

# Tai Chi as an Alternative and Complimentary Therapy for Anxiety: A Systematic Review

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## Abstract

Anxiety has become a global public health problem. Tai chi offers one possible way of reducing anxiety. The purpose of this study was to examine studies from 1989 to March 2014 to assess whether tai chi can be an efficacious approach for managing anxiety. A systematic search of Medline, CINAHL, and Alt HealthWatch databases was conducted for quantitative articles involving applications of tai chi for anxiety. A total of 17 articles met the inclusion criteria. Of these, 8 were from the United States, 2 from Australia, 2 from Japan, 2 from Taiwan, and 1 each from Canada, Spain, and China. Statistically significant results of anxiety reduction were reported in 12 of the studies reviewed. Despite the limitations of not all studies using randomized controlled designs, having smaller sample sizes, having different outcomes, having nonstandardized tai chi interventions, and having varying lengths, tai chi appears to be a promising modality for anxiety management.

## Keywords

tai chi, anxiety, mind–body, alternative medicine, stress

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## Introduction

In China, tai chi, a type of mindfulness-based exercise,<sup>1</sup> has been used as a form of therapy for multiple ailments since the 12th century.<sup>2</sup> The therapeutic benefits of tai chi reported in the literature are related to improvement in memory, concentration, depression, anxiety, cancer, arthritis, and blood pressure.<sup>3,4</sup> Practicing tai chi regularly has also been known to alleviate health problems associated with aging and inactivity—improving the balance of elderly for fall prevention. Although benefits have widely been reported in the literature, the physiological mechanism by which tai chi improves health is not fully understood.<sup>5</sup>

Tai chi utilizes slow, gentle movements where practitioners shift their weight between feet while moving their arms.<sup>6</sup> The exercise consists of elements that combine martial arts, meditation, imagery, and deep breathing.<sup>6</sup> Practitioners of almost any age can perform tai chi, including the elderly and those with physical limitations or disabilities.<sup>4</sup> Due to the relatively simple nature of learning and practicing tai chi, and not needing expensive equipment or medicine, many Westerners are turning to it as an alternative and/or complementary treatment for their illnesses.<sup>6</sup> The increase in popularity and prevalence of tai chi, along with other forms of complementary and alternative medicine, may be due to the focus on one's health as opposed to the disease they are attempting to treat.<sup>4</sup> Studies also suggest

that the social stigma related to conventional therapies to treat anxiety and stress disorders, such as medications and behavioral therapy, has led some sufferers to look for alternative forms of treatment.<sup>7</sup>

The World Health Organization surmises that mental illness, including anxiety, will become the second most common disability by 2020.<sup>7</sup> In the United States, there are an estimated 40 million adults suffering from anxiety, annually.<sup>2</sup> Anxiety is a complex disease, closely related to the physical and mental state of the sufferer, as well as their ability to interact with their environment and society.<sup>7</sup> Anxiety disorders include general anxiety disorder, social phobia, obsessive compulsive disorder, panic disorder, and posttraumatic stress disorder. Distinct symptoms are displayed for those suffering from anxiety, including shortness of breath, dizziness, heart palpitations, gastrointestinal issues, and an abnormally high body temperature.<sup>8</sup> Anxiety sufferer may experience life dissatisfaction,<sup>4</sup> and the

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disorder can be detrimental to their social and emotional well-being.<sup>2</sup>

Reducing a person's anxiety can improve their energy, quality of life, memory, and cognitive functioning.<sup>9</sup> The current therapies used to treat anxiety include antidepressants, cognitive behavioral therapy, benzodiazepines such as Xanax, self-help techniques, and life style modifications to remove the triggers of anxiety from one's life. Cognitive behavioral therapy includes components such as psychoeducation, relaxation training, and behavioral reconstruction. Unfortunately, the use of cognitive behavioral therapy and/or antidepressants is estimated to alleviate symptoms of anxiety in only 50% to 65% of patients. Many patients are left with symptoms of their anxiety and are in need of alternative therapies. One such option for patients has been benzodiazepines. These drugs are often prescribed to patients with panic disorders or episodes of mania related to their anxiety. Although efficacious, benzodiazepines are usually described for short-term use as they are highly addictive and patients have been known to abuse such drugs.<sup>8</sup> Due to the lack of safe and effective options for anxiety sufferers, it is imperative that additional avenues of therapy, including nonchemical treatments, be explored.<sup>6</sup>

Alternative and complementary forms of medicine to treat anxiety include acupuncture, meditation, herbal supplements, homeopathic techniques, and mind-body practices such as tai chi.<sup>8</sup> Tai chi offers benefits to anxiety sufferers without the side effects and risks associated with prescription drugs.<sup>8,9</sup> Because tai chi integrates low physical impact body movements with deep breathing and mental concentration, relaxation is possible, thus making it an alternative option to conventional anxiety treatments.<sup>10</sup> Additionally, anxiety disorders are often comorbid with other physical and psychological problems. Because tai chi is a form of exercise, it can act as a tool for health promotion—mitigating the ancillary health problems of anxiety sufferers.<sup>2</sup>

The research question being addressed in this study include the following: Is tai chi efficacious alone, or in tangent with medication or other conventional therapies, to significantly reduce anxiety levels of health and anxiety-stricken subjects and is there sufficient data available to draw conclusions regarding the efficacy of tai chi in treating anxiety? What are the methodological limitations of present research studies and how can these be addressed in future research? The purpose of this review is to provide evidence that can facilitate the improvement of clinical guidelines for the treatment of anxiety.

## Methods

The inclusion criteria for this review include studies that (a) were published in the English language; (b) were published between January 1, 1989, and March 31, 2014; (c) were peer-reviewed; (d) enlisted some form of tai chi as part of an intervention; (e) used a quantitative study design; (f) measured anxiety as an outcome (State-Trait Anxiety Inventory, Beck's Anxiety Inventory, Visual Analog Scale, and so on); and (g) were indexed in Medline, CINAHL (Cumulative Index to Nursing and Allied Health), or Alt HealthWatch. Studies that were excluded include those that (a) did not use tai chi as a treatment

option; (b) did not measure anxiety as an outcome and; (c) did not index in any of the following databases: CINAHL (Cumulative Index to Nursing and Allied Health), Medline, or Alt HealthWatch. The logic to including studies over a long time period is to increase the sample of studies reviewed as the literature related to tai chi and anxiety is not vast. In addition, studies that measured anxiety as a comorbidity to other ailments were not excluded as they met the eligibility criteria.

The 3 phases utilized to return studies to meet the aforementioned criteria include a Boolean search, distillation, and reference review (Figure 1). CINAHL, Medline, and Alt HealthWatch databases were indexed to find studies meeting the criteria for this review as part of Phase 1. The Boolean search term used was "Tai Chi AND Anxiety."

Using the above-mentioned search terms, 115 articles were returned from CINAHL (n = 48), Medline (n = 46), and Alt HealthWatch (n = 21). Phase II, distillation, was composed of eliminating: duplicates (n = 21), review/discussion/secondary data articles (n = 52), studies not incorporating tai chi as an intervention (n = 14), and those not using a quantitative design (n = 1). Of the remaining articles (n = 27), 10 were excluded, including one that included only the intervention protocol. The remaining (n = 17) articles satisfied the eligibility criteria (Figure 1).

## Results

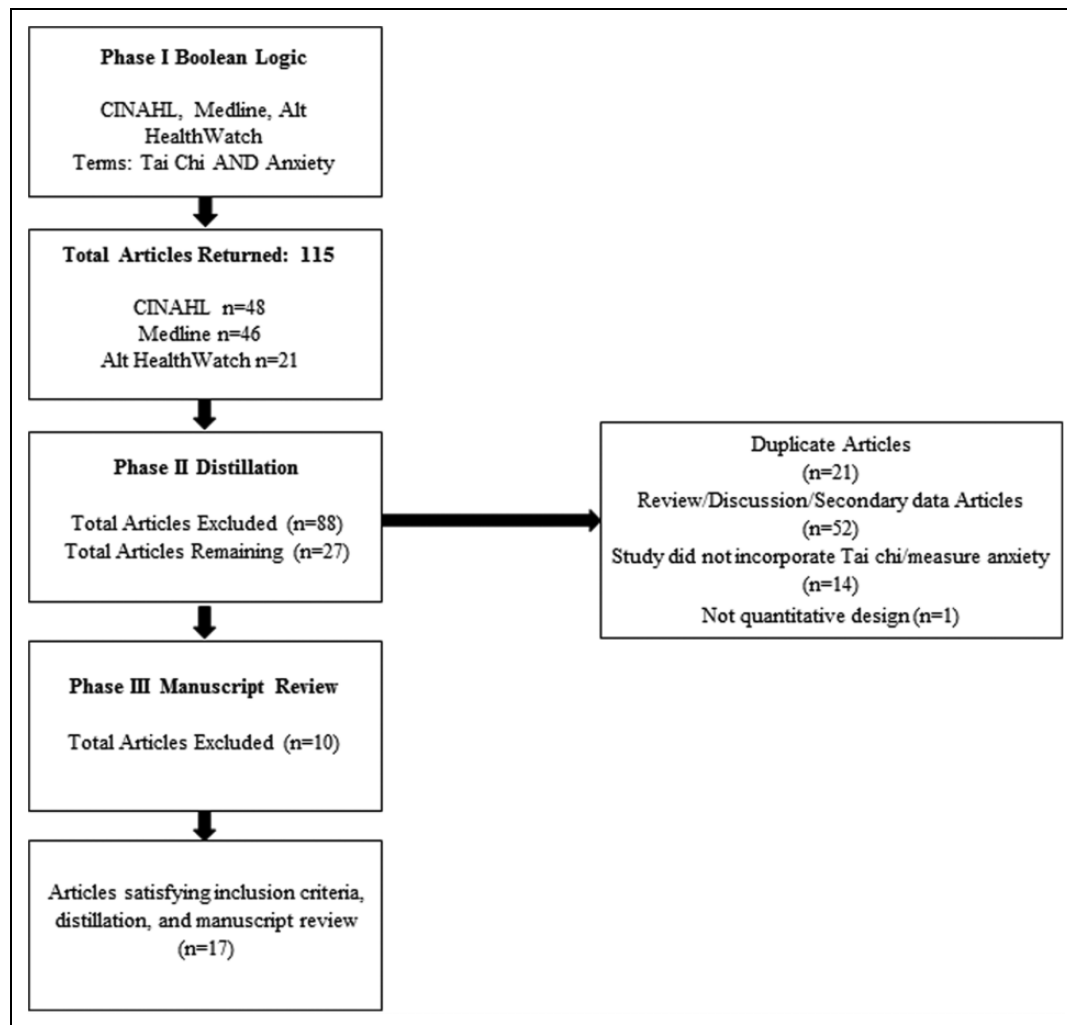
The results of the data extraction process included 16 articles meeting the eligibility criteria set forth in this review. The year of publication, authors, country of origin, study design, sample, and setting, age of participants, intervention modality and dosage, outcome measures, and salient finding are listed in Table 1. The studies are listed in ascending order by year of publication.

## Discussion

The purpose of this review was to analyze the efficacy of tai chi as an alternative and/or complementary treatment for anxiety by reviewing articles published from January 1, 1989, to March 31, 2014. A total of 17 articles met the inclusion criteria. Below, the studies are analyzed specifying the reductions in anxiety, sample size, bias, dosage and duration of interventions, study design, and the reliability and validity of the scales used.

Of the 17 studies, 8 were performed in the United States,<sup>2,9,13,16,18,19,20,22</sup> 2 were performed in Australia,<sup>11,12</sup> 2 in Japan,<sup>5,14</sup> 2 in Taiwan,<sup>15,21</sup> and 1 each in Canada,<sup>17</sup> Spain,<sup>10</sup> and China.<sup>23</sup> Statistically significant results were reported in 12 of the studies reviewed.<sup>2,10-13,15,16,18,19,21-23</sup> It is important to note that in some of these studies the changes were significant when comparing intragroup changes (baseline vs study end),<sup>2,10,13,19</sup> whereas others compared intergroup changes (tai chi intervention vs control group).<sup>11,12,15,16,18,21-23</sup> In some cases, statistically significant reductions were noted for both tai chi and exercise intervention groups<sup>16,18</sup> as compared with baseline and/or the control group.

Considering a little more than half of the studies (n = 10) enlisted an intervention targeting anxiety and ancillary ailments (severe learning disabilities [attention deficient and/or



**Figure 1.** Three-phase data extraction process.

hyperactivity],<sup>17</sup> degenerative diseases related to aging,<sup>5,9,18,23</sup> prenatal depression,<sup>22</sup> HIV/AIDS,<sup>16</sup> geriatric depression,<sup>20</sup> and fibromyalgia<sup>10</sup>), it can be difficult to determine if anxiety reductions were secondary to reductions in comorbidities of anxiety. This means that some subjects suffered anxiety as a secondary condition, while others were healthy, and still other subjects were diagnosed with generalized anxiety disorder as their primary ailment. Due to these variations in anxiety, results may not be comparable among studies. Additionally, some studies utilized tai chi as a complementary treatment. Since tai chi was an addition, after medication and other therapies had already been prescribed to these subjects, it was not deemed a confounding factor related to the improvement in anxiety reported. Some examples of such studies were by Lavretsky and colleagues,<sup>20</sup> who gave Escitalopram, and Song and colleagues,<sup>23</sup> who gave antianxiety medication along with tai chi.

The articles reviewed used a diversity of scales to measure anxiety outcomes, including State-Trait Anxiety Inventory—including those for children (State-Trait Anxiety Inventory for Children) and youth (State-Trait Anxiety Inventory Form Y1/State-Trait Anxiety Inventory Form Y2); Hamilton Anxiety

Scale; Generic Quality of Life Inventory-74; Taylor Manifest Anxiety Scale; Hamilton Disease Rating Scale; Fibromyalgia Impact Questionnaire; Multiple Affect Adjective Check List; the Multiple Affect Adjective Check List-Revised; Hospital Anxiety and Depression Scale; and the General Health Questionnaire. To evaluate the efficacy of an intervention, it is important that researchers report the psychometric properties of the scales they use, as these determine change in anxiety. Specifically, the State-Trait Anxiety Inventory for Children scale was reported to have an  $\alpha$  reliability of .82 for males and .87 for females,<sup>17</sup> which is acceptable psychometrically. For another study utilizing a quasi-experimental design measuring tai chi among a large group of participants, Cronbach's  $\alpha$  for their Beck Anxiety Inventory scale was .91,<sup>21</sup> which is again indicative of acceptable internal consistency. It is important to note that the State-Trait Anxiety Inventory scale has been in several studies all reporting the high validity and internal consistency of the scale.<sup>22</sup> Additionally, another study reported State-Trait Anxiety Inventory scale with test-retest reliabilities ranging from .62 to .85 and a Cronbach's  $\alpha$  of .93.<sup>18</sup> In a randomized control trial of 37 participants using the State-Trait

**Table 1.** Summary of Tai Chi Interventions for Anxiety Done Between 1989 and March 2014 (n = 17).

Year	Authors/Country	Design, Sample and Setting	Age	Intervention Modality	Intervention Dosage	Outcome Measures	Salient Findings
1989	Jin; Australia <sup>11</sup>	Three-way factorial design, with phase (before tai chi, during tai chi, and after tai chi), experience (beginners and practitioners), and time (morning, afternoon, and evening) as the independent variables (n = 66). Participants were drawn from 2 tai chi schools. Setting was university.	Practitioner group 37.7 ± 14.3 years; beginner group 33.2 ± 9.0 years	Total of 66 adults; 25 practitioners and 23 beginners practiced the Long Form of Yang Style tai chi chuan, while 8 practitioners and 10 beginners practiced the Wu-variation of Yang style developed by Wu Chian-chyan	Practitioner group over 1 year; Beginner group <8 months	<ul style="list-style-type: none"> <li>State anxiety</li> </ul>	<ul style="list-style-type: none"> <li>State anxiety was significantly lower during tai chi than prior to doing it, <math>F(1, 60) = 47.58, P &lt; .001</math></li> </ul>
						<ul style="list-style-type: none"> <li>Trait anxiety</li> </ul>	<ul style="list-style-type: none"> <li>Practice of tai chi raised heart rate, increased noradrenaline excretion in urine, and decreased salivary cortisol</li> </ul>
						<ul style="list-style-type: none"> <li>Profile of mood states</li> </ul>	<ul style="list-style-type: none"> <li>Practice of tai chi led to less tension, depression, anger, fatigue, and confusion</li> </ul>
						<ul style="list-style-type: none"> <li>Heart rate</li> <li>Concentrations of noradrenaline, adrenaline, dopamine, and serotonin (5HT) in urine</li> </ul>	
						<ul style="list-style-type: none"> <li>Salivary cortisol</li> </ul>	
1992	Jin; Australia <sup>12</sup>	Randomized control design with 4 groups: tai chi (n = 24), brisk walking (n = 24), meditation (n = 24), and neutral reading (n = 24). Participants had similar trait-anxiety scores: $57.7 \pm 9.5$ for the males and $57.0 \pm 11.5$ for the females. Setting was university.	48 males (aged 34.6 ± 8.5 years) and 48 females (aged 37.8 ± 10.1 years)	96 Participants were exposed to mental stress in the form of 10 minutes of mental arithmetic under high time pressure and noisy conditions and shown a stressful film. Tai chi group practiced either the long form of Yang Style or the Wu variation of the Yang Style. Meditation group visualized tai chi practice.	1 hour of tai chi [1 hour]	<ul style="list-style-type: none"> <li>Heart rate</li> </ul>	<ul style="list-style-type: none"> <li>Tai chi was found to be better than neutral reading in the reduction of state anxiety</li> </ul>

(continued)

**Table 1.** (continued)

Year	Authors/Country	Design, Sample and Setting	Age	Intervention Modality	Intervention Dosage	Outcome Measures	Salient Findings
1996	Chen and Sun; USA <sup>9</sup>	Quasi-experimental design with experimental group (n = 18) and control group (n = 10). Participants were older adults and intervention was done in community setting.	50-74 years	28 adults of which 18 practiced tai chi chuan	One-hour session twice a week × 16 weeks plus instruction to practice at home [32 hours]	<ul style="list-style-type: none"> <li>• Blood pressure</li> <li>• State anxiety</li> <li>• Profile of mood states</li> <li>• Concentrations of noradrenaline, adrenaline, and dopamine in urine</li> <li>• Salivary cortisol level</li> <li>• State anxiety</li> </ul>	<ul style="list-style-type: none"> <li>• Tai chi group had comparable cardiovascular changes to that for the brisk walking group and greater than that for the meditation and reading groups</li> <li>• Anxiety scores did not show significant change in the initial part of the program</li> </ul>
1999	Ross, Bohannon, Davis, and Gurchiek; USA <sup>13</sup>	Pretest/posttest design (n = 11). Participants were older adults and intervention was community setting.	68-92 years	11 elderly women were trained by a certified and experienced tai chi instructor	One-hour session 3 times a week × 8 weeks [24 hours]	<ul style="list-style-type: none"> <li>• Heart rate</li> <li>• Blood pressure</li> <li>• Muscle tension</li> <li>• Balance</li> </ul>	<ul style="list-style-type: none"> <li>• In the tai chi group flexibility improved (<math>P &lt; .05</math>) and muscle tension decreased (<math>P &lt; .05</math>)</li> <li>• Statistically significant improvements (t test), at the .05 level, in pain and trait anxiety</li> </ul>
2000	Naruse and Hirai; Japan <sup>14</sup>	Two experiments: (a) n = 14 body	13-20 years	Junior high students and college freshmen did	Participants must complete 18 classes [18 hours]	<ul style="list-style-type: none"> <li>• Sway</li> <li>• Range of motion</li> <li>• Perceived decreased pain</li> <li>• Trait anxiety</li> <li>• Respiration</li> </ul>	<ul style="list-style-type: none"> <li>• Measurable improvements in flexibility, balance, sway</li> <li>• Slow tempo exercise does not increase</li> </ul>

(continued)

**Table 1.** (continued)

Year	Authors/Country	Design, Sample and Setting	Age	Intervention Modality	Intervention Dosage	Outcome Measures	Salient Findings
2003	Tsai et al; Taiwan <sup>15</sup>	movements at preferred and slow tempos; (b) n = 23 body movements and varying tempos studied effect on anxiety	35-65 years	slow movement tempo tai chi	1-minute exercise period; 3-minute rest [1 session]		physiological or psychological arousal
				37 participants practiced Yang style tai chi chuan	50 minute classes 3 × per week for 12 weeks [30 hours]	<ul style="list-style-type: none"> <li>Heart rate</li> <li>State-trait anxiety</li> <li>Heart rate</li> </ul>	<ul style="list-style-type: none"> <li>Significant decrease in systolic blood pressure of 15.6 mm Hg and diastolic blood pressure 8.8 mm Hg</li> </ul>
2005	Galantino et al; USA <sup>16</sup>	Randomized controlled trial. A group of advanced HIV patients (n = 13) in tai chi group; n = 13 patients in aerobic exercise group; and n = 12 in control group	Males between the ages of 20 and 60 years old who were HIV +	The process consisted of seated meditation, chi movement consisting of the t'ai ji drum, healing chi circle, and seated chi movement	Experimental groups exercised 2 × weekly for 8 weeks [16 hours]	<ul style="list-style-type: none"> <li>Resting blood pressure</li> <li>Blood lipid</li> <li>State-trait anxiety</li> <li>Quality of life</li> </ul>	<ul style="list-style-type: none"> <li>Lower scores on both state (<math>30.6 \pm 6.2</math>) and trait (<math>32.8 \pm 6.2</math>) anxiety compared to the baseline (<math>P &lt; .01</math>)</li> <li>Tai chi and aerobic exercise improve physiologic parameters, functional outcomes (<math>P &lt; .001</math>), and quality of life</li> </ul>
						<ul style="list-style-type: none"> <li>Spiritual well-being</li> <li>Functional reach (balance)</li> <li>Sit and reach for flexibility</li> <li>Sit up test for endurance</li> <li>Qualitative data journals, focus groups, observation</li> <li>Profile of mood states</li> </ul>	<ul style="list-style-type: none"> <li>The Profile of Mood States showed significant main effect for time in tension-anxiety (<math>P &lt; .005</math>)</li> </ul>

(continued)

Table 1. (continued)

Year	Authors/Country	Design, Sample and Setting	Age	Intervention Modality	Intervention Dosage	Outcome Measures	Salient Findings
2005	Baron and Faubert; Canada <sup>17</sup>	Single case research design; n = 3 upper elementary children with special needs	Mean age 13.3 years	A professional tai chi instructor provided instruction in tai chi chuan	10 weeks, 1-hour sessions twice weekly [20 hours]	<ul style="list-style-type: none"> <li>• Attention deficit or hyperactivity</li> <li>• State-Trait Anxiety Inventory for Children</li> </ul>	<ul style="list-style-type: none"> <li>• Strongest effect on child with hyperactivity and heightened anxiety</li> <li>• Small sample size yielded inconclusive results</li> </ul>
2007	Frye, Scheinthal, Kemarskaya, and Pruchno; USA <sup>18</sup>	Randomized trial of tai chi (n = 23), low-impact exercise (n = 28), no exercise (n = 21). Participants were at least 50 years old.	52-82 years	Yang family style. Ten forms: (a) commence tai chi, (b) ward off—left, (c) grasp the sparrow's tail—right, (d) wave hands like cloud—left, (e) single whip—left, (f) brush knee/push palm—right/left, (g) fair lady weaves shuttles—left/right, (h) grasp sparrow's tail—left, (i) carry tiger to the mountain, (j) close tai chi	<ul style="list-style-type: none"> <li>• 12 weeks of three 60-minute classes per week [36 hours]</li> </ul>	<ul style="list-style-type: none"> <li>• Chair stand test; 2-minute step test; sit and reach test: 8 foot up and go test)</li> </ul>	<ul style="list-style-type: none"> <li>• Anxiety level of people in both tai chi and low-impact exercise groups decreased significantly (<math>P &lt; .01</math>), while the control group had increased anxiety over time</li> </ul>
2009	Hoffman-Smith, Ma, Yeh, DeGuire, and Smith; USA <sup>2</sup>	Pretest–posttest design (n = 66) lacking a control group. Sample consisted of patients diagnosed with moderate-severe anxiety	18-65 years; mean 52 years	Twenty-four simplified Yang -style tai chi forms	10 weeks; 1-hour classes 2 × per week [20 hours]	<ul style="list-style-type: none"> <li>• Self-report of depressive symptoms; functional abilities, sleep, falls anxiety</li> <li>• Psychiatric screening to measure degree of anxiety (Hamilton Anxiety Scale-A scale)</li> </ul>	<ul style="list-style-type: none"> <li>• Participants in the tai chi group reported better subjective health and sleep</li> <li>• The median pretest score on the Hamilton Anxiety Scale-A scale for anxiety was 23 points. This reduced by 11 points after tai chi to 12 points.</li> <li>• Increased feelings of being relaxed and peaceful</li> </ul>
2010	Wang et al; Japan <sup>5</sup>	Randomized trial of tai chi (n = 17) and rehabilitation (n = 17) on elderly	50 and older; mean 77 years	Based on classical Yang style. Each session had (a) 10 minutes of warm-up and a review of tai chi principles; (b) 30 minutes of tai chi practice; and (c) 10 minutes of cool down	12 weeks; 50-minute class; 1 class/week [10 hours]	<ul style="list-style-type: none"> <li>• P300 electroencephalograph records</li> </ul>	<ul style="list-style-type: none"> <li>• No significant effects among group and time for P300 amplitudes</li> <li>• Significant time/group interactions for sleep quality, anxiety/insomnia, and severe depression</li> </ul>
						<ul style="list-style-type: none"> <li>• General Health Questionnaire</li> <li>• Pittsburgh Sleep quality</li> </ul>	

(continued)

**Table 1.** (continued)

Year	Authors/Country	Design, Sample and Setting	Age	Intervention Modality	Intervention Dosage	Outcome Measures	Salient Findings
2010	Field, Diego, and Hernandez-Reif; USA <sup>19</sup>	Pre-post assessment (n = 38) to reduce stress and enhance performance	21-59 years; mean 41 years	Session included standing tai chi movements, balancing poses, and a short tai chi form and 10 minutes of standing, sitting, and lying down yoga poses	One time 20-minute tai chi/yoga class [1 session]	<ul style="list-style-type: none"> <li>State-Anxiety Inventory</li> </ul>	<ul style="list-style-type: none"> <li>Increased relaxation including decreased self-reported anxiety (<math>P &lt; .02</math>) and a trend for increased EEG activity</li> </ul>
2011	Lavretsky et al; USA <sup>20</sup>	Randomized trial (n = 112) entered the trial; n = 73 did not benefit from escitalopram were randomized into tai chi who completed (n = 33) and health education (n = 35). Participants were suffering from depression.	Elderly 60 and over with major depression	120 minute session based on tai chi chuan that included 10 minutes of warm up and 5 minutes of cool down	Tai chi for 2 hours/week; for 10 weeks [20 hours]	<ul style="list-style-type: none"> <li>EKG</li> <li>EEG</li> <li>Math computations</li> <li>Depression</li> </ul>	<ul style="list-style-type: none"> <li>Improved performance on computations</li> <li>Escitalopram and tai chi group were more likely to show greater reduction of depressive symptoms and to achieve a depression remission as compared with those receiving escitalopram and health education</li> </ul>
2012	Romero-Zurita et al; Spain <sup>10</sup>	Pretest-posttest design (n = 23). All participants were fibromyalgia patients.	51.4 ± 6.8 years	8 forms from Yang style tai chi: 15 minutes of warm-up; 30 minutes of tai chi exercises, and finally 15 minutes of relaxation	28 weeks; 60-minute session; 3 × weekly [84 hours]	<ul style="list-style-type: none"> <li>Anxiety</li> <li>Resilience</li> <li>Health related quality of life</li> <li>Cognitive performance</li> <li>Inflammation</li> <li>Assessment of the tender points</li> <li>Blind flamingo test</li> <li>Chair stand test</li> <li>Psychological outcomes</li> <li>Body composition</li> <li>Chair sit and reach</li> <li>Back scratch</li> <li>8 feet up and go</li> <li>Handgrip strength</li> <li>6-Minute walk tests</li> </ul>	<ul style="list-style-type: none"> <li>Tai chi group had less anxiety as compared to health education group (ns)</li> <li>Anxiety level decreased from 7.63 (2.32) units at pretest to 5.10 (2.77) units at posttest and was 6.29 (2.41) units at detraining (<math>P &lt; .001</math>)</li> </ul>

(continued)



**Table 1.** (continued)

Year	Authors/Country	Design, Sample and Setting	Age	Intervention Modality	Intervention Dosage	Outcome Measures	Salient Findings
2013	Chang et al; Taiwan <sup>21</sup>	Quasi-experimental design (n = 133) of a control group (n = 64) and a tai chi group (n = 69)	Intervention group age was $56.45 \pm 8.51$ while control group age was $62.26 \pm 12.91$ ( $P = .003$ )	Tai chi Chung	12-week 60-minute group sessions $3 \times$ a week [36 hours]	<ul style="list-style-type: none"> <li>Blood pressure</li> </ul>	<ul style="list-style-type: none"> <li>Tai chi group mean anxiety levels decreased from pretest (4.67) to posttest (2.20), significantly, based on the Beck Anxiety Inventory (<math>P = .007</math>). Inter-group comparison shows a significant decrease in anxiety for the Tai Chi group versus the control (<math>P = .001</math>) at the 12-week follow-up</li> </ul>
2013	Field et al; USA <sup>22</sup>	Randomized controlled trial (n = 92) to tai chi/ yoga (n = 37 completed) or wait-list control group (n = 38 completed). All women were prenatally depressed pregnant women.	Control group age was 26.0 (5.6) years while intervention group age was 24.4 (4.7) (ns)	Combination of yoga and tai chi as an approach	12 weeks; 20-minute group session $1 \times$ per week [4 hours]	<ul style="list-style-type: none"> <li>Anxiety</li> <li>BMI</li> <li>Waist circumference</li> <li>Depression</li> </ul>	<ul style="list-style-type: none"> <li>Tai chi/yoga group anxiety levels decreased from 54.2 (9.2) units at pretest to 46.1 (7.9) units at posttest, which was significant compared to control group (<math>P &lt; .01</math>)</li> </ul>
2014	Song et al; China <sup>23</sup>	Randomized controlled trial (n = 32) to tai chi with drug therapy (n = 16) or control group with only drug therapy (n = 16). The group consisted of elder patients suffering from anxiety.	Experimental group mean age was $65.3 \pm 7.1$ years old; control group mean age was $66.1 \pm 8.3$ years old	Chen style tai chi with activity of all joints in the whole body. Focus on stretching. The second part included 18 essences that integrates 18 postures required by the modern fitness training.	35 minutes morning and evening $\times$ 45 days [52.5 hours]	<ul style="list-style-type: none"> <li>Anxiety</li> <li>Sleep</li> <li>Hamilton Anxiety Scale</li> </ul>	<ul style="list-style-type: none"> <li>After 45 days, Hamilton Anxiety Scale score and Generic Quality of Life Inventory scores improved (<math>P &lt; .05</math>) in the experimental group</li> </ul>
						<ul style="list-style-type: none"> <li>Generic Quality of Life Inventory-74</li> </ul>	<ul style="list-style-type: none"> <li>On following for 2 months after patients stopped the drug, it was found that the recurrence rate was 42.86% in the control group, while in the experimental group it was only 9.09%</li> </ul>

Abbreviations: EKG, electrocardiogram; EEG, electroencephalogram; BMI, body mass index.

Anxiety Inventory scale, researchers reported the Cronbach  $\alpha$  values of .84 for trait anxiety and .89 for state anxiety, respectively.<sup>15</sup> It is also important to note that each of these scales is subjective and based on the self-reported feelings of the subject. However, with the use of pre- and posttests, along with comparison groups, these inherent biases are minimized. The studies that did report the psychometric properties of the scales used were high, but only few reported those properties.

For this review, it is important to differentiate between studies that utilized the randomized control trial design<sup>5,12,15,16,18,20,22,23</sup> as opposed to quasi-experimental,<sup>9,21</sup> pretest/posttest design,<sup>2,10,13,19</sup> or any variation<sup>11,14,17</sup> that does not include randomly assigning subjects to a control or intervention group. Randomized control designs are characterized by their use of randomly assigning subjects to control and intervention groups—making them the most robust type of study design. Eight of the studies utilized the randomized control trial design. Quasi-experimental designs, although they assign subjects to a control or intervention group, do not randomize the sample—sometimes matching subjects between groups. Two of the studies utilized quasi-experimental design. Pretest/posttest design does not utilize a comparison group—only comparing baseline measures with those reported at the end of the intervention. Four of the studies use this type of design. Additionally, 3 studies utilized some other type of design, including a 3-factorial design with variations in phase of tai chi (before/after), experience, and time of practice for 2 groups.<sup>11</sup> Another study that did not utilize the 3 common designs indicated above involved 2 interventions for 2 different samples.<sup>14</sup> Last, one study applied a single case research design—focusing on a small sample size of children suffering from attention deficient hyperactivity disorder.<sup>17</sup>

Sample size is also an important factor in determining the robustness and rigor of a study. The sample size ranged from 3 to 133, with a mean sample size of 53 (standard deviation = 38). A large number of studies have used sample size less than 30 participants. For such studies not much confidence can be asserted in the results. It is very important for future studies to conduct power analysis, and a software G\*Power can do that analysis very easily.

Past reviews have indicated that duration and dosage of intervention can have an effect on the efficacy of tai chi to treat anxiety.<sup>4</sup> Intervention duration varied in the 17 studies reviewed from 1 day<sup>12,19</sup> to 1 year.<sup>11</sup> Specifically, the majority of the studies lasted between 8 and 12 weeks.<sup>2,5,13,15-18,20-23</sup> Likewise, the dosage of intervention also varied from one 1-minute session<sup>14</sup> to 60-minute classes 3 times a week for up to 28 weeks.<sup>10,13,18</sup> The mean total instruction time for tai chi was 30 hours (standard deviation = 34 hours). In terms of duration of each session, the majority of the studies utilized hour-long sessions of tai chi practice,<sup>2,9,10,12,13,16-18,20,21</sup> which seems to be practically feasible.

All of the studies provided regular tai chi practice in a group setting, allowing practice teachers to ensure students are practicing tai chi correctly. Additionally, several studies used a sign-in sheet to monitor the dosage of tai chi subjects received.

This also allowed for the monitoring of attrition rates. Some studies reported attrition rates due to participants dropping out of the study but not all studies reported these rates. High attrition rates for any form of practice can alter the applicability of the treatment option. Incentives to ensure subjects remained in the intervention were used by some studies.

In addition, no study incorporated the use of a behavioral theory to help participants adopt and use the behavior of tai chi. Use of behavioral theory can make the interventions more efficient and also gauging changes in the constructs of a behavioral theory can provide insights into the efficacy of these interventions.<sup>24</sup> More specifically, theory can provide guidance into which components work for effecting behavior change and which components do not.

There are some limitations of the present review. First this is a qualitative review and not a meta-analysis, which is quantitative and gives an indication of the effect size of the intervention. Second, this study only tapped 3 databases in English language. It is likely that there may be some tai chi interventions and their evaluations published in Chinese or other languages that were missed in this review. However, the 3 databases chosen for this study carry a large majority of publications in the area of complementary and alternative systems of medicine. Finally, there could have been publication bias as only interventions with successful results are generally accepted for publication and the ones that are not successful get rejected. However, in the present review we did find several studies that did not show changes in anxiety related outcomes but had still been published.

## Conclusions

Anxiety is a major public health problem and there is need to explore alternative and complimentary approaches for preventing, treating, and managing anxiety. Tai chi seems to offer such an approach. A total of 17 interventions from 1989 to March 2014 looked at tai chi and its efficacy in alleviating anxiety. Of these 12 interventions were able to find positive effects in outcome measures related to anxiety. Despite the limitations of not all studies using randomized controlled design, having smaller sample sizes, having different outcome measures, having nonstandardized tai chi intervention, and having varying lengths of intervention, tai chi is a promising modality for anxiety management. All practitioners working with preventing or managing anxiety must teach tai chi as one of the approaches for anxiety reduction.

## Author Contributions

MS conceptualized the study, developed the inclusion criteria, collected the data, developed the table, analyzed the data, and reviewed the article. TH collected the data, analyzed the data, and wrote the first draft of the article.

## Declaration of Conflicting Interests

The authors declare no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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## Ethical Approval

This study did not warrant institutional review board review as no human subjects were involved.

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