

Review article

Psychological interventions for depression in Chinese university students: A systematic review and meta-analysis

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ARTICLE INFO

Keywords:

Meta-analysis
University students
Depression
Psychological interventions
China

ABSTRACT

Background: University students in China are vulnerable to depression with a high estimated prevalence. It is currently unknown which types of psychological interventions are being delivered to treat depression in this population and whether they are effective. Therefore, a systematic review was conducted to address this issue. **Methods:** We searched records in English and Chinese databases up to January 2019.

Results: From 2,739 records, we identified 39 randomized controlled trials (RCTs) and 54 non-RCTs. A range of psychological interventions were identified including cognitive behaviour therapy, interpersonal therapy, and local interventions. Hedge's *g* pooled effect size of 23 comparisons from 21 RCTs (*N* = 858) compared to a control group (*N* = 802) was 1.08 (95% CI: 0.72 to 1.45). Heterogeneity was moderate with $I^2 = 47$ (95%CI: 14 to 68). Type of control group was significantly associated with the effect size ($p = 0.039$). Comparisons between the intervention condition and the 'no intervention' condition yielded a higher effect size (Hedges' *g* = 1.38, 95% CI: 0.89 to 1.87) than comparisons between the intervention condition and the 'usual care/control' condition (Hedges' *g* = 0.56, 95% CI 0.08 to 1.05). No other significant differences based on the study characteristics were observed.

Limitations: Publication bias and quality of inclusions.

Conclusions: Collectively, there is evidence that psychological interventions for depression in Chinese university students are effective as compared to control groups, although the effects merit further examination by research of higher quality. Innovations in treatment delivery could facilitate wider dissemination of evidence-based interventions.

1. Introduction

Depression is a prevalent mental health condition predicted to be the leading cause of disease burden by 2020 (Ferrari et al., 2013). It is characterised by loss of interest or pleasure in daily activities and depressed mood. Along with other cognitive and somatic symptoms, depression can cause significant distress and have impact on multiple aspects of individuals' life (World Health Organization, 2012).

One population that might be particularly vulnerable is university students (Auerbach et al., 2018). University students are in a period of life in which they grow from adolescents to adults denoted as "emerging adulthood" (Arnett, 2000), during which adolescents explore their identities and possible directions in life, and slowly come into contact with their future responsibilities. During this crucial stage, university

students can experience substantial stress due to academic pressures, interpersonal relationships, and preoccupation with post-graduation life (Bayram and Bilgel, 2008). On top of their regular academic demands, university students have to cope with challenges connected to the development of an autonomous personal life both in psychological and psychosocial domains. These accumulated stresses could jeopardize the mental health status of this group and increase the likelihood of depression.

Depression can be detrimental to the university students' life in many aspects including their physical and emotional health (Bardone et al., 1998; Hare et al., 2014), relationship dysfunction (Kerr and Capaldi, 2011), academic achievement (Hysenbegasi et al., 2005), and can be a contributing factor that leads to suicide (Wang et al., 2014). Furthermore, depression in the early adulthood is

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<https://doi.org/10.1016/j.jad.2019.11.058>

Received 5 June 2019; Received in revised form 25 October 2019; Accepted 10 November 2019

Available online 10 November 2019

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associated with far-reaching adverse outcomes in later adulthood like labour market marginalization, and persistent physical health problems (Li et al., 2014; Scott et al., 2016).

Evidence supports the high prevalence of depression in this population. From a large-scaled survey among the university students worldwide, 18.5% had major depression episodes in the last 12 months, which was higher than the 12-month prevalence in general young adults aged 18–25 years old (9.6%) (Auerbach et al., 2016; Mojtabai et al., 2016). A recent meta-analysis concluded that around 30% of university students worldwide report depressive symptoms (Ibrahim et al., 2013). In China, with the large increases of university enrolment, around 28 million students are on campus now, representing approximately 30% of the young adult population (18–25 years old) in China (China National Health and Family Planning Commission, 2018). Recent epidemiology data from a meta-analysis of prevalence in China revealed that the occurrence of depressive symptoms in university students was also in a parallel level with point prevalence around 24% (Lei et al., 2016).

Depression among Chinese university students has become a salient problem, emphasizing the necessity to examine factors that are uniquely related to depression in this population, and to provide suitable interventions to mitigate depression symptoms among university students (Evans-Lacko and Thornicroft, 2019; Parker et al., 2001). With the increasing awareness of the depression prevalence in Chinese students, professional counselling centers situated inside the campus have become a standard configuration in Chinese universities and more studies on psychological interventions have been done in this group. However, these centres offer psychological interventions that vary in theoretical orientation and format, and are not necessarily aligned with evidence-based interventions recommended in Western clinical guidelines, such as the National Institute for Health and Care Excellence (NICE; Middleton et al., 2005). For example, Zhongyong psychoeducation (which has roots in traditional Chinese philosophy) is concurrently delivered alongside evidence-based psychotherapies such as cognitive behavior therapy (CBT) in some Chinese universities (Cui et al., 2016; Yang et al., 2016). The effectiveness of the combination of these interventions still remains unclear.

Previous reviews focused on interventions delivered in low and middle-income countries have identified several randomized controlled trials conducted in China. However, they did not specifically assess effectiveness amongst university students and only included articles in English language (Arjadi et al., 2015; Cuijpers et al., 2018, 2016). Therefore, it is currently unknown to what extent different psychological interventions are being implemented to treat depression amongst the Chinese university students, and more importantly, whether or not they are effective. Thus, in an effort to fill this gap, we conducted a systematic review and meta-analysis of RCTs to examine the effectiveness of psychological interventions when delivered to university students in China. To provide an overview of the different types of psychological interventions being delivered, we also conducted a qualitative synthesis of psychological interventions investigated in other types of study designs (e.g., pre-post, non-randomized controlled trial, case study).

2. Methods

The current systematic review and meta-analysis was registered on PROSPERO (<https://www.crd.york.ac.uk/PROSPERO/>) with registration number CRD42018088221. The Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) were followed (Moher et al., 2009).

2.1. Identification and selection of studies

A comprehensive search in four international databases (PubMed, PsycINFO, Cochrane, and Embase) and three Chinese local academic

databases (Weipu, Chinese Academic Journals (CNKI), Wanfang) was performed up to December, 2017 and updated in January, 2019. The search terms combined Mesh terms and text words (wildcards were used if necessary) indicative of (1) depression, (2) intervention, (3) China, and (4) university students. The full search string can be found in Appendix 1 of the supplementary material. Reference lists of relevant reviews and included articles in the current review were examined. The articles citing the included articles were also examined in case of missing studies beyond the period in which the initial search was carried out.

Studies were included eligible if the following criteria were fulfilled:

- The primary focus of the psychological intervention should be depression;
- 'psychological intervention' herein was broadly interpreted as any intervention in which a psychological element was involved according to the description of the articles;
- a measure of depressive symptom severity was used as an outcome;
- only studies with participants from universities situated in the mainland of China, HongKong, Macau, and Taiwan were included; publications in Chinese or English were all included.

Unpublished data of any form including dissertations, conference proceedings were excluded. When multiple publications with available data from the same study cohort were available, the publications with longest period of follow-up length were included. If equal, the studies with largest number of total participants were included.

Covidence (<https://www.covidence.org>) was used for importing the initially identified records from the databases and for removing duplicates. Title/Abstract screening, full text screening, and data extraction of records were conducted by two researchers (SZ and ZF) independently. Disagreements were resolved with the help of a senior reviewer (AW).

2.2. Data extraction and risk of bias assessment

The following information was extracted:

- Identification: name of first author, publication year;
- Study population: sample size, gender distribution, age, geographical.
- Research design: type of research design ((pair-matched, cluster, individual) random controlled trials, control before-and-after with/without control studies, case control study, case series), inclusion/exclusion criteria, intervention details (setting, manual/theoretical foundation, guidance and delivery, follow-up length);
- Methodological and Statistical: measure of depression, effect size definition (including post-test and follow-up data after intervention), incomplete data handling (per protocol, intent to treat analysis)

If a study met the inclusion criteria but reported insufficient data to calculate effect sizes, the corresponding authors were requested to provide the aggregate data. Studies were excluded in the available meta-analysis if the data were not provided.

The Cochrane risk of bias tool was used to assess the quality of the included RCT studies (Higgins et al., 2011). The following domains were addressed: random sequence generation, allocation concealment, blinding of participants and personnel (participants were not aware of what condition they were allocated), blinding of outcome assessment, incomplete outcome data, and selective reporting. Two independent researchers (ZF and SZ) assessed these domains independently and disagreements were solved with discussion. Each domain was rated as '+' (low risk of bias with score 1), '?' (unclear with score 0), '-' (high risk of bias with score 0). An article was defined as "high quality" when it scored 60% or more of the maximal possible score (max score = 6). In

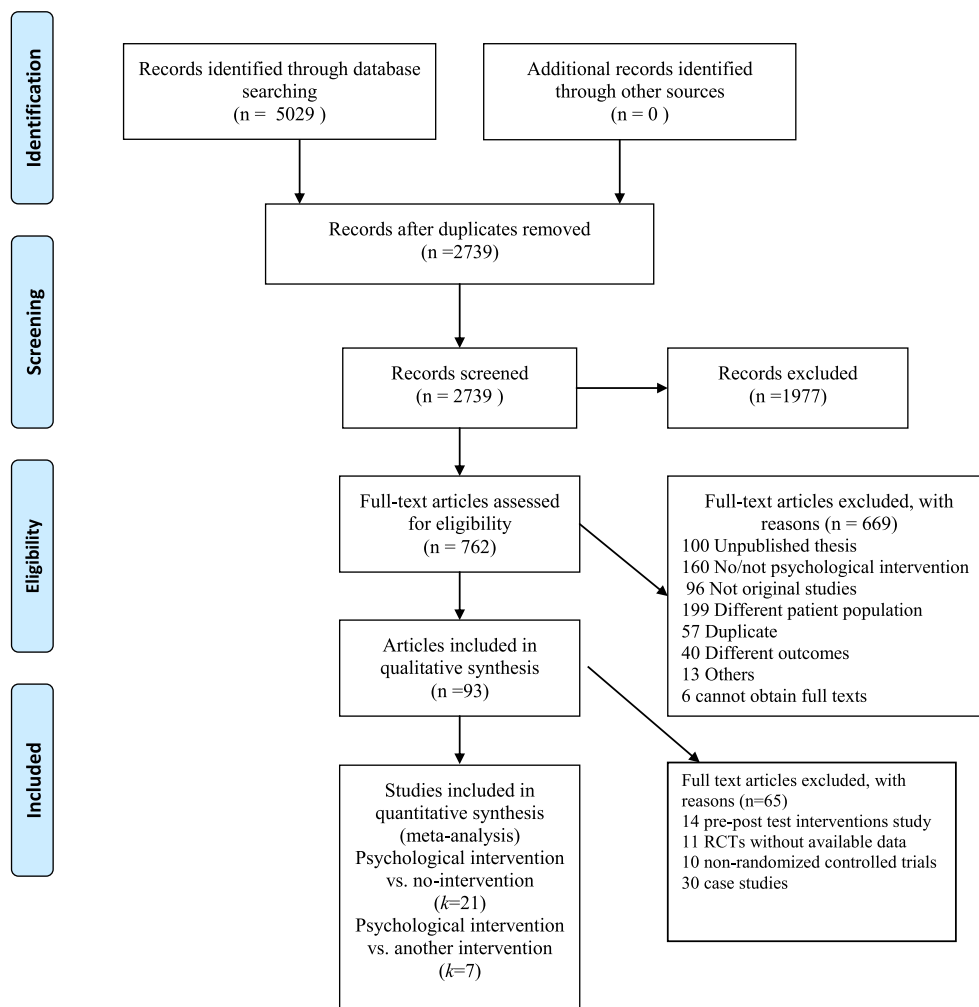


Fig. 1. Flow diagram of systematic review

this case, 4 or more indicated low risk of bias (i.e. high quality) and lower than 4 indicated high risk of bias (low quality). Grading of Recommendations Assessment, Development and Evaluation (GRADE) systems was adopted to evaluate the overall confidence of the included studies in the available meta-analysis.

2.3. Analyses

Comprehensive Meta-Analysis software (CMA, Version 3; Borenstein et al., 2013) was used to calculate the pooled effect sizes on post-intervention comparisons between intervention and control groups if enough randomized controlled trials could be retrieved. We calculated effect sizes (Hedges' g) for each comparison between a psychological intervention and a comparison group. In case of more than one depression measure, the outcomes of different measures were combined within the study via the calculation in CMA, so that each study contributed one effect size to the overall analysis. Number-needed-to-treat (NNT) was calculated to facilitate clinical interpretation of the effect size (Preti, 2015). The NNT indicates how many patients should receive the treatment to have one more positive outcome than the comparison group.

If applicable, two meta-analyses were conducted according to the type of comparison group. We categorized the comparison group into two primary types: control group (including treatment as usual, assessment only, waitlist, other non-psychological treatment, and active control) and other psychological/medication intervention group.

Because we expected considerable heterogeneity (variation in study

outcomes between studies), we a priori chose a random effects pooling model in all analyses (Borenstein et al., 2011). We analysed the effect sizes at post-intervention and excluded the follow-up results since not all studies had a follow-up assessment, and the follow-up periods differed extensively between studies. To assess heterogeneity, Q -statistics were calculated to indicate distribution of effect sizes and systematic differences between studies (Higgins and Thompson, 2002). The I^2 was calculated to describe the proportion of total variation across studies caused by heterogeneity in effect size. In general, heterogeneity is categorized at 25 (low), 50 (moderate), and 75 (high) (Higgins et al., 2003). We calculated 95% confidence intervals around I^2 in accordance with the formula of (Borenstein et al., 2011). If the I^2 is larger than 50, subgroup analysis or meta-regression is recommended to investigate possible explanations of the variance. Subgroup analyses based on the risk of bias, type of intervention, type of control group, theoretical framework, type of guidance, intensity of intervention were performed if at least three studies could be included in each subgroup as a prerequisite.

In the cases with multiple comparison (in which one psychological intervention was compared with two or more control groups), to avoid the inflation of the possibility of an artificial reduction of heterogeneity and the further impact on the pooled effect size (ES), sensitivity analysis were conducted by including only 1 ES from this study.

Sensitivity analyses were also performed to examine the effect of outliers (95% CI of the effect size did not overlap with the 95% CI of the pooled effect size) and to investigate whether risk of bias affected the pooled effect sizes. To examine potential publication bias, we inspected

the funnel plot and tested its asymmetry with Egger's test (Egger et al., 1997). Duval and Tweedie's trim and fill procedure was implemented to estimate the overall effect size accounted for publication bias (Duval and Tweedie, 2000).

2.4. Qualitative synthesis

For each intervention implemented in the Chinese universities, we determined the following features: the psychotherapeutic orientation (CBT, psychodynamic intervention, interpersonal therapy (IPT), Zhongyong psychoeducation, etc.), the format to deliver the intervention (individual, group, self-help, blended, etc), the quality of the intervention (manual based, delivered by professionals), and cultural ingredients' involvements. A qualitative synthesis based on these features was also conducted.

3. Results

3.1. Selection and inclusion of studies

A total of 5029 records were identified in the search. After removal of duplicates, the Titles and Abstracts of 2739 articles were screened for eligibility. Full texts of 762 articles were retrieved. A total of 93 articles were included in this systematic review (see Fig. 1 for flow diagram). The major reasons for exclusion were that the identified articles were not original research studies ($k = 196$), did not include a psychological intervention ($k = 160$), or focused on a different study population (e.g. children, adolescents, elderly group, unselected population etc.; $k = 199$). Of the retrieved 93 articles with 92 studies (Li et al., 2006 a,b included same cohort), 39 were randomized controlled trials (RCT), 10 were non-randomized controlled trials with parallel groups, 14 were pre-post treatment design without a control group, and 30 were case series. RCTs with available data (28 studies) were included in the meta-analysis. All 92 studies were included in the qualitative synthesis. Selected characteristic of each of the included studies is reported in the Appendix 2. An overview of the characteristics of the included RCTs is reported in Table 1.

3.2. Characteristics of included RCTs

The 39 studies included a total of 2887 participants ($N = 1462$ in the intervention group and $N = 1421$ in the control group) who completed the baseline measurement of depression and 2798 ($N = 1405$ in the intervention group and $N = 1393$ in the control group) participants who completed post-intervention measures. The follow-up time period varied (8 studies ≤ 3 months, 6 studies ≥ 6 months) and 26 studies did not include any follow-up.

Twenty-nine studies (21 with data available to calculate effect sizes) compared a psychological intervention to a control group (e.g. treatment as usual, assessment only, waitlist, placebo) and ten studies (seven with available data) compared a psychological intervention to another active psychological/medical treatment (e.g., CBA vs. ACT, psychological intervention vs. medication for depression). Most studies recruited from a university setting ($k = 34$) whereas four studies recruited from a hospital setting and one from a mental health centre. CBT was referred to as the most commonly adopted intervention in the included studies ($k = 13$). The number of intervention sessions ranged from 5 to 20. Most interventions used a group format ($k = 28$). The quality of the included studies was far from optimal. Only four studies met at least 4 quality criteria (scored as low risk of bias) and characteristics of risk of bias for all RCT studies can be found in Appendix 3.

3.3. Psychological intervention, compared with control groups

The overall effect (Hedges' g) of psychological interventions compared with a control group in 21 studies with 23 comparisons was 1.08

(95% CI: 0.72 to 1.45), which corresponds to a NNT of 1.8. Heterogeneity was moderate with I^2 as 47 (95%CI: 14 to 68). Effect sizes and 95% confidence intervals of each comparison were presented in the forest plot in Fig. 2.

In this meta-analysis, we included two studies (Yang et al., 2015; Cui et al., 2016) with multiple comparisons. We first included only the comparison with the largest ES and then we conducted another analysis by only including the smallest ES. The resulting ESs were comparable with the ones found in the overall analyses (see Table 2). Heterogeneity remained moderate (both I^2 were 47).

Eight comparisons were potential outliers (Cui et al., 2016; Guan et al., 2014; Xiao et al., 2017; Liang, 2018; Liu et al., 2018; Jiang, 2014; Wang et al., 2016; Chen and Guo, 2016). After exclusion of these outliers, the pooled Hedges' g was 0.99 (95% CI: 0.74 to 1.26; NNT=1.94) with low heterogeneity as $I^2 = 17$ (95% CI: 0 to 54).

Visual inspection of the funnel plot, as well as Egger's regression intercept ($p < 0.001$) indicated possible publication bias, although Duval and Tweedie's trim and fill procedure suggested otherwise (studies needed to be trimmed = 0; overall ES required no adjustment). With the evaluation of GRADE system, the overall effect size can be interpreted with high levels of confidence. Several subgroup analyses were conducted based on key characteristics of the study (e.g., theory of intervention, guidance of treatment, format of intervention, outcome measures, geographic region, language of publication, baseline depression). The results are shown in Table 2.

We found that the type of control group was significantly associated with the effect size ($p = 0.039$). Comparisons between the psychological intervention condition and the 'no intervention' condition (including assessment only and waitlist) yielded a higher effect size (Hedges' $g = 1.38$, 95% CI: 0.89 to 1.87) than comparisons between the psychological intervention condition and the 'usual care/active control' condition (Hedges' $g = 0.56$, 95% CI 0.08 to 1.05). No other significant differences based on the study characteristics (e.g. type of theoretical orientation) were observed.

3.4. Psychological intervention, compared with other interventions

There were ten studies with 12 comparisons of one type of psychological intervention against another psychological/medical intervention for depression. Specifically, three compared a psychological intervention plus physical exercise to another psychological intervention, five compared a psychological intervention plus medicine to medical treatment, one compared a psychological intervention plus acupuncture to another psychological intervention, and three compared two different psychological interventions (i.e. ACT vs. CBT, Psychodynamic group therapy vs. Problem solving group therapy, and DBT vs. CBT).

Given the number of each type of comparisons were limited and data were available from only seven studies, explorative analysis based on these seven studies with two types of comparisons (psychological intervention combined with medicine compared to medicine, psychological intervention combined with physical exercise compared with psychological intervention) were conducted (see Figure 3). Results revealed that the overall effect sizes pooled from both comparisons (Hedges' $g = 0.52$ with 95% CI: -0.58 to 1.63; Hedges' $g = -0.11$ with 95% CI: -2.42 to 2.40) were not significant with zero in their confidence intervals, which indicated combination of interventions were no better than singular intervention in the current review.

3.5. Qualitative synthesis

Several types of studies (e.g., non-randomized controlled trials, pre-post studies, case study) were also identified. This section provides a qualitative summary of the theoretical orientations of the psychological interventions delivered, irrespective of study design. The other characteristics of the intervention (e.g. format, guidance) are presented in

Table 1
Characteristic of randomized controlled trials included in the qualitative review

Author, Year	Setting	Condition	Inclusion criteria	N(pre)	N(post)	Mean age (SD)	Female (%)	Follow-up length	Depression measure
Bao, 2015	Hospital	Intervention A vs. Intervention B (vs. Intervention C)	depression diagnosis of WHO, HAM-D > 20; no physical disease;	110	110	24.84 (3.15)	0.45	0	HAMD
Chen and Guo, 2016	University	Intervention vs. Usual care	SCL-90 depression subscale > 3;	45	45	20.6 (1.01)	0.59	3 months	HAMD
Chen et al., 2015	Nursing school	Intervention vs. Assessment only	DMSRIA > 8; no severe hearing impairments, acute disease or pain; not taking any psychotropic medication;	80	80	18.5 (NA)	0.97	0	DMRIA
Cui et al., 2016	University	Intervention vs. Assessment only	SDS > 56; not currently receiving psychotherapy or medication for psychological problems; without MDE;	180	158	19.42 (1.66)	0.61	6 months	SDS
Dong et al., 2011	University	Intervention vs. Assessment only	SDS standard > = 50; not bipolar disorder;	20	20	22.33 (2.27)	NA	6 months	SDS
Guan et al., 2014	University	Intervention vs. Placebo	BDI > = 14;	355	355	21.43(2.04)	0.39	0	BDI
Han, 2017	University	Intervention vs. Assessment only	depressive symptoms; no comorbidity with physical disease, psychotic disorder, communication disorder;	50	50	22.36 (1.12)	0.56	3 months	BDI
Jiang, 2014	University	Intervention vs. Assessment only	SDS 53-72;	86	86	NA	0.54	0	SDS
Li and Jiang, 2018	Hospital	Intervention A vs. Intervention B (vs. Intervention C)	Met diagnosis criteria of depression;	50	50	18.02 (2.65)	0.51	0	HAMD
Li et al., 2016	Hospital	Intervention A vs. Intervention B (vs. Intervention C)	fulfil diagnosis criteria of CCMD-3 depressive episode;	100	100	26.3 (4.9)	NA	0	HAMD-3
Li et al., 2016b, a	University	Intervention vs. Assessment only	53 < SDS < 72; no physical disease; psychoactive substance abuse;	70	68	NA	NA	0	SDS
Li, 2014	University	Intervention A vs. Intervention B (vs. Intervention C)	CCMD-3 minor depression;	49	49	22.13 (1.44)	0.71	4,6 months	SDS
Liang, 2018	University	Intervention vs. Placebo	Mild to moderate depression based on BDI (> 10);	90	90	NA	NA	0	BDI
Lin et al., 2019	University	Intervention A vs. Intervention B (vs. Intervention C)	Ko's depression inventory > 21; Chinese version of borderline personality disorder features scale > 5 and confirmed by clinical diagnosis; no psychotic disorders; no psychotropic medications;	82	81	20.38(0.68)	0.71	8 months	KDI
Liu et al., 2018	University	Intervention vs. Assessment only	SDS > 53; Pittsburgh Sleep Quality Index > 7; without mindfulness training within one year, no medical treatment; no other severe physical and mental disorder;	70	70	NA	NA	3 months	SDS
Pan and Xie, 2015	University	Intervention vs. Assessment only	SDS, SAS, SCL-90 positive;	56	56	20.5 (0.6)	0.59	0	SDS
Ren et al., 2016	University	Intervention vs. Waitlist	SCL-90 depression subscale > 3 in the first screening; second-screening, CES-D > 15 and PHQ-9 > 5; third screening step: ICD-10 diagnosis as first depression episode was confirmed by a psychiatrist; no suicidal intention; SDS > 50; limited annual income;	62	45	20.82 (1.62)	0.62	0	CES-D
Song and Zhang, 2009	University	Intervention vs. Assessment only	met CCMD II-R depression diagnosis, HAM-D > 17; no physical disease;	24	24	NA	NA	0	SDS
Tai et al., 2010	Medical college	Intervention A vs. Intervention B (vs. Intervention C)	BDI > 15;	76	76	18-29	0.54	2,4,6 weeks	HAMD
Wang and Wu, 2014	University	Intervention vs. Usual care	SDS	26	26	19.75(1.37)	0.3	0	BDI
Wang et al., 2015	University	Intervention vs. Assessment only	BDI > = 10;	36	36	19.15 (1.46)	0.56	0	SDS
Wang et al., 2016	University	Intervention vs. Assessment only	HAMD -24 scored mild to moderate (> 8); without physical disease and other mental disorders;	64	64	17.86 (1.25)	0.25	0	BDI
Wu and Lv, 2019	University	Intervention A vs. Intervention B (vs. Intervention C)	SDS > 42;	70	70	19.52(1.91)	0.59	0	HAMD-24
Xi, 2011	University	Intervention vs. Assessment only	SDS > 50; limited annual income;	24	24	NA	NA	3, 6 months	SDS
Xiang, 2007	University	Intervention vs. Assessment only	CES-D > 25 in the first screening, HAM-D17 17-24 in the second screening; BDI > = 8; exclude those with communication disorder, psychotic disorder, severe physical disease;	22	22	NA	NA	0	SDS
Xiao et al., 2018	University	Intervention vs. Placebo		196	196	22.57 (4.21)	0.43	10 weeks	HAMD-17
Xiong et al., 2017	Hospital	Intervention A vs. Intervention B (vs. Intervention C)		120	120	19.7(1.2)	0.53	3 months	BDI

(continued on next page)

Table 1 (continued)

Author, Year	Setting	Condition	Inclusion criteria	N(pre)	N(post)	Mean age (SD)	Female (%)	Follow-up length	Depression measure
Xu et al., 2017	University	Intervention vs. Assessment only	SCL > = 3	300	291	18.53 (16-24)	0.76	0	
Yang et al., 2014	University	Intervention vs. Waitlist control	5 < = BDI-II < 21;	81	80	19.2 (1.4)	0.68	3 months	BDI-II
Yang et al., 2015	University	Intervention vs. Placebo	BDI-II > 14; exclude participants: 1. current episode of MDD, bipolar disorder, schizophrenia, or organic mental disorder; 2. any concurrent psychotherapy; 3. any concurrent psychotropic medication; 50 < SDS < 60; exclude those with previous psychological disorders diagnosis, without serious suicidal ideation, and not attending any other intervention programs;	77	77	19.44 (1.58)	0.74	0	BDI-II
Yang et al., 2016	Medical School	Intervention vs. Placebo	53 < SDS < 72; exclude physical disease; psychoactive substance abuse;	30	27	18.8 (0.99)	0.8	0	SDS
Yang et al., 2017	University	Intervention vs. Assessment only	53 < SDS < 72; exclude physical disease; psychoactive substance abuse;	70	68	NA	NA	0	SDS
Yang et al., 2018	University	Intervention vs. Assessment only	SDS > 50, MINI diagnosed depressive disorders;	74	67	18.5 (1.0)	0.6	6 months	BDI-II
Ye et al., 2012	University	Intervention A vs. Intervention B (vs. Intervention C)	ICD-10 major depression diagnosis; course > = 2 months; HAMD > = 25;	100	94	20.2 (2.10)	NA	0	HAMD
Haiyin and Sun, 2010	University	Intervention vs. Assessment only	SDS > = 40, has interpersonal problems;	36	36	NA	0.67	0	SDS
Zhang et al., 2016	University	Intervention vs. Assessment only	UPI item positive; UPI > = 25; SDS > = 53;	24	24	NA	0.75	0	SDS
Zhang et al., 2018	University	Intervention vs. Placebo	PHQ-9 had 2-4 symptoms of depression experienced more than half of the days or nearly every day for 2 or more weeks;	62	60	18.41(2.01)	NA	0	PHQ-9
Zhao et al., 2013	University	Intervention A vs. Intervention B (vs. Intervention C)	Depression and rumination scores higher than mean score;	40	27	19.43/19.15	0.56	9 weeks	SDS
Zhong et al., 2017	Mental health center	Intervention A vs. Intervention B (vs. Intervention C)	Met ICD-10 criteria for depression; first onset;	60	60	23.45 (2.29)	NA	0	SDS

Note: NA, not available; TAU, treatment as usual; WLC, waitlist control; BDI, Beck Depression Inventory-I, II; CES-D, Centre Epidemiological Screening – Depression; DMSRIA, Depression Mood Self Report Inventory for Adolescence; HAMD-17, 17-item Hamilton Depression rating scale; PHQ-9, Patient Health Questionnaire-9; SCL-90, Symptom Checklist-90; SDS, Self-Rating Depression Scale; CBT, Cognitive Behaviour Therapy; ACT, Acceptance and Commitment therapy; RET, Rational Emotion Therapy; KDI = Ko's depression inventory; MINI, ;UPI, University personality inventory; ICD-10, International Categories of Disease; SAS, Self-reported Anxiety Scale; HAMD, Hamilton Rating Scale of Depression.

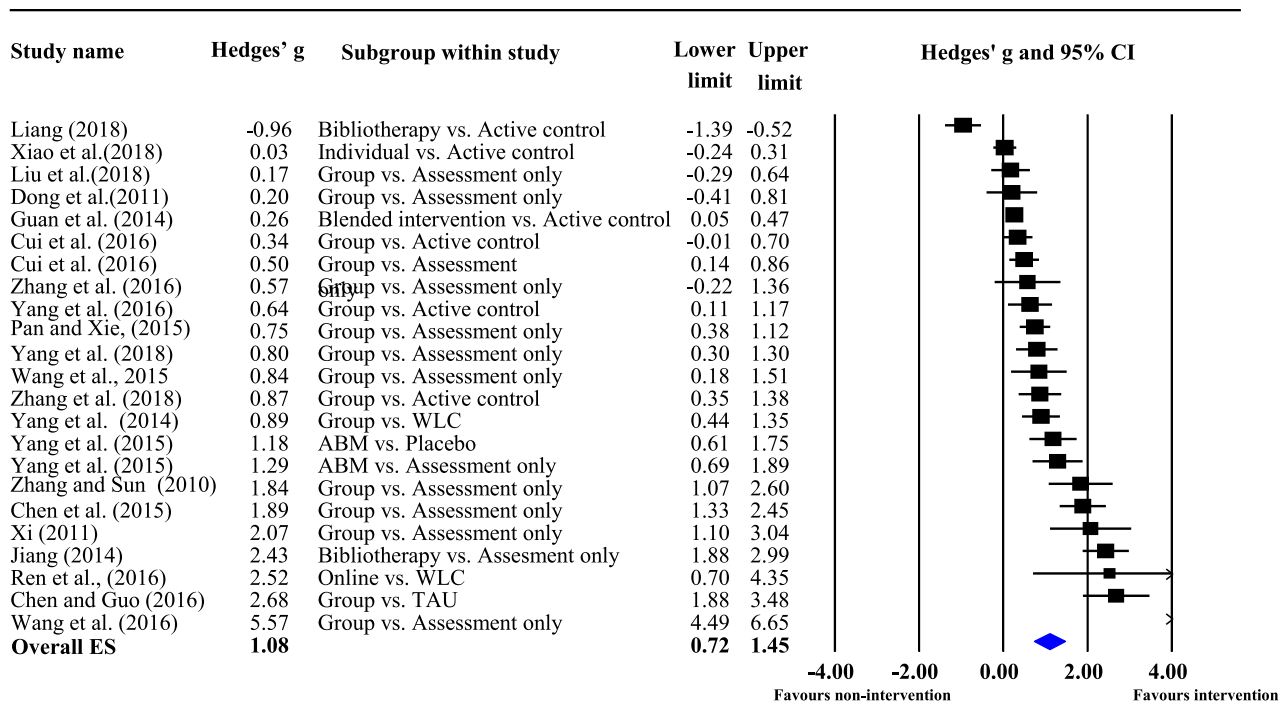


Fig. 2. Forest plot of effect sizes from randomized controlled trials of psychological interventions for depression in university students in China (compared with no-intervention group)

Table 2

Subgroup analysis based on study characteristics (among studies compared with control groups)

Subgroup	N (comparisons)	Hedge's g	95% CI	p value
All comparisons	23	1.08	0.72 1.45	$p < 0.001$
One ES per study (only highest)	21	1.13	0.72 1.53	$p < 0.001$
One ES per study (only lowest)	21	1.11	0.71 1.52	$p < 0.001$
Outliers excluded	15	0.99	0.74 1.26	$p < 0.001$
Control group				$p = 0.019$
Assessment only/WLC	15	1.38	0.89 1.87	
Placebo/TAU	8	0.56	0.08 1.05	
Outcome measures				$p = 0.798$
BDI	7	1.18	0.33 2.04	
SDS	12	1.06	0.59 1.52	
Region				$p = 0.36$
South	10	1.13	0.73 1.54	
North	7	1.52	0.79 2.27	
Theory based intervention	N (study)	Hedge's g	95% CI	p value
Yes	20	1.07	0.64 1.50	$p = 0.168$
CBT (including third wave)	11	0.94	0.47 1.40	$p < 0.001$
Others	9	1.74	0.69 2.78	$p < 0.001$
No	1	0.57	-0.22 1.36	$p = 0.155$
Guidance of intervention				$p = 0.859$
Professional	12	1.21	0.59 1.81	
Non-professional/NA	9	1.29	0.57 2.01	
Format of intervention				$p = 0.882$
Group	15	1.25	0.81 1.69	
Others (individual, combined, self-help, etc.)	6	1.17	0.14 2.19	
Language of article				$p = 0.272$
Chinese	15	1.38	0.75 2.01	
English	6	0.95	0.53 1.38	
Quality				$p = 0.578$
High	3	1.00	0.72 1.28	
Low	18	1.15	0.71 1.60	

Note: ES, effect size; CBT, cognitive behaviour therapy; BDI, Beck Depression Inventory-I, II; SDS, Self-Rating Depression Scale; NA, not available; WLC, waiting list control; TAU, treatment as usual.

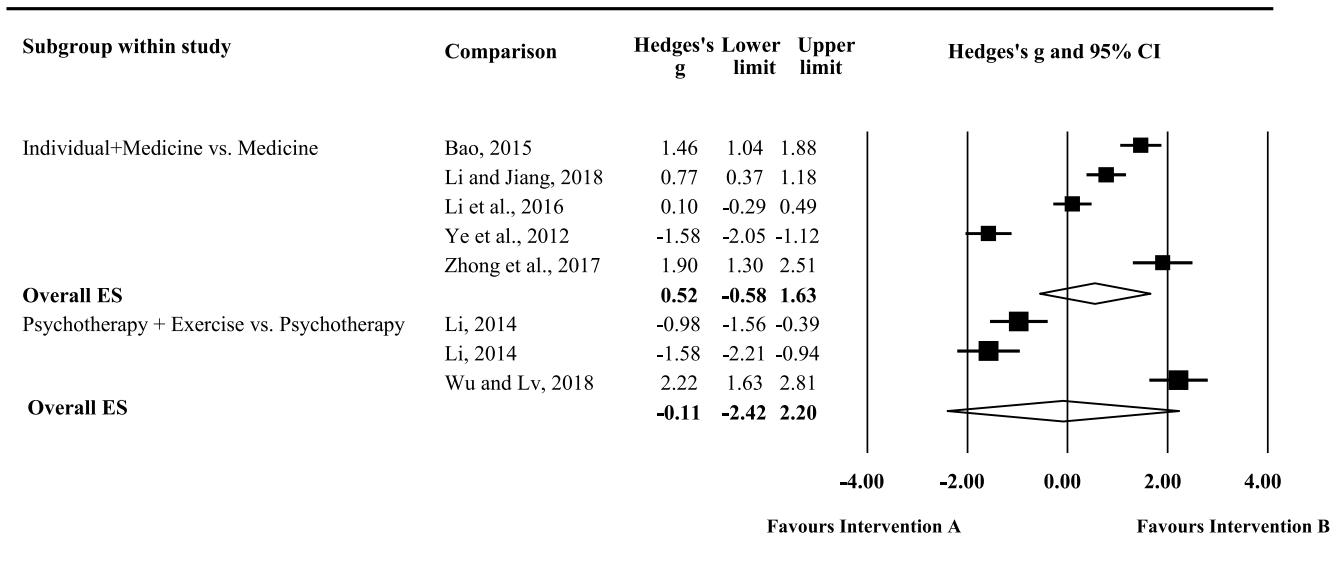


Fig. 3. Forest plot of effect sizes from randomized controlled trials of psychological interventions for depression in university students in China (compared with medicine or other psychological intervention)

Appendix 2.

Of the total 92 studies, 11 did not report the theoretical orientation of the intervention, therefore only the psychological interventions in the remaining 81 studies were synthesized. As presented in the supplementary material, psychological interventions based on different theories were identified including CBT, Psychodynamic therapy, Art therapy, Interpersonal therapy, Sand-play, and supportive care. A number of psychological interventions were roughly categorized into CBT including traditional CBT based on Beck's theory ($k=17$), Solution-Focused Behaviour Therapy (SFBT, $k=2$), Mindfulness-based Cognitive Therapy (MBCT, $k=3$), Comprehensive self-control training (CSCT, $k=1$), Meta-cognitive Therapy ($k=1$), and Rational Emotive Behaviour Therapy (REBT, $k=5$). In the 81 studies implementing intervention with theoretical basis, CBT was reported in 29 studies. CBT remained the dominant theoretical orientation when we narrowed down the studies to those employing a RCT design (11 of 19 RCTs reported CBT as their intervention group).

The second category of intervention frequently delivered was a blended intervention (15/81 studies), which combined different types of interventions (e.g. cognitive therapy combined with medication, cognitive therapy combined with interpersonal therapy). Specifically, cognitive therapy was identified as the primary intervention within these integrations ($k=7$).

Art therapy including music therapy and painting therapy (8 studies), and supportive care (6 studies) were identified as the third and fourth frequently implemented interventions. Supportive care included basic therapeutic skills (e.g. sympathy, listening, etc.). Other psychological interventions of minority were identified as positive psychology ($k=5$), bibliotherapy ($k=5$), interpersonal therapy ($k=3$), Morita therapy ($k=1$), psychodynamic therapy ($k=2$), sand-play ($k=3$), narrative therapy ($k=1$), attention bias modification ($k=1$) and some innovative working frameworks (one with "The Work" by Byron Katie, one with Zhongyong psychoeducation).

Seven studies integrating local Chinese elements in their interventions were identified. Among these studies, three integrated Chinese traditional philosophy in the intervention. One combined the traditional Chinese physical exercise Taichi with the education of philosophy underlying Taichi (i.e. submissive to the nature, to approach to the world in a dialectic way). The other one investigated the Zhongyong Thinking (Doctrine of the Mean) rooted in Confucian Culture in the intervention on mild depression. Two studies combined acupuncture

with psychological interventions in their treatment on depression. In the other two studies, music therapy based on Chinese Five-element music (water, fire, wood, metal, and earth; which represent the transformation of everything in the universe) were implemented to diminish depression.

4. Discussion

In the current systematic review, we aimed to examine the effect of psychological interventions for depression delivered to local Chinese university students. When comparing all psychological interventions to the control groups (assessment only, waitlist, care-as-usual/placebo; 21 studies), the overall effect size and corresponding NNT (Hedges' $g=1.08$; 95% CI: 0.72 to 1.45; NNT=1.8) collectively indicated the potential clinical relevance of such psychological interventions. This overall effect size is comparable to that reported in the psychological intervention studies in low-and-middle income countries (Hedges' $g=1.10$, 95% CI: 0.91 to 1.30) (Cuijpers et al., 2018), but is higher than that based on Western samples ($g=0.60$, 95% CI: 0.55 to 0.64) (Cuijpers et al., 2018). Researchers suggest that this discrepancy could be related to differences in the use of control groups across countries (Cuijpers et al., 2018). For example, in Western studies, control group normally consisted of 'usual-care' which often implies some standard level of care, whereas, in the case of the current review and other studies conducted in low-and-middle income countries, the control group more often means 'no care' (Cuijpers et al., 2011). To further disentangle the potential influence of the control group, we categorized control groups into active control (i.e. treatment as usual, placebo) and inactive control (i.e. waitlist, assessment only). When the effect size was calculated using an active control, the overall effect size was similar to that reported in Western samples ($g=0.56$), suggesting that the effectiveness of psychological intervention in both Western and Eastern samples may be comparable. However, with a relatively broad confidence interval of the effect size from active control group, future studies are necessary before drawing a firm conclusion.

Some additional features of the current meta-analysis warrant comment. There were relatively low rates of attrition across the included studies. This might be attributed to the nature of the intervention setting as students living and participating on campus may have been incentivized to participate, especially when the study duration was limited. Cultural characteristics, such as respect for authority and

submissiveness, may have further contributed to the low attrition rate. Overall, in the current meta-analysis, the control group comprised of ‘assessment only’ represented a large portion of the control group, therefore the observed effect may have been inflated by this contrast. Additionally, some of the included studies were rated as being of low quality, which could also have inflated the observed effect size. Therefore, caution is warranted when interpreting the overall effect size.

In terms of the specific psychological interventions studied in university students in China, cognitive behaviour therapy was identified as the most common type of intervention (36%). This could be due to pragmatic issues relating to the requirement of psychological service delivery as structured and time limited under the university setting, which is in alignment with the nature of CBT. It is of note that in the current review the delivery of CBT was generally of lower intensity (normally 6–8 group sessions) compared to the delivery of the other types of interventions (normally more than 8 sessions). Nevertheless, our results indicated that CBT (as the most commonly-used and studied intervention) did not produce differential results when compared to the other psychological interventions (e.g. IPT, psychodynamic therapy etc.) which is in line with the findings of previous meta-analysis (Cuijpers et al., 2011). As such, it implicated a potentially important step forward in further dissemination of CBT in Chinese universities. However, the limited data precluded a full analysis of potential moderators (e.g., treatment length/intensity, specific theoretical orientation), therefore these limitations need to be taken into account when considering the lack of difference in outcomes amongst the interventions based on varied theories.

A range of psychological interventions based on well-known theoretical classes such as CBT, psychodynamic therapy, and IPT were identified, as well as others like sand-play, bibliotherapy and art therapy. Whereas many of the psychological interventions delivered were drawn from Western culture, several interventions adopted local cultural elements, particularly the perspective of body-mind unification of Chinese tradition. This demonstrated an attempt to integrate empirically supported techniques in Western countries with local Chinese culture.

The current systematic review aimed to address this issue by taking an inclusive approach to the search process. By including studies published in both English and Chinese databases, we were able to examine efficacy data based on 21 available RCTs. However, the limited number of total inclusions prevented us from conducting a more fine-grained analysis based on cultural factors (e.g., comparing interventions based exclusively on Chinese culture compared with Western interventions). Interpretation of the results requires cautions due to the exclusive reliance on self-report measures, and high risk of bias (which indicated low quality) of the included studies.

Taken together, our meta-analysis provides evidence for the efficacy of psychological interventions for treating depressive symptomatology in Chinese students, even when some of these interventions deviate from the prototypical ‘Western’ approach to psychological wellbeing. The findings call for efforts for more studies of high quality to confirm the current findings in order to facilitate the dissemination of evidence-based psychological interventions. Innovative methods like Internet and mobile application could also be considered to provide efficient ways to address the large demand for psychological services in such a densely populated country. In addition, investigation of therapeutic components of traditional Chinese approaches could benefit the intervention in a culturally sensitive manner.

5. Conflict of interest

All the authors clarified that they have no conflicts of interest.

Author Statements

Author ZF and AW together initiated the project and designed the study;

Author ZF did literature search, systematically screening, extracting the data, data analysis, and writing;

Author SZ contributed to literature search, all screening process as second screener, extracting the data as second examiner, and involved in drafting the manuscript;

Author HB provided constructive advice on data analysis, and contributed to revising the manuscript;

Author CLB made critical and constructive comments on the complete manuscript;

Author AW was involved in the whole procedures to supervise the project and made major decisions on inclusions of the current review, and helped to build and complete the manuscript in writing aspect.

Funding source

The first author ZF is financially supported by the Chinese Scholarship Council Grant #201606040157 for her PhD. The funding source had no role in the design or execution of the research.

Declaration of Competing Interest

All the authors clarified that they have no conflicts of interest.

Acknowledgement

None.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.jad.2019.11.058.

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