

Review

**Mindfulness in Tai Chi Chuan as Practised amongst Higher Education Students with Implications for Health and Learning: A Narrative Review**Marcus A. Henning<sup>1,\*</sup>, Xuan Joanna Feng<sup>2</sup>, Yan Chen<sup>3</sup>, Fiona Moir<sup>4</sup>, Christian U. Krägeloh<sup>5</sup>, Jennifer Hobson<sup>6</sup>, Craig S. Webster<sup>7</sup>

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doi:10.21926/obm.icm.2104033**Received:** May 17, 2021  
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This review examines the quality of the research exploring mindfulness within tai chi chuan and the way this integrative practice benefits health and learning for higher education students. A narrative review based on a systematic search was conducted. Ten English and three Chinese databases were utilised to appraise the relevant literature. The initial search identified 874 potentially appropriate English articles and 265 Chinese articles. A final review of 52 Chinese and 8 English articles was conducted. We used an evidence classification framework to determine the research rigour of the 60 articles (levels 1 to 4). We found that



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the majority of the studies reviewed were deemed to be either descriptive studies or based on opinion. From a narrative synthesis of patterns emerging within the purported benefits of tai chi chuan cited in the reviewed papers, we identified four clear categories, namely physiological outcomes, motor function and balance, learning, and psychological status. We found that more literature was published in Chinese than English, suggesting the need for reviews to be conducted across language databases. Moreover, we established that tai chi chuan as an integrative meditational exercise can enhance health and learning for higher education students.

### **Keywords**

Mindfulness; tai chi chuan; higher education; narrative review

## **1. Introduction**

Higher education is a system of learning that propagates many benefits whilst also having some challenges. The challenges faced by higher education students include managing one's time, living with debt, developing a balanced lifestyle, mental ill-health, physical ill-health, choosing an appropriate course of study, pressure of study and examinations, finding new friends, and living costs [1, 2]. These challenges sometimes become overwhelming and increase pressure on counselling and health services [2, 3]. To address these challenges, it is important to consider group-based methods that could assist learning, counselling and health services. There is evidence indicating that one group-based method, tai chi chuan (TCC), is being taught in higher education settings at both formal and informal levels. For example, in China TCC is often taught as part of a physical education curriculum [4], moreover one US university offers a course and qualification in TCC [5], and many universities offer informal co-curricular courses in TCC [6, 7]. Therefore, exploring the efficacy of TCC as an integrative meditation process is crucial to substantiating claims being made regarding its health and learning benefits.

In the current literature, there is a burgeoning interest in mindfulness as a standalone, meditation practice [8-11]. Mindfulness practices have been linked to various positive health outcomes, such as developing a greater sense of relaxation, ameliorating the adverse impact of stress, enhancing concentration, and promoting healthy personal relationships [8, 12]. It has been proposed at a conceptual level that the aim of self-cultivation in TCC is to become aware of three important facets, namely Yi (意 or mind), Qi (气), and Shen (神) [13, 14].

The concept of Yi refers to the idea of intention in which each movement is enacted with deliberate awareness and purpose. The idea of Qi or chi refers to the 'natural force or energy' and is associated with physiological and psychological functionality [15]. The idea of Shen is linked to the notion of *spirit* which is intertwined with the workings of the psyche [16]. Hence, mindfulness within this context refers to the state of integration of these essences, resulting in the phrase 'the mind motivates the chi, the chi mobilises the body' and a key facet underpinning the motivation is *Shen* [13]. Therefore, mindfulness within the TCC context refers to the awareness and cultivation of the integration of calmness, stillness, relaxation and sinking (or visualising the relaxation of the muscles) [14].

A preliminary review of the English language literature indicated a scarcity of research investigating TCC and its efficacy in relation to the higher education context. Nevertheless, one systematic review focussed on the higher education context, incorporating 76 studies and 9263 TCC participants [17]. In this review, they reported substantial evidence for the physical health and psychological benefits of higher education students engaging in TCC practice. This systematic review also revealed that the majority of research conducted in this area is being published in Chinese language journals. In a further pilot study, Wang and colleagues [18] reported benefits in the physical and mental health of university students in terms of increased vitality and greater emotional wellbeing. However, these studies do not address the importance of mindfulness within TCC. This distinction is important given that some schools teach TCC as a purely physical exercise regimen and do not focus on the meditative aspect of the process [19]. In this narrative review, we focused on mindfulness within TCC and how it promotes wellbeing and learning. In addition, the quality of evidence was assessed regarding the claims underlying the efficacy of this integrative process.

In this case, a narrative review is crucial as it enabled us to describe and interpret how the theory of TCC influences practice and whether the extant research substantiates the claims being made. Therefore, we had two questions driving this research, namely:

1. What is the quality of the research evidence associated with the investigation of the impact of mindfulness in TCC on students' wellbeing and learning in higher education?
2. What are the key health and learning benefits associated with this integrative practice (mindfulness meditation within TCC) in reference to higher education students?

## **2. Materials and Methods**

### **2.1 Search Process**

We chose a narrative review process, as we wanted to describe and evaluate all published articles with some consideration of the study methods employed [20]. Our review used the following criteria for narrative reviews [21]:

*Types of participants:* students undertaking study in a higher education tertiary setting.

*Types of intervention:* this narrative search considered any form of TCC intervention with an expressed mindfulness component. Qigong was not treated as TCC and was excluded from search strategies.

*Types of outcome measures:* mindfulness is an outcome of TCC, or mindfulness is linked to a reported outcome or health effect of TCC.

Initial searches were conducted during August 2017 in the Ovid databases Medline, Embase, and PsycINFO. Given the purported origins of TCC stemming from the Chinese region [9] we felt it important to investigate both the English and Chinese language evidence. Table 1 shows the variants for the keywords and phrases associated with TCC, mindfulness, and students.

**Table 1** Keywords used in English-language database searches.

<b><i>Tai Chi keywords</i></b>		
tai chi	taiji	taijiquan
tai ji	t'aichi	t'ai chi

<b>Mindfulness keywords</b>		
mindful*	attention	concentrat*
meditat*	awareness	focus*
mind adj3 body	conscious*	
<b>Student keywords</b>		
student*	tertiary	Intern
freshm?n	faculty	Interns
post graduate*	school*	Trainee*
postgraduate*	universit*	Medical trainee*
graduate*	college*	
sophmore	polytech*	
education	technical school*	

Note: The asterisk (\*) is used as a wildcard symbol to assist searching for terms that have similar prefixes, e.g., Meditat\* will find meditation, meditator, meditators, meditational and so forth.

The final search strategies (see Table 2 for an exemplar of one search algorithm) were run on the 30<sup>th</sup> of September 2017 in 10 English databases. This allowed broad coverage across disciplines. Ovid databases include AMED (1985-Present), Embase (1980-Present), Medline (1946-Present), PsycINFO (1806-Present) and SPORTDiscus (1975-Present). The EBSCOhost databases were CINAHL Plus (1937-Present), Education Research Complete (1880-Present), Eric (1966-Present) and ProQuest Education Database (1988-Present). All segments of the Cochrane Library were searched. Two authors (proficient in English and Chinese) developed and conducted the English database searches.

**Table 2** Summary of search strategy: English-language databases (Medline, Embase, PsycInfo, Eric).

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**Search terms** (including subject headings from all databases):

tai chi/  
 tai ji/  
 (tai ji or taiji or taijiquan or tai chi).mp.

mindfulness/ or mindful\*.mp.  
 meditation/ or meditat\*.mp  
 mind adj3 body.mp.

exp student/  
 exp Students/  
 library schools/ or exp schools, health occupations/ or universities/  
 school/ or college/ or community college/ or medical school/ or pharmacy school/  
 exp education/  
 schools/ or academic settings/ or exp colleges/ or graduate schools/ or institutional schools/ or  
 military schools/ or technical schools/

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exp higher education/ or nursing education/ or social work education/ or exp teacher education/  
or exp curriculum/ or education, pre dental/ or education, premedical/ or exp education,  
professional/  
exp Faculty/  
(student\* or post graduate\* or postgraduate\* or graduate\* or freshm?n or sophomore or  
trainee\* or intern or interns).mp.  
(universit\* or college\* or faculty or school\* or polytech\* or higher education or tertiary).mp.

exp Faculty/

(student\* or post graduate\* or postgraduate\* or graduate\* or freshm?n or sophomore or  
trainee\* or intern or interns).mp.

(universit\* or college\* or faculty or school\* or polytech\* or higher education or tertiary).mp.

[Note: T'ai Chi etc, yielded no new results in the OVID databases]

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Three leading Chinese databases were searched on 4<sup>th</sup> of October 2017: China Academic Journals (CAJ), Wanfang, and the National Central Library of Taiwan (NCL). Search strategies used the Chinese characters that corresponded to the main English concepts of mindfulness, TCC, and university student. Traditional Chinese character forms were used in NCL, and simplified Chinese characters were used in CAJ, and Wanfang. Two authors developed and conducted the Chinese database searches.

In addition to database searches, the reference lists of included studies were hand searched, and additional studies were selected for inclusion if relevant. A search via Google Scholar was conducted by using the 'cited by' facility. All studies that cited an included study were evaluated and selected for inclusion if relevant.

## **2.2 Study Selection**

References were stored in the reference management software EndNote (version X7; Clarivate Analytics, Philadelphia, United States).

The following steps outline the study selection process and the inclusion/exclusion criteria:

1. Duplicate studies were removed.
2. Studies published in English and Chinese languages were included. Studies published in other languages were excluded due to resource limits.
3. Both qualitative and quantitative studies were included. The following types of publications were excluded: grey literature, books, book chapters, newspaper articles, and magazine articles. Research theses were included.
4. Two authors independently reviewed article titles and abstracts. Studies were selected for full text assessment based on consensus between these authors. If a consensus was not reached, the article was included for full text assessment.
5. Two authors independently retrieved and reviewed the full texts of selected studies. Inclusion of articles in the evidence synthesis was based on a consensus between these reviewers. Disagreements were discussed among the whole research team until a consensus was reached.
6. Hand-searched articles were evaluated and nominated following the same selection process.

## **2.3 Data Analysis**

The decision-making process of the articles for each stage of the review was documented using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines [22]

as shown in Figure 1. The levels of evidence used to determine the quality of each article were based on the criteria shown in Table 3 [23].

A final summary table was developed, which included both the Chinese and English language articles relevant to this search. Two Chinese language speakers were able to translate and summarise the main findings of the Chinese studies, whilst all authors reviewed the English studies.

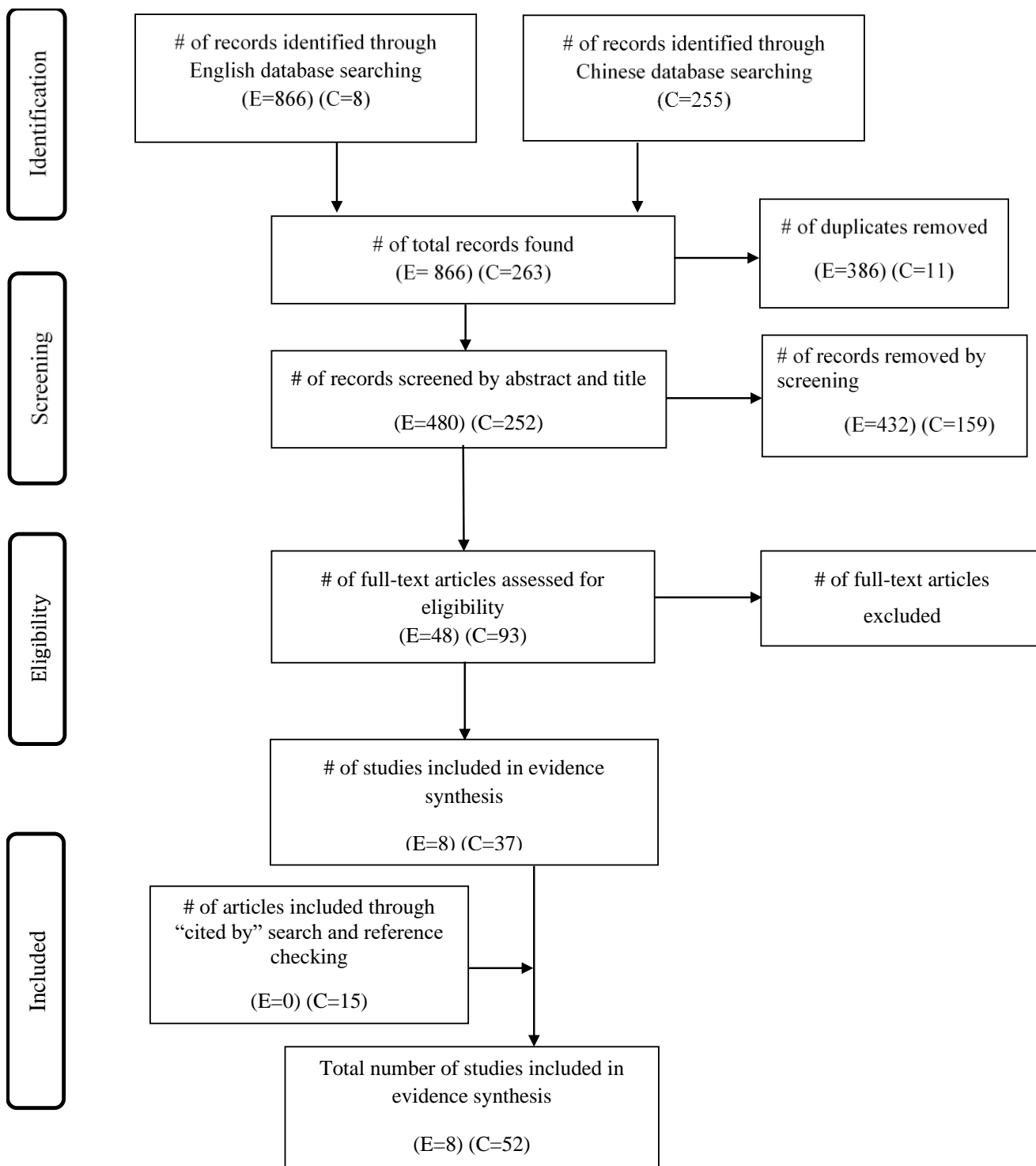
The summary table was developed through adapting criteria employed in other narrative reviews [e.g., 24]. The key elements chosen for this review and relevant to this field of study were: (1) evidence level, study type and incorporation of mindfulness; (2) author (date); and (4) key outcomes. The salient themes and patterns emerging from the key findings of the final reviewed articles were analysed using a narrative synthesis approach and key categories were identified [25].

### **3. Results**

#### ***3.1 Summary of the Search Strategy***

The number of initial hits generated from English databases was much higher than that from Chinese databases, although fewer English articles were included into the subsequent evidence synthesis (Figure 1). English databases generated 874 articles in total, of which eight articles were written in Chinese, and 866 articles were in English or other languages. Two hundred and fifty-five Chinese-language articles were identified through Chinese databases. In total, there were 263 Chinese-language articles in this review, including eight Chinese-language articles from English databases.

The selection process for English-language articles started with 866 articles. After removing duplicates and articles not meeting the inclusion criteria regarding their titles and abstracts, 48 articles remained for full text assessment. Forty articles were then discarded as they were deemed out of scope, and thus eight articles were selected for final analysis. In reference to the Chinese-language articles, 93 articles remained for the full text assessment. Among the 93 articles, 37 articles were included into the final analysis. Hand searching added a further 15 Chinese-language articles. In total, 60 articles including 52 Chinese-language articles and eight English-language articles were selected for final appraisal.



**Figure 1** Combined flow diagram for Chinese (C) and English (E) database searches.

### 3.2 Levels of Evidence

As shown and described in Table 3, the reviewed articles were classified using a previously published evidence-quality classification system [23]. No articles at the highest level of evidence,

i.e., level 1a (meta-analysis of randomised controlled studies) were found. However, both Chinese and English-language articles using randomisation and a control group in their study designs were identified i.e., level 1b ( $n=5$ ). Chinese and English-language empirical studies were identified as levels 2a and 2b ( $n=14$ ), using either a non-randomised control group or incorporating a quasi-experimental design. The majority of studies reviewed were designated level 3 or 4 (respectively, non-experimental descriptive studies and reports of expert opinion,  $n=41$ ).

**Table 3** Levels of evidence: Classification system adapted from Jensen et al [23].

Level of evidence	Description of classification	No. of studies ( $n=60$ )*
1a	Evidence from meta-analysis of randomized controlled trials	C = 0 E = 0
1b	Evidence from at least one randomized control trial	C = 4 E = 1
2a	Evidence from at least one controlled study without randomization	C = 4 E = 2
2b	Evidence from at least one other type of quasi-experimental study (for example one-group, pre-test, post-test studies)	C = 7 E = 1
3	Evidence from non-experimental descriptive studies, such as comparative studies, correlation studies and case-control studies	C = 7 E = 3
4	Evidence from expert committee reports or opinions and/ or clinical experience of respected authorities	C = 30 E = 1

\*Number of reports: E = English, C = Chinese.

### 3.3 Overall Summary of the Reviewed Articles

The key elements of the studies included in the review are shown in Table 4. All authors of the articles highlighted the usefulness of the synthesis of mindfulness meditation and TCC as an intervention within the higher education context, thus fulfilling the requirements for inclusion in our review. The key outcomes from these articles were analysed (Table 4), resulting in four categories (or themes) summarising the purported benefits of TCC with a mindfulness component:

1. Physiological outcomes
2. Motor function and balance
3. Learning
4. Psychological status

**Table 4** Summary of the articles included in the final review ( $n=60$ ).

Evidence level, study type and incorporation of mindfulness	Author (date)	Key outcomes
1b. Randomised control trial	李珍 (2009)	Improved motivated to learn and understanding of TCC. No effect on blood circulation.



<p>All studies hypothesise mind (Yi) influences Qi, which mobilise the body, e.g., “calm and concentrated mind/Yi guides movements and breathing”.</p>	<p>董华, 赵福临 (1999) 纵艳芳, 童锦 (2012) 吴广 (2009) Zheng et al (2015)</p>	<p>Improved attention span, sleep quality and academic performance. Improved TCC performance. Improved long distance run time, mood regulation, self-confidence, sense of achievement, awareness of exercise, learning interest, and lung capacity. No differences - 50m run time, grip strength, and weight. Improved flexibility and balance ability (open and closed eyes). No changes - lower limb proprioception function, self-efficacy, psychological symptoms, stress and attention. No difference on cardio-pulmonary function, blood pressure, resting heart rate, self-esteem, mood and mindfulness, quality of life, or quality of sleep.</p>
<p>2a. Non-randomised control study</p>	<p>李秀华 (1998) 张大力 (2009) 张颖 (2014)</p>	<p>Greater interest in learning and heightened attention. Improved EEG alpha wave increase, and breathing. Improved heart and lung function indexes and self-evaluation.</p>
<p>Studies purport mind (Yi) influences body, e.g., “using Yi, with relaxing body, breathing, and visualisation”.</p>	<p>王建伟 (2017) Caldwell et al (2011) Converse et al (2014)</p>	<p>Improved attention. Increases in mindfulness scores, wellbeing measures and sleep quality. No difference for self-efficacy. Improvements in attention. No differences on working memory, response inhibition, affective processing, physical balance.</p>
<p>2b. Comparative study</p>	<p>刘笃涛, 马效萍 (2003) 孙细英, 张瑞洁, 崔璨 (2008)</p>	<p>Improved psychological well-being (somatisation, interpersonal sensitivity, depression, anxiety). Decreases in heart rate and blood pressure and improved lung functions, sit-ups, standing long jump, sitting body flexion. No change in waist measurements.</p>
<p>Studies suggest mind (Yi) influences Qi, which mobilises the body/breathing, e.g., “Yi/mind directs Qi to abdomen and breathing to mobilise movements”.</p>	<p>刘晨 董婕 (2011) 张丹丹 (2013) 尹辉, 杨靖 (2007) 张登峰, 耿延敏 (2013) 李继刚 (2004)</p>	<p>Decreased depression and resting heart rate. Improved systolic pressure and cardiac output. Improved standing long jump but no changes for standing on one leg, skipping rope, height, and weight. Improved appetite and health symptoms. Increases in balance, lung capacity and decreased resting heart rate with significant decreased measures in waist, hip, BMI. No change in systolic and diastolic pressures Improved body coordination, flexibility, strength, somatisation, obsessive-compulsive disorder, attention, interpersonal relationship, depression, anxiety, phobic anxiety and paranoid ideation. No improvement - endurance, weight, hostility and psychoticism.</p>

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	Caldwell et al (2010)	Increased mindfulness scores.
3. Descriptive survey study	曹志飞, 高加亮 (2013) 段胜利 (2015)	Improved physical fitness, self-defence, and self-cultivation. improved relaxation, happiness, fitness. 2% reported no effect.
As above, all studies suggest mind (Yi) influences Qi, which mobilises the body, e.g., “calm, concentrated mind/Yi, with abdominal breathing, Qi awareness and body movements”.	韦朝贵 (2009) 王楠 (2012) 祁浩浩 (2015) 张红 (2017)  方礼钦 (2009) Gryffin & Chen (2013) Moore (1992)	Visualising movements improves TCC. Improved respiratory system and blood circulation. Increased attention and study productivity. Improved confidence, energy levels, attention, sleep quality, alertness, appetite, memory, body flexibility and coordination, emotion regulation, attention, cognition, and immune response. Relieves period pain, peripheral coldness. Well-being and calmness benefits. Enhanced mindfulness and breaking cycles of addiction. Improved vocabulary learning, confidence and communication ability.
4. Opinion	Webster et al (2016) 关睿 (2010)	Increased flexibility, reduced depression/anxiety, and improved interpersonal sensitivity. Improved blood circulation, balance, body co-ordination, flexibility, central nervous system, cardio-vascular system, and muscle development.
As above all studies suggest mind (Yi) influences Qi, which mobilises the body, e.g., practising TCC requires a relaxed and undistracted mind that mobilises the body movements.	刘玲芬 (2007) 司红玉 (2003) 孙美 (2002) 孟帅 (2015) 张斌 (2013) 曹秋, 祁志恒, 李影 (2015) 程梅玲 (2001)  苏文玲 (2011)	Improved breathing, blood/lymph circulation, liver function, reaction ability, and muscle function. Develops calm, concentrated mind, psychological wellbeing. Regulates thinking, and brain function. Deep breathing increases venous blood reflux. Increases body strength and balance. Decreases heart rate. Regulates organs, systems, meridians, and balance of qi and blood. Improves physical health, and cultivates volition. Relaxes breath, mind, and body. Improves physical and psychological well-being. Loosens muscles and ligaments, relaxes the chest, calms the mind and coordinates breathing with movements. Improves CNS, flexibility, and other body systems. Coordinates breathing with movements increasing blood/lymph circulation, prevents heart disease and atherosclerosis. Improves central nervous system function, stress, and cardio-vascular function.

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邱金昌(2008)	Improves central nervous system and internal organs, confidence and mental health.
陈孝道 (2010)	Improves mental health, blood/lymph flow, and cardiovascular function.
陈清富(2014)	Improves heart/lung function, blood circulation, and mental health.
黄兴裕, 吴秀华, 黄海 (2013)	Improves psychological wellbeing, muscle strength, response time, balance, oxygen uptake, heart rate, and sympathetic and parasympathetic function.
张丽丽(2015)	Improves motor, respiratory, and nervous systems.
杨晓敏, 张宏磊, 牛大三(2003)	Improves blood circulation, mind-body awareness and energy.
王利 (2012)	Cultivates awareness of movements and increases creativity.
酉杰峰(2010)	Improves fatigue, cardio-vascular function and other bodily functions.
于晓红(2016)	Eliminates discursive thoughts. Improves concentration and mindfulness.
冯玉娟 (2010)	Reduces depression. Improves breathing, microvascular circulation, lung capacity and cardiac function.
刘后振 (2004)	Assists with conflict management, depression, mood control, and anxiety.
王向阳 (2007)	Improves the body immunity, blood circulation, energy, and joint function. Prevents disease, strengthens bones/tendons.
田慧芳 (2011)	Benefits central nervous system, human body systems and organs.
高清伟 (2004)	Improve memory, concentration, mental productivity, psychological well-being, sleep quality and sensory function.
张荣清 (2011)	Cultivates mental relaxation, happiness, self-esteem, and self-confidence.
朱继华, 程梅玲 (2004)	Benefits physical and psychological health. Beneficial to central nervous system and improves other systems/organs. Enhances breathing, blood/lymph circulation and cardiovascular and immune systems.
李瑛 (2009)	Benefits central nervous system and other systems/organs. Regulates mood, anxiety and/or stressed.
杨旭杰 (2013)	Improves mood states, cardiopulmonary activity, central nervous system, and respiratory/blood circulation.
王红梅 (2008)	Ameliorates stress, anxiety and depression. Engenders energy, concentration, confidence, and calmness.
马磊 (2011)	Enhances emotional regulation and physical health.

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王居河 (2017)	Improves physical and psychological well-being, immunity, and sleep quality.
Zheng et al (2014)	Design for the Zheng et al (2015) study.

The key beneficial outcomes, associated with the synthesis of mindfulness and TCC as applied within a higher education setting, and linked to the highest reviewed level of evidence (1b, see Table 5) [26-30] are: (1) specific physiological benefits (e.g., improved sleep quality, and increased lung function); (2) motor function and balance improvement (e.g., improved balance whilst moving); (3) learning enhancements (e.g., increased attention capability and learning motivation); and (4) improved psychological status (e.g., enhanced mood management). Nonetheless, there were studies [26, 30] reporting no statistically significant differences (i.e.  $p>0.05$ ), such as in relation to cardio-pulmonary function, blood pressure, resting heart rate, self-esteem, mood and mindfulness, quality of life, or quality of sleep.

**Table 5** Selected characteristics of Randomised Control Trial studies demarcated as 1b in Table 4.

Study	Country (region)	Intervention	Control	N	Measures
李珍 (2009)	China (Gansu province)	Focusing on “Yi” of Eight-form TCC (music and mnemonic phrases assisted learning) prior to learning 24-form TCC for 13 weeks in total	24-form Tai Chi Chuan only for 13 weeks	60	Tai Chi Chuan performance test, number of students voluntarily practising TCC
董华, 赵福临 (1999)	China (Fujian province)	24-form TCC 20-25 minute sessions, every morning for two months	No Tai Chi Chuan intervention	160	Attention span, academic performance
纵艳芳, 童锦 (2012)	China (Anhui province)	Visualising each movement of 24-form TCC before practising them for four months	Only 24-form TCC for four months	160	Theory test of TCC, performance test of TCC, and technique assessment of TCC
吴广 (2009)	China (Sichuan province)	Mindful breathing and practice of 24-form TCC for one semester of formal TCC class	Only physical 24-form TCC for a semester of Tai Chi Chuan class	270	Physical exercise measures, body mass index, interest in TCC, understanding performance facets of TCC
Zheng et al (2015)	China (Fujian province)	Tai Chi Chuan 60-minute sessions, five days per week for 12 weeks	No specific exercise intervention	206	Balance ability, lower limb proprioception, flexibility, psychological symptoms, self-efficiency, cardio-pulmonary function, and stress.

According to level 2 studies [31-44], similar benefits were reported. These included (1) physiological benefits (e.g., improved sleep quality and cardiovascular function); (2) motor function and balance (e.g., improvements on sit-ups, standing long jump, and sitting body flexion); (3) learning enhancements (e.g., inspired their learning interest); and (4) improved psychological status (e.g., interpersonal relationship, depression, anxiety, phobic anxiety and paranoid ideation). In contrast, some studies [35, 36] showed no significant differences in terms of measures associated with working memory, response inhibition, affective processing, physical balance, self-regulation, and self-efficacy.

Non-experimental studies (level 3) [17, 45-53] and articles based on expert opinion (level 4) [54-84] purported claims consistent with the outcomes from the higher levels of evidence. These studies reinforced physiological, motor function, learning and psychological benefits. Nonetheless, some non-aligned studies made assertions that were descriptive such as breaking cycles of addiction [52], mastery of vocabulary, and improving the ability to communicate [53].

#### **4. Discussion**

This review explored the scholarly literature situated in refereed journals that described the importance of mindfulness within TCC and how this integrative system influenced health and learning amongst higher education students. The majority of the literature was opinion-based and thus deemed low in methodological rigour [23]. Nonetheless, this literature was a rich source of narrative as it elucidated the theory behind the utilisation of TCC. The papers incorporating robust research design somewhat validating these conceptual discourses. Therefore, the narratives described the interaction between the conceptual elements of TCC, its practice, and links to purported health and learning outcomes. The evidence for the meditational influence is purported in the Chinese literature although considerable work needs to be done in the form of more lifespan longitudinal work.

The concept and practice of mindfulness as applied to the context of TCC involves the awareness of the integration of Yi, Shen and Qi. In this review of the literature, there are many examples within the articles appraised [e.g., 59, 62, 69] that have referred to the activation or development of the Yi as being critical to developing a deep understanding of how the body is mobilised. These results are consistent with the classical order, as put forward by the notable tai chi expert Cheng Man-Ch'ing, that states the mind directs the Qi, which in turn mobilises the body [13].

To evaluate the efficacy of this integrative practice, the quality and origins of research evidence were reviewed and this enabled us to comment on the purported health and learning benefits for higher education students.

##### **4.1 Quality and Origins of Research Evidence**

As shown in Tables 3 and 4, the majority of the evidence (87%) reviewed in this study was written in Chinese. In addition, the evidence is mostly descriptive (levels 3 and 4,  $n=41$ , 68%) with only five studies (8%) being classified as level 1b and none at 1a, and 14 studies (23%) classified as level 2. This suggests that very few studies used rigorous research protocols, which is surprising given that it has been estimated that 2.5 million individuals practise TCC in the USA alone [85].

The randomised controlled trials (RCTs) reviewed in this study were mainly conducted in Chinese, with only one in English. The challenge when applying RCTs to the determination of efficacy of TCC

is controlling and matching for factors such as interest, motivation, kinaesthetic and tactile aptitude, personality, state of relaxation, capacity to concentrate, teacher characteristics and expertise, the learning environment, and number of hours involved in formal and individual practice [9, 13, 86]. Therefore, a definitive investigation of the benefits of TCC, especially with a focus on a higher education context, requires a series of studies using different research methodologies to investigate the impact of these underlying factors.

#### 4.1.1 Key Outcomes for Higher Education Students

The papers in our review distinctly suggest that the integrative nature of TCC has positive health and learning benefits for higher education students. According to the reports described in papers with quality evidence (levels 1 and 2), the benefits include: (1) improved attention span and academic performance [27]; (2) enhanced self-confidence, sense of achievement, awareness of exercise, learning interest [29]; (3) increased motivation to learn [31]; (4) better psychological well-being, i.e., such as, improvements in interpersonal sensitivity, depression, and anxiety [37, 44]; and (5) improved sleep quality [26].

It is likely that when mindfulness and movement are synthesised, TCC becomes more focused [87]. In TCC, the movements are slow and precise and with the explicit inclusion of the teaching of meditation, this allows practitioners to attain both mental and physical benefits, with low risk of injury. As with other mind-body systems, TCC with a strong meditation focus unites awareness of thinking, sensing and moving [87]. These benefits suggest that an integrative approach leads to beneficial health and educational outcomes.

#### **4.2 Implications for Teaching and Learning TCC**

Our review has shown that mindfulness embedded within TCC results in positive health and learning outcomes for higher education students. Nevertheless, we can surmise from the articles we have reviewed that this view of TCC is a multi-faceted system, which makes it difficult to ascertain the 'real' benefit of each facet. Furthermore, a lifelong commitment is required to develop the integrative and accomplished level of TCC practice resulting in a calm, concentrated mind state (Yi), synthesised with abdominal breathing and Qi awareness to mobilise body movements [48]. This suggests that teaching the full spectrum of TCC to higher education students is challenging.

To deliver a principled transmission of TCC requires teachers to be honest about the length of training and effort required to achieve higher levels of expertise. Even though some authors suggest that TCC can be learned in a short period of time [88], the treatise by Man-Ch'Ing [13] on TCC describes the complexity of the teaching and learning process. It is relatively easy to learn the basic movements of the form (body level and breathing) [88], but integrating these with Yi and Qi may take a lifetime or *several lifetimes* [13, 14, 89]. In the empirical studies cited in this review, the interventions were over a very short time due to research feasibility, hence lifespan research is required to tease out the long term benefits of integrative TCC practice.

As stated by Yang and colleagues [90] there is immense variability in the way TCC is taught. This makes comparative research difficult given the apparent lack of standardisation across methods. As such, there is little consistency in terms of delivery of TCC, length and frequency of training required to show a positive TCC effect, and how the duration of TCC practice contributes to a meaningful outcome. In their bibliometric analysis of the published data in the area of TCC, Yan and colleagues

[90] found that “10.4 % of included primary studies had more than one Tai Chi group with the aim of evaluating the potential benefits, advantages and/or acceptability of the different styles, forms, frequencies, duration, delivery modes and settings for the target population.” They noted there was some consistency in the teaching of TCC, in that most studies reviewed showed that sessions lasted about 60 minutes in duration and practice occurred around two to three times per week usually lasting 3 to 6 months. However, they noted that intensity of TCC training was variable and the influence of individual differences between teachers and participants was difficult to measure. They further suggested that studies in the future investigate the notion of the multifactorial nature of the dose-response effects of TCC, and consider more fine grained analysis of the reporting of contextual and participatory elements around service delivery. Therefore, the challenges to research in this area are linked to reporting adequate information about the many variables involved in the teaching process, such as the instructor’s capability and experience, the various factors influencing the dissemination and learning of the skills and knowledge, and evaluating the desired outcome/s of teachers and learners.

In addition, Klein and Adams (91) explored the feasibility of facilitating a programme incorporating TCC. They suggested that exercise persistence and cost effectiveness need to be considered. They found that TCC persistence in diabetic management and cardiac rehabilitation programmes was low (10% to 50%). This is an issue that needs to be considered when purporting the benefits of TCC and is especially significant when applied to the higher education setting, given the demands and distractions of student life. Therefore, if classes are presented as an informal option it is likely that only a few students will persist.

If, however, the programme is embedded within the curriculum the impact will likely be longer lasting [92]. To advocate a compulsory inclusion suggests that TCC (as a meditative movement process) is an optimal form of exercise. This begs the question, how is the integrative version TCC (meditation in motion) better or different to other mind-body practices (e.g., Yoga and Pilates)? From this review, there appears to be very few studies conducted in the higher education context that compares the integrative practice of TCC with other exercise regimens, which suggests that formal inclusion should be treated with caution until more comparative research has been conducted.

## **5. Conclusions**

This narrative review has enabled us to make several assertions about mindfulness and TCC in relation to the higher education context. First, the quality of evidence was skewed towards opinion articles. This is likely due to the difficulty with conducting comparative longitudinal studies and problems associated with attrition, ensuring randomisation, and allocation concealment. Second, Chinese investigation and subsequent publications regarding the efficacy and use of TCC far exceeds (both in quality and frequency) Western investigation, underscoring the importance of including this body of literature in any review of this topic. Third, the health and learning benefits of engaging in an integrative approach to TCC are being established. For TCC to be accepted as a formal inclusion in curricula, TCC needs to be investigated further especially in terms of its relative efficacy and cost-benefit assurance in comparison to other exercise and meditation practices.

## Author Contributions

All authors contributed to the conception or design of the work analysis, and interpretation of data for the work. All authors contributed to the drafting of the work and revising it critically for important intellectual content. All authors contributed to the final approval of the version to be published. All authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. Three authors (XJF, YC, JH) were involved in the initial acquisition of the papers for review.

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## Competing Interests

The authors have declared that no competing interests exist.

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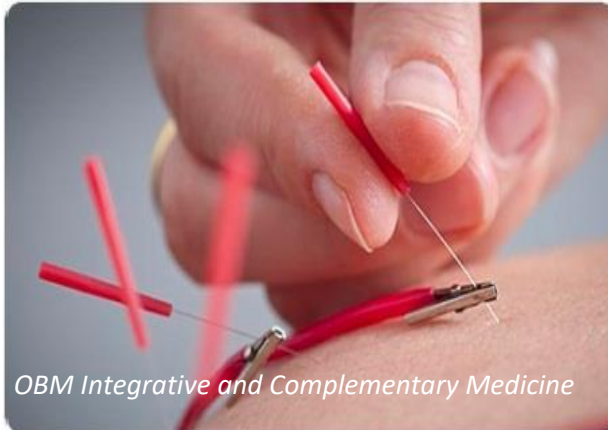


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