selected for the study. Among them, qigong meditation is a form of meditation in traditional Chinese sports, and qigong meditation is a unique form of meditation with physical activity.⁴⁶

Literature search

The search, inclusion, screening, and exclusion criteria for the literature in this study were developed strictly according to the process specified in the PRIMSA entry⁴⁷ and in accordance with the principles of PICOS for evidence-based medicine. The literature was searched in Elsevier ScienceDirect, Web of Science, PubMed, ProQuest, Scopus, The Cochrane Library, CNKI, WFDSP, and VIP databases using ("undergraduate" or "student" or "youth" or "college") and ("physical and mental exercise" or "mind-body exercises" or "yoga" or "Qigong Meditation" or "taijiquan" or "Baduan Jin" or "Qigong" or "Yi Jin Jing" or "Five Animal Play") and ("psychological" or "depression" or "anxiety" or "negative emotions" or "negative psychology") and ("randomized controlled trial" or "controlled clinical trial") as Chinese subject terms for Boolean logic search. ("College" or "Student" or "Young" or "University") and ("Mind and body exercise" or "Yoga" or "Qigong Meditation" or "Tai chi" or "Baduan Jin" or "Qigong" or "Yijinjing" or "Five Animal Play") and ("Psychology" or "Depression" or "Anxiety" or "Negative emotion") and ("Psychology" or "Depression" or "Anxiety" or "Negative emotion" or "Negative psychology") and ("Randomized controlled trial" or "Controlled clinical trial" or "Randomized") were used as English subject terms for the Boolean logic search. Language was limited to Chinese and English, and only core journals were included in the Chinese search, which was performed from January 2000 to April 1, 2022. The literature was also accessed by other means, such as tracing references to relevant studies, using PubMed as an example. (Figure 6)

Literature inclusion criteria: The study included only randomized controlled trials (RCTs) of college students who received physical and mental exercise interventions for negative emotions (including anxiety, depressive tendencies or symptoms) in the RCT. Inclusion criteria included mild, moderate and severe anxiety and depressive symptoms, graded according to the level of detail of the different measurement instruments (Graded levels of anxiety and depression).the interventions in the intervention group were any of the following physical and mental exercise forms: yoga, Qigong Meditation, Tai Chi and the Ba Duan Jin, Five Animal Play and Yi Jin Jing of Qigong. For the control group, the intervention measure was no regular physical activity. The outcome index was depression and anxiety. The experimental group and the control group used unlimited types of depression and anxiety self-rating scales to test the mental health of college students before and after the intervention. The intervention was considered effective when the difference between the values measured after the intervention and before the intervention was less than 0.

The exclusion criteria were non-RCT experiments, animal experimental studies, descriptive and survey literature, review literature, secondary studies, literature included in academic conferences, and repeatedly published literature. Studies with subjects other than college students or had other clinical conditions and other characteristics were also excluded. Experimental results data that were not presented in ($x \pm s$) form


```
#1 ("negative"[All Fields] OR "negatively"[All Fields] OR "negatives"[All Fields] OR "negativities"[All Fields] OR "negativity"[All Fields]) AND "psychology"[MeSH Terms]
#2 "Psychology"[Title/Abstract]OR"Depression"[Title/Abstract] OR "Anxiety"[Title/Abstract] OR "negative emotion"[Title/Abstract] OR "negative psychology"[Title/Abstract]
#3 #1 OR #2
#4 "Psychology"[Title/Abstract] OR "Depression"[Title/Abstract] OR "Anxiety"[Title/Abstract] OR "negative emotion"[Title/Abstract] OR "negative psychology"[Title/Abstract]
#5 "College"[Title/Abstract] OR "Student"[Title/Abstract] OR "Young"[Title/Abstract] OR "University"[Title/Abstract]
#6 ("Mind"[Title/Abstract] AND "bodyexercise"[Title/Abstract]) OR "Yoga"[Title/Abstract] OR "Meditation"[Title/Abstract]OR"Taichi"[Title/Abstract]OR"Qigong"[Title/Abstract]OR"Yijinjing"[Title/Abstract] OR "Wuqinxi"[Title/Abstract]
#7 "randomized controlled trial"[Publication Type] OR "controlled clinical trial"[Publication Type]
#8 #3 AND #4 AND #5 AND #6 AND #7
```

Figure 6. PubMed search strategy

or when the data could not be extracted were excluded. Studies that included the interventions with other interventions or provided data descriptions were incomplete or could not be converted were excluded. Chinese published literature in non-core journals was excluded. Literature on the absence of anxiety and depression after scale assessment was also excluded.

Literature screening and data extraction: Two researchers introduced the collected literature into Endnote X9.1 software according to the study strategy, and duplicate literature was excluded. Selected studies were independently screened according to the title and abstract. L HJ and D ZH both independently screened and extracted the literature. The full text was read in detail and screened using the inclusion and exclusion criteria. The two researchers cross-checked the results of the screening, and the study was included when there was agreement. A third researcher was consulted for disagreements, and a joint decision was made after discussion and agreement. Information was extracted from the final included literature, and the data of the included literature and the risk of bias records were summarized using a predefined information extraction form. Data extraction primarily included¹ basic information of the included literature (title, one work, year, etc.),² subject characteristics and information (sample size, age, gender, etc.),³ intervention and control details (type, duration, frequency, etc.),⁴ Literature quality Article quality was mainly assessed by two researchers independently performed the quality assessment of the included studies using the risk of bias assessment tool in the Cochrane version 5.1 systematic assessment manual, with indicators including: Generation of random sequences, Assign hidden, Blinding of Subjects and Experimenters, Blinding of measurers, Data Integrity, Selective reporting, Other risk sources.⁵ outcome indicators and main study results.

Risk of bias evaluation of the included literature: Two researchers independently performed the quality assessment of the included studies using the risk of bias assessment tool in the Cochrane version 5.1 systematic assessment manual.⁴⁸ Inconsistent assessment results were discussed with the other researcher to achieve a resolution.

QUANTIFICATION AND STATISTICAL ANALYSIS

Statistical processing: Meta-analysis of the data was performed using Stata 17.0 software, with outcome indicators as continuous variables. Due to the different instruments used for the same indicators in the included literature, standardized mean differences (SMDs) were used to express the baseline uniformly adjusted to $\alpha = 0.05$. The Q test and I² test were used to test for heterogeneity, and the Egger test was used for publication bias analysis. When reticulated meta-analysis was performed, nodal analysis was used for inconsistency testing when there was a closed-loop structure in the reticulated evidence map. The results of the ring inconsistency test were analyzed for a consistency model when $P > 0.05$. The local inconsistency test was also performed using the node splitting method, and the results were directly compared in the conventional meta-analysis for this comparison when the results were $P < 0.05$. The

ranking of the superiority of each intervention ($0 \leq \text{SUCRA} \leq 1$) was performed using the area under the cumulative ranking probability plot SUCRA value (surface under the cumulative ranking, SUCRA). Based on the SUCRA values of the two outcome indicators, cluster hierarchical analysis was used to examine the optimal group of physical and psychological exercise therapy. Publication bias was evaluated using corrected comparison funnel plots.