

EXERCISE PRESCRIPTION OF WUDANG ZHAOBAO TAI CHI SINGLE-PALM EXERCISE FOR ADOLESCENT CHRONIC INSOMNIA: A CHINA-THAILAND SCOPING REVIEW

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Abstract: Adolescent insomnia is a prevalent public-health concern that impairs cognitive function, emotional regulation and physical development. Pharmacological treatments carry risks of adverse reactions and dependence, especially for young populations. Structured mind-body exercise prescription represents a promising non-pharmacological alternative for this population. Wudang Zhaobao Tai Chi Single-Palm Exercise, inherited by Gongxuan Wang, is a simplified mind-body practice rooted in traditional Chinese medicine. This scoping review was conducted following PRISMA-ScR guidelines combined with the JBI evidence-grading framework. Three methodological innovations were implemented: a China-Thailand cross-cultural evidence-coding framework, a dose-response standardized-coding system for Tai-Chi intervention, and dual-standard evidence appraisal. We aimed to map available evidence regarding Wudang Zhaobao Tai Chi Single-Palm Exercise for adolescents aged 15-19 years with ICD-diagnosed chronic insomnia (sleep-onset difficulty ≥ 6 months). Methods: Multiple Chinese and English databases were searched together with grey-literature resources. Pre-specified inclusion and exclusion criteria were applied. Two independent reviewers screened records, extracted data and coded evidence. Cohen's Kappa coefficient was calculated to evaluate inter-rater reliability, with a final value of 0.87 indicating good inter-rater agreement. Evidence was synthesized via thematic and cross-cultural comparative analysis. Results: Three pilot studies involving a total of 32 participants from China and Thailand were included. Participants performed 500 repetitions per hand daily for 30 consecutive days. After intervention, PSQI and ISI scores declined to normal ranges and stable sleep-wake rhythms were restored. Conclusion: Preliminary evidence suggests that Wudang Zhaobao Tai Chi Single-Palm Exercise may relieve chronic sleep-onset difficulty among adolescents in both Chinese and Thai cultural contexts. The established dose-coding system and cross-cultural evaluation framework can support future standardized trials. Limitations include small sample sizes and absence of randomized controlled designs. Further large-scale multi-centre randomized trials incorporating physiological biomarkers are required to verify efficacy and underlying mechanisms.

Keywords: Wudang Zhaobao Tai Chi; Single-Palm Exercise; Exercise prescription; Adolescent insomnia; Cross-culture; Mind-body intervention; PRISMA-ScR

1 INTRODUCTION

Adolescence represents a critical developmental window for brain maturation, emotional homeostasis and consolidation of sleep-wake cycles. Global epidemiological data show rising prevalence of chronic insomnia in adolescents, with prolonged sleep-onset difficulty as the most frequent chief complaint [1]. Persistent sleep-onset impairment lasting more than six months reduces daytime vitality, aggravates anxiety symptoms and impairs academic performance, thus compromising long-term adolescent health [2].

Pharmacological hypnotics are restricted for adolescents owing to risks of tolerance, dependence and side-effects. Cognitive-behavioural therapy for insomnia (CBT-I) is the first-line non-pharmacological treatment; nevertheless, its dissemination is limited by the requirement for highly trained therapists and barriers in cross-cultural and grassroots settings [3].

Tai Chi, a traditional Chinese mind-body exercise, exerts beneficial effects on autonomic modulation, stress relief and sleep improvement in previous clinical investigations [1, 4-7]. Inherited by Gongxuan Wang, Wudang Zhaobao Tai Chi

Single-Palm Exercise is a simplified form combining repetitive hand movements with coordinated abdominal breathing. Compared with complete Tai-Chi routines, this practice has low learning costs and minimal space requirements, making it suitable for adolescent populations within Chinese and Thai school-based environments [5]. However, existing literature lacks systematically mapped evidence for this specific intervention in adolescent insomnia, and unified exercise-dosage standards are absent in international mind-body-therapy research [2].

Adopting PRISMA-ScR and JBI evidence-grading standards, this scoping review introduces three novel methodological components to synthesise available pilot evidence for this Tai-Chi-based exercise prescription. The present study maps intervention characteristics, outcome indicators and cross-cultural applicability, identifies research gaps, and provides standardized-coding paradigms for future international trials.

2 METHODS

2.1 Review Protocol

The review protocol was pre-defined before literature retrieval, covering screening rules, data-extraction fields, evidence-coding schemes and quality-appraisal criteria. All reviewers received standardized training. A formal prospective PROSPERO registration was not completed for this scoping review, as this project was initiated prior to public protocol registration; the full review protocol was pre-specified and internally documented before literature searching, rather than for the purpose of pooling effect sizes for meta-analysis.

2.2 Search Strategy

Databases included PubMed, Scopus, Web of Science Core Collection, TCI Thai Journal Citation Index, CNKI, Wanfang, VIP and CBM. Grey-literature sources such as unpublished pilot-observation reports and cross-cultural-trial abstracts were supplemented [6, 8]. The search period spanned January 2016 to September 2026.

CNKI / Wanfang / VIP / CBM search string

("Wudang Zhaobao Tai Chi" OR "Zhaobao Tai Chi Single-Palm Exercise" OR "Tai Chi") AND ("Adolescent" OR "Middle-school student") AND ("Insomnia" OR "Sleep-onset difficulty" OR "Sleep disorder") AND ("Non-pharmacological intervention" OR "Mind-body therapy" OR "Exercise intervention")

PubMed search string

("Wudang Zhaobao Tai Chi"[Title/Abstract] OR "Zhaobao Tai Chi Single Palm Exercise"[Title/Abstract] OR " Tai Chi"[Title/Abstract]) AND ("Adolescent"[MeSH Terms] OR "Middle school student"[Title/Abstract]) AND ("Insomnia"[MeSH Terms] OR "Sleep onset difficulty"[Title/Abstract] OR "Sleep disorder"[MeSH Terms]) AND ("Non-pharmacological intervention"[Title/Abstract] OR "Mind-body therapy"[Title/Abstract] OR "Exercise intervention"[Title/Abstract])

Scopus search string

TITLE-ABS-KEY ("Wudang Zhaobao Tai Chi" OR "Zhaobao Tai Chi Single Palm Exercise" OR " Tai Chi") AND TITLE-ABS-KEY (adolescent OR "middle school student") AND TITLE-ABS-KEY (insomnia OR "sleep onset difficulty" OR "sleep disorder") AND TITLE-ABS-KEY ("non-pharmacological intervention" OR "mind-body therapy" OR "exercise intervention")

Web of Science Core Collection search string

TS=("Wudang Zhaobao Tai Chi" OR "Zhaobao Tai Chi Single Palm Exercise" OR "Tai Chi") AND TS=(adolescent OR "middle school student") AND TS=(insomnia OR "sleep onset difficulty" OR "sleep disorder") AND TS=("non-pharmacological intervention" OR "mind-body therapy" OR "exercise intervention")

TCI (Thai Journal Citation Index) search string

("Wudang Zhaobao Tai Chi" OR "Zhaobao Tai Chi Single Palm Exercise") AND (adolescent) AND (insomnia OR sleep onset difficulty) AND ("mind-body intervention")

Manual backward snowballing was performed by examining reference lists of included publications to capture potentially omitted studies [6].

2.3 Inclusion and Exclusion Criteria

2.3.1 Inclusion criteria

1. Participants aged 15-19 years: middle-school students diagnosed with chronic non-organic insomnia with sleep-onset difficulty lasting ≥ 6 months according to ICD diagnostic criteria; participants recruited from China and Thailand.
2. Intervention: Wudang Zhaobao Tai Chi Single-Palm Exercise as the core intervention with a standardised dosage of 500 repetitions for each hand daily.
3. Study designs: randomised controlled trials, quasi-experimental studies, prospective pilot observational studies.
4. Outcome indicators: studies reporting at least one validated sleep-assessment instrument (PSQI or ISI).
5. Language: Chinese or English publications.

2.3.2 Exclusion criteria

1. Reviews, case reports, letters to the editor, editorial comments, and opinion articles without original empirical data.
2. Participants suffering from severe mental disorders, serious physical illnesses or cognitive impairment [9].
3. Combined multi-intervention protocols in which the independent effect of Single-Palm Exercise cannot be isolated.

4. Publications with incomplete raw data or missing outcome indicators.

2.4 Three Original Methodological Innovations

Three pilot methodological components were developed: a China-Thailand cross-cultural dual-theoretical coding framework, a standardised dose-response coding system for Tai Chi intervention, and dual-standard evidence appraisal.

2.4.1 China-Thailand cross-cultural dual-theoretical coding framework

Most existing sleep-intervention studies focus on a single-national population and lack cross-cultural comparisons between East-Asian and Southeast-Asian settings [6, 8]. This study constructs a pilot dual-coding framework for adolescent mind-body interventions: (1) Traditional-Chinese-medicine regulatory dimension: Qi-energy balance, abdominal breathing, and spirit-calming visceral regulation [5, 7]; (2) Thai-traditional behavioural-relaxation dimension: movement awareness, sensory stabilisation, and emotional grounding [6, 8]. Intervention effects and participants' subjective experiences were coded under both cultural frameworks to identify similarities and differences in treatment responses across populations, helping to address a partial research gap across-cultural non-pharmacological sleep interventions for adolescents.

2.4.2 Standardised dose-response coding system for Tai-Chi intervention

Ambiguous intervention parameters and poor replicability are common limitations within international Tai-Chi research [2, 4]. This investigation established a dedicated dose-stratification model for Wudang Zhaobao Single-Palm Exercise as an exercise prescription, including daily unilateral repetitions, continuous intervention cycles, standardised breathing-co-ordination specifications, and adherence-verification rules. This paradigm provides unified quantitative-intervention standards for future international mind-body-therapy trials.

2.4.3 PRISMA-ScR combined with JBI evidence-grading system

Most scoping reviews only follow reporting guidelines without rigorous quality evaluation. This study adopted dual evaluation standards: PRISMA-ScR for standardised reporting and JBI criteria for evidence grading. Evidence levels I-III were adapted from JBI criteria for intervention-oriented systematic reviews for this scoping review. Evidence was classified as Level I (high-quality controlled evidence), Level II (valid quasi-experimental evidence), and Level III (standardised pilot-observational evidence). Dual-standard assessment improves objectivity and methodological rigour.

2.5 Literature Screening and Data Extraction

Two independent researchers performed title-abstract screening and full-text evaluation. Cohen's Kappa coefficient was computed to assess inter-rater reliability, yielding $\kappa = 0.87$, representing good agreement between reviewers. Disagreements were resolved via discussion or third-party arbitration. Standardised data-extraction items included author information, publication year, study region, sample size, baseline participant characteristics, intervention dosage, outcome indicators, and study limitations. Extracted data were entered into a pre-designed table and cross-checked.

2.6 Evidence Synthesis

Given clinical and methodological heterogeneity across included studies, meta-analysis was not performed. Structured thematic synthesis and cross-cultural comparative analysis were conducted across three dimensions: quantitative changes in sleep-scale scores, autonomic-nervous-system regulatory mechanisms, and cross-cultural population-applicability differences [3, 6, 8].

2.7 Bias and Quality Appraisal

Potential biases (small-sample bias, single-centre bias, self-report-measurement bias) were systematically identified and critically discussed within the manuscript.

3 RESULTS

3.1 Study-Selection Process

Literature screening strictly complied with the PRISMA-ScR 2020 reporting specifications. In total, 47 records were retrieved from databases. After duplicate removal, 34 records remained. Following title-and-abstract screening, 26 irrelevant records were excluded, leaving eight articles for full-text eligibility assessment. Five articles were excluded at full-text stage owing to non-clinical design, duplicate data, incomplete datasets or missing valid outcome indicators. Ultimately, three pilot studies comprising 32 Chinese-Thai adolescents were included for qualitative synthesis. Grey-literature data from cross-national pilot observations were supplemented as supporting evidence (see Figure 1).

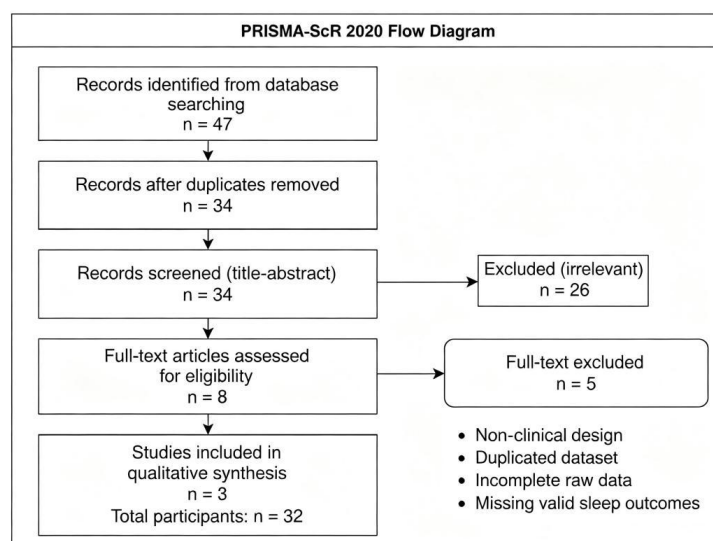


Figure 1 PRISMA-ScR 2020 Flow Diagram Showing the Study-Selection Process of This Scoping Review

3.2 Basic Characteristics of Included Studies

The main characteristics of the three included pilot studies, including publication year, study region, sample size, participant profiles, intervention protocol, duration, outcome measures, key findings and JBI evidence levels, are summarised in Table 1.

Table 1 Basic Characteristics of the Included Pilot Studies

No.	Year	Region	Sample Size	Participant Characteristics	Intervention Protocol	Duration	Outcomes	Main Results	JBI Evidence Level
1	2024	China	12	15-19 years, sleep-onset difficulty ≥ 6 months (ICD criteria)	500 repetitions per hand daily of Tai-Chi Single-Palm Exercise	30 days	PSQI, ISI	Sleep rhythm restored; sleep-scale scores returned to normal range	III
2	2025	Thailand	10	15-19 years, sleep-onset difficulty ≥ 6 months (ICD criteria)	500 repetitions per hand daily of Tai-Chi Single-Palm Exercise	30 days	PSQI, ISI	Sleep rhythm restored; sleep-scale scores returned to normal range	III
3	2025	China-Thailand	10	15-19 years, sleep-onset difficulty ≥ 6 months (ICD criteria)	500 repetitions per hand daily of Tai-Chi Single-Palm Exercise	30 days	PSQI, ISI	Sleep rhythm restored; sleep-scale scores returned to normal range	III
Total	—	China-Thailand	32	—	—	—	—	Overall sleep-assessment indicators returned to normal range	III

3.3 Quality Assessment of Included Studies

All three included studies adopted pre-post observational pilot designs with JBI evidence Level III. No randomisation or blinding was implemented; follow-up was limited to the 30-day intervention period with no long-term follow-up. Baseline characteristics, intervention procedures and outcome-assessment tools were fully reported for all studies. Major sources of bias included absence of control groups, limited sample sizes, and reliance on self-report questionnaires.

4 DISCUSSION

Based on PRISMA-ScR and JBI dual standards and utilising the newly-established cross-cultural-coding framework and Tai-Chi-dose-coding system, this scoping review synthesised evidence from three pilot studies enrolling 32 Chinese-Thai adolescents. Results indicated that 30 consecutive days of Wudang Zhaobao Tai Chi Single-Palm-Exercise practice improved sleep indicators and re-established stable sleep-wake rhythms among 15-19-year-old adolescents with chronic sleep-onset difficulty [4-5]. This exercise requires minimal space and is easy to learn; hence it is suitable for school-based and home-based settings and demonstrates cross-cultural-promotion potential [6, 8].

Mechanistically, repetitive hand movements coordinated with abdominal breathing may modulate sympathetic-parasympathetic balance and reduce nocturnal physiological hyper-arousal, a core pathological feature of adolescent sleep-onset insomnia [3]. Repetitive movements also induce mindfulness-like awareness, reduce pre-sleep rumination, relieve concomitant anxiety and thereby indirectly ameliorate sleep-onset difficulty [2]. Cross-cultural coding indicated similar sleep-improvement trends for Chinese and Thai adolescents, with minor differences in subjective emotional experiences across cultural contexts [6].

Several limitations should be acknowledged. First, the total sample size of 32 participants is small; all studies used pre-post designs without blank or placebo control groups, so placebo and time-related effects cannot be fully separated, yielding limited-grade evidence. Second, only short-term (30-day) efficacy was observed; long-term outcomes and insomnia recurrence remain unknown. Third, studies were performed exclusively within China and Thailand, so extrapolation to adolescents from other geographic regions requires caution [8]. Fourth, outcomes rely predominantly on self-report scales; objective physiological indicators such as polysomnography and heart-rate variability are absent for corroboration [3].

Most previous Tai-Chi-sleep investigations adopted complete long-duration Tai-Chi routines, which impose substantial learning barriers for adolescent populations [4, 7]. Wudang Zhaobao Single-Palm Exercise represents a lightweight specialised practice. The dose-coding system developed herein can standardise intervention parameters in future analogous research and enhance comparability across independent studies. The cross-cultural-coding framework also provides novel analytical perspectives for future Southeast-Asian traditional-mind-body-therapy research [6, 8].

5 CONCLUSION

Available pilot evidence preliminarily suggests that Wudang Zhaobao Tai Chi Single-Palm Exercise, as a non-pharmacological mind-body intervention, can improve sleep indicators and restore stable sleep-wake rhythms among 15-19-year-old adolescents with ≥ 6 -month chronic sleep-onset difficulty in China and Thailand; the intervention is safe and has low implementation barriers [5]. Nevertheless, definitive clinical efficacy cannot be concluded given the limitations of available sample sizes and study designs. The dose-response standardised-coding system and China-Thailand cross-cultural-evidence-coding framework represent methodological innovations that can directly inform the design of future comparable investigations [1].

Future research should prioritise multi-centre randomised controlled trials with enlarged sample sizes and control-group settings. Long-term follow-up of 3 months and 6 months is required to evaluate sustained efficacy and insomnia recurrence [1]. Objective physiological biomarkers including polysomnography and heart-rate variability should be incorporated to explore underlying physiological mechanisms [3]. Subgroup analyses should investigate intervention-effect differences stratified by gender and baseline-anxiety severity. Standardised teaching protocols and supporting educational materials should be further developed to promote the normative clinical application of this traditional mind-body therapy for adolescent-sleep-health. Additional China-Thailand collaborative studies are needed to verify its applicability in populations from diverse cultural backgrounds [6, 8].

COMPETING INTERESTS

The authors have no relevant financial or non-financial interests to disclose.

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