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ORIGINAL STUDY

The Effects of Jasmine and Champaca Aromatherapy Combined with Acupressure on Sleep Quality in Older Adults with Non-Communicable Diseases: A Quasi-Experimental Study in Rural Northern Thailand

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Abstract

Background: **Poor sleep is common among older adults and negatively affects physical and mental health. This study evaluated the effects of jasmine and champaca essential oil aromatherapy combined with acupressure on sleep quality and cardiovascular parameters among older adults.**

Methods: **A quasi-experimental study was conducted in rural Phayao, Thailand. Older adults aged ≥60 years with non-communicable diseases and poor sleep quality (Pittsburgh Sleep Quality Index [PSQI] >5) were assigned to either an intervention group (n = 54), receiving aromatherapy and acupressure for 6 weeks, or a control group (n = 54), receiving usual care. Sleep quality, blood pressure (BP), and pulse rate (PR) were assessed at baseline, post-intervention, and 3 months after intervention completion.**

Results: **Repeated-measures ANOVA showed significant time and group-by-time effects for PSQI, SBP, DBP, and PR (all $p < 0.05$). ANCOVA confirmed greater improvements in the intervention group, with significant reductions in PSQI, SBP, DBP, and PR at both post-intervention and 3-month follow-up (all $p < 0.001$).**

Conclusions: **Jasmine and champaca aromatherapy combined with acupressure significantly improved sleep quality and cardiovascular parameters, supporting its use as a complementary intervention for older adults in rural communities.**

Keywords: Jasmine and champaca, Aromatherapy, Acupressure, Sleep quality, Older adults, Non-communicable diseases

1. Introduction

Insomnia in older adults is a common sleep disorder characterized by difficulty falling asleep, fragmented sleep, early awakening, or waking up feeling unrefreshed [1]. This condition often coexists with age-related physiological changes and chronic diseases prevalent in the elderly, such as diabetes, hypertension, and cardiovascular disease, all of which contribute to a progressive decline in sleep quality [1–3]. It is estimated that 10.0% of the adult population

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experiences insomnia, while an additional 20% reports occasional episodes of poor sleep [3,4]. Previous reviews have indicated that insufficient or inadequate sleep can disrupt fundamental neural processes and negatively impact brain function [5]. This disruption may lead to psychiatric disorders and increase the risk of chronic diseases (also called non-communicable diseases), as well as exacerbate existing conditions [5,6]. Furthermore, the burden of chronic diseases may lead to a decline in sleep quality, which in turn affects overall quality of life [6]. Thus, there is a bidirectional relationship between insomnia and chronic conditions [7].

The management of insomnia in older adults can be divided into two approaches: pharmacological and non-pharmacological interventions [8]. The use of medications carries a higher risk of side effects in the elderly compared to other age groups, due to age-related changes in pharmacokinetics and pharmacodynamics [8,9]. Some studies have indicated that alternative therapies can reduce adverse symptoms and promote better sleep quality [8,9]. A previous review has shown that aromatherapy has been proven effective in reducing stress and promoting sleep quality [10]. In addition, a systematic review has indicated that non-pharmacological interventions are evidence-based and safe, making them a recommended strategy for addressing poor sleep quality in patients, including older adults [9].

NCDs represent a significant global health burden, accounting for 71.0% of all deaths worldwide [7]. In Thailand, statistics from the elderly population in 2024 indicate that approximately 85.0% have at least one chronic condition, and 56.0% have two or more chronic conditions [11]. Patients with NCDs often experience severe psychological distress, including anxiety about death and insomnia, which can negatively impact their quality of life [12]. Moreover, medications commonly prescribed for NCDs, such as antihypertensives, statins, metformin, and antidepressants, have been reported to alter sleep quality and sleep architecture, potentially exacerbating insomnia symptoms [13]. Previous studies have shown that poor sleep quality negatively impacts the incidence of cardiovascular and metabolic diseases, reduces quality of life, and increases mortality rates [14,15]. Some studies have indicated that individuals with poor sleep often have lower heart rates during sleep compared to those with good sleep quality [15,16].

Aromatherapy is a widely recognized approach within Complementary and Alternative Medicine (CAM) and is closely integrated with Thai traditional medicine (TTM). It emphasizes the use of plant-derived essential oils to restore physical and psychological balance [17,18]. Among essential oils, lavender is the most extensively studied for sleep improvement, with several reviews demonstrating its effectiveness in reducing anxiety and improving sleep onset and duration [19,20]. Despite this well-established evidence base, jasmine (*Jasminum sambac*) and champaca (*Michelia champaca*) were selected in the present study due to their unique cultural relevance and accessibility in Thailand. Both plants are traditionally used in TTM to promote relaxation, calm the mind, nourish the heart and relieve dizziness [21]. Moreover, their widespread availability and familiarity, particularly in rural communities, may enhance acceptability, adherence, and feasibility of implementation compared with less locally integrated oils such as lavender.

To further support this selection, from a phytochemical perspective, jasmine and champaca essential oils contain a variety of volatile aromatic compounds. The major constituents reported in jasmine essential oil include benzyl acetate, benzyl benzoate, and linalool [22], whereas champaca essential oil is characterized by compounds such as α- and β-ionones, dihydro-β-ionone, cis-linalool oxide, and linalool [23]. Among these constituents, linalool is considered important bioactive compounds present in both oils. In comparison, lavender essential oil is primarily composed of monoterpenes, and also contains linalool, which is commonly regarded as a key chemical marker and a major contributor to its anxiolytic and sedative effects [24]. Experimental and preclinical studies further suggest that this compound may influence central nervous system activity through mechanisms such as potential inhibition of NMDA receptors and enhancement of GABA-A receptor function, thereby reducing arousal and promoting relaxation. [25–27]. These mechanisms are also associated with autonomic nervous system regulation [28], such as reduced sympathetic activity and increased parasympathetic tone, which may contribute to relaxation and improved sleep [26,27,29].

However, these effects remain hypothetical and are primarily supported by preclinical evidence, with limited direct clinical validation. In terms of clinical evidence, although lavender has stronger clinical evidence that it can enhance the sleep quality of adults [30], emerging clinical studies indicate that jasmine aromatherapy may also improve sleep quality in specific patient groups, such as individuals undergoing hemodialysis in patients with chronic conditions [27]. Nevertheless, comparative clinical evidence remains limited, particularly for champaca and for the combined use of these oils. While jasmine and champaca have comparatively limited clinical evidence relative to lavender, their cultural embeddedness within Thai traditional medicine and

practical accessibility in rural settings support their relevance in this study context. This focus also delineates a clear gap in existing research, as no prior studies have systematically evaluated the combined use of these essential oils with acupressure among older adults with NCDs.

Acupressure is a non-pharmacological therapy rooted in traditional Chinese medicine (TCM), which involves applying pressure with the fingers or blunt instruments on specific points of the body to restore energy balance [31]. Several studies have indicated that acupressure can enhance sleep quality across various populations [32]. Its safety, ease of self-administration, ability to reduce the side effects of medication, and modest treatment costs make it a viable alternative [32]. According to TCM, insomnia is believed to result from an imbalance of Qi (vital energy) and Xue (blood) [32]. Acupressure is a therapeutic method that helps restore energy balance along the meridian pathways and alleviates tension in the nervous system [32]. Key acupressure points, such as Shenmen (HT7), Neiguan (PC6), Yongquan (KI1), and Sanyinjiao (SP6), are commonly used for this purpose [33]. A previous study has found that acupressure at HT7 and KI1 points helps increase melatonin levels and improve sleep quality [34,35]. Some studies also indicate that acupressure can address factors associated with poor sleep quality, such as pain and inflammation [36].

Furthermore, this study applies self-care concept to intervention activities to enable elderly people in rural areas with chronic non-communicable diseases to independently manage their sleep health [37,38]. This approach engages individuals, families, and communities in promoting sleep, preventing insomnia, and addressing NCD-related sleep disturbances [37,39]. Prior research has indicated that self-care strategies can significantly improve knowledge and skills in managing sleep problems among the elderly [39,40]. While there is evidence supporting the use of both aromatherapy and acupressure in promoting sleep, studies integrating these two approaches specifically the use of jasmine and champaca essential oils combined with acupressure in older adults with NCDs remain limited.

This study aimed to evaluate the effectiveness of jasmine and champaca essential oil therapy combined with acupressure on sleep quality in elderly individuals living in rural northern Thailand. All of our participants had the one of six most prevalent NCDs among older adults in Thailand: hypertension (HT), type 2 diabetes mellitus (DM), chronic kidney disease (CKD), stroke, coronary artery disease (CAD), and hyperlipidemia, as they represent critical conditions associated with poor sleep quality and adverse health outcomes [16].

2. Method

2.1. Research design

This study employed a quasi-experimental pretest−posttest design, with participants assigned to an experimental group and a control group. The research was conducted from December 2024 to May 2025 in the rural area of Pha Chang Noi Subdistrict, Pong District, Phayao Province, Thailand. This is a remote, highland region located near the provincial border. The majority of the population belongs to an ethnic group of Chinese descent resulting from historical migration [41].

2.2. Participants and sample size

The researchers employed purposive sampling to select the study area from among the seven subdistricts of Pong District, Phayao Province. Older adults with NCDs were selected as the target population because they are at increased risk of poor sleep quality and related adverse health outcomes. Selection criteria included subdistricts with a rapidly increasing number of registered older adults with NCDs in rural areas and the willingness of the subdistrict health-promoting hospital administrators to collaborate in the research implementation. The sampling procedure consisted of three steps: (1) selecting two villages (Village 2 and Village 8) from the eight villages in Pha Chang Noi Subdistrict via simple random sampling using a lottery method; (2) compiling lists of older adults with specified NCDs for the selected villages from the Phayao Health Data Center database; and (3) randomly sampling participants from these lists using a lottery method to achieve the required sample size.

Village 2 was designated as the intervention group and Village 8 as the control group (Fig. 1). Both groups lived in settlements in hilly regions with little access to transportation, about ten kilometers apart. The risk of contamination was minimal because of the geographical distance between the groups, which decreased contacts and resource sharing. Additionally, the social and demographic traits of the two groups were similar. Selection bias was reduced because of the cluster allocation, geographic distance between the two villages, and demographic similarity between the two groups.

Inclusion criteria were: (a) aged 60 years or older; (b) diagnosed by a physician and registered as a patient with NCDs, specifically HT, DM, CKD,

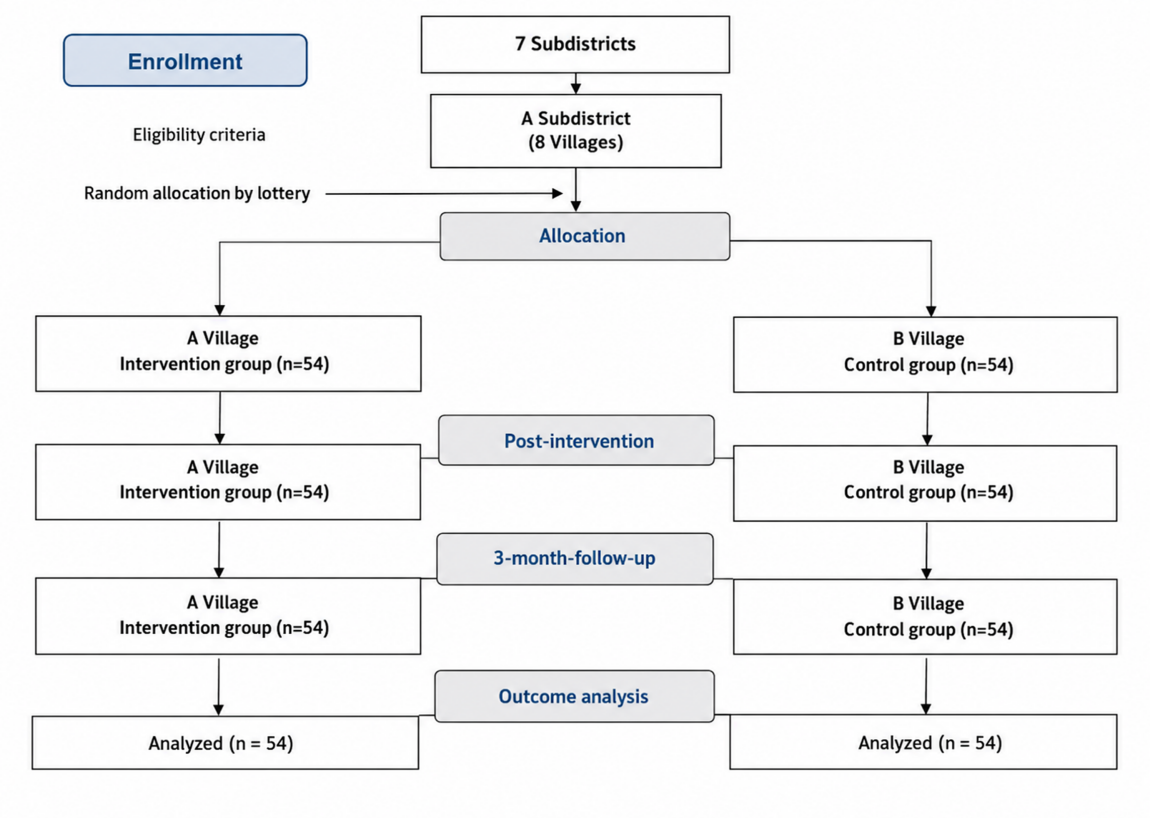

Fig. 1. CONSORT flow diagram of the study participants.

stroke, CAD, or hyperlipidemia, in the HOSxP system (Hospital Information eXtreme Platform) of the Health Data Center Phayao for at least one year; (c) a Pittsburgh Sleep Quality Index (PSQI) score greater than 5 within the past month; (d) residing in Pha Chang Noi Subdistrict for at least one year; (e) able to communicate in Thai (central Thai) or the local Northern Thai dialect (Kham Mueang), which are commonly used in the study area and (f) willing to participate and providing written informed consent. Exclusion criteria included individuals with cognitive or psychiatric disorders, diagnosed dementia, blindness, or those with severe medical conditions or undergoing replacement therapy (e.g., hemodialysis or peritoneal dialysis).

2.3. Sample size calculation

In this study, the sample size was calculated using G*Power Version 3.1.9.7 [42] using the following conditions: ANOVA repeated measures, within-between interaction, statistical power of 0.8, a significance level of 0.05, and nonsphericity correction of 0.9. Based on a literature review [43], a medium effect size (f = 0.25) was determined. This calculation indicated a required sample size of 90 participants per group. To account for potential attrition during program participation, the sample size was increased by 20%. The resulting recommended sample size was a total of 108 participants for the study, divided equally into an experimental group and a control group of 54 participants each.

2.4. Data collection instruments

The research instrument was an interviewer-administered questionnaire. Its content validity was evaluated by a panel of three experts in internal medicine, public health, and TCM to ensure its appropriateness for use among older adults in the study area. The item-objective congruence (IOC) technique was employed to evaluate the content validity of all questionnaires through review by subject-matter experts. The PSQI was pilot tested with 30 individuals who shared similar characteristics to the target older adult population. The instrument demonstrated good internal consistency, yielding a Cronbach's alpha coefficient of 0.85.

The questionnaire consisted of two parts. *Part 1* included sociodemographic and health-related

variables: age, gender, marital status, education, occupation, income, income sufficiency, sleep quality information, alcohol consumption, smoking status, caffeine intake, underlying diseases, blood pressure (BP), and pulse rate (PR). *Part 2* consisted of the Pittsburgh Sleep Quality Index (PSQI), translated into Thai by Jirapramukpitak T. [43]. The PSQI is a self-administered questionnaire that assesses sleep quality and sleep disturbances over the past month. It comprises 19 items grouped into seven components: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleep medication, and daytime dysfunction. Each component is scored from 0 to 3, where a score of 0 indicates no difficulty and 3 indicates severe difficulty. The seven component scores are summed to generate a global score ranging from 0 to 21. A total score greater than 5 indicates poor sleep quality [43].

2.5. Intervention tools and procedures

The intervention tools were adapted from previous studies and were informed by the Self-Care Concept, Traditional Chinese Medicine (TCM) theory of Qi and meridian balance, and Thai Traditional Medicine (TTM) principles related to the use of aromatic medicinal plants. The intervention program consisted of champaca essential oil combined with acupressure to improve sleep quality among older adults with chronic NCDs [29,31]. It integrated both TCM and TTM, incorporating the concept of self-care [37]. The activities were designed to enable participants to take care of their own health and well-being through continuous practice and learning that responded to their fundamental needs.

The essential oils and almond oil used in this study were supplied by CHEMIPAN.COM (Chemipan Corporation Co., Ltd., Thailand). The products were manufactured under certified quality standards (e.g., GMP and ISO 9001) in Thailand. The formulation consisted of jasmine and champaca essential oils diluted in almond oil to achieve a total concentration of 10% (v/v), adapted from a previous clinical aromatherapy study [44]. The blend was prepared in a 1:1 ratio (5% jasmine and 5% champaca). Almond oil was used as a carrier due to its favorable safety profile and common use in aromatherapy practice [45].

Participants were instructed to inhale the formulation each night before bedtime by holding the bottle approximately 3 cm below the nostrils and breathing normally for approximately 5 min [44]. The intervention was conducted for seven consecutive nights to assess short-term effects on sleep outcomes. Upon waking each morning, participants recorded their sleep quality in a designated daily log.

Participants were specifically instructed to maintain natural, relaxed breathing (i.e., normal tidal breathing) throughout the procedure, without engaging in slow deep breathing or any controlled breathing techniques. No structured inhalation−exhalation pattern (e.g., timed breathing cycles) was imposed. In this context, "continuous inhalation" refers to uninterrupted normal breathing over the 5-minute period, with no pauses between breaths rather than sustained or forced inhalation [46]. Based on typical resting respiratory rates (approximately 12 breaths per minute) [46], this corresponds to approximately 60−80 breathing cycles, depending on individual variability.

During the implementation phase, research assistants were recruited from the local area, including two public health officers, two nurses, and four village health volunteers. The principal investigator conducted a structured 2-h training session for research assistants, divided into four components: (1) 30-minute introduction, objective clarification, and orientation to data collection instruments (interview questionnaires, PSQI, and BP/PR measurement protocols); (2) 45-minute hands-on practice of intervention procedures, including jasmine and champaca essential oil application, acupressure techniques based on TCM principles, and daily logbook recording; (3) 30-minute review of observational guidelines, follow-up, and fidelity monitoring protocols; and (4) 15-minute standardized competency assessment to ensure uniform understanding across the team. Assistants practiced under direct supervision with immediate feedback to ensure consistency, although formal standardized testing was not implemented. Inter-rater reliability was not formally assessed; however, procedural standardization was maintained through the principal investigator's weekly supervision of follow-up visits, including logbook reviews and home visit observations. Therefore, these procedures ensured standardized delivery of the intervention and minimize variability in implementation.

During the intervention phase, participants in the experimental group received a daily logbook and a self-care manual developed by the researchers based on an adaptation and review of relevant literature [44,47,48]. The logbook was used to record daily activities, including bedtime, sleep onset time, waking time, BP, and PR. The manual also provided instructions for acupressure techniques based on TCM principles. Participants completed the logbook themselves; while research assistants conducted

weekly follow-ups to review entries. A total of 10 follow-up sessions were carried out during the study period.

This program was designed as a series of small–group activities conducted once weekly over a six-week period. Each session lasted approximately 3 h, with flexibility to adjust the duration as needed based on the nature of the activities and participant convenience. The research intervention program consisted of the components illustrated in Fig. 2.

Week: comprised three activities: (1) Rapport-building and orientation. This session aimed to foster a positive relationship with older participants. It included member introductions, an explanation of the research objectives, and a structured group process designed to encourage discussion and exchange of information and experiences. Participants collaboratively analyzed the causes and consequences of insomnia commonly observed among older adults. A representative from the group was invited to present the discussion outcomes to promote engagement and communication (60 min). (2) Acupressure demonstration (60 min): Participants were trained to perform self-administered acupressure nightly before bedtime. The intervention targeted five acupoints along the meridian pathways: BAI HUI (GV20), YIN TANG (EX-HN3), SHEN MEN (HT7), NEI GUAN (PC6), and SAN YIN JIAO (SP6) [49]. Participants were instructed to apply pressure to each point for 2–3 min every night for three consecutive weeks and to record their sleep outcomes using the provided logbook and manual [49] (Fig. 3 and Table 1. Self-acupressure for sleep promotion). (3) Instruction on the use of jasmine and champaca essential oils (60 min): Participants were guided on how to use champaca essential oil to promote relaxation before bedtime, with an emphasis on hands-on practice and preliminary evaluation as described previously. Follow-up and record keeping: All older participants were provided with a daily activity logbook designed by the research team to record sleep quality and serve as a self-reminder tool. During the intervention, research assistants monitored and evaluated participants' adherence on a daily basis. In addition, the research team conducted systematic weekly follow-ups to ensure that the activities were implemented according to protocol and that consistency in practice was maintained.

Week 2: included two activities: (1) Health education session (90 min): Participants received a lecture on NCDs, supplemented with researcher-designed animated cartoons to enhance understanding. The session also introduced the "My Body System" model, created by the researchers to explain the functions of various organs related to bodily degeneration and the development of chronic non-communicable diseases in older adults. (2) Sleep education session (60 min): Participants were provided with information on sleep quality in older adults, the effects of insufficient sleep on physical and mental health, and self-care strategies to promote healthy sleep. At the

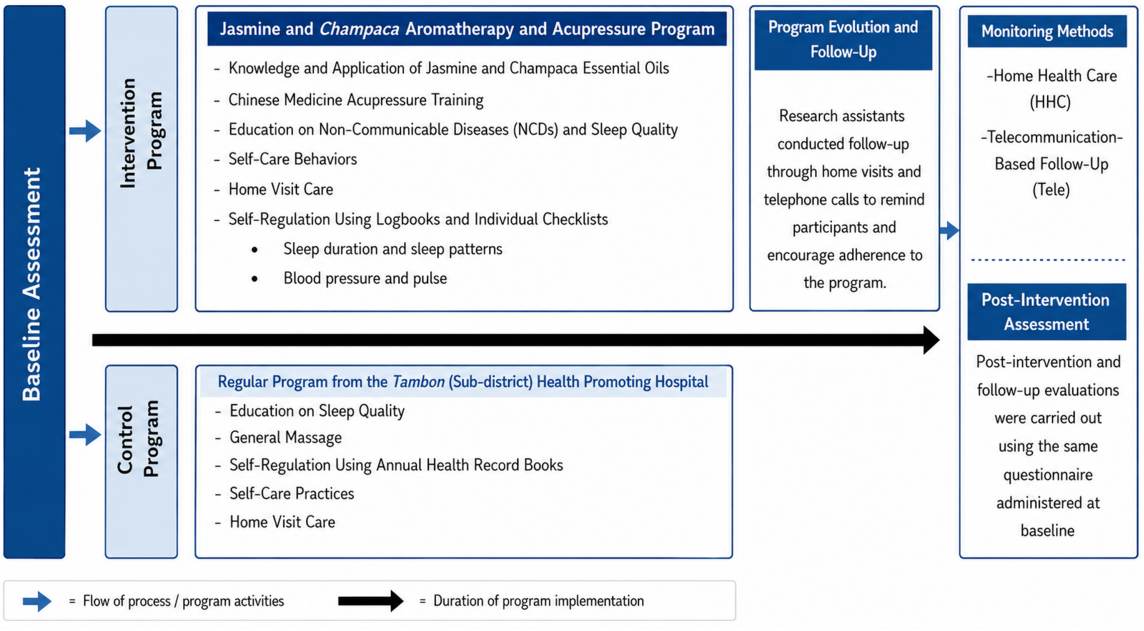

Fig. 2. Schedule of intervention.



Fig. 3. Chinese medicine acupressure intervention: (a) BAI HUI, GV20; (b) YIN TANG, EX-HN3; (c) SHEN MEN, HT7; (d) NEI GUAN, PC6; (e) SAN YIN JIAO, SP6.

conclusion of the session, older adult participants were invited to present and summarize what they had learned from the activities. This exercise aimed to encourage self-expression and facilitate knowledge sharing among group members (60 min). Follow-up assessments were conducted to monitor participants' ongoing use of jasmine and champaca essential oils, as well as acupressure techniques, to evaluate adherence and the effectiveness of these self-care practices in their daily lives.

Week 3: Self-regulation activities; "Caring for the Mind for Better Sleep, Caring for Life for Better Health." The objective was to help older adults set goals and self-regulate behaviors that promote healthy sleep, using complementary and alternative medicine approaches, particularly locally sourced herbal essential oils and TCM acupressure techniques (120 min). During this session, participants also received hands-on training in the correct use of jasmine and champaca essential oil inhalation, conducted by a TTM practitioner (See section 2.5). Participants practiced the technique under direct supervision. Research staff gave immediate feedback and correction were provided to ensure accurate performance. Participants were also trained in the correct acupressure technique for the selected acupoints. The pressure intensity was standardized based on the participant's comfortable pain threshold corresponding to the De-qi sensation (e.g., soreness, distension, or numbness). This approach is consistent with the concept proposed by Mehta et al. (2017) [50], which suggests that the physiological effects of pressure application may vary depending on anatomical location and individual response. Consequently, selecting a pressure intensity tailored to the participant's condition and physiological tolerance helps optimize therapeutic outcomes and ensures that stimulation at each

Table 1. Self-acupressure for sleep promotion.

Acupoint	Location	Acupressure technique	Frequency and duration	Evaluation
BAI HUI, GV20 (百会)	On the vertex of the head at the sagittal midline of the scalp at the midpoint of the line connection the apexes of both ears.	Using 4 finger pads gently tap the area of this acupoint on the scalp.	60/min for 1 min.	PSQI
YIN TANG, EX-HN3 (印堂)	At the midpoint between the medial ends of the eyebrows.	Use the pad of the index finger to gently press and massage the acupoint located between the eyebrows.	60/min for 1 min.	
SHEN MEN, HT7 (神门)	On the posteromedial aspect of the wrist radial to the flexor carpi ulnaris tendon at the palmar wrist crease.	Using thumb pad firmly massage the surrounding area of this acupoint on the ulnar side of the wrist unilaterally.	60/min for 1 min (bilateral, 2 mins in total).	
NEI GUAN, PC6 (内关)	On the medial aspect of the forearm between the palmaris longus and flexor carpi medial tendons, 2 cun proximal to the palmar wrist crease.	Using thumb pad firmly massage the surrounding area of this acupoint on the medial side of the wrist unilaterally.	60/min for 1 min (bilateral, 2 mins in total).	
SAN YIN JIAO, SP6 (三阴交)	On the tibial aspect of the leg posterior to the medial border of the tibia, 3 cun superior to the prominence of the medial malleolus.	Using the pad of the thumb, firmly massage the area surrounding this acupoint on the medial side of one ankle.	60/min for 1 min (bilateral, 2 mins in total).	

Note: Cun is a traditional Chinese proportional body measurement used for acupoint location. One cun is approximately equal to the width of the patient's thumb at the interphalangeal joint; 1.5 cun corresponds to the combined width of the index and middle fingers, and 3 cun corresponds to the width of four fingers held together (excluding the thumb).

acupoint is applied both safely and effectively. Additionally, a brainstorming activity titled "Pairing Good Sleep with Good Health" was conducted to encourage participants to analyze the relationship between sleep behaviors and chronic NCDs. Participants were divided into small groups to discuss and present their findings (60 min).

Week 4: Goal-setting activity; "Sleep Goal for Health" aimed to enhance motivation and awareness among older adults to modify sleep-related behaviors (120 min). This activity focused on guiding participants to set personal goals related to "sleep time management" and "pre-sleep self-care" through an empowerment process, fostering sustainable behavioral change. Following this, a reflective learning activity was conducted using jasmine and champaca essential oils combined with relaxation acupressure techniques. This session served to evaluate the effectiveness of aromatherapy in promoting sleep quality and preventing chronic NCDs (60 min).

Weeks 5−6: Self-management activities to promote sleep in older adults. The objective of these sessions was to enable participants to analyze the benefits and limitations of using jasmine and champaca essential oils in combination with relaxation acupressure techniques (120 min). Brainstorming and experience-sharing activities were conducted, during which participants discussed strategies to modify sleep-related behaviors, such as adjusting bedtime, sleep duration, and evaluating outcomes from the various learned practices. To objectively assess adherence, participants were instructed to record bedtime, sleep onset, waking time, and sleep duration daily in their logbooks. Local research assistants reviewed these entries weekly to verify compliance. Predefined behavioral targets included maintaining consistent bedtimes (within ±30 min of the set goal) and achieving a sleep duration of 6−8 h per night. These thresholds were used to evaluate adherence and ensure systematic monitoring of compliance. These activities served as a practical guide for maintaining self-care and promoting overall health (60 min).

Weeks 7−12: Follow-up activities were conducted to assess the continuity and effectiveness of self-care practices for sleep among older adults. The process emphasized communication and empowerment through active participation of local research assistants. Follow-up activities were standardized to ensure consistency across participants. Each participant in the intervention group received two scheduled home visits (30−40 min each) or, if home visits were not feasible, two telephone follow-up phone conversations (20−30 min each), with pre-specified frequency and duration to maintain comparability. These follow-up sessions aimed at building rapport and providing close guidance, while also offering encouragement, providing reminders, and monitoring progress in implementing

the intervention activities. Research assistants also reviewed participants' logbook entries during these follow-up visits to verify adherence, reinforce correct practice (including essential oil inhalation technique), and address any difficulties encountered. For the control group, routine follow-up was provided by primary health service staff, including review of their senior health logbook, to minimize differential attention and reduce the risk of attention bias.

The control group received standard care provided by local health services, including general health education and a senior health logbook from the subdistrict health-promoting hospital to monitor daily health. This logbook differed from the intervention version, lacking acupressure instructions or TCM-based guidance. Research assistants monitored potential contamination by screening control participants during assessments and inquiring about cross–group interactions during intervention follow-ups; no exposure to intervention elements among the control group occurred.

Assessments were conducted at baseline and immediately post-intervention (over a 12-week period), as well as at a 3-month follow-up. The same interview-based instruments were used in both groups to evaluate changes in outcomes, including BP, PR, and sleep quality as measured by the PSQI.

2.6. Data analysis

Descriptive statistics were used to examine general data in order to determine frequency, percentage, mean, and standard deviation. The independent t-test for continuous variables and the Chi-square test for categorical variables were used to compare demographic traits between the experimental and control groups. Using repeated-measures analysis of variance (ANOVA), data on PSQI, Systolic Blood Pressure (SBP), Diastolic Blood Pressure (DBP), and PR were examined to assess the statistical significance of the program effect across the different time periods. The Greenhouse–Geisser correction was applied when the assumption of sphericity was violated according to Mauchly's test. Pairwise comparisons were adjusted using the Bonferroni method. In addition, analysis of covariance (ANCOVA) was performed to compare between-group differences in change from baseline at post-intervention and follow-up, with the baseline value of each outcome included as a covariate. The level of statistical significance was set at 0.05. All statistical analyses were performed using IBM SPSS Statistics Version 29 (IBM Corp., Armonk, NY).

2.7. Ethical statement

The study was conducted in accordance with the Declaration of Helsinki and was approved by the University of Phayao Human Ethics Committee, Thailand (HREC-UP-HSST 1.2/062/68; approval date: March 2025). All participants provided informed consent before participation, and their data were handled confidentially.

3. Results

Baseline characteristics of all one hundred and eight participants (54 in the intervention group and 54 in the control group) indicated that the mean age (SD) was 68.0 (6.21) years. The majority were female (62.0%) and married (69.4%); more than half had an education (53.7%) and reported sufficient income (64.8%). The mean duration since diagnosis with NCDs was 6.96 years (range 2–19 years; SD = 4.12). Classification of NCDs revealed that the majority had hypertension (HT) (87.0%) or hyperlipidemia (51.9%), while smaller proportions had diabetes mellitus (DM) (33.3%), stroke (14.8%), coronary artery disease (CAD) (5.6%), and chronic kidney disease (CKD) (0.9%). Additionally, most participants had a caregiver (70.4%) around one-fifth received information (17.6%). More than half of the participants reported alcohol intake (50.9%), caffeine intake (63.0%), while fewer participants reported smoking (35.2%), exercising (24.1%), and a history of falls (25.9%). Almost one-third of participants had an overweight body mass index (BMI) (31.5%). Results from Chi-square tests showed no significant differences in demographic characteristics between the two groups at baseline ($p > 0.05$; Table 2).

The analysis of repeated-measures ANOVA revealed a statistically significant interaction effect of the Jasmine and Champaca aromatherapy combined with acupressure program on changes in PSQI scores, BP, and PR, with reductions observed in these parameters among participants ($p < 0.05$). The results also showed significant time-dependent effects on PSQI, BP levels, and PR ($p < 0.05$). The program produced significant group effects for PSQI and BP, whereas the group effect for PR showed a trend toward significance ($p = 0.079$; Table 3).

A comparison of outcomes between the intervention and control groups was conducted at baseline, post-intervention, and follow-up. At baseline, no statistically significant differences were observed in PSQI scores, DBP, or PR between the two groups; however, SBP was significantly lower in the intervention group than in the control group ($p < 0.05$). Following the intervention and at follow-

Table 2. Demographic characteristics among participants in intervention and control groups.

Variable	Total (n = 108)	Intervention group (n = 54)	Control group (n = 54)	*p*-value
	n (%)	n (%)	n (%)	
Age				0.222
Mean (SD)	68.06 (6.21)	68.80 (6.06)	67.33 (6.32)	
Min-max	60–89	60–89	60–89	
Duration of non-communicable ddisease				0.377
Mean (SD)	6.96 (4.12)	7.31 (4.12)	6.61 (4.13)	
Min-max	2–19	2–18	2–19	
Gender				0.428
Male	41 (38.0%)	33.3%	42.6%	
Female	67 (62.0%)	66.7%	57.4%	
Marital status				0.676
Married	75 (69.4%)	72.2%	66.7%	
Single/widowed/divorced/separated	33 (30.6%)	27.8%	33.3%	
Education				0.563
No	50 (46.3%)	42.6%	50.0%	
Yes	58 (53.7%)	57.4%	50.0%	
Occupation				0.331
No	46 (42.6%)	48.1%	37.0%	
Yes	62 (57.4%)	51.9%	63.0%	
Income				0.546
Insufficient	38 (35.2%)	38.9%	31.5%	
Sufficient	70 (64.8%)	61.1%	68.5%	
HT				1.000
No	14 (13.0%)	13.0%	13.0%	
Yes	94 (87.0%)	87.0%	87.0%	
DM				0.307
No	72 (66.7%)	61.1%	72.2%	
Yes	36 (33.3%)	38.9%	27.8%	
CKD				1.000[a]
No	107 (99.1%)	98.1%	100.0%	
Yes	1 (0.9%)	1.9%	0.0%	
Stroke				0.787
No	92 (85.2%)	83.3%	87.0%	
Yes	16 (14.8%)	16.7%	13.0%	
CAD				1.000[a]
No	102 (94.4%)	94.4%	94.4%	
Yes	6 (5.6%)	5.6%	5.6%	
Hyperlipidemia				0.177
No	52 (48.1%)	55.6%	40.7%	
Yes	56 (51.9%)	44.4%	59.3%	
Has a caregiver				0.833
No	32 (29.6%)	31.5%	27.8%	
Yes	76 (70.4%)	68.5%	72.2%	
Alcohol intake				0.248
No	53 (49.1%)	55.6%	42.6%	
Yes	55 (50.9%)	44.4%	57.4%	
Smoking				0.314
No	70 (64.8%)	70.4%	59.3%	
Yes	38 (35.2%)	29.6%	40.7%	
Caffeine intake				0.319
No	40 (37.0%)	42.6%	31.5%	
Yes	68 (63.0%)	57.4%	68.5%	
Exercising				0.500
No	82 (75.9%)	72.2%	79.6%	
Yes	26 (24.1%)	27.8%	20.4%	
History of falls				0.511
No	80 (74.1%)	77.8%	70.4%	
Yes	28 (25.9%)	22.2%	29.6%	
Receiving information				0.614
No	89 (82.4%)	79.6%	85.2%	
Yes	19 (17.6%)	20.4%	14.8%	

(*continued on next page*)

Table 2. (continued)

Variable	Total (n = 108)	Intervention group (n = 54)	Control group (n = 54)	*p*-value
	n (%)	n (%)	n (%)	
BMI				0.448
Underweight (<18.50 kg/m^2)	10 (9.3%)	11.1%	7.4%	
Normal (18.50–22.99 kg/m^2)	54 (50.0%)	42.6%	57.4%	
Overweight (23.00–24.99 kg/m^2)	34 (31.5%)	37.0%	25.9%	
Obesity (≥25.00 kg/m^2)	10 (9.3%)	9.3%	9.3%	

Abbreviations: HT, hypertension; DM, diabetes mellitus; CKD, chronic kidney disease; CAD, coronary artery disease; BMI, body mass index.

[a] *p*-value is calculated using Exact test.

up, the intervention group showed significantly lower mean PSQI scores, BP levels, and PR compared with the control group ($p < 0.05$), as presented in Table 4 and Fig. 4.

ANCOVA showed significant between-group differences in changes from baseline in PSQI, SBP, DBP, and PR at both post-intervention and follow-up times, with baseline values included as covariates ($p < 0.05$). At post-intervention, the intervention group demonstrated greater reductions in PSQI (−2.3 points), SBP (−8.2 mmHg), DBP (−3.7 mmHg), and PR (−4.2 bpm) than the control group. At follow-up, the intervention group continued to demonstrate greater reductions in PSQI (−3.4 points), SBP (−14.0 mmHg), DBP (−6.5 mmHg), and PR (−6.5 bpm) than the control group (all $p < 0.05$; Table 5).

4. Discussion

The findings of this study demonstrate that participants who received the jasmine and champaca essential oil aromatherapy combined with acupressure experienced significant improvements in sleep quality. In addition, the intervention significantly reduced BP and PR and enhanced overall sleep quality among older adults with NCDs. These effects may be explained by the use of jasmine and champaca essential oils, developed by the researchers based on prior work [34], in conjunction with acupressure massage applied to five acupoints along meridian pathways according to TCM principles. The intervention was performed nightly before bedtime for six consecutive weeks, with weekly activities specifically designed to facilitate behavioral and physiological changes in accordance with the predefined program objectives. As a result, mean PSQI scores, BP levels, and PR decreased compared with the control group throughout the three-month study period, which may be associated with improved autonomic balance [39]. But causality cannot be confirmed due to the quasi-experimental design. These findings are consistent with previous studies on the benefits of aromatherapy using essential oils, which have demonstrated sedative, calming, muscle-relaxant, and analgesic properties [51]. Some studies have reported that aromatherapy using plant-derived extracts serves as a complementary therapy that helps reduce stress and improve sleep quality [28–30].

However, baseline PSQI scores were relatively high; thus, the possibility of regression to the mean should be considered when interpreting the observed improvements. As shown in Table 4, both groups demonstrated some reduction in PSQI scores over time. This improvement in the control group may partly reflect natural variation or the effect of standard care, as participants received a self-care manual aimed at promoting better sleep practices. Yet, the magnitude of improvement was notably greater in the intervention group.

In addition to the manual provided to both groups, participants in the intervention group received training in aromatherapy and acupressure, which may have enhanced the intervention effect.

Table 3. Repeated measures ANOVA of participants' outcomes between the intervention and control groups.

Variable	F-test	df	*p*-value	Partial eta squared
PSQI (score)				
Intervention	66.598	1	<0.001*	0.386
Time[a]	1600.460	1.854	<0.001*	0.938
Intervention x time[a]	71.415	1.854	<0.001*	0.403
SBP (mmHg)				
Intervention	50.515	1	<0.001*	0.323
Time[a]	358.916	1.453	<0.001*	0.772
Intervention x time[a]	37.528	1.453	<0.001*	0.261
DBP (mmHg)				
Intervention	5.059	1	0.027*	0.046
Time[a]	302.603	1.521	<0.001*	0.741
Intervention x time[a]	60.510	1.521	<0.001*	0.363
PR (bpm)				
Intervention	3.154	1	0.079	0.029
Time[a]	263.544	1.424	<0.001*	0.713
Intervention x time[a]	66.907	1.424	<0.001*	0.387

PSQI= Pittsburgh Sleep Quality Index; SBP = systolic blood pressure; DBP = diastolic blood pressure; PR = pulse rate.

[a] Greenhouse-Geisser correction.

[*] Significance at 0.05 level.

Table 4. Comparing the mean values for outcome measures at baseline, after intervention, and at 3-month follow-up among intervention and control groups.

Variable	Total (n = 108)	Intervention group (n = 54)	Control group (n = 54)	Mean difference (SE)	*p*-value
	Mean (SD)	Mean (SD)	Mean (SD)		
PSQI (score)					
Baseline	15.05 (1.44)	14.94 (1.38)	15.15 (1.50)	0.204 (0.277)	0.464
Post-intervention	10.03 (1.98)	8.81 (1.68)	11.24 (1.45)	2.426 (0.303)	<0.001*
Follow-up	7.31 (2.34)	5.59 (1.68)	9.04 (1.49)	3.444 (0.305)	<0.001*
SBP (mmHg)					
Baseline	136.44 (6.95)	135.11 (6.41)	137.78 (7.27)	2.667 (1.319)	0.046*
Post-intervention	125.26 (9.42)	120.37 (7.10)	130.15 (8.94)	9.778 (1.554)	<0.001*
Follow-up	117.22 (11.67)	109.67 (6.91)	124.78 (10.52)	15.111 (1.713)	<0.001*
DBP (mmHg)					
Baseline	81.52 (7.48)	81.83 (5.60)	81.20 (9.03)	0.630 (1.445)	0.664
Post-intervention	76.97 (6.92)	75.37 (4.62)	78.57 (8.36)	3.204 (1.300)	0.015*
Follow-up	74.12 (6.93)	71.11 (3.90)	77.13 (7.95)	6.019 (1.206)	<0.001*
PR (bpm)					
Baseline	90.64 (10.37)	90.83 (10.53)	90.44 (10.30)	0.389 (2.004)	0.847
Post-intervention	86.56 (9.20)	84.63 (8.53)	88.50 (9.52)	3.870 (1.739)	0.028*
Follow-up	84.14 (9.54)	81.07 (7.84)	87.20 (10.16)	6.130 (1.746)	0.001*

*Significance at 0.05 level.
PSQI= Pittsburgh Sleep Quality Index; SBP = systolic blood pressure; DBP = diastolic blood pressure; PR = pulse rate.

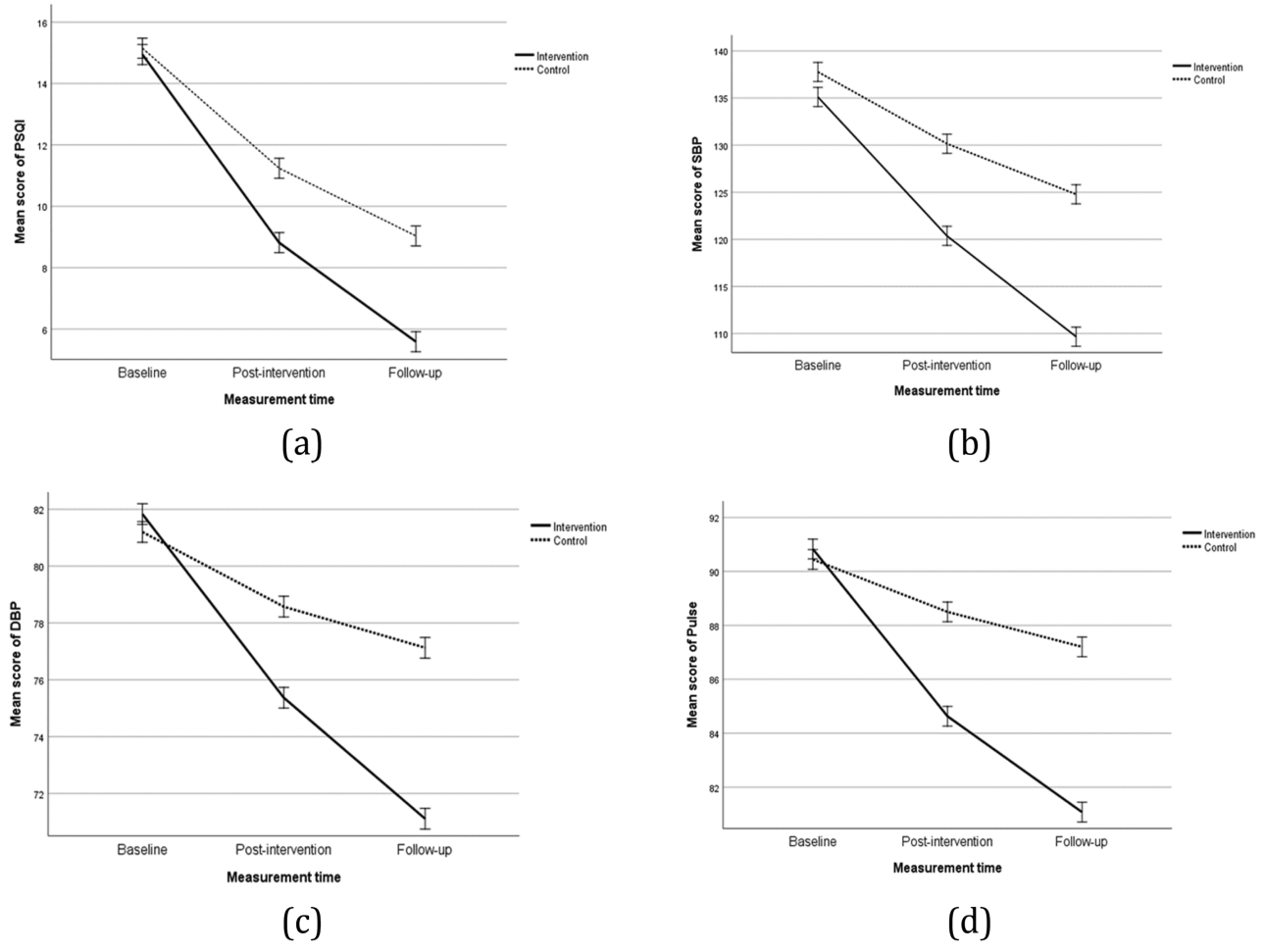

Fig. 4. Comparison of variables among participants between two groups: (a) Mean score of PSQI; (b) Mean score of SBP; (c) Mean score of DBP; (d) Mean score of PR.

Table 5. Mean changes from baseline and between-group differences at post-intervention and follow-up, estimated using ANCOVA.

Outcome	Mean change (SD)		Difference (95%CI)[a]	*p*-value	Partial eta squared
	Intervention group (n = 54)	Control group (n = 54)			
PSQI (score)					
Baseline to post-intervention	−6.13 (1.41)	−3.91 (1.29)	−2.29 (−2.78, −1.81)	<0.001*	0.456
Baseline to follow-up	−9.35 (1.82)	−6.11 (1.41)	−3.35 (−3.90, −2.80)	<0.001*	0.579
SBP (mmHg)					
Baseline to post-intervention	−14.74 (6.61)	−7.63 (8.14)	−8.16 (−10.86, −5.45)	<0.001*	0.255
Baseline to follow-up	−25.44 (7.82)	−13.00 (10.57)	−13.98 (−17.27, −10.70)	<0.001*	0.404
DBP (mmHg)					
Baseline to post-intervention	−6.46 (3.41)	−2.63 (2.52)	−3.72 (−4.76, −2.69)	<0.001*	0.327
Baseline to follow-up	−10.72 (4.30)	−4.07 (3.45)	−6.47 (−7.71, −5.22)	<0.001*	0.502
PR (bpm)					
Baseline to post-intervention	−6.20 (3.27)	−1.94 (1.56)	−4.20 (−4.97, −3.43)	<0.001*	0.529
Baseline to follow-up	−9.76 (4.77)	−3.24 (2.47)	−6.45 (−7.70, −5.19)	<0.001*	0.498

* Significance at 0.05 level.

[a] Between-group differences are adjusted mean differences in change from baseline, controlling for the baseline value of each outcome. The differences are between the treatment and control groups.

Apart from these physiological effects, improvements may also reflect psychosocial engagement during Weeks 2–6, including empowerment, group interaction, and motivational activities. Consistent with the self-care concept [37–40], these components likely enhanced self-efficacy and social support, thereby contributing to better sleep outcomes. Thus, the observed benefits are attributable to the combined effects of aromatherapy, acupressure, and psychosocial participation rather than a single element alone.

Post-intervention analysis of sleep quality (PSQI) revealed that older adults in the intervention group showed significantly lower mean scores, which indicates better sleep quality, both immediately after the intervention and at follow-up, compared with the control group. These findings indicate improvements in both perceived sleep quality and behavioral sleep indicators, which were all key components of the PSQI. Individual components of subjective sleep quality include sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleep medication, and daytime dysfunction.

We gather that these improvements in PSQI were due to participants performing aromatherapy and acupressure before bedtime daily throughout the intervention period.

Participants received a skill-enhancement module on NCDs and sleep quality using educational materials and self-care guidance. Sleep diaries, telephone follow-up, and home visits were used to support self-monitoring and reinforce adherence.

The findings of this study are consistent with previous research indicating that knowledge enhancement and continuous follow-up can help sustain the effects of acupressure on sleep quality [52]. Our results highlight the importance of integrating educational activities with physical interventions to improve long-term efficacy.

When considering the biological components of aromatherapy oils improve sleep quality, systematic reviews have reported that aromatherapy, particularly with lavender essential oil, significantly improves sleep quality in older adults and also reduces symptoms of depression and anxiety [53]. These findings are consistent with the present study, which used jasmine and champaca essential oils containing key bioactive compounds such as linalool, benzyl acetate, benzyl alcohol, and methyl anthranilate. Prior literature suggests that these compounds may influence the central nervous system through inhalation, potentially stimulating the olfactory bulb and sending signals to the limbic system, which is involved in the regulation of emotion and sleep [19,26,28,53]. Previous reviews also indicate that inhalation of essential oils combined with acupressure before bedtime can balance the autonomic nervous system by reducing sympathetic arousal and enhancing parasympathetic tone. These effects lead to relaxation, slower heart rate, and improved sleep quality in older adults [53].

In terms of mechanisms of acupressure's impact on sleep quality, review studies have also indicated that improvements in sleep quality are associated with the balancing of Qi circulation and autonomic nervous system responses [54,55]. These findings are consistent with research conducted in Australia, which applied acupressure to Shen Men (HT7), Nei Guan (PC6), and San Yin Jiao (SP6) in community-dwelling older adults, demonstrating that

structured acupressure improved sleep quality, reduced anxiety, and enhanced quality of life [52]. Similarly, a study in Taiwan using targeted acupuncture points—including Tian-Zhu, Ju-Que, Yong-Quan, Bai-Hui, and Nei-Guan—among older adults in nursing homes found significant improvements in sleep quality [36].

Post-intervention analysis of PR revealed that older adults in the intervention group showed significantly greater reductions in mean PR both immediately after the intervention and at follow-up, compared with the control group. We infer that the reduction in PR may be associated with enhanced self-regulation and self-care behaviors promoted by the intervention. This finding is consistent with previous evidence supporting the effectiveness of non-pharmacological interventions among older adults [56].

Previous reviews have suggested that the effects of essential oil inhalation on PR and sleep may be mediated through olfactory system stimulation, which in turn may send signals to the limbic system involved in regulating emotion, stress, and sleep [57]. In the present study, these pathways are considered literature-supported hypotheses rather than confirmed mechanisms. In addition, systematic reviews indicate that aromatherapy improves sleep quality in older adults and is associated with the regulation of autonomic nervous system function [53]. Aromatherapy helps modulate the autonomic nervous system and physiological stress, which are associated with reductions in PR when combined with consistent pre-sleep preparation [20,56,57]. However, again, these mechanisms remain hypothetical, as no biomarkers were directly measured in this study.

Similar to PR, post-intervention analysis of BP revealed that older adults in the intervention group showed significantly greater reductions in mean BP both immediately after the intervention and at follow-up, compared with the control group. These outcomes align with the principles of self-management and self-care, which emphasize goal-directed behavior and empowerment activities [58]. Furthermore, systematic reviews have confirmed that both aromatherapy and acupressure are highly effective in significantly enhancing sleep quality in older adults in addition, they monitored and analyzed their own BP readings recorded in diaries. Follow-up support emphasized communication and motivation through the involvement of local research assistants. These findings are consistent with studies indicating that combining self-management with group activities in older adults, along with empowerment and active participation in health-promoting activities, can significantly reduce BP and enhance self-care abilities [59]. Furthermore, several previous reviews have indicated that autonomic nervous system stimulation through essential oil inhalation and acupressure can reduce stress and anxiety, leading to lower BP and improved sleep quality [60]. The underlying mechanisms have been proposed in prior literature to involve modulation of autonomic nervous system responses and potential reductions in cortisol secretion, which may contribute to relaxation, decreased physiological tension, and restoration of cardiovascular homeostasis [10,55].

In the present study, these pathways remain hypothetical, as no biomarkers were directly measured.

However, the findings for both PR and BP should also be interpreted in light of possible expectancy effects and attention bias, as the intervention group received substantially greater contact time and engagement (weekly sessions, home visits, phone calls, and diary reinforcement) compared with standard care. Such factors may have influenced participants' perceptions and contributed to the outcomes. When considering our results' statistical significance, reductions in PSQI and SBP approach established minimal clinically important differences, comparable to standard lifestyle interventions such as exercise and dietary modification. Although sustainability requires longer-term follow-up, the present results suggest clinically meaningful benefits.

The present study demonstrated substantial improvements in sleep quality and BP following the intervention. In the intervention group, the PSQI score, in which a higher score indicates poor sleep quality, decreased from 14.94 at baseline to 8.81 post-intervention and 5.59 at follow-up, corresponding to reductions of 6.13 and 9.35 points, respectively. Previous evidence indicates that the minimal clinically important difference (MCID) for PSQI ranges from approximately 2.5 to 2.7 points, with a minimal important change (MIC) of around 3 points. Using these benchmarks, the improvement in PSQI observed in this study exceeds established clinical thresholds [61]. Similarly, notable reductions were observed in BP. SBP decreased from 135.11 mmHg at baseline to 120.37 mmHg post-intervention and 109.67 mmHg at follow-up, representing a reduction of 25.44 mmHg, while DBP decreased from 81.83 mmHg to 75.37 mmHg and 71.11 mmHg, corresponding to a 10.72 mmHg reduction. These reductions are clinically meaningful and appear comparable to, or greater than, those reported for common non-pharmacological interventions. From a meta-analysis, it was shown

that 150 min per week of aerobic exercise reduced SBP by approximately 7.23 mmHg and DBP by 5.58 mmHg in adults with hypertension [62]. These findings suggest that the intervention may provide clinically meaningful benefits for both sleep quality and BP control.

The observed time effects were relatively large. This magnitude may be partly explained by statistical phenomena such as regression to the mean or repeated measurement effects, which can occur when outcomes are assessed repeatedly over time. In addition, some variation in standard deviations (SD) across time points was observed, particularly in the intervention group. Such variation is commonly reported in behavioral and non-pharmacological interventions, where individual responses to treatment may differ over time. Previous systematic reviews of non-pharmacological treatments for insomnia have also reported heterogeneous responses among participants, particularly when interventions involve multiple behavioral or complementary components [9].

In the present study, the intervention combined aromatherapy, acupressure, and psychosocial engagement, which may have contributed to differences in response magnitude among participants.

This study has several limitations. First, as a quasi-experimental and non-randomized design, there are inherent constraints in sample selection and generalizability. The results may reflect only the specific context of rural areas in Phayao Province and may not be fully applicable to other populations. In addition, the absence of placebo control and lack of cluster adjustment may introduce bias. Lifestyle covariates such as diet and physical activity were not controlled, which could have influenced outcomes. Second, the study participants were older adults with NCDs who were on continuous medication. This may have affected their cognitive abilities, responsiveness to the intervention, and could have introduced side effects such as drowsiness, dizziness, or mood disturbances, potentially influencing both sleep quality and self-assessment. Therefore, outcome analyses should carefully consider baseline health status and medication use to avoid misinterpretation. Health-related variables should be controlled in statistical analyses to enhance the accuracy and reliability of the findings. Third, sleep quality was assessed using the PSQI, a self-reported measure, which may be subject to response bias. Scores depend on participants' personal perceptions and self-assessment abilities, which can be influenced by comprehension of the questions, educational level, or current emotional state. Therefore, interpretation of these results should be approached with caution. Incorporating multiple measurement tools or expert assessments may enhance accuracy and reduce self-report bias. Finally, since participants' BP and PR were re-assessed at week 12 after program completion and during the three-month follow-up, it is necessary to examine the long-term effects of the intervention. This would allow evaluation of the sustainability of health outcomes, including the maintenance of improved sleep behaviors and physiological benefits resulting from aromatherapy and acupressure.

Additionally, to enhance the accuracy of outcome assessment and mitigate the limitations of relying solely on behavioral indicators, future studies could incorporate both subjective assessments and biomarker measurements. Examples include salivary or blood cortisol levels as indicators of stress, or melatonin levels related to sleep−wake cycles. The use of biomarkers can provide deeper insights into the biological mechanisms responding to the intervention. Future research could also adopt a longitudinal study design to examine the sustainability of program outcomes, such as changes in sleep quality, health behaviors, and physiological indicators over several months or years, and expand the sample to include populations from diverse social and cultural contexts.

5. Conclusion

This study suggests that a program combining jasmine and champaca essential oil aromatherapy with acupressure was associated with improvements in sleep quality and healthier sleep behaviors among older adults with NCDs, with favorable trends observed in BP and PR regulation. The findings highlight the potential role of complementary and alternative approaches, including TTM and TCM, in supporting self-care among rural older populations. However, these results should be interpreted with caution given the quasi-experimental design, absence of placebo control, and reliance on subjective sleep measures. While the study provides preliminary evidence that may guide future community-based initiatives, confirmation through well-designed randomized controlled trials and economic evaluations is needed before broader implementation can be recommended.

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Declaration of generative AI and AI-assisted technologies

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Conflict of interest

The author(s) have no conflict of interest to declare.

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