

Traditional Chinese Exercise for Cardiovascular Diseases: Systematic Review and Meta-Analysis of Randomized Controlled Trials

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Background—Traditional Chinese exercise (TCE) has widespread use for the prevention and treatment of cardiovascular disease; however, there appears to be no consensus about the benefits of TCE for patients with cardiovascular disease. The objective of this systematic review was to determine the effects of TCE for patients with cardiovascular disease.

Methods and Results—Relevant studies were searched by PubMed, Embase, Web of Science, the Cochrane Library, the Cumulative Index to Nursing and Allied Health Literature, and the China National Knowledge Infrastructure. We covered only published articles with randomized controlled trials. The outcome measures included physiological outcomes, biochemical outcomes, physical function, quality of life, and depression. A total of 35 articles with 2249 cardiovascular disease patients satisfied the inclusion criteria. The pooling revealed that TCE could decrease systolic blood pressure by 9.12 mm Hg (95% Cl -16.38 to -1.86, *P*=0.01) and diastolic blood pressure by 5.12 mm Hg (95% Cl -7.71 to -2.52, *P*<0.001). Patients performing TCE also found benefits compared with those in the control group in terms of triglyceride (standardized mean difference -0.33, 95% Cl -0.56 to -0.09, *P*=0.006), 6-minute walk test (mean difference 59.58 m, 95% Cl -153.13 to 269.93, *P*=0.03), Minnesota Living With Heart Failure Questionnaire results (mean difference -17.08, 95% Cl -23.74 to -10.41, *P*<0.001), 36-Item Short Form physical function scale (mean difference 0.82, 95% Cl 0.32-1.33, *P*=0.001), and Profile of Mood States depression scale (mean difference -3.02, 95% Cl -3.50 to -2.53, *P*<0.001).

Conclusions—This study demonstrated that TCE can effectively improve physiological outcomes, biochemical outcomes, physical function, quality of life, and depression among patients with cardiovascular disease. More high-quality randomized controlled trials on this topic are warranted. (*J Am Heart Assoc.* 2016;5:e002562 doi: 10.1161/JAHA.115.002562)

Key Words: cardiovascular disease • exercise • meta-analysis • rehabilitation

C ardiovascular diseases (CVDs) are the leading causes of disability and death in the world and in 2010 were considered the main risk factor for the overall global burden

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An accompanying Data S1 is available at http://jaha.ahajournals.org/content/5/3/e002562/suppl/DC1

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© 2016 The Authors. Published on behalf of the American Heart Association, Inc., by Wiley Blackwell. This is an open access article under the terms of the Creative Commons Attribution-NonCommercial License, which permits use, distribution and reproduction in any medium, provided the original work is properly cited and is not used for commercial purposes. of disease.^{1,2}According to the World Health Organization,³ \approx 17.3 million people worldwide died from CVD in 2008, and 80% of CVD-related deaths were recorded in low- and middle-income countries. Among CVDs, heart disorder has reportedly claimed 7.3 million lives, whereas stroke has caused 6.2 million deaths. Low-cost, easily accessible, and symptom-free programs are needed to treat and prevent CVD.

Physical inactivity is estimated to be the fourth main risk factor for global mortality.^{4,5} Regular exercise is shown to have significant benefits for the maintenance of blood pressure and blood cholesterol.^{6–8} The practice and increasing global popularity of traditional Chinese exercises (TCEs), such as tai chi, qigong, and baduanjin, for >2000 years has substantially benefited human health.^{9–13} TCE is a low-risk, promising intervention that can help improve physiological outcomes, biochemical outcomes, physical function, quality of life, and depression among patients with CVD.^{14–16}

Although TCEs have been widely performed for the prevention and treatment of CVD,^{17,18} no consensus has been reached about the benefits of these exercises for the maintenance of physiological outcomes, biochemical outcomes, physical function, and quality of life or for the prevention of depression among CVD patients. We are also unaware of any systematic reviews that have assessed the effect of TCEs on physiological outcomes, blood cholesterol, quality of life, and depression among patients with CVD.

The effect of TCEs in CVD patients must be determined based on scientific evidence to conserve time and resources. The objective of this systematic review was to determine the effects of TCEs on physiological outcomes, biochemical outcomes, physical function, quality of life, and depression among CVD patients.

Methods

The protocol for our study is registered in the international prospective register of systematic reviews (PROSPERO registration number CRD42013006474).

Search Strategy

Relevant studies published between January 1957 and January 2015 were obtained from the following electronic data sources: PubMed, Embase, Web of Science, the Cochrane Library, Cumulative Index to Nursing and Allied Health Literature (CINAHL), and the China National Knowledge Infrastructure. No language restrictions were imposed, and the search was limited to randomized controlled trials (RCTs). The full electronic search strategies for all databases are provided in Data S1.

Inclusion Criteria

First, the only studies covered were published RCTs. Second, we included articles that discussed patients with CVD including ischemic heart disease or coronary artery disease (eg, heart attack), cerebrovascular disease (eg, stroke), diseases of the aorta and arteries (eg, hypertension), and peripheral vascular disease. Third, we considered only articles that compared an intervention group, that is, a group performing TCEs (eg, tai chi, gigong, baduanjin) with a control group that performed other exercises (eg, strength exercises), that received usual care, or that did not undergo any intervention. Fourth, outcome measures included physiological outcomes (eg, blood pressure, heart rate, peak oxygen uptake), biochemical outcomes (eg, cholesterol and triglyceride [TG]), physical function (eg. 6-minute walk test, timed up and go test), quality of life (eg, Minnesota Living With Heart Failure Questionnaire [MLHFQ], General Health Questionnaire [GHQ], and 36-Item Short Form [SF-36]), and depression (eg, Hamilton Depression Rating Scale [HAMD], Profile of Mood States [POMS] depression scale).

Two authors independently used the same selection criteria to screen the titles, abstracts, and full contents of the relevant articles. A study was removed from the selection if the inclusion criteria were not fulfilled. Any disagreements were resolved by discussion. A third author was consulted if a disagreement persisted.

Data Extraction and Management

The following data were extracted: study characteristics (eg, author and year), participant characteristics (eg, age and number of participants), description of interventions, duration of trial period, types of assessed outcomes, and time points. The 2 authors who selected the studies also extracted the data from the included articles. Any disagreement was resolved by discussion, and a third author was consulted if a disagreement persisted.

Quality Assessment

As recommended,¹⁹ we used the Cochrane Collaboration tool for assessing the risk of bias of the included trials. The following information was evaluated: random sequence generation, allocation concealment, blinding of participants and personnel, blinding of outcome assessments, incomplete outcome data, selective reporting, and other sources of bias.

The trials were graded as unclear, high, or low risk of bias. The methodological quality of each study was independently assessed by 2 review authors. A third author was consulted if any disagreement occurred.

Statistical Analysis

The Review Manager software (RevMan 5.2; Cochrane Collaboration) was used to conduct the meta-analysis. We used the chi-square test and the I² statistic to evaluate heterogeneity among the studies. The outcome measures from the individual studies were combined by meta-analysis using a random-effects model. Given that all variables in the included studies were continuous data, we used the standardized mean difference (SMD) or mean difference (MD) and 95% CI to analyze the studies. The MD was used as a summary statistic in meta-analysis when all studies reported the same outcome using the same scale. The SMD was used as a summary statistic in meta-analysis when all studies assessed the same outcome using different scales (ie, the outcome was measured using different units). We considered *P*<0.05 to be statistically significant. Funnel plot asymmetry was used to assess possible publication bias by the Egger's regression test. Sensitivity analysis was conducted by removing each study individually to evaluate the quality and consistency of the results.

If the continuous data were reported as median and interquartile range, the median would be assumed to be equivalent to the mean, and the relationship of interquartile range and the standard deviation would be roughly computed as SD=IQR/1.35.²⁰ The standard deviation could be obtained from the standard error of a mean by multiplying by the square root of the sample size: SD=SE× \sqrt{N} .²⁰ In specific cases, we also estimated the means and standard deviations for the data and reported them graphically rather than in a table. The authors of the selected studies were contacted if the standard deviations were not shown in the paper or could not be derived from their data. If the authors contacted did not reply, their articles were excluded.

Results

Search Results

We identified 68 potentially eligible records from the 2824 records obtained from PubMed, the Cochrane Library, Embase, CINAHL, the China National Knowledge Infrastructure, and Web of Science. After reviewing the full content of the papers, 35 articles²¹⁻⁵⁵ satisfied the inclusion criteria. The remaining 33 articles were excluded for several reasons (eg. participants did not have CVD, studies were not randomized). The process of identifying the eligible studies is outlined in Figure 1. Table 1 summarizes the characteristics of each included study. The 35 articles covered 2249 patients with CVD (15 articles covered patients with heart disease, 13 articles covered those with hypertension, and 7 articles covered those with cerebrovascular disease). The countries or regions of publication were mainly the People's Republic of China (n=17, 48.57%), the United States (n=5, 14.28%), the United Kingdom (n=3, 8.57%), the Republic of Korea (n=3, 8.57%), Japan (n=2, 5.71%), Hong Kong (n=1, 2.85%), Italy (n=1, 2.85%), Taiwan (n=1, 2.85%), New Zealand (n=1, 2.85%), and Israel (n=1, 2.85%).

Risk of Bias Among the Selected Articles

We assessed the risk of bias in all selected articles (Table 2). All articles used the generation of the allocation sequence (n=35, 100%). Allocation concealment was inadequate in most articles (n=26, 74%). None of the studies blinded their participants or personnel. Eight articles (23%) masked their outcome assessors to the treatment allocation. A low risk of incomplete outcome bias was reported in 31 articles (88.5%), whereas a low risk of selective reporting bias was reported in most articles (n=28, 73.6%).

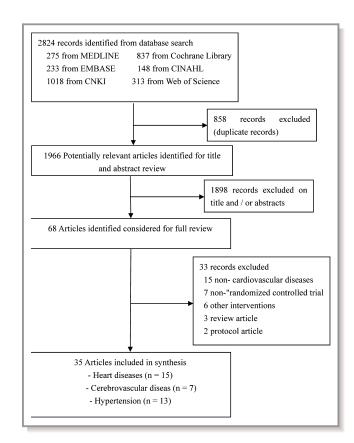


Figure 1. Flow chart of the study selection procedure. CKNI indicates China National Knowledge Infrastructure.

Effects of TCE on Physiological Outcomes

Blood pressure

Sixteen articles* involving 939 patients compared the systolic blood pressures (SBPs) and diastolic blood pressures (DBPs) between patients performing TCEs and those in the control group. Based on a random-effects model, TCE was found to decrease SBP by 9.12 mm Hg (95% Cl – 16.38 to – 1.86, P=0.01; I²=99%, P<0.00001) and DBP by 5.12 mm Hg (95% Cl – 7.71 to –2.52, P<0.001; I²=97%, P<0.00001) among patients performing TCEs compared with those in the control group (Figure 2 and Table 3).

Heart rate

Nine articles^{**} involving 463 patients compared the heart rate between patients performing TCEs and those in the control group. No significant differences were observed between the 2 groups based on a random-effects model (MD -2.39 beats per minute, 95% Cl -5.61 to -0.82, P=0.14) (Table 3).

Peak oxygen uptake

Four articles^{42,50,52,53} involving 166 patients compared the peak oxygen uptake of patients performing TCEs and those in

^{*}References 21, 24–27, 29, 33–35, 38, 39, 41, 42, 44, 53, 54. **References 24, 25, 29, 33, 34, 42, 44, 51, 53.

[&]quot; References 24, 25, 29, 33, 34, 42, 44, 51, 53

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Time Point	16 weeks	8 weeks	3 months	12 weeks	8 weeks	10 weeks	12 weeks
Outcomes	Physiological outcomes (blood pressure), quality of life (MLHFQ), depression (SCL-R depression index)	aol (GHQ)	aol (whoaol-bref)	Physiological outcomes (blood pressure, heart rate), physical function (6MWT)	Physiological outcomes (blood pressure, heart rate)	Physiological outcomes (blood pressure), biochemical outcomes (endothelin)	Physiological outcomes (blood pressure)
Duration of Trial Period	Twice a week for 16 weeks	Once a week for 8 weeks	4 to 5 times a week for 3 months	4 sessions a week for 8 weeks	Twice weekly for 3 weeks then weekly for a further 5 weeks	7 times a week for 9 weeks	6 times a week for 12 weeks
Intervention	G1: Tai chi exercise G2: Standard medical care	G1: Tai Chi and qigong exercise G2: No exercise	 G1: Baduanjin and health education G2: Health education 	G1: Tai chi exercise plus endurance training G2: Endurance training	G1: Tai chi exercise G2: Aerobic exercise	G1: Tai chi plus drug G2: Drug	 G1: Conventional treatment and tai chi G2: Conventional treatment
Disease	Heart failure	Brain injury	Stroke	Chronic heart failure	Acute myocardial infarction	Hypertension	Hypertension
Participant Characteristics, Sample Size	65 participants (G1=32, G2=33). Mean age: G1=68.4 years, G2=67.9 years	20 participants (G1=10, G2=10). Mean age (SD): G1=46.2 years (11.27), G2=44.5 years (10.52). Mean duration of disease (SD): G1=16.40 years (9.04), G2=14.98 years (13.62)	60 participants (G1=30, G2=30). Mean age (SD): G1=60.3 years (10.5), G2=61.3 years (7.4)	60 participants (G1=30, G2=30). Mean age (SD): G1=73.4 years (2), G2=73.8 years (6). Duration of disease: >3 months	79 participants (G1=38, G2=41). Age range: 39– 80 years	40 participants (G1=20, G2=20). Mean age: G1=64.3 years, G2=60.7. Mean duration of disease (SD): G1=8.4 years (4.9), G2=7.8 years (5.4)	68 participants (G1=50, G2=18). Age range: 30– 82 years
Country/ Region	¥	ž	China	Italy	Я	China	China
Article, Year	Barrow (2007) ²¹	Blake (2009) ²²	Cai (2010) ²³	Caminiti (2011) ²⁴	Channer (1996) ²⁵	Chen (2006) ²⁶	Chen (2013) ²⁷

Table 1. Characteristics of Included Studies

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Time Point	12 weeks	4 weeks 8 weeks 12 weeks 16 weeks	6 weeks 6 months	6 weeks	6 weeks 12 weeks	10 weeks	10 weeks	8 weeks
Outcomes	Biochemical outcomes (TC, TG, LDL-C, HDL-C)	Physiological outcomes (blood pressure, heart rate), biochemical outcomes (TC, TG, LDL-C, HDL-C), QOL (SF-36), depression (Beck Depression Inventory)	00L (SF-36)	QOL (SF-36)	QOL (Duke Health Profile)	Physiological outcomes (blood pressure, heart rate)	Physiological outcomes (blood pressure, heart rate)	Physiological outcomes (blood pressure), biochemical outcomes (TC, TG, HDL-C)
Duration of Trial Period	4 times a week for 12 weeks	4 hours a week for 16 weeks	5 times a week for 6 months	Once a week for 6 weeks	Twice a week for 12 weeks	7 times a week for 10 weeks	3 times a week for 10 weeks	7 times a week for 8 weeks
Intervention	G1: Conventional treatment and tai chi G2: Conventional treatment	G1: Qigong exercise G2: conventional exercise	G1: Tai chi exercise G2: Walking G3: No intervention	G1: TCE (tai chi) G2: No intervention	G1: TCE (tai chi) G2: Hydrotherapy G3: No intervention	G1: Qigong exercise G2: No intervention	G1: Qigong exercise G2: No intervention	G1: Qigong exercise G2: No intervention
Disease	Coronary disease	Hypertension	Percutaneous transluminal coronary intervention	Braumatic brain injury	Stroke	Hypertension	Hypertension	Hypertension
Participant Characteristics, Sample Size	60 participants (G1=32, G2=28). Mean age (SD): G1=69.3 years (10.6), G2=68.7 years (11.1)	 88 participants (G1=47, G2=41). Mean age (SD): G1=57.2 years (9.5), G2=51.2 years (7.4). Mean duration of disease (SD): G1=4.0 years (5.6), G2=3.9 years (5.1) 	90 participants (G1=30, G2=30, G3=30). Mean age (SD): G1=66.2 years (11.6), G2=64.9 years (11.0), G3=66.7 years (13.1)	18 participants (G1=9, G2=9)	152 participants (G1=56, G2=55, G3=41). Mean age (SD): G1=70.8 years (6.3), G2=70 years (6.3), G3=69.6 years (6.1)	58 participants (G1=29, G2=29). Mean age (SD): G1=55.8 years (6.3), G2=57.1 years (7.6)	58 participants (G1=29, G2=29). Mean age (SD): G1=56.0 years (5.9), G2=56.5 years (7.2)	36 participants (G1=17, G2=19). Mean age (SD): G1=52.6 years (5.1), G2=54.3 years (5.5)
Country/ Region	China	Hong Kong, China	China	New Zealand	Israel	Korea	Korea	Korea
Article, Year	Chen (2013) ²⁸	Cheung (2005) ²⁹	Ding (2013) ³⁰	Gemmell (2006) ³¹	Hart (2004) ³²	Lee (2003) ³³	Lee (2003) ³⁴	Lee (2004) ³⁵

Table 1. Continued

Time Point	5 weeks	8 weeks 20 weeks	6 months	8 weeks	8 weeks	24 weeks	1 year	8 weeks
Outcomes	Depression (HAMD)	aor	Physiological outcomes (blood pressure)	Physiological outcomes (blood pressure), biochemical outcomes (endothelin, no)	Biochemical outcomes (TC, TG)	Physiological outcomes (blood pressure), biochemical outcomes (TC, TG, HDL-C)	Physiological outcomes (peak oxygen uptake, blood pressure, heart rate)	Physical function (Short Physical Performance Battery), QOL (SF-36)
Duration of Trial Period	Twice weekly for 5 weeks	4–5 times a week for23 weeks	7 times a week for 6 months	6 times a week for 8 weeks	2 or 3 times a week for 6 months	5 times a week for 24 weeks	4 times a week for 1 year	Once a week for 8 weeks
Intervention	G1: Tai chi exercise G2: Strength exercise	G1: Baduanjin G2: Conventional exercise	G1: Tai chi plus drug G2: Drug	G1: Tai chi exercise G2: Drug	G1: Tai chi exercise G2: Drug	G1: Baduanjin exercise plus drug G2: Drug	G1: Tai chi exercise plus conventional rehabilitation G2: Conventional rehabilitation	G1: Tai chi G2: Usual care
Disease	Stroke	Coronary artery bypass graffing	Hypertension	Hypertension	Coronary disease	Hypertension	Coronary disease	Chronic stroke
Participant Characteristics, Sample Size	68 participants (G1=36, G2=32). Age range: 38- 76 years	60 participants (G1=30, G2=30). Mean age (SD): G1=66.47 years (8.26) G2=64.90 years (8.87)	84 participants (G1=44, G2=40). Mean age (SD): G1=44.74 years (12.1), G2=44.86 years (13.05)	62 participants (G1=51, G2=11). Mean age: G1=62.2 years, G2=63.3	50 participants (G1=26, G2=24). Mean age (SD): G1=53.9 years (6.4), G2=53.5 years (6.7)	48 participants (G1=24, G2=24). Mean age (SD): G1=62.1 years (5.8), G2=61.4 years (7.1)	20 participants (G1=10, G2=10). Mean age (SD): G1=68 years (5), G2=68 years (4). Mean duration of disease (SD): G1=19 months (15), G2=21 months (13)	28 participants (G1=16, G2=12). Mean age (SD): G1=72.8 years (10.1), G2=64.5 years (10.9). Mean duration of disease (SD): G1=58.3 months (46.7), G2=47.9 months (42.5)
Country/ Region	China	China	China	China	China	China	Japan	USA
Article, Year	Li (2012) ³⁶	Lin (2012) ³⁷	Luo (2006) ³⁸	Mao (2006) ³⁹	Ning (2010) ⁴⁰	Pan (2009) ⁴¹	Sato (2010) ⁴²	Taylor-Piliae (2012) ⁴³

Table 1. Continued

Table 1. Continued

Time Point	12 weeks	1 year	12 weeks	6 months	3 months 6 months	6 months	12 weeks	12 weeks
Outcomes	Physiological outcomes (blood pressure, heart rate), biochemical outcomes (TC, TG, LDL-C, HDL-C)	Biochemical outcomes (TC, TG, LDL-C, HDL-C)	QOL (GHQ), depressing (GHQ)	QOL (SF-36) and depression (HAMD)	00L (SF-36)	Physical function (6MWT), quality of life (SF-36)	Physiological outcomes (peak oxygen uptake), biochemical outcomes (BNP), physical function (6MWT), QOL (MLHFQ)	Biochemical outcomes (BNP), physical function (6MWT), quality of life (MLHFQ)
Duration of Trial Period	3 times a week for 12 weeks	7 times a week for 1 year	Once a week for 12 weeks	2 times a week for 3 months	5 times a week for 6 months	>5 times a week for 6 months	Twice weekly for 12 weeks	Twice weekly for 12 weeks
Intervention	G1: TCE (tai chi chuan) G2: Sedentary life controls	G1: Qigong exercise plus drug G2: Drug	G1: TCE (tai chi) G2: Rehabilitation exercise	G1: Tai chi exercise G2: Conventional exercise	G1: Conventional treatment and tai chi G2: Conventional treatment	G1: Conventional treatment and tai chi G2: Conventional treatment	G1: Usual care and tai chi exercise G2: Usual care	G1: Tai chi exercise and usual care G2: Usual care
Disease	Hypertension	Hypertension	Cerebral vascular disorder	Stroke	Percutaneous transluminal coronary intervention	Chronic heart failure	Chronic heart failure	Chronic heart failure
Participant Characteristics, Sample Size	76 participants (G1=37, G2=39). Mean age (SD): G1=50.5 years (7), G2=62.7 years (4)	100 participants (G1=50, G2=50). Age range: 45–65	34 participants (G1=17, G2=17). Age: >50 years	69 participants (G1=36, G2=33). Mean age (SD): G1=55.8 years (3.54), G2=51.2 years (7.8)	60 participants (G1=30, G2=30). Mean age (SD): G1=55.25 years (11.13), G2=54.86 years (12.05)	150 participants (G1=80, G2=70). Mean age (SD): G1=52.4 years (6.32), G2=51.7 years (7.26)	30 participants (G1=15, G2=15). Mean age (SD): G1=66 years (12), G2=61 years (14)	18 participants (G1=8, G2=10). Mean age (SD): G1=54.7 years (11.8), G2=64.2 years (16.2)
Country / Region	Taiwan, China	China	Japan	China	China	China	USA	USA
Article, Year	Tsai (2003) ⁴⁴	Wang (1989) ⁴⁵	Wang (2010) ⁴⁶	Wang (2012) ⁴⁷	Wang (2013) ⁴⁸	Yao (2010) ⁴⁹	Yeh (2004) ⁵⁰	Yeh (2008) ⁵¹

Article, Year	Country / Region	Participant Characteristics, Sample Size	Disease	Intervention	Duration of Trial Period	Outcomes	Time Point
Yeh (2011) ⁵²	NSA	100 participants (G1=50, G2=50). Mean age (SD): G1=68.1 years (11.9), G2=66.6 years (12.1)	Chronic heart failure	 G1: Usual care and tai chi exercise G2: Usual care and education sessions 	Twice weekly for 12 weeks	Physiological outcomes (peak oxygen uptake), biochemical outcomes (BNP), physical function (timed up and go, 6MWT), QOL (MLHFO), depression (POMS)	12 weeks
Yeh (2013) ⁵³	NSA	16 participants (G1=8, G2=8). Mean age (SD): G1=68 years (11), G2=63 years (11)	Heart failure	G1: Tai chi exercise G2: Aerobic exercise	Twice weekly for 12 weeks	Physiological outcomes (blood pressure, Peak oxygen uptake, heart rate), biochemical outcomes (BNP), physical function (time up and go, 6MWT), quality of life (MLHF), depression (POMS)	12 weeks
Yu (2013) ⁵⁴	China	104 participants (G1=52, G2=52). Age range: 40– 70 years	Hypertension	 G1: Baduanjin exercise plus education G2: Education 	3 or 4 times a week for 1 year	Blood pressure	1 year
Zhang (2013) ⁵⁵	China	120 participants (G1=60, G2=60). Mean age: G1=73.9 years, G2=76.5 years	Hypertension	G1: Baduanjin exercise plus drug G2: Drug	7 times a week for 2 months	doL	2 months

oww indicates o-minute wark test, burk, B-type natructic peptuee; o, group; ortd, General relatin Question destron bepression hating scare; HUL-L, ngh-density inpoprotein cholesterol; LUL-L, iow-density inpoprotein cholesterol; LUL-B, ngh-density more than the more than the

Table 1. Continued

Table 2.	Risk of E	Bias Assessment	of	Included	Studies
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Article, Year	Random Sequence Generation	Allocation Concealment	Blinding of Participants and Personnel	Blinding of Outcome Assessment	Incomplete Outcome Data	Selective Reporting	Other Bias
Barrow (2007) ²¹	Low	High	High	High	Low	Low	Unclear
Blake (2009) ²²	Low	Low	High	High	Low	Low	Unclear
Cai (2010) ²³	Low	High	High	High	Low	Low	Unclear
Caminiti (2011) ²⁴	Low	High	High	High	Low	Low	Unclear
Channer (1996) ²⁵	Low	High	High	High	Low	Low	Unclear
Chen (2006) ²⁶	Low	High	High	High	Low	Low	Unclear
Chen (2013) ²⁷	Low	High	High	High	Low	Low	Unclear
Chen (2013) ²⁸	Low	High	High	High	Low	Low	Unclear
Cheung (2005) ²⁹	Low	Low	High	Low	Low	Low	Unclear
Ding (2013) ³⁰	Low	High	High	High	Low	Low	Unclear
Gemmell (2006) ³¹	Low	High	High	Low	Low	Low	Unclear
Hart (2004) ³²	Low	High	High	High	Low	Low	Unclear
Lee (2003) ³³	Low	High	High	High	Unclear	Unclear	Unclear
Lee (2003) ³⁴	Low	Low	High	High	Unclear	Unclear	Unclear
Lee (2004) ³⁵	Low	High	High	High	Low	Unclear	Unclear
Li (2012) ³⁶	Low	High	High	High	Low	Low	Unclear
Lin (2012) ³⁷	Low	High	High	High	Low	Low	Unclear
Luo (2006) ³⁸	Low	High	High	High	Low	Low	Unclear
Mao (2006) ³⁹	Low	High	High	High	Low	Low	Unclear
Ning (2010) ⁴⁰	Low	High	High	High	Low	Low	Unclear
Pan (2009) ⁴¹	Low	Low	High	High	Low	Low	Unclear
Sato (2010) ⁴²	Low	High	High	High	Low	Low	Unclear
Taylor-Piliae (2012) ⁴³	Low	Low	High	Low	Low	Low	Unclear
Tsai (2003) ⁴⁴	Low	Low	High	Low	Low	Low	Unclear
Wang (1989) ⁴⁵	Low	High	High	High	Low	Low	Unclear
Wang (2010) ⁴⁶	Low	High	High	Low	Low	Low	Unclear
Wang (2012) ⁴⁷	Low	High	High	High	Unclear	Low	Unclear
Wang (2013) ⁴⁸	Low	High	High	High	Low	Low	Unclear
Yao (2010) ⁴⁹	Low	High	High	High	Low	Low	Unclear
Yeh (2004)50	Low	Low	High	Low	Low	Unclear	Unclear
Yeh (2008) ⁵¹	Low	High	High	High	Unclear	Unclear	Unclear
Yeh (2011) ⁵²	Low	Low	High	Low	Low	Unclear	Unclear
Yeh (2013) ⁵³	Low	Low	High	Low	Low	Unclear	Unclear
Yu (2013) ⁵⁴	Low	High	High	High	Low	Low	Unclear
Zhang (2013)55	Low	High	High	High	Low	Low	Unclear

the control group. The peak oxygen uptake of patients performing TCEs did not increase significantly compared with that of the patients in the control group, based on a random-effects model (SMD 0.04, 95% Cl -0.46 to 0.55, *P*=0.87) (Table 3).

Sensitivity analysis revealed that the pooled results of SBP, DBP, and peak oxygen uptake did not change statistical significance of the overall analysis when studies were removed 1 by 1. When 1 study²⁴ was removed, however, the result of heart rate was significant in the sensitivity analysis; it offered

$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$			TCE		C	ontrol			Mean Difference	Mean Difference	
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Random, 95% CI	IV, Random, 95% Cl	
$\begin{array}{c ccccc} \mbox{Channer (1996) 25} & -3 & 3.3 & 38 & -4 & 7.5 & 41 & 6.9\% & 1.00 [-1.52, 3.52] \\ \mbox{Chenn(2005) 26} & -27 & 8.1 & 20 & -3 & 7.2 & 20 & 6.7\% & 24.00 [-28.75, -19.25] \\ \mbox{Chenn(2013) 27} & -12.84 & 21.31 & 50 & -1.28 & 21.71 & 18 & 5.9\% & -11.56 [-23.20, 0.08] \\ \mbox{Chenn(2005) 29} & -7.1 & 10.56 & 39 & 2.9 & 12.05 & 39 & 6.7\% & 4.20 [+23.5, -19.25] \\ \mbox{Lee} (2003) 34 & -16.96 & 2.83 & 29 & 3.63 & 109 & 29 & 6.6\% & -18.72 [-24.57, -12.87] \\ \mbox{Lee} (2004) 35 & -12.07 & 8.46 & 17 & 1.55 & 10.44 & 19 & 6.6\% & -13.62 [-19.80, -7.44] \\ \mbox{Lee} (2004) 35 & -12.07 & 8.46 & 17 & 1.55 & 10.44 & 19 & 6.6\% & -13.62 [-19.80, -7.44] \\ \mbox{Lee} (2004) 35 & -12.07 & 8.46 & 17 & 1.55 & 10.44 & 19 & 6.6\% & -13.62 [-19.80, -7.44] \\ \mbox{Lee} (2009) 41 & -19.8 & 5.81 & 24 & -9.8 & 4.62 & 24 & 6.9\% & -10.00 [-12.97, -7.03] \\ \mbox{Para} an (2009) 41 & -19.8 & 5.81 & 24 & -9.8 & 4.62 & 24 & 6.9\% & -10.00 [-12.97, -7.03] \\ \mbox{Para} an (2009) 41 & -19.8 & 5.81 & 24 & -9.8 & 4.62 & 24 & 6.9\% & -10.00 [-12.97, -7.03] \\ \mbox{Para} an (2009) 41 & -19.8 & 5.81 & 24 & -9.8 & 4.62 & 24 & 6.9\% & -10.00 [-12.97, -7.03] \\ \mbox{Para} an (2009) 41 & -15.6 & 8.2 & 37 & 6.4 & 11.85 & 39 & 6.7\% & -22.00 [-26.68, -17.32] \\ \mbox{Para} re(1003) 53 & -2 & 27.65 & 8 & -27 & 31.81 & 8 & 3.3\% & 25.00 [-4.21, 54.21] \\ \mbox{Para} re(103) 54 & -12.7 & 10.29 & 52 & -4.3 & 10.68 & 52 & 6.8\% & -8.40 [-12.43, -4.37] \\ \mbox{Para} re(1965) \mbox{Lee} resure \\ \mbox{Diastolic blood pressure} \\ \mbox{Demony 12 & -4 & 2.6 & 2.5 & -7 & 4.1 & 27 & 7.6\% & 3.00 [1.15, 4.85] \\ \mbox{Dhammer} (1966) 25 & -2 & 2.7 & 38 & -1 & 3.7 & 41 & 7.8\% & -1.00 [-2.42, 0.42] \\ \mbox{Dhammer} (1966) 25 & -2 & 2.7 & 38 & -1 & 3.7 & 41 & 7.8\% & -1.00 [-2.42, 0.42] \\ Dh$	Barrow (2007) 21	-2	1.3	25	-8	3.9	27	6.9%	6.00 [4.44, 7.56]	*	
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	Caminiti (2011) 24	-6.4	1.3	30	-13.4	2.4	30	6.9%	7.00 [6.02, 7.98]	· · · · ·	
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	Channer (1996) 25	-3	3.3	38	-4	7.5	41	6.9%	1.00 [-1.52, 3.52]	t	
Cheung (2005) 29 -7.1 10.56 39 -2.9 12.05 39 6.7% -4.20 [9.23, 0.83] .ee (2003) 33 -15.62 10.2 29 3.1 12.43 29 6.6% -18.72 [24.57, -12.87] .ee (2003) 34 -16.96 2.83 29 3.63 1.09 29 6.9% -20.59 [-21.69, -19.49] .ee (2004) 35 -12.07 8.46 17 1.55 10.44 19 6.6% -13.62 [-19.80, -7.44] .ee (2004) 35 -12.07 8.46 17 1.55 10.44 19 6.6% -13.62 [-19.80, -7.44] .ee (2004) 35 -12.07 8.46 17 1.55 10.44 19 6.6% -13.62 [-19.80, -7.44] .ee (2004) 35 -12.07 8.46 17 1.55 10.44 19 6.6% -13.62 [-19.80, -7.44] .ee (2003) 31 -16.8 6.32 44 -21.03 5.68 40 6.9% -12.12 [-14.69, 9.55] .wtao(2006) 39 -10.92 14.14 51 0.26 42.5 11 3.7% -11.18 [-36.59, 14.23] Pan (2009) 41 -19.8 5.81 24 -9.8 4.62 24 6.9% -10.00 [-12.97, -7.03] Pan (2009) 41 -19.8 5.81 24 -9.8 4.62 24 6.9% -10.00 [-2.668, -17.32] Fisai (2003) 44 -15.6 8.82 37 6.4 11.85 39 6.7% -22.00 [-26.68, -17.32] (rel(2013) 53 -2 27.65 8 -27 31.81 8 3.3% 25.00 [-4.21, 54.21] (ru (2013) 54 -12.7 10.29 52 -4.3 10.68 52 6.8% -8.40 [-12.43, -4.37] Fotal (95% CI) 503 436 100.0% -9.12 [-16.38, -1.86] -50 -25 0 -25 0 -25 Study or Subgroup Mean SD Total Mean SD Total Weight IV. Random, 95% CI Favors [TCE] Favors [C Diastolic blood pressure Study or Subgroup Mean SD Total Mean SD Total Weight IV. Random, 95% CI Pharmar (1996) 25 -2 2.7 38 -1 3.7 41 7.8% -1.00 [-2.42, 0.42] Channer (1996) 25 -14.2 5.9 20 -3.6 5.4 20 6.9% -10.60 [-1.411, -7.09] Channer (1996) 25 -2 2.7 38 -1 3.7 41 7.8% -1.00 [-2.42, 0.42] Channer (1996) 25 -1.42 5.9 20 -3.6 5.4 20 6.9% -10.60 [-1.411, -7.09] Chance (2003) 33 -5.86 6.96 29 1.38 6.1 29 7.9% -5.78 [-9.68, -1.88] Cheu(2003) 34 -6.06 2.42 29 1.82 0.61 29 7.9% -7.24 [-10.61, -3.87] .ee (2003) 34 -6.06 2.42 29 1.82 0.61 29 7.9% -7.24 [-10.61, -3.87] .ee (2003) 34 -6.06 2.9 1.38 6.1 29 7.9% -7.24 [-10.61, -3.87] .ee (2003) 34 -6.06 2.7 3.5 44 -4.62 2.01 40 7.9% -3.45 [-4.38, -25.2] Wao(2006) 39 -2.225 7.43 51 2.17 7.265 11 0.3% -2.42 [-2.68, 01, 19.17]	Chen(2006) 26	-27	8.1	20	-3	7.2	20	6.7%	-24.00 [-28.75, -19.25]		
Lee (2003) 33 - 15.62 10.2 29 3.1 12.43 29 6.6% $-18.72[-24.57, -12.87]$ Lee (2003) 34 - 16.96 2.83 29 3.63 1.09 29 6.9% $-20.59[-21.69, -19.49]$ Lee (2004) 35 - 12.07 8.46 17 1.55 10.44 19 6.6% $-13.62[-19.80, -7.44]$ Luc(2006) 38 - 33.15 6.32 44 -21.03 5.68 40 6.9% $-12.12[-14.69, -9.55]$ Par (2009) 41 - 19.8 5.81 24 -9.8 4.62 24 6.9% $-10.00[-12.97, -7.03]$ Par (2009) 41 - 15.6 8.82 37 6.4 11.85 39 6.7% $-22.00[-26.68, -17.32]$ Par (2009) 41 - 15.6 8.82 37 6.4 11.85 39 6.7% $-22.00[-26.68, -17.32]$ Par (2003) 44 - 15.6 8.82 37 6.4 11.85 39 6.7% $-22.00[-26.68, -17.32]$ Par (2003) 44 - 15.6 8.82 37 6.4 11.85 39 6.7% $-22.00[-26.68, -17.32]$ Par (2003) 44 - 15.6 8.82 37 6.4 11.85 39 6.7% $-22.00[-26.68, -17.32]$ Par (2013) 54 - 12.7 10.29 52 -4.3 10.68 52 6.8% $-8.40[-12.43, -4.37]$ Par (2013) 54 - 12.7 10.29 52 -4.3 10.68 52 6.8% $-8.40[-12.43, -4.37]$ Par (2013) 54 - 12.7 10.29 52 -4.3 10.68 52 6.8% $-8.40[-12.43, -4.37]$ Par (2013) 54 - 12.7 10.29 52 -4.3 10.68 52 6.8% $-8.40[-12.43, -4.37]$ Par (2007) 21 - 4 2.6 25 -7 4.1 27 7.6% 3.00[1.15, 48.5] Caminti (2011) 24 -4.3 0.7 30 -5.6 1.4 30 7.9% 1.30[0.74, 1.86] Dramer (1996) 25 -2 2.7 38 -1 3.7 41 7.8% -1.00[-2.42, 0.42] Charner (1996) 25 -2 2.7 38 -1 3.7 41 7.8% -1.00[-2.42, 0.42] Charner (1996) 25 -2 2.7 38 -1 3.7 41 7.8% -1.00[-2.42, 0.42] Charner (1996) 25 -2 2.7 38 -1 3.7 41 7.8% -1.00[-2.42, 0.42] Charl(2006) 26 -14.2 5.9 20 -3.6 5.4 20 6.9% -10.60[-14.11, -7.09] Charler (2003) 33 -5.86 6.96 29 1.138 6.1 29 7.9% -7.38[-8.79, 6.97] Lee (2003) 34 -5.66 4.39 -4.1 5.69 39 7.3% -1.40[-4.12, 1.32] Lee (2003) 34 -5.66 6.94 2.9 1.82 0.61 29 7.9% -7.88[-8.79, 6.97] Lee (2003) 34 -5.66 6.94 2.9 1.82 0.61 29 7.9% -7.88[-8.79, 6.97] Lee (2003) 34 -5.66 6.94 2.9 1.82 0.61 29 7.9% -7.88[-8.79, 6.97] Lee (2003) 34 -5.66 6.94 2.9 1.82 0.61 29 7.9% -7.88[-8.79, 6.97] Lee (2003) 34 -5.66 6.94 2.92 1.82 0.61 29 7.9% -7.88[-8.79, 6.97] Lee (2003) 34 -5.66 6.94 2.92 1.82 0.61 29 7.9% -7.88[-8.79, 6.97] Lee (2003) 34 -5.66 6.94 2.92 1.82 0.61 2	Chen(2013) 27	-12.84	21.31	50	-1.28	21.71	18	5.9%	-11.56 [-23.20, 0.08]		
$\begin{array}{c} \text{ce} (2003) 34 & -16.96 & 2.83 & 29 & 3.63 & 1.09 & 29 & 6.9\% & -20.59 \begin{bmatrix} -21.69 & -19.49 \end{bmatrix} \\ \text{ce} (2004) 35 & -12.07 & 8.46 & 17 & 1.55 & 10.44 & 19 & 6.6\% & -13.62 \begin{bmatrix} -19.80 & -7.44 \end{bmatrix} \\ \text{ce} (2004) 35 & -13.25 & 6.32 & 44 & -21.03 & 5.68 & 40 & 6.9\% & -12.12 \begin{bmatrix} -14.69 & -9.55 \end{bmatrix} \\ \text{aa} (2006) 39 & -33.15 & 6.32 & 44 & -21.03 & 5.68 & 40 & 6.9\% & -10.00 \begin{bmatrix} -12.97 & -7.03 \end{bmatrix} \\ \text{aa} (2006) 39 & -10.92 & 14.14 & 51 & 0.26 & 42.5 & 11 & 3.7\% & -11.18 \begin{bmatrix} -36.59 & 14.23 \end{bmatrix} \\ \text{aa} (2003) 41 & -19.8 & 5.81 & 24 & -9.8 & 4.62 & 24 & 6.9\% & -10.00 \begin{bmatrix} -12.97 & -7.03 \end{bmatrix} \\ \text{aa} (2003) 44 & -15.6 & 8.82 & 37 & 6.4 & 11.85 & 39 & 6.7\% & -22.00 \begin{bmatrix} -26.68 & -17.32 \end{bmatrix} \\ \text{ce} (P_{2}013) 53 & -2 & 27.65 & 8 & -27 & 31.81 & 8 & 3.3\% & 25.00 \begin{bmatrix} -4.21 & 5.4.21 \end{bmatrix} \\ \text{ce} (P_{2}013) 54 & -12.7 & 10.29 & 52 & -4.3 & 10.68 & 52 & 6.8\% & -8.40 \begin{bmatrix} -12.43 & -4.37 \end{bmatrix} \\ \text{ceterogeneity: Tau^2 = 197.49, Chi^p = 1749.07, df = 15 (P < 0.00001); P = 99\% \\ \text{fest for overall effect: Z = 2.46 (P = 0.01) \end{array}$	Cheung (2005) 29	-7.1	10.56	39	-2.9	12.05	39	6.7%	-4.20 [-9.23, 0.83]		
$\begin{array}{c} \text{ce} (2004) 35 & -12.07 & 8.46 & 17 & 1.55 & 10.44 & 19 & 6.6\% & -13.62 \begin{bmatrix} -19.80, -7.44 \end{bmatrix} \\ \text{uo}(2006) 38 & -33.15 & 6.32 & 44 & -21.03 & 5.68 & 40 & 6.9\% & -12.12 \begin{bmatrix} -14.69, -9.55 \end{bmatrix} \\ \text{Mac}(2006) 39 & -10.92 & 14.14 & 51 & 0.26 & 42.5 & 11 & 3.7\% & -11.18 \begin{bmatrix} -36.59, 14.23 \end{bmatrix} \\ \text{Par}(2009) 41 & -19.8 & 581 & 24 & -9.8 & 4.62 & 24 & 6.9\% & -10.00 \begin{bmatrix} -12.97, -7.03 \end{bmatrix} \\ \text{Sato} (2010) 42 & -6 & 14.33 & 10 & 8 & 18.69 & 10 & 5.4\% & -14.00 \begin{bmatrix} -28.60, 0.60 \end{bmatrix} \\ \text{Sato} (2010) 42 & -6 & 14.33 & 10 & 8 & 18.69 & 10 & 5.4\% & -14.00 \begin{bmatrix} -28.60, -17.32 \end{bmatrix} \\ \text{(eh}(2013) 53 & -2 & 27.65 & 8 & -27 & 31.81 & 8 & 3.3\% & 25.00 \begin{bmatrix} -4.21, 54.21 \end{bmatrix} \\ \text{(u}(2013) 54 & -12.7 & 10.29 & 52 & -4.3 & 10.68 & 52 & 6.8\% & -8.40 \begin{bmatrix} -12.43, -4.37 \end{bmatrix} \\ \text{(eterogeneity: Tau^2 = 197.49, ChP = 1749.07, df = 15 (P < 0.00001); P = 99\% \\ \text{Fest for overall effect: Z = 2.46 (P = 0.01) } \\ \end{array}$.ee (2003) 33	-15.62	10.2	29	3.1	12.43	29	6.6% ·	-18.72 [-24.57, -12.87]		
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	_ee (2003) 34	-16.96	2.83	29	3.63	1.09	29	6.9%	-20.59 [-21.69, -19.49]	· ·	
$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$	_ee (2004) 35	-12.07	8.46	17	1.55	10.44	19	6.6%	-13.62 [-19.80, -7.44]		
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	_uo(2006) 38	-33.15	6.32	44	-21.03	5.68	40	6.9%	-12.12 [-14.69, -9.55]	-	
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	Mao(2006) 39	-10.92	14.14	51	0.26	42.5	11	3.7%	-11.18 [-36.59, 14.23]		
Trail (2003) 44 -15.6 8.82 37 6.4 11.85 39 6.7% -22.00 [-26.68, -17.32] (eh(2013) 53 -2 27.65 8 -27 31.81 8 3.3% 25.00 [-4.21, 54.21] (ru (2013) 54 -12.7 10.29 52 -4.3 10.68 52 6.8% -8.40 [-12.43, -4.37] Total (95% CI) 503 436 100.0% -9.12 [-16.38, -1.86]	Pan (2009) 41	-19.8	5.81	24	-9.8	4.62	24	6.9%	-10.00 [-12.97, -7.03]	~	
Total (95% CI) 503 436 100.0% 9.12 [-16.38, -1.86] I (2013) 54 -12.7 10.29 52 -4.3 10.68 52 6.8% -8.40 [-12.43, -4.37] Total (95% CI) 503 436 100.0% -9.12 [-16.38, -1.86] Heterogeneity: Tau ² = 197.49; Chi ² = 1749.07, df = 15 (P < 0.00001); P = 99%	Sato (2010) 42										
True (2013) 54 -12.7 10.29 52 -4.3 10.68 52 6.8% -8.40 [-12.43 , -4.37] Fotal (95% CI) 503 436 100.0% -9.12 [-16.38 , -1.86] Heterogeneity: Tau ² = 197.49; Chi ² = 1749.07, df = 15 (P < 0.00001); P = 99% -50 -25 0 22 Fest for overall effect: Z = 2.46 (P = 0.01) TCE Control Mean Difference Mean Difference Mean Difference Normal Mean Normal Mean SD Total Mean SD Total Weight V , Random, 95% CI	. ,										
Total (95% CI) 503 436 100.0% -9.12 [-16.38, -1.86] Heterogeneity: Tau ² = 197.49; Chi ² = 1749.07, df = 15 (P < 0.00001); P = 99%	<td>Yeh(2013) 53</td> <td>-2</td> <td>27.65</td> <td>8</td> <td>-27</td> <td>31.81</td> <td></td> <td>3.3%</td> <td>25.00 [-4.21, 54.21]</td> <td></td>	Yeh(2013) 53	-2	27.65	8	-27	31.81		3.3%	25.00 [-4.21, 54.21]	
Leterogeneity: Tau ² = 197.49; Chi ² = 1749.07, df = 15 (P < 0.00001); P = 99% Fest for overall effect: Z = 2.46 (P = 0.01) Diastolic blood pressure TCE Control Mean Difference Mean Difference Study or Subgroup Mean SD Total Mean Difference Mean Difference Study or Subgroup Mean SD Total Mean SD Total Mean Difference Mean Difference Mean Difference Study or Subgroup Mean SD Total Mean 7.9% 3.00 [1.15, 4.85] Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Colspan="2">Colspan="2">Colspan="2">Colspan="2">Mean Difference Mean Difference </td <td>Yu (2013) 54</td> <td>-12.7</td> <td>10.29</td> <td>52</td> <td>-4.3</td> <td>10.68</td> <td>52</td> <td>6.8%</td> <td>-8.40 [-12.43, -4.37]</td> <td>-</td>	Yu (2013) 54	-12.7	10.29	52	-4.3	10.68	52	6.8%	-8.40 [-12.43, -4.37]	-	
Leterogeneity: Tau ² = 197.49; Chi ² = 1749.07, df = 15 (P < 0.00001); P = 99% Fest for overall effect: Z = 2.46 (P = 0.01) Diastolic blood pressure TCE Control Mean Difference Mean Difference Study or Subgroup Mean SD Total Mean Difference Mean Difference Study or Subgroup Mean SD Total Mean SD Total Mean Difference Mean Difference Mean Difference Study or Subgroup Mean SD Total Mean 7.9% 3.00 [1.15, 4.85] Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Colspan="2">Colspan="2">Colspan="2">Colspan="2">Mean Difference Mean Difference </td <td>Fotal (95% CI)</td> <td></td> <td></td> <td>503</td> <td></td> <td></td> <td>436</td> <td>100 0%</td> <td>-9 12 [-16 38 -1 86]</td> <td></td>	Fotal (95% CI)			503			436	100 0%	-9 12 [-16 38 -1 86]		
-50 -25 0 22 Test for overall effect: Z = 2.46 (P = 0.01) Favors [TCE] Favors [C Test for overall effect: Z = 2.46 (P = 0.01) TCE Control Mean Difference Mean Difference Study or Subgroup Mean SD Total Mean SD Total Weight IV, Random, 95% CI IV, Random, 95% CI Study or Subgroup Mean SD Total Mean SD Total Weight IV, Random, 95% CI IV, Random, 95% CI Study or Subgroup Mean SD Total Mean SD Total Mean SD Total Mean SD Total Mean Mean SD Total Mean Mean SD Total Mean Mean SD Total Mean Mean Mean Mean Mean Mean SD Total Mean	. ,								0.12[10.00, 1.00]	*	
Study or Subgroup Mean SD Total Mean SD Total Weight IV. Random, 95% CI IV. Random, 95% CI Barrow (2007) 21 -4 2.6 25 -7 4.1 27 7.6% 3.00 [1.15, 4.85] Image: Comparison of the start of t	est for overall effect: Z	2 = 2.46 (P = 0.0	1)	df = 15 (P < 0.00	0001); i	2 = 99%		50 -25 0 25 50 Favors [TCE] Favors [control]	
Barrow (2007) 21 -4 2.6 25 -7 4.1 27 7.6% 3.00 [1.15, 4.85] Caminiti (2011) 24 -4.3 0.7 30 -5.6 1.4 30 7.9% 1.30 [0.74, 1.86] Channer (1996) 25 -2 2.7 38 -1 3.7 41 7.8% -1.00 [-2.42, 0.42] Chen(2006) 26 -14.2 5.9 20 -3.6 5.4 20 6.9% -10.60 [-14.11, -7.09] Chen(2005) 27 -7.56 8.39 50 -1.78 6.79 18 6.7% -5.78 [-9.68, -1.88] Cheung (2005) 29 -5.5 6.54 39 -4.1 5.69 39 7.3% -1.40 [-4.12, 1.32] Lee (2003) 33 -5.86 6.96 29 1.38 6.1 29 7.9% -7.88 [-8.79, -6.97] Lee (2003) 34 -6.06 2.42 29 1.82 0.61 29 7.9% -7.88 [-8.79, -6.97] Lee (2004) 35 -13.92 7.06 17 3.1 6.06 19 6.5% -17.02 [-21.34, -12.70] Luo(2006) 38 -8.07<	Fest for overall effect: Z	2 = 2.46 (P = 0.0	1)				2 = 99%		Favors [TCE] Favors [control]	
Caminiti (2011) 24 -4.3 0.7 30 -5.6 1.4 30 7.9% 1.30 [0.74, 1.86] Channer (1996) 25 -2 2.7 38 -1 3.7 41 7.8% -1.00 [-2.42, 0.42] Chen(2006) 26 -14.2 5.9 20 -3.6 5.4 20 6.9% -10.60 [-14.11, -7.09] Chen(2005) 26 -14.2 5.9 20 -3.6 5.4 20 6.9% -10.60 [-14.11, -7.09] Chen(2013) 27 -7.56 8.39 50 -1.78 6.79 18 6.7% -5.78 [-9.68, -1.88] Cheung (2005) 29 -5.5 6.54 39 -4.1 5.69 39 7.3% -1.40 [-4.12, 1.32] Lee (2003) 33 -5.86 6.96 29 1.38 6.1 29 7.9% -7.88 [-8.79, -6.97] Lee (2003) 34 -6.06 2.42 29 1.82 0.61 29 7.9% -7.88 [-8.79, -6.97] Lee (2004) 35 -13.92 7.06 17 3.1 6.06 19 6.5% -17.02 [-21.34, -12.70] Luo (2006) 38 <t< th=""><th>Test for overall effect: Z Diastolic blo</th><th>z = 2.46 (bod p</th><th>P = 0.0 ress TCE</th><th>1) ure</th><th></th><th>Control</th><th></th><th></th><th>Mean Difference</th><th>Favors [TCE] Favors [control] Mean Difference</th></t<>	Test for overall effect: Z Diastolic blo	z = 2.46 (bod p	P = 0.0 ress TCE	1) ure		Control			Mean Difference	Favors [TCE] Favors [control] Mean Difference	
Channer (1996) 25 -2 2.7 38 -1 3.7 41 7.8% -1.00 [-2.42, 0.42] Chen(2006) 26 -14.2 5.9 20 -3.6 5.4 20 6.9% -10.60 [-14.11, -7.09] Chen(2013) 27 -7.56 8.39 50 -1.78 6.79 18 6.7% -5.78 [-9.68, -1.88] Cheung (2005) 29 -5.5 6.54 39 -4.1 5.69 39 7.3% -1.40 [-4.12, 1.32] Lee (2003) 33 -5.86 6.96 29 1.38 6.1 29 7.0% -7.24 [-10.61, -3.87] Lee (2003) 34 -6.06 2.42 29 1.82 0.61 29 7.9% -7.88 [-8.79, -6.97] Lee (2004) 35 -13.92 7.06 17 3.1 6.06 19 6.5% -17.02 [-21.34, -12.70] Luo (2006) 38 -8.07 2.35 44 -4.62 2.01 40 7.9% -3.45 [-4.38, -2.52] Wao (2006) 39 -22.25 27.43 51 2.17 72.65 11 0.3% -24.42 [-68.01, 19.17] <td>Fest for overall effect: Z Diastolic blo Study or Subgroup</td> <td>z = 2.46 (bod p <u>Mean</u></td> <td>P = 0.0 ress TCE SD</td> <td>1) ure</td> <td>Mean</td> <td>Control SD</td> <td>Total</td> <td>Weight</td> <td>Mean Difference : IV, Random, 95% Cl</td> <td>Favors [TCE] Favors [control]</td>	Fest for overall effect: Z Diastolic blo Study or Subgroup	z = 2.46 (bod p <u>Mean</u>	P = 0.0 ress TCE SD	1) ure	Mean	Control SD	Total	Weight	Mean Difference : IV, Random, 95% Cl	Favors [TCE] Favors [control]	
Chen(2006) 26 -14.2 5.9 20 -3.6 5.4 20 6.9% -10.60 [-14.11, -7.09] Chen(2013) 27 -7.56 8.39 50 -1.78 6.79 18 6.7% -5.78 [-9.68, -1.88] Cheung (2005) 29 -5.5 6.54 39 -4.1 5.69 39 7.3% -1.40 [-4.12, 1.32] Lee (2003) 33 -5.86 6.96 29 1.38 6.1 29 7.0% -7.24 [-10.61, -3.87] Lee (2003) 34 -6.06 2.42 29 1.82 0.61 29 7.9% -7.88 [-8.79, -6.97] Lee (2004) 35 -13.92 7.06 17 3.1 6.06 19 6.5% -17.02 [-21.34, -12.70] Luo (2006) 38 -8.07 2.35 44 -4.62 2.01 40 7.9% -3.45 [-4.38, -2.52] Wao (2006) 39 -22.25 27.43 51 2.17 72.65 11 0.3% -24.42 [-68.01, 19.17]	Test for overall effect: Z Diastolic blo Study or Subgroup Barrow (2007) 21	2 = 2.46 (Dod p <u>Mean</u> -4	P = 0.0 ress TCE <u>SD</u> 2.6	1) ure <u>Total</u> 25	Mean -7	Control SD 4.1	Total 27	Weight	Mean Difference IV, Random, 95% CI 3.00 [1.15, 4.85]	Favors [TCE] Favors [control] Mean Difference	
Chen(2013) 27 -7.56 8.39 50 -1.78 6.79 18 6.7% -5.78 [-9.68, -1.88] Cheung (2005) 29 -5.5 6.54 39 -4.1 5.69 39 7.3% -1.40 [-4.12, 1.32] Lee (2003) 33 -5.86 6.96 29 1.38 6.1 29 7.0% -7.24 [-10.61, -3.87] Lee (2003) 34 -6.06 2.42 29 1.82 0.61 29 7.9% -7.88 [-8.79, -6.97] Lee (2004) 35 -13.92 7.06 17 3.1 6.06 19 6.5% -17.02 [-21.34, -12.70] Luo (2006) 38 -8.07 2.35 44 -4.62 2.01 40 7.9% -3.45 [-4.38, -2.52] Wao (2006) 39 -22.25 27.43 51 2.17 72.65 11 0.3% -24.42 [-68.01, 19.17]	Test for overall effect: Z Diastolic blo Study or Subgroup Barrow (2007) 21 Caminiti (2011) 24	2 = 2.46 (Dod p <u>Mean</u> -4 -4.3	P = 0.0 ress TCE <u>SD</u> 2.6 0.7	1) ure <u>Total</u> 25 30	<u>Mean</u> -7 -5.6	Control <u>SD</u> 4.1 1.4	Total 27 30	Weight 7.6% 7.9%	Mean Difference IV, Random, 95% CI 3.00 [1.15, 4.85] 1.30 [0.74, 1.86]	Favors [TCE] Favors [control] Mean Difference	
Cheung (2005) 29 -5.5 6.54 39 -4.1 5.69 39 7.3% -1.40 [-4.12, 1.32] Lee (2003) 33 -5.86 6.96 29 1.38 6.1 29 7.0% -7.24 [-10.61, -3.87] Lee (2003) 34 -6.06 2.42 29 1.82 0.61 29 7.9% -7.88 [-8.79, -6.97] Lee (2004) 35 -13.92 7.06 17 3.1 6.06 19 6.5% -17.02 [-21.34, -12.70] Luo (2006) 38 -8.07 2.35 44 -4.62 2.01 40 7.9% -3.45 [-4.38, -2.52] Mao (2006) 39 -22.25 27.43 51 2.17 72.65 11 0.3% -24.42 [-6.80,1, 19.17]	Test for overall effect: Z Diastolic blo Study or Subgroup Barrow (2007) 21 Caminiti (2011) 24 Channer (1996) 25	2 = 2.46 (Dod p <u>Mean</u> -4 -4.3 -2	P = 0.0 ress TCE 2.6 0.7 2.7	1) Ure 25 30 38	Mean -7 -5.6 -1	Control SD 4.1 1.4 3.7	Total 27 30 41	Weight 7.6% 7.9% 7.8%	Mean Difference IV, Random, 95% CI 3.00 [1.15, 4.85] 1.30 [0.74, 1.86] -1.00 [-2.42, 0.42]	Favors [TCE] Favors [control] Mean Difference	
Lee (2003) 33 -5.86 6.96 29 1.38 6.1 29 7.0% -7.24 [-10.61, -3.87] Lee (2003) 34 -6.06 2.42 29 1.82 0.61 29 7.9% -7.88 [-8.79, -6.97] Lee (2004) 35 -13.92 7.06 17 3.1 6.06 19 6.5% -17.02 [-21.34, -12.70] Luo (2006) 38 -8.07 2.35 44 -4.62 2.01 40 7.9% -3.45 [-4.38, -2.52] Wao (2006) 39 -22.25 27.43 51 2.17 72.65 11 0.3% -24.42 [-68.01, 19.17]	Test for overall effect: Z Diastolic blo Study or Subgroup Barrow (2007) 21 Caminiti (2011) 24 Channer (1996) 25 Chen(2006) 26	Dood p Mean -4 -4.3 -2 -14.2	P = 0.0 ress TCE <u>SD</u> 2.6 0.7 2.7 5.9	1) Total 25 30 38 20	<u>Mean</u> -7 -5.6 -1 -3.6	Control SD 4.1 1.4 3.7 5.4	Total 27 30 41 20	Weight 7.6% 7.9% 7.8% 6.9%	Mean Difference IV, Random, 95% CI 3.00 [1.15, 4.85] 1.30 [0.74, 1.86] -1.00 [-2.42, 0.42] -10.60 [-14.11, -7.09]	Favors [TCE] Favors [control] Mean Difference	
Lee (2003) 34 -6.06 2.42 29 1.82 0.61 29 7.9% -7.88 [-8.79, -6.97] Lee (2004) 35 -13.92 7.06 17 3.1 6.06 19 6.5% -17.02 [-21.34, -12.70] Luo (2006) 38 -8.07 2.35 44 -4.62 2.01 40 7.9% -3.45 [-4.38, -2.52] Mao (2006) 39 -22.25 27.43 51 2.17 72.65 11 0.3% -24.42 [-68.01, 19.17]	Test for overall effect: Z Diastolic blo Study or Subgroup Barrow (2007) 21 Caminiti (2011) 24 Channer (1996) 25 Chen(2006) 26 Chen(2013) 27	Z = 2.46 (Dod p <u>Mean</u> -4 -4.3 -2 -14.2 -7.56	P = 0.0 ressi TCE 2.6 0.7 2.7 5.9 8.39	1) Ure 25 30 38 20 50	Mean -7 -5.6 -1 -3.6 -1.78	Control SD 4.1 1.4 3.7 5.4 6.79	Total 27 30 41 20 18	Weight 7.6% 7.9% 7.8% 6.9% 6.7%	Mean Difference IV, Random, 95% CI 3.00 [1.15, 4.85] 1.30 [0.74, 1.86] -1.00 [-2.42, 0.42] -10.60 [-14.11, -7.09] -5.78 [-9.68, -1.88]	Favors [TCE] Favors [control] Mean Difference	
Lee (2004) 35 -13.92 7.06 17 3.1 6.06 19 6.5% -17.02 [-21.34, -12.70]	Test for overall effect: Z Diastolic blo Study or Subgroup Barrow (2007) 21 Caminiti (2011) 24 Channer (1996) 25 Chen(2006) 26 Chen(2013) 27 Cheung (2005) 29	2 = 2.46 (Dod p <u>Mean</u> -4 -4.3 -2 -14.2 -7.56 -5.5	P = 0.0 ress TCE 2.6 0.7 2.7 5.9 8.39 6.54	1) Total 25 30 38 20 50 39	Mean -7 -5.6 -1 -3.6 -1.78 -4.1	Control SD 4.1 1.4 3.7 5.4 6.79 5.69	Total 27 30 41 20 18 39	Weight 7.6% 7.9% 7.8% 6.9% 6.7% 7.3%	Mean Difference IV, Random, 95% CI 3.00 [1.15, 4.85] 1.30 [0.74, 1.86] -1.00 [-2.42, 0.42] -10.60 [-14.11, -7.09] -5.78 [-9.68, -1.88] -1.40 [-4.12, 1.32]	Favors [TCE] Favors [control] Mean Difference	
Luo(2006) 38 -8.07 2.35 44 -4.62 2.01 40 7.9% -3.45 [-4.38, -2.52] Mao(2006) 39 -22.25 27.43 51 2.17 72.65 11 0.3% -24.42 [-68.01, 19.17]	Test for overall effect: Z Diastolic blo Study or Subgroup Barrow (2007) 21 Caminiti (2011) 24 Channer (1996) 25 Chen(2006) 26 Chen(2013) 27 Cheung (2005) 29 Lee (2003) 33	Mean -4 -4 -43 -2 -14.2 -7.56 -5.5 -5.86	P = 0.0 ress TCE 2.6 0.7 2.7 5.9 8.39 6.54 6.96	1) Total 25 30 38 20 50 39 29	Mean -7 -5.6 -1 -3.6 -1.78 -4.1 1.38	Control <u>SD</u> 4.1 1.4 3.7 5.4 6.79 5.69 6.1	Total 27 30 41 20 18 39 29	Weight 7.6% 7.9% 7.8% 6.9% 6.7% 7.3% 7.0%	Mean Difference IV, Random, 95% Cl 3.00 [1.15, 4.85] 1.30 [0.74, 1.86] -1.00 [-2.42, 0.42] -10.60 [-14.11, -7.09] -5.78 [-9.68, -1.88] -1.40 [-4.12, 1.32] -7.24 [-10.61, -3.87]	Favors [TCE] Favors [control] Mean Difference	
Mao(2006) 39 -22.25 27.43 51 2.17 72.65 11 0.3% -24.42 [-68.01, 19.17]	Test for overall effect: Z Diastolic blo Study or Subgroup Barrow (2007) 21 Caminiti (2011) 24 Channer (1996) 25 Chen(2006) 26 Chen(2013) 27 Cheung (2005) 29 Lee (2003) 33 Lee (2003) 34	Mean -4 -43 -2 -14.2 -7.56 -5.5 -5.86 -6.06	P = 0.0 ressi TCE 2.6 0.7 2.7 5.9 8.39 6.54 6.96 2.42	1) Total 25 30 38 20 50 39 29 29	Mean -7 -5.6 -1 -3.6 -1.78 -4.1 1.38 1.82	Control <u>SD</u> 4.1 1.4 3.7 5.4 6.79 5.69 6.1 0.61	Total 27 30 41 20 18 39 29 29	Weight 7.6% 7.9% 7.8% 6.9% 6.7% 7.3% 7.0% 7.9%	Mean Difference IV, Random, 95% Cl 3.00 [1.15, 4.85] 1.30 [0.74, 1.86] -1.00 [-2.42, 0.42] -10.60 [-14.11, -7.09] -5.78 [-9.68, -1.88] -1.40 [-4.12, 1.32] -7.24 [-10.61, -3.87] -7.88 [-8.79, -6.97]	Favors [TCE] Favors [control] Mean Difference	
	Test for overall effect: Z Diastolic blo Study or Subgroup Barrow (2007) 21 Caminiti (2011) 24 Channer (1996) 25 Chen(2006) 26 Chen(2013) 27 Cheung (2005) 29 Lee (2003) 33 Lee (2003) 34 Lee (2004) 35	Mean -4 -43 -2 -14.2 -7.56 -5.5 -5.86 -6.06 -13.92	P = 0.0 ressi TCE <u>SD</u> 2.6 0.7 2.7 5.9 8.39 6.54 6.96 2.42 7.06	1) Total 25 30 38 20 50 39 29 29 29 17	Mean -7 -5.6 -1 -3.6 -1.78 -4.1 1.38 1.82 3.1	Control <u>SD</u> 4.1 1.4 3.7 5.4 6.79 5.69 6.1 0.61 6.06	Total 27 30 41 20 18 39 29 29 29 19	Weight 7.6% 7.9% 7.8% 6.9% 6.7% 7.3% 7.0% 7.9% 6.5%	Mean Difference IV, Random, 95% Cl 3.00 [1.15, 4.85] 1.30 [0.74, 1.86] -1.00 [-2.42, 0.42] -10.60 [-14.11, -7.09] -5.78 [-9.68, -1.88] -1.40 [-4.12, 1.32] -7.24 [-10.61, -3.87] -7.88 [-8.79, -6.97] -7.88 [-8.79, -6.97] -17.02 [-21.34, -12.70]	Favors [TCE] Favors [control] Mean Difference	
Pan (2009) 41 -10.8 5.31 24 -6.6 4.86 24 7.2% -4.20 [-7.08, -1.32]	Test for overall effect: Z Diastolic blo Study or Subgroup Barrow (2007) 21 Caminiti (2011) 24 Channer (1996) 25 Chen(2006) 26 Chen(2003) 27 Cheung (2005) 29 Lee (2003) 33 Lee (2003) 34 Lee (2004) 35 Luo(2006) 38	2 = 2.46 (Dod p <u>Mean</u> -4 -43 -2 -14.2 -7.56 -5.5 -5.86 -6.06 -13.92 -8.07	P = 0.0 ress TCE <u>SD</u> 2.6 0.7 2.7 5.9 8.39 6.54 6.96 2.42 7.06 2.35	1) Total 25 30 38 20 50 39 29 29 29 17 44	<u>Mean</u> -7 -5.6 -1 -3.6 -1.78 -4.1 1.38 1.82 3.1 -4.62	Control SD 4.1 1.4 3.7 5.4 6.79 6.1 0.61 6.06 2.01	Total 277 300 411 200 188 399 299 299 199 400	Weight 7.6% 7.9% 7.8% 6.9% 6.7% 7.3% 7.0% 7.9% 6.5% 7.9%	Mean Difference IV, Random, 95% CI 3.00 [1.15, 4.85] 1.30 [0.74, 1.86] -1.00 [-2.42, 0.42] -10.60 [-14.11, -7.09] -5.78 [-9.68, -1.88] -1.40 [-4.12, 1.32] -7.24 [-10.61, -3.87] -7.88 [-8.79, -6.97] -17.02 [-21.34, -12.70] -3.45 [-4.38, -2.52]	Favors [TCE] Favors [control] Mean Difference	
	Test for overall effect: Z Diastolic blo Study or Subgroup Barrow (2007) 21 Caminiti (2011) 24 Channer (1996) 25 Chen(2006) 26 Chen(2013) 27 Cheung (2005) 29 Lee (2003) 33 Lee (2004) 35 Luo(2006) 38 Mao(2006) 39	Mean -4 -43 -2 -14.2 -7.56 -5.5 -5.86 -6.06 -13.92 -8.07 -22.25	P = 0.0 ress TCE <u>SD</u> 2.6 0.7 2.7 5.9 8.39 6.54 6.96 2.42 7.06 2.35 27.43	1) Total 25 30 38 20 50 39 29 29 29 17 44 51	Mean -7 -5.6 -1.78 -4.1 1.38 1.82 3.1 -4.62 2.17	Control SD 4.1 1.4 3.7 5.4 6.79 5.69 6.1 0.61 6.06 2.01 72.65	Total 277 300 411 200 188 399 299 299 199 400 111	Weight 7.6% 7.9% 7.8% 6.9% 6.7% 7.3% 7.0% 7.9% 6.5% 7.9% 0.3%	Mean Difference IV, Random, 95% CI 3.00 [1.15, 4.85] 1.30 [0.74, 1.86] -1.00 [-2.42, 0.42] -10.60 [-14.11, -7.09] -5.78 [-9.68, -1.88] -1.40 [-4.12, 1.32] -7.24 [-10.61, -3.87] -7.88 [-8.79, -6.97] -17.02 [-21.34, -12.70] -3.45 [-4.38, -2.52] -24.42 [-68.01, 19.17]	Favors [TCE] Favors [control] Mean Difference	
	Test for overall effect: Z Diastolic blo Study or Subgroup Barrow (2007) 21 Caminiti (2011) 24 Channer (1996) 25 Chen(2006) 26 Chen(2013) 27 Cheung (2005) 29 Lee (2003) 33 Lee (2004) 35 Luo(2006) 38 Mao(2006) 39 Pan (2009) 41	Mean -4 -43 -7.56 -5.5 -5.86 -6.06 -13.92 -8.07 -22.25 -10.8	P = 0.0 ressi TCE <u>SD</u> 2.6 0.7 2.7 5.9 8.39 6.54 6.96 2.42 7.06 2.35 27.43 5.31	1) Total 25 30 50 50 29 29 29 29 29 17 44 51 24	Mean -7 -5.6 -1 -3.6 -1.78 -4.1 1.38 1.82 3.1 -4.62 2.17 -6.6	Control SD 4.1 1.4 3.7 5.4 6.79 5.69 6.1 0.61 0.61 0.61 2.01 72.65 4.86	Total 27 30 41 20 18 399 29 29 29 19 40 11 24	Weight 7.6% 7.9% 7.8% 6.9% 6.7% 7.3% 7.0% 7.9% 6.5% 7.9% 0.3% 7.2%	Mean Difference IV, Random, 95% CI 3.00 [1.15, 4.85] 1.30 [0.74, 1.86] -1.00 [-2.42, 0.42] -10.60 [-14.11, -7.09] -5.78 [-9.68, -1.88] -1.40 [-4.12, 1.32] -7.24 [-10.61, -3.87] -7.88 [-8.79, -6.97] -17.02 [-21.34, -12.70] -3.45 [-4.38, -2.52] -24.42 [-68.01, 19.17] -4.20 [-7.08, -1.32]	Favors [TCE] Favors [control] Mean Difference	
Tsai (2003) 44 -8.8 8.36 37 3.4 8.88 39 6.8% -12.20 [-16.08, -8.32]	Test for overall effect: Z Diastolic blo Study or Subgroup Barrow (2007) 21 Caminiti (2011) 24 Channer (1996) 25 Chen(2006) 26 Chen(2013) 27 Cheung (2005) 29 Lee (2003) 33 Lee (2004) 35 Luo(2006) 38 Mao(2006) 39 Pan (2009) 41	Mean -4 -43 -7.56 -5.5 -5.86 -6.06 -13.92 -8.07 -22.25 -10.8	P = 0.0 ressi TCE <u>SD</u> 2.6 0.7 2.7 5.9 8.39 6.54 6.96 2.42 7.06 2.35 27.43 5.31	1) Total 25 30 50 50 29 29 29 29 29 17 44 51 24	Mean -7 -5.6 -1 -3.6 -1.78 -4.1 1.38 1.82 3.1 -4.62 2.17 -6.6	Control SD 4.1 1.4 3.7 5.4 6.79 5.69 6.1 0.61 0.61 0.61 2.01 72.65 4.86	Total 27 30 41 20 18 399 29 29 29 19 40 11 24	Weight 7.6% 7.9% 7.8% 6.9% 6.7% 7.3% 7.0% 7.9% 6.5% 7.9% 0.3% 7.2%	Mean Difference IV, Random, 95% CI 3.00 [1.15, 4.85] 1.30 [0.74, 1.86] -1.00 [-2.42, 0.42] -10.60 [-14.11, -7.09] -5.78 [-9.68, -1.88] -1.40 [-4.12, 1.32] -7.24 [-10.61, -3.87] -7.88 [-8.79, -6.97] -17.02 [-21.34, -12.70] -3.45 [-4.38, -2.52] -24.42 [-68.01, 19.17] -4.20 [-7.08, -1.32]	Favors [TCE] Favors [control] Mean Difference	
Yeh(2013) 53 -2 10.2 8 -10 16.08 8 2.6% 8.00 [-5.20, 21.20]	Test for overall effect: Z Diastolic blo Study or Subgroup Barrow (2007) 21 Caminiti (2011) 24 Channer (1996) 25 Chen(2006) 26 Chen(2013) 27 Cheung (2005) 29 Lee (2003) 33 Lee (2003) 34 Lee (2004) 35 Luo(2006) 38 Mao(2006) 39	Mean -4 -43 -7.56 -5.5 -5.86 -6.06 -13.92 -8.07 -22.25 -10.8 -6	P = 0.0 ressi TCE <u>SD</u> 2.6 0.7 2.7 5.9 8.39 6.54 6.96 2.42 7.06 2.35 27.43 5.31 14.33	1) Total 25 30 50 50 29 29 29 29 29 17 44 51 24 10	<u>Mean</u> -7 -566 -1- -3.66 -1.78 -4.11 1.38 1.82 3.11 -4.62 2.17 -6.66 8	Control SD 4.1 1.4 3.7 5.4 6.79 5.69 6.1 0.61 6.06 2.01 72.65 4.86 18.69	Total 27 30 41 20 18 399 29 29 29 19 40 11 24 40 11 24	Weight 7.6% 7.9% 7.8% 6.9% 6.7% 7.3% 7.0% 7.9% 6.5% 7.9% 0.3% 7.2% 2.3%	Mean Difference IV, Random, 95% CI 3.00 [1.15, 4.85] 1.30 [0.74, 1.86] -1.00 [-2.42, 0.42] -10.60 [-14.11, -7.09] -5.78 [-9.68, -1.88] -1.40 [-4.12, 1.32] -7.24 [-10.61, -3.87] -7.88 [-8.79, -6.97] -17.02 [-21.34, -12.70] -3.45 [-4.38, -2.52] -24.42 [-68.01, 19.17] -4.20 [-7.08, -1.32] -14.00 [-28.60, 0.60]	Favors [TCE] Favors [control] Mean Difference	
Yu (2013) 54 -8.4 8.01 52 -4 7.66 52 7.2% -4.40 [-7.41, -1.39]	Test for overall effect: Z Diastolic blo Study or Subgroup Barrow (2007) 21 Caminiti (2011) 24 Channer (1996) 25 Chen(2006) 26 Chen(2013) 27 Cheung (2005) 29 Lee (2003) 33 Lee (2004) 35 Luo(2006) 38 Mao(2006) 39 Pan (2009) 41 Sato (2010) 42 Tsai (2003) 44	Mean -4 -43 -2 -14.2 -7.56 -5.5 -5.86 -6.06 -13.92 -8.07 -22.25 -10.8 -6 -8.8	P = 0.0 ress TCE <u>SD</u> 2.6 0.7 2.7 5.9 8.39 6.54 6.96 2.42 7.06 2.35 27.43 5.31 14.33 8.36	1) Total 25 30 38 20 50 39 29 29 29 17 44 51 24 10 37	Mean -7 -566 -1- -366 -1.78 -4.1 1.38 1.82 3.1 1.38 1.82 3.1 -4.62 2.17 -6.6 8 3.4	Control SD 4.1 1.4 3.7 5.4 6.79 5.69 6.1 0.61 6.06 2.01 72.65 4.86 18.69 8.88	Total 27 300 411 200 18 399 299 299 199 400 111 244 100 399	Weight 7.6% 7.9% 7.8% 6.9% 6.7% 7.3% 7.0% 7.9% 6.5% 7.9% 0.3% 7.2% 2.3% 6.8%	Mean Difference IV, Random, 95% CI 3.00 [1.15, 4.85] 1.30 [0.74, 1.86] -1.00 [-2.42, 0.42] -10.60 [-14.11, -7.09] -5.78 [-9.68, -1.88] -1.40 [-4.12, 1.32] -7.24 [-10.61, -3.87] -7.88 [-8.79, -6.97] -17.02 [-21.34, -12.70] -3.45 [-4.38, -2.52] -24.42 [-68.01, 19.17] -4.20 [-7.08, -1.32] -14.00 [-28.60, 0.60] -12.20 [-16.08, -8.32]	Favors [TCE] Favors [control] Mean Difference	
Total (95% CI) 503 436 100.0% -5.12 [-7.71, -2.52]	Test for overall effect: Z Diastolic blo Study or Subgroup Barrow (2007) 21 Caminiti (2011) 24 Channer (1996) 25 Chen(2006) 26 Chen(2013) 27 Cheung (2005) 29 Lee (2003) 33 Lee (2004) 35 Luo(2006) 38 Mao(2006) 39 Pan (2009) 41 Sato (2010) 42 Tsai (2003) 44 Yeh(2013) 53	Mean -4 -43 -2 -14.2 -7.56 -5.5 -5.86 -6.06 -13.92 -8.07 -22.25 -10.8 -6 -8.8 -8.8 -2	P = 0.0 ress TCE <u>SD</u> 2.6 0.7 2.7 5.9 8.39 6.54 6.96 2.42 7.06 2.35 27.43 5.31 14.33 8.36 10.2	1) Total 25 30 38 20 50 39 29 29 29 17 44 51 24 10 37 8	Mean -7 -566 -1- -3.66 -1.78 -4.11 1.38 1.82 3.11 -4.62 2.177 -6.66 8 3.44 -10	Control SD 4.1 1.4 3.7 5.4 6.79 5.69 6.1 0.61 6.06 2.01 72.65 4.86 18.69 8.88 16.08	Total 27 300 411 200 18 399 299 299 199 400 111 244 100 399 8	Weight 7.6% 7.9% 7.8% 6.9% 6.7% 7.3% 7.0% 7.9% 6.5% 7.9% 0.3% 7.2% 2.3% 6.8% 2.6%	Mean Difference IV, Random, 95% CI 3.00 [1.15, 4.85] 1.30 [0.74, 1.86] -1.00 [-2.42, 0.42] -10.60 [-14.11, -7.09] -5.78 [-9.68, -1.88] -1.40 [-4.12, 1.32] -7.24 [-10.61, -3.87] -7.88 [-8.79, -6.97] 17.02 [-21.34, -12.70] -3.45 [-4.38, -2.52] -24.42 [-68.01, 19.17] -4.20 [-7.08, -1.32] -14.00 [-28.60, 0.60] -12.20 [-16.08, -8.32] 8.00 [-5.20, 21.20]	Favors [TCE] Favors [control] Mean Difference	
Heterogeneity: Tau ² = 22.02; Chi ² = 453.13, df = 15 (P < 0.00001); l ² = 97%	Test for overall effect: Z Diastolic blo Study or Subgroup Barrow (2007) 21 Caminiti (2011) 24 Channer (1996) 25 Chen(2006) 26 Chen(2013) 27 Cheung (2005) 29 Lee (2003) 34 Lee (2004) 35 Luo(2006) 38 Mao(2006) 39 Pan (2009) 41 Sato (2010) 42 Tsai (2003) 44 Yeh(2013) 53 Yu (2013) 54	Mean -4 -43 -2 -14.2 -7.56 -5.5 -5.86 -6.06 -13.92 -8.07 -22.25 -10.8 -6 -8.8 -8.8 -2	P = 0.0 ress TCE <u>SD</u> 2.6 0.7 2.7 5.9 8.39 6.54 6.96 2.42 7.06 2.35 27.43 5.31 14.33 8.36 10.2	1) Total 25 30 38 20 50 39 29 29 17 44 51 24 10 37 8 52	Mean -7 -566 -1- -3.66 -1.78 -4.11 1.38 1.82 3.11 -4.62 2.177 -6.66 8 3.44 -10	Control SD 4.1 1.4 3.7 5.4 6.79 5.69 6.1 0.61 6.06 2.01 72.65 4.86 18.69 8.88 16.08	Total 277 300 411 200 188 399 299 199 400 111 244 100 399 8 8 522	Weight 7.6% 7.9% 7.8% 6.9% 6.7% 7.3% 7.9% 6.5% 7.9% 6.5% 7.2% 2.3% 6.8% 2.6% 7.2%	Mean Difference IV, Random, 95% CI 3.00 [1.15, 4.85] 1.30 [0.74, 1.86] -1.00 [-2.42, 0.42] -10.60 [-14.11, -7.09] -5.78 [-9.68, -1.88] -1.40 [-4.12, 1.32] -7.24 [-10.61, -3.87] -7.88 [-8.79, -6.97] -7.78 [-8.79, -6.97] -7.78 [-8.79, -6.97] -7.28 [-8.79, -6.97] -7.28 [-8.79, -6.97] -7.24 [-10.61, -3.87] -7.28 [-8.79, -6.97] -7.24 [-10.61, -3.87] -7.28 [-8.79, -6.97] -7.24 [-10.61, -3.87] -7.24 [-10.61, -3.87] -7.2	Favors [TCE] Favors [control] Mean Difference	

Figure 2. Meta-analysis of effects of traditional Chinese exercise on blood pressure: (A) systolic blood pressure, (B) diastolic blood pressure. IV, inverse variance; Std., standardized; TCE, traditional Chinese exercise.

inferior evidence for the effect of TCE on heart rate. The sensitivity analysis did not affect heterogeneity of blood pressure, heart rate, or peak oxygen uptake outcomes.

Effects of TCE on Biochemical Outcomes

Triglyceride

Six articles^{28,29,35,41,44,45} involving 408 patients compared the TG levels of patients performing TCEs and those in the control

group. Based on a random-effects model, the TG levels of patients performing TCEs significantly decreased (SMD -0.33, 95% Cl -0.56 to -0.09, *P*=0.006; l²=28%, *P*=0.23) compared with those of the patients in the control group (Figure 3A and Table 3).

Total cholesterol

Six $articles^{28,29,35,41,44,45}$ involving 408 patients were included to estimate the effect of TCEs on the amount of

Outcome	Trials	Participants	Statistical Method	Effect Estimate	Heterogeneity	P Value
Physiological outcomes						
SBP, mm Hg	$16^{21,24,25,26,27,29,33,34,35,38,39,41,42,44,53,54}$	939	MD (IV, random, 95% Cl)	-9.12 [-16.38 to -1.86]	<0.001	0.01
DBP, mm Hg	$16^{21,24-27,29,33-35,38,39,41,42,44,53,54}$	939	MD (IV, random, 95% CI)	-5.12 [-7.71 to -2.52]	<0.001	<0.001
Heart rate, beats per minute	924,25,29,33,34,42,44,51,53	463	MD (IV, random, 95% Cl)	-2.39 [-5.61 to 0.82]	<0.001	0.14
Peak oxygen uptake, L/min	42,50,52,53	166	SMD (IV, random, 95% CI)	0.04 [-0.46 to 0.55]	0.11	0.87
Biochemical outcomes		-		-		-
TG	628,29,35,41,44,45	408	SMD (IV, random, 95% CI)	-0.33 [-0.56 to -0.09]	0.23	0.006
TC	628,29,35,41,44,45	408	SMD (IV, random, 95% CI)	-1.12 [-1.97 to -0.27]	<0.001	0.01
LDL-C	428,29,44,45	324	SMD (IV, random, 95% CI)	-0.81 [-1.24 to -0.38]	0.02	<0.001
HDL-C	628,29,35,41,44,45	408	SMD (IV, random, 95% CI)	0.74 [0.29–1.18]	<0.001	0.001
BNP, ng / mL	350,52,53	146	MD (IV, random, 95% CI)	-23.04 [-27.10 to -18.98]	0.73	<0.001
Physical function						
Timed up and go test, s	252,53	116	MD (IV, random, 95% CI)	-0.20 [-0.64 to 0.24]	0.77	0.38
6-minute walk test, m	624,49-53	374	MD (IV, random, 95% CI)	59.58 [4.95–114.20]	<0.001	0.03
Quality of life						
MLHFQ	521,50-53	216	MD (IV, random, 95% CI)	-17.08 [-23.74 to -10.41]	0.02	<0.001
GHQ	222,46	49	MD (IV, random, 95% Cl)	-1.02 [-2.91 to 0.87]	0.19	0.29
SF-36, total	230,49	148	MD (IV, random, 95% Cl)	-5.95 [-16.16 to 4.27]	0.02	0.25
SF-36, general health	329,31,49	126	MD (IV, random, 95% Cl)	-1.56 [-2.52 to -0.61]	0.4	0.001
SF-36, physical function	329,31,43	131	MD (IV, random, 95% CI)	0.82 [0.32–1.33]	0.45	0.001
SF-36, mental health	329,31,43	131	MD (IV, random, 95% CI)	-2.67 [-10.08 to 4.75]	0.09	0.48
Depression						
HAMD	236,47	129	MD (IV, random, 95% CI)	-3.97 [-5.05 to -2.89]	0.91	<0.001
POMS depression scale	2 ^{52,53}	116	MD (IV, random, 95% Cl)	-3.02 [-3.50 to -2.53]	0.76	<0.001

Table 3. Summary of Results

		TCE		0	Control			Std. Mean Difference	Std. Mean Difference
Study or Subgroup	Mean		Total	Mean		Total	Weight		IV, Random, 95% Cl
Chen(2013) 28	-0.39	0.66	32	-0.26	0.41	28	15.7%	-0.23 [-0.74, 0.28]	
Cheung (2005) 29	0	0.87	47	-0.1	0.61	41	20.6%	0.13 [-0.29, 0.55]	
Lee (2004) 35	-34.08			15.14		19	10.1%	-0.64 [-1.31, 0.03]	
Pan (2009) 41	-0.54		24	-0.32	0.6	24		-0.38 [-0.95, 0.20]	
Tsai (2003) 44	-23.8	63	37		61.34	39	18.3%	-0.53 [-0.99, -0.07]	
Wang (1989) 45	-22.06		50		28.23	50		-0.48 [-0.88, -0.09]	
Wally (1969) 45	-22.00	27.40	50	-0.40	20.25	50	22.070	-0.40 [-0.00, -0.09]	
Total (95% Cl)			207			201	100.0%	-0.33 [-0.56, -0.09]	
Heterogeneity: Tau ² =	,		<i>,</i>	(P = 0.	23); l² =	28%		-	-2 -1 0 1 2
Test for overall effect:	Z = 2.74	(P = 0.0	06)						Favors [TCE] Favors [contro
3 Total chole	esterol	l							
		TCE		С	ontrol			Std. Mean Difference	Std. Mean Difference
Study or Subgroup		SD	Total			Total	Weight		IV, Random, 95% Cl
Chen(2013) 28		0.15	32	-0.12	0.64	28	15.1%	-3.95 [-4.84, -3.06]	
Cheung (2005) 29		0.78	47	-0.12	0.78	41	17.4%	0.13 [-0.29, 0.55]	+
• • •								• • •	_
Lee (2004) 35	-11.37	40	17		52.73	19	16.4%	-0.30 [-0.96, 0.36]	_]
Pan (2009) 41	-1.31		24	-0.36	0.52	24	16.4%	-1.59 [-2.24, -0.93]	
Tsai (2003) 44	-23.8	63	37		61.34	39	17.3%	-0.53 [-0.99, -0.07]	
Wang (1989) 45	-8.69	9.33	50	1.26	14.54	50	17.4%	-0.81 [-1.22, -0.40]	
Total (95% CI)			207			201	100.0%	-1.12 [-1.97, -0.27]	•
Total (95% CI) Heterogeneity: Tau ² =	1 03: Ch	i² = 75 ?	207	5 (P < 1	0 00001		100.0% 33%	-1.12 [-1.97, -0.27]	→
Heterogeneity: Tau ² = Test for overall effect:	Z = 2.58	(P = 0.0	86, df = 010)			1); ² = 9		-1.12 [-1.97, -0.27] -	-4 -2 0 2 4 Favors [TCE] Favors [contro
Heterogeneity: Tau ² =	Z = 2.58	(P = 0.0 oprot	86, df = 010)	chole	ester	1); ² = 9		· · · · ·	Favors [TCE] Favors [contro
Heterogeneity: Tau ² = Test for overall effect:	Z = 2.58	(P = 0.0 oprot TCE	86, df = 910) Sein (chole	ester Control	1); ² = 9 01		Std. Mean Difference	
Heterogeneity: Tau ² = Test for overall effect: Cow-densit	Z = 2.58 ty lipe Mean	(P = 0.0 oprot TCE SD	86, df = 10) eein (Total	chole C Mean	ester Control	1); ² = 9 01	93% Weight	Std. Mean Difference IV. Random, 95% Cl	Favors [TCE] Favors [contro Std. Mean Difference
Heterogeneity: Tau ² = Test for overall effect: Chew-densit Study or Subgroup Chen(2013) 28	Z = 2.58 ty lipe <u>Mean</u> -0.54	(P = 0.0 Oprot TCE <u>SD</u> 0.43	96, df = 910) cein (<u>Total</u> 32	chole C <u>Mean</u> -0.06	ester Control SD 0.28	1); ² = 9 01 <u>Total</u> 28	93% Weight 22.1%	Std. Mean Difference <u>IV. Random, 95% Cl</u> -1.29 [-1.85, -0.73]	Favors [TCE] Favors [contro Std. Mean Difference
Heterogeneity: Tau ² = Test for overall effect: Chew-densit Study or Subgroup Chen(2013) 28 Cheung (2005) 29	Z = 2.58 ty lipe <u>Mean</u> -0.54 -0.1	(P = 0.0 oprot TCE <u>SD</u> 0.43 0.32	6, df = 10) ein <u>Total</u> 32 47	chole c <u>Mean</u> -0.06 0.1	control SD 0.28 0.44	1); ² = 9 0 1 28 41	Weight 22.1% 26.3%	Std. Mean Difference IV. Random, 95% Cl -1.29 [-1.85, -0.73] -0.52 [-0.95, -0.09]	Favors [TCE] Favors [contro Std. Mean Difference
Heterogeneity: Tau ² = Test for overall effect: Cherner Comparison Cherner Cherner Che	Z = 2.58 ty lipe <u>Mean</u> -0.54 -0.1 -19.7	(P = 0.0 DDTCE SD 0.43 0.32 16.2	36, df = 10) tein Total 32 47 37	chole C Mean -0.06 0.1 2.9	ester control <u>SD</u> 0.28 0.44 22.2	0); ² = 9 0 1 28 41 39	Weight 22.1% 26.3% 24.4%	Std. Mean Difference IV. Random, 95% Cl -1.29 [-1.85, -0.73] -0.52 [-0.95, -0.09] -1.15 [-1.63, -0.66]	Favors [TCE] Favors [contro Std. Mean Difference
Heterogeneity: Tau ² = Test for overall effect: Chew-densit Study or Subgroup Chen(2013) 28 Cheung (2005) 29	Z = 2.58 ty lipe <u>Mean</u> -0.54 -0.1	(P = 0.0 DDTCE SD 0.43 0.32 16.2	6, df = 10) ein <u>Total</u> 32 47	chole C Mean -0.06 0.1 2.9	control SD 0.28 0.44	1); ² = 9 0 1 28 41	Weight 22.1% 26.3% 24.4%	Std. Mean Difference IV. Random, 95% Cl -1.29 [-1.85, -0.73] -0.52 [-0.95, -0.09]	Favors [TCE] Favors [contro Std. Mean Difference
Heterogeneity: Tau ² = Test for overall effect: Chern(2013) 28 Cheung (2005) 29 Tsai (2003) 44 Wang (1989) 45 Total (95% CI)	Z = 2.58 ty lipe -0.54 -0.1 -19.7 -15.85	(P = 0.0 DDTCE 0.43 0.32 16.2 20.84	6, df = 10) Total 32 47 37 50 166	chole 0.06 0.1 2.9 -6.89	Sontrol 0.28 0.44 22.2 24.72	(); ² = 9 () () () () () () () () () () () () ()	Weight 22.1% 26.3% 24.4%	Std. Mean Difference IV. Random, 95% Cl -1.29 [-1.85, -0.73] -0.52 [-0.95, -0.09] -1.15 [-1.63, -0.66]	Favors [TCE] Favors [contro Std. Mean Difference
Heterogeneity: Tau ² = Test for overall effect: CLOW-densit Study or Subgroup Chen(2013) 28 Cheung (2005) 29 Tsai (2003) 44 Wang (1989) 45 Total (95% CI) Heterogeneity: Tau ² =	Z = 2.58 ty lipo -0.54 -0.1 -19.7 -15.85 0.14; Ch	(P = 0.0 DDDDTCE 0.43 0.32 16.2 20.84 P ² = 10.3	66, df = 10) Total 32 47 37 50 166 8, df =	chole 0.06 0.1 2.9 -6.89	Sontrol 0.28 0.44 22.2 24.72	(); ² = 9 () () () () () () () () () () () () ()	Weight 22.1% 26.3% 24.4% 27.2%	Std. Mean Difference IV. Random, 95% Cl -1.29 [-1.85, -0.73] -0.52 [-0.95, -0.09] -1.15 [-1.63, -0.66] -0.39 [-0.78, 0.01]	Favors [TCE] Favors [contro
Heterogeneity: Tau ² = Test for overall effect: Chern(2013) 28 Cheung (2005) 29 Tsai (2003) 44 Wang (1989) 45 Total (95% CI)	Z = 2.58 ty lipo -0.54 -0.1 -19.7 -15.85 0.14; Ch	(P = 0.0 DDDDTCE 0.43 0.32 16.2 20.84 P ² = 10.3	66, df = 10) Total 32 47 37 50 166 8, df =	chole 0.06 0.1 2.9 -6.89	Sontrol 0.28 0.44 22.2 24.72	(); ² = 9 () () () () () () () () () () () () ()	Weight 22.1% 26.3% 24.4% 27.2%	Std. Mean Difference IV. Random, 95% Cl -1.29 [-1.85, -0.73] -0.52 [-0.95, -0.09] -1.15 [-1.63, -0.66] -0.39 [-0.78, 0.01]	Favors [TCE] Favors [contro
Heterogeneity: Tau ² = Test for overall effect: CLOW-densit Study or Subgroup Chen(2013) 28 Cheung (2005) 29 Tsai (2003) 44 Wang (1989) 45 Total (95% CI) Heterogeneity: Tau ² = Test for overall effect:	Z = 2.58 ty lipe -0.54 -0.1 -19.7 -15.85 0.14; Ch Z = 3.68	(P = 0.0) DDFOOT TCE 0.43 0.32 16.2 20.84 $P^2 = 10.3$ (P = 0.0)	66, df = 110) Total 32 47 37 50 166 8, df = 002)	Mean -0.06 0.1 2.9 -6.89 3 (P = 0	Control SD 0.28 0.44 22.2 24.72 0.02); I ²	1); ² = 9 Total 28 41 39 50 158 = 71%	Weight 22.1% 26.3% 24.4% 27.2%	Std. Mean Difference IV. Random, 95% Cl -1.29 [-1.85, -0.73] -0.52 [-0.95, -0.09] -1.15 [-1.63, -0.66] -0.39 [-0.78, 0.01]	Favors [TCE] Favors [contro
Heterogeneity: Tau ² = Test for overall effect: CLOW-densit Study or Subgroup Chen(2013) 28 Cheung (2005) 29 Tsai (2003) 44 Wang (1989) 45 Total (95% CI) Heterogeneity: Tau ² =	Z = 2.58 ty lipe -0.54 -0.54 -0.1 -19.7 -15.85 0.14; Ch Z = 3.68 ity lip	(P = 0.0 D TCE 0.43 0.32 16.2 20.84 P = 10.3 (P = 0.0 O O O O O O O O	66, df = 110) Total 32 47 37 50 166 8, df = 002)	chold C -0.06 0.1 2.9 -6.89 3 (P = 0 chol	Control SD 0.28 0.44 22.2 24.72 0.02); ² ester	1); ² = 9 Total 28 41 39 50 158 = 71%	Weight 22.1% 26.3% 24.4% 27.2% 100.0%	Std. Mean Difference <u>IV. Random, 95% Cl</u> -1.29 [-1.85, -0.73] -0.52 [-0.95, -0.09] -1.15 [-1.63, -0.66] -0.39 [-0.78, 0.01] -0.81 [-1.24, -0.38]	Favors [TCE] Favors [contro
Heterogeneity: Tau ² = Test for overall effect: CLOW-densit Study or Subgroup Chen(2013) 28 Cheung (2005) 29 Tsai (2003) 44 Wang (1989) 45 Total (95% Cl) Heterogeneity: Tau ² = Test for overall effect: CHigh-densit	Z = 2.58 ty lipe -0.54 -0.54 -19.7 -15.85 0.14; Ch Z = 3.68 ity lip	(P = 0.0 Dprot TCE SD 0.43 0.32 16.2 20.84 P = 10.3 (P = 0.0 Opro TCE	6, df = 110) ein (Total 32 47 37 50 166 8, df = 002) tein	chold <u>C</u> <u>Mean</u> -0.06 0.1 2.9 -6.89 3 (P = C chol C	Control SD 0.28 0.44 22.2 24.72 0.02); ² ester control	ol <u>Total</u> 28 41 39 50 158 = 71%	Weight 22.1% 26.3% 24.4% 27.2% 100.0%	Std. Mean Difference <u>IV. Random, 95% Cl</u> -1.29 [-1.85, -0.73] -0.52 [-0.95, -0.09] -1.15 [-1.63, -0.66] -0.39 [-0.78, 0.01] -0.81 [-1.24, -0.38] Std. Mean Difference	Favors (TCE) Favors (contro
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Figure 3. Meta-analysis of effects of traditional Chinese exercise on biochemical outcomes: (A) triglyceride, (B) total cholesterol, (C) low-density lipoprotein cholesterol, (D) high-density lipoprotein cholesterol. IV, inverse variance; TCE, traditional Chinese exercise.

total cholesterol (TC). TC of the patients performing TCEs significantly improved (SMD -1.12, 95% Cl -1.97 to -0.27, P=0.01; l²=93%, P<0.00001) compared with that of the patients in the control group based on a random-effects model (Figure 3B and Table 3).

Low-density lipoprotein cholesterol

Four articles^{28,29,44,45} involving 324 patients compared the low-density lipoprotein cholesterol (LDL-C) levels between patients performing TCEs and those in the control group. In a random-effects model, the LDL-C of patients performing TCEs significantly decreased (SMD -0.81, 95% Cl -1.24 to -0.38, P<0.001; l²=71%, P=0.02) compared with that of the patients in the control group (Figure 3C and Table 3).

High-density lipoprotein cholesterol

Six articles^{28,29,35,41,44,45} involving 408 patients were included in the meta-analysis to assess the effect of TCE on HDL-C. The HDL-C of patients performing TCEs significantly improved (SMD 0.74, 95% CI 0.29–1.18, *P*=0.001; I^2 =79%, *P*=0.0003) compared with that of the patients in the control group based on a random-effects model (Figure 3D and Table 3).

B-type natriuretic peptide

Three articles^{50,52,53} involving 146 patients compared the Btype natriuretic peptide (BNP) of patients performing TCEs and those in the control group. Based on a random-effects model, the BNP of the patients performing TCEs significantly improved (MD -23.04 ng/mL, 95% CI -27.10 to -18.98, *P*<0.001) compared with that of the patients in the control group (Table 3).

Sensitivity analysis revealed that TG, TC, LDL-C, and HDL-C outcomes were stable when studies were removed 1 by 1. The significance of the BNP outcome was changed in the sensitivity analysis when 1 study⁵² was removed; this result offered inferior evidence for the effect of TCE on BNP. The sensitivity analysis did not affect heterogeneity of TG, TC, LDL-C, HDL-C and BNP outcomes.

Effects of TCE on Physical Function

Timed up and go test

Two articles^{52,53} involving 116 patients compared the timed up and go tests of patients performing TCEs and those in the control group. No significant difference was found between the 2 groups (MD -0.2 second, 95% CI -0.64 to 0.24, *P*=0.38) (Table 3).

Six-minute walk test

Six articles $^{24,49-53}$ involving 374 patients were used to estimate the effect of TCE on 6-minute walk test. The

6-minute walk tests of patients performing TCEs improved by 59.58 m (95% CI 4.95–114.20, P=0.03; I²=93%, P<0.00001) compared with that of the control group, based on a random-effects model (Figure 4A and Table 3). Sensitivity analysis revealed that the 6-minute walk test outcome was not stable when studies were removed 1 by 1. The sensitivity analysis did not affect heterogeneity of the timed up and go or 6-minute walk test outcomes.

Effects of TCE on Quality of Life

Minnesota Living With Heart Failure Questionnaire

Five articles^{21,50–53} involving 216 patients were included to assess the effect of TCE on MLHFQ. The MLHFQ scores of patients performing TCEs significantly improved (MD – 17.08, 95% CI –23.74 to –10.41, P<0.001; I²=67%, P=0.02) compared with that of the patients in the control group, based on a random effects model (Figure 4B and Table 3).

General Health Questionnaire

Two articles^{22,46} involving 49 patients compared the GHQ scores of patients performing TCEs and those in the control group. No significant differences were found between these groups based on a random-effects model (MD -1.02, 95% Cl -2.91 to 0.87, *P*=0.29; I²=43%, *P*=0.29) (Table 3).

36-Item Short Form

Five articles^{29–31,43,46,49} involving 374 patients were used to estimate the effect of TCE on SF-36. Compared with the patients in the control group, those performing TCEs showed improved SF-36 general health results (MD – 1.56, 95% Cl –2.52 to –0.61, P=0.001; l²=0%, P=0.4) and SF-36 physical function (MD 0.82, 95% Cl 0.32–1.33, P=0.001; l²=0%, P=0.45). No significant differences were found between the 2 groups in terms of SF-36 total score (MD –5.95, 95% Cl –16.16 to 4.27, P=0.25; l²=82%, P=0.02) and SF-36 mental health results (MD –2.67, 95% Cl –10.08 to 4.75, P=0.29; l²=43%, P=0.09) (Table 3).

Sensitivity analysis revealed that MLHFQ outcome was stable when studies were removed 1 by 1. The significance of SF-36 outcome was changed in the sensitivity analysis when 1 study was removed;³¹ this result offered inferior evidence for the effect of TCE on SF-36. The sensitivity analysis did not affect heterogeneity of SF-36 outcome, but sensitivity analysis affected heterogeneity of MLHFQ outcome.

Effects of TCE on Depression

Hamilton Depression Rating Scale

Two articles^{36,47} involving129 patients compared HAMD scores for patients performing TCEs and those in the control

$\begin{aligned} fao (2010) 49 & 180 96.47 80 90 104.28 70 20.9\% 90.00 [57.69, 122.31] \\ feh(2004) 50 85 121.88 15 -51 159.59 15 12.7\% 136.00 [43.8, 237.62] \\ feh(2001) 52 35 59.21 50 2 53.45 50 21.7\% 33.00 [10.89, 55.11] \\ feh(2013) 53 68.8 199.82 8 10.4 230.77 8 5.1\% 58.40 [-153.13, 269.93] \\ Total (95% CI) 191 183 100.0\% 59.58 [4.96, 114.20] \\ Heterogeneity: Tau2 = 3446.62; Ch2 = 75.58, df = 5 (P < 0.00001); P = 93\% \\ Fest for overall effect: Z = 2.14 (P = 0.03) \\ \hline Total (95% CI) 191 25 -2.4 8.98 27 31.6\% -12.50 [-17.42, -7.58] \\ \hline Total (95% CI) 191 25 -2.4 8.98 27 31.6\% -12.50 [-17.42, -7.58] \\ \hline Total (95% CI) 191 25 -2.4 8.98 27 31.6\% -12.50 [-17.42, -7.58] \\ \hline Fevtors [control] Favors [TCE] \\ \hline Study or Subgroup Mean SD Total Mean SD Total Weight IV. Random. 95% CI V. Random, 95% CI V. Random, 95% CI P(2008) 51 -17 14 8 7 10 10 17.9% -24.00 [-35.51, -12.49] \\ feh(2004) 50 -17 24.16 15 8 25 15 10.4\% -25.00 [-42.59, -7.41] \\ re(h2(2013) 53 -4.1 18.7 8 -13.4 30.41 8 6.1\% 9.30 [-15.44, 34.04] \\ \hline Total (95% CI) 106 110 100.0\% -17.08 [-23.74, -10.41] \\ reterogeneity: Tau2 = 30.21; Ch2 = 12.05, df = 4 (P = 0.02); P = 67\% \\ Fet for overall effect: Z = 5.02 (P < 0.00001) \\ \hline Total (95% CI) 106 100 100 200 [-5.76] \\ \hline Total (95% CI) 106 - 100 100.0\% -3.97 [-5.05, -2.89] \\ \hline Total (95% CI) 106 - 10 2.55 30 -6 2.28 30 77.9\% -4.00 [-5.22, -2.78] \\ \hline Total (95% CI) 106 - 30.0\% -3.37 [-5.05, -2.89] \\ \hline tetrogeneity: Tau2 = 0.01; Ch2 = 0.01; df = 1 (P = 0.91); P = 0\% \\ \hline Total (95% CI) 66 - 31 100.0\% -3.37 [-5.05, -2.89] \\ \hline tetrogeneity: Tau2 = 0.00; Ch2 = 0.01; df = 1 (P = 0.91); P = 0\% \\ \hline Total (95% CI) 66 - 31 100.0\% -3.37 [-5.05, -2.89] \\ \hline tetrogeneity: Tau2 = 0.00; Ch2 = 0.01; df = 1 (P = 0.91); P = 0\% \\ \hline Total (95\% CI) - 50 - 0.5 10 \\ \hline Total (95\% CI) - 50 - 0.5 10 \\ \hline Total (95\% CI) - 50 - 0.01; df = 1 (P = 0.91); P = 0\% \\ \hline Total (95\% CI) - 50 - 0.01; df = 1 (P = 0.91); P = 0\% \\ \hline Total (95\% CI) - 50 - 0.01; df = 1 (P = 0.91); P = 0\% \\ \hline Total (95\% CI) - 50 - 0.01; df = 1 (P = 0.91); P = 0\% \\ \hline Tot$			TCE		(Control			Mean Difference	Mean Difference	
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	rao (2010) 49	180	96.47	80	90	104.28	70	20.9%			
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$\begin{array}{c c c c c c c c c c c c c c c c c c c $	(eh(2008) 51	76	52	8	-33	85	10	17.2%	109.00 [45.17, 172.83]		
Total (95% CI) Heterogeneity: Tau ² = 3446.62; Ch ² = 75.58, df = 5 (P < 0.00001); P = 93% Test for overall effect: Z = 2.14 (P = 0.03) B Minnesota Living with Heart Failure Questionnaire TCE Control Mean Difference Study or Subgroup Mean SD Total Mean SD Total Weight V. Random, 95% CI Barrow (2007) 21 -14.9 9.1 25 -2.4 8.98 27 31.6% -12.50 [-17.2, -7.58] Yeh(20015) -17 24.16 15 8 25 15 10.4% -25.00 [-42.59, -7.41] Yeh(2018) 51 -17 14 8 7 10 10 17.9% -24.00 [-35.51, -12.49] Yeh(2011) 52 -19 8.33 50 1 10.96 50 34.0% -20.00 [-23.82, -16.18] Yeh(2013) 53 -4.1 18.7 8 -13.4 30.41 8 6.1% 9.30 [-15.44, 34.04] Total (95% CI) 106 110 100.0% -17.08 [-23.74, -10.41] Heterogeneity: Tau ² = 30.21; Chi ² = 12.05, df = 4 (P = 0.02); P = 67% Test for overall effect: Z = 5.02 (P < 0.00001) C Hamilton depression rating scales TCE Control Mean Difference Study or Subgroup Mean SD Total Mean SD Total Weight IV. Random, 95% CI Li(2012) 36 -10 2.55 30 -6 2.28 30 77.9% -4.00 [-5.22, -2.78] Wang (2012) 47 -13.66 3.67 36 -9.81 5.74 33 22.1% -3.85 [-6.15, -1.55] Total (95% CI) 66 63 100.0% -3.97 [-5.05, -2.89] Heterogeneity: Tau ² = 0.00; Chi ² = 0.01, df = 1 (P = 0.91); I ² = 0%	Yeh(2011) 52	35	59.21	50	2	53.45	50	21.7%	33.00 [10.89, 55.11]	-	
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	Yeh(2013) 53	68.8	199.82	8	10.4	230.77	8	5.1%	58.40 [-153.13, 269.93]		
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Total (95% CI) 66 63 100.0% -3.97 [-5.05, -2.89] Heterogeneity: Tau ² = 0.00; Chi ² = 0.01, df = 1 (P = 0.91); l ² = 0%	Yeh(2011) 52 Yeh(2013) 53 Total (95% CI) Heterogeneity: Tau ² = Test for overall effect: C Hamilton of Study or Subgroup	-19 -4.1 30.21; (Z = 5.02 depre	18.7 Chi ² = 12 ? (P < 0.0 SSION TCE n SD	8 106 .05, df 20001) rati	-13.4 = 4 (P = ng so Mear	30.41 = 0.02); cales Control	8 110 ² = 679 <u>Total</u>	6.1% 100.0% 6 Weight	9.30 [-15.44, 34.04] -17.08 [-23.74, -10.41] - Mean Difference IV. Random. 95% Cl	Favors [TCE] Favors [control] Mean Difference	
Heterogeneity: Tau ² = 0.00; Chi ² = 0.01, df = 1 (P = 0.91); l ² = 0%	Yeh(2011) 52 Yeh(2013) 53 Total (95% CI) Heterogeneity: Tau ² = Test for overall effect: C Hamilton of <u>Study or Subgroup</u> Li(2012) 36	-19 -4.1 30.21; C Z = 5.02 depre <u>Mea</u> -1	18.7 Chi ² = 12 (P < 0.0 ssion TCE n SD 0 2.55	8 106 05, df 00001) rati <u>Total</u> 30	-13.4 = 4 (P = ng so (<u>Mear</u>	30.41 = 0.02); cales Control <u>S</u> 2.28	8 110 ² = 679 <u>Total</u> 30	6.1% 100.0% 6 <u>Weiaht</u> 77.9%	9.30 [-15.44, 34.04] -17.08 [-23.74, -10.41] Mean Difference IV. Random. 95% C1 -4.00 [-5.22, -2.78]	Favors [TCE] Favors [control] Mean Difference	
-10 -5 0 5 10	Yeh(2011) 52 Yeh(2013) 53 Total (95% CI) Heterogeneity: Tau ² = Test for overall effect: C Hamilton of <u>Study or Subgroup</u> Li(2012) 36 Wang (2012) 47	-19 -4.1 30.21; C Z = 5.02 depre <u>Mea</u> -1	18.7 Chi ² = 12 (P < 0.0 ssion TCE n SD 0 2.55	8 106 005, df 00001) rati <u>Total</u> 30 36	-13.4 = 4 (P = ng so (<u>Mear</u> -9.81	30.41 = 0.02); cales Control <u>S</u> 2.28	8 110 ² = 679 Total 30 33	6.1% 100.0% 6 <u>Weight</u> 77.9% 22.1%	9.30 [-15.44, 34.04] -17.08 [-23.74, -10.41] Mean Difference IV. Random. 95% Cl -4.00 [-5.22, -2.78] -3.85 [-6.15, -1.55]	Favors [TCE] Favors [control] Mean Difference	
Test for overall effect: Z = 7.20 (P < 0.00001)	Yeh(2011) 52 Yeh(2013) 53 Total (95% CI) Heterogeneity: Tau ² = Test for overall effect: C Hamilton of <u>Study or Subgroup</u> Li(2012) 36 Wang (2012) 47 Total (95% CI)	-19 -4.1 30.21; C Z = 5.02 depre <u>Mea</u> -1 -13.6	18.7 Chi ² = 12 (P < 0.0 ssion TCE n SD 0 2.55 16 3.67	8 106 005, df 00001) rati <u>Total</u> 30 36 66	-13.4 = 4 (P = ng so <u>Mear</u> -6 -9.81	30.41 = 0.02); cales Control <u>SD</u> 5 2.28 5.74	8 110 ² = 679 Total 30 33 63	6.1% 100.0% 6 <u>Weight</u> 77.9% 22.1%	9.30 [-15.44, 34.04] -17.08 [-23.74, -10.41] Mean Difference IV. Random. 95% Cl -4.00 [-5.22, -2.78] -3.85 [-6.15, -1.55]	Favors [TCE] Favors [control] Mean Difference	

Figure 4. Meta-analysis of effects of traditional Chinese exercise on (A) 6-minute walk test, (B) Minnesota Living with Heart Failure Questionnaire, and (C) Hamilton depression rating scales. IV, inverse variance; TCE, traditional Chinese exercise.

group. The HAMD scores of patients performing TCEs improved (MD -3.97, 95% Cl -5.05 to -2.89, *P*<0.001; I²=0, *P*=0.91) compared with those of patients in the control group, based on a random-effects model (Figure 4C and Table 3).

POMS Depression Scale

Two articles^{52,53} involving 116 patients were included to assess the effect of TCE on the POMS depression scale. The POMS depression scale scores of the patients performing TCEs significantly improved (MD -3.02, 95% Cl -3.50 to -2.53, *P*<0.001; l²=0%, *P*=0.76) compared with those of patients in the control group, based on a random-effects model (Table 3).

Publication Bias

The Egger's regression test results did not show any publication bias for SBP (asymmetry test P=0.46), DBP (asymmetry test P=0.406), TG (asymmetry test P=0.503), TC (asymmetry test P=0.08), HDL-C (asymmetry test P=0.814), 6-minute walk test (asymmetry test P=0.871), and MLHFQ (asymmetry test P=0.304).

Discussion

TCEs are mind-body exercises that focus on posture, coordination of breathing patterns, and meditation. Several

TCEs are used to treat patients with CVDs. Previous systematic reviews focused on specific TCEs, such as tai chi and qigong.^{18,56–58} This systematic review compiled evidence from a large number of trials assessing the effectiveness of TCEs to evaluate the overall effect of TCEs on patients with CVD compared with other exercises or of the absence of any intervention.

This systematic review and meta-analysis included 35 RCTs involving 2249 patients with CVD to provide further evidence of the effect of TCEs on physiological outcomes, biochemical outcomes, quality of life, and depression in CVD patients. The SBP, DBP, TG, TC, LDL-C, HDL-C, BNP, 6-minute walk test, MLHFQ, SF-36 (general health and physical function), HAMD, and POMS depression scale of patients performing TCEs significantly improved compared with those of the patients in the control group. The benefits of TCEs for SBP, DBP, TG, TC, LDL-C, HDL-C, MLHFQ, and depression of CVD patients reached certain levels that could signify clinical importance. In particular, the effects TCE on blood pressure and blood lipids are clinically significant because blood pressure and LDL-C are the primary targets for cardiovascular risk reduction.

A meta-analysis⁵⁹ showed that by reducing the SBP and DBP by 10 and 5 mm Hg, respectively, TCE could reduce the occurrences of stroke and coronary heart disease by 41% and 22%, respectively. Another systematic review revealed that the morbidity and mortality of CVDs could be reduced by up to 50% if blood cholesterol was reduced by \approx 20%, SBP by 10 to 15 mm Hg, and DBP by 5 to 8 mm Hg.⁶⁰ Based on current evidence from systematic reviews, TCE could improve the quality of life and reduce the depression of CVD patients; however, no significant differences were found between patients performing TCEs and those in the control group in terms of heart rate, peak oxygen uptake, timed up and go test, and 12-item GHQ.

Although the intensity of TCE ranged from low to moderate, we found that TCE could improve physiological outcomes (eg, blood pressure), biochemical outcomes (eg, cholesterol and TG), quality of life (eg, MLHFQ), and depression of patients with CVDs. TCE has a complex mechanism for treating CVD. TCE is based on the theoretical principles of traditional Chinese medicine. The integrated exercise of mind and body, which includes stillness of mind, flow of breath, movement of body, and self-correction of posture, activates the natural self-regulatory (self-healing) ability and evokes a balanced release of endogenous neurohormones and a wide array of natural health recoverymechanisms.⁶¹ Nevertheless, the contribution of TCEs in improving the health of patients with CVD requires further investigation.

The pooled estimate of effect for the outcome (Figure 2) has significant heterogeneity. There may be important clinical and methodological differences among studies that influence

the differences between intervention and controls. Some differences existed in inclusion criteria and among the participants, who came from different countries and may have different understandings of TCE. Different types of TCE include not only include tai chi but also baduanjin, yijinjing, and other forms. Even tai chi has a lot of branches.

Strengths and Limitations

This paper is the first systematic review and meta-analysis to assess and compare the effects of TCE with other exercises or with no intervention regarding physiological outcomes (eg, blood pressure), biochemical outcomes (eg, cholesterol and TG), quality of life, and depression among patients with CVD. Unlike prior systematic reviews, more than a quarter of the included studies were published within the past 2 years.

This systematic review searched a wide variety of electronic databases for relevant articles. We searched primarily for articles in the Chinese electronic database because TCEs originated in China. Two reviewers independently selected the studies, extracted the data, and evaluated the quality of the studies to decrease bias and transcription errors. Consequently, the results of our systematic review are considered robust.

Our meta-analysis had several limitations. First, although all included studies were RCTs, only a few (9 of 35) clearly indicated allocation concealment in their experimental procedures; therefore, selection bias or confounding may be present. Moreover, only 8 of the included studies blinded their assessors. Second, only 2 or 3 of the included studies assessed the effect of TCE on BNP, timed up and go test, GHQ-12, SF-36, HAMD, and POMS. More quality RCTs are needed to have confidence in the results in the future. Third, although 6 electronic databases were searched systematically for relevant articles by using a prespecified search strategy and because publication bias was assessed by Egger's regression test, we did not search for any unpublished trials. Consequently, the probability of publication bias may also exist in our study. Fourth, the follow-up durations of most studies were no longer than 1 year; therefore, we did not perform the meta-analysis to assess the long-term effect of TCE for CVD patients. Although each included study was an RCT, most of these studies did not adhere to the generally accepted standards in reporting clinical trials (eg, the Consolidated Standards of Reporting Trials statement).⁶² The methodological standards of future studies must be improved in terms of allocation concealment, blinding of outcome assessment, adequate follow-up, and intention-to-treat analysis. Fifth, TCE includes different types of exercise, and it is necessary to have detailed subgroups for different types of TCE and different types of controls in the future.

Conclusions

This study showed that TCE could provide more benefits than other exercises or no intervention for decreasing SBP and DBP and improving biochemical outcomes, physical function, quality of life, and depression in patients with CVD. The results may improve some CVD risk factors; therefore, the clinical implications of our systematic review results showed that TCE should be useful for patients with CVD, medical staff, and health care decision makers. Nevertheless, extreme heterogeneity in the analyses remained unexplained, and the number of high-quality studies was not large in the systematic review. More multicenter RCTs with large sample sizes must be conducted to assess the effects of TCEs in CVD patients. The long-term effectiveness of TCEs for patients with CVD must also be evaluated. Theories about how TCE could treat patients with CVDs and prevent such diseases should be further clarified.

Author Contributions

All authors read and approved the final manuscript. Conceived and designed the experiments: P.-J. Chen, X.Q. Wang and Y.L. Pi. Extracted the information from the eligible studies: Y. Liu, R. Wang, X. Li. Analyzed the data: B.L. Chen, Y. Zhu, X.Q. Wang. Contributed reagents/materials/analysis tools: Y.J. Yang, Z.B. Niu. Wrote the paper: X.Q. Wang, P.J. Chen.

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Disclosures

None.

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