Research Article

INTEGRATING MINDFULNESS AND YOGA: A BUDDHIST-INSPIRED PROGRAM TO ENHANCE COGNITIVE FLEXIBILITY AND EMOTION REGULATION IN OLDER THAI ADULTS

Areeya Nilsson*, Amaraporn Surakarn, Narisara Peungposop
Applied Psychology, Behavioral Science Research Institute, Srinakharinwirot University, Bangkok, Thailand
*Corresponding author E-mail: areeyanilsson@icloud.com

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Abstract

Background and Objectives: Thailand was facing a rapidly aging population, with older adults increasingly vulnerable to cognitive decline and emotional dysregulation. In response, this study examined a culturally tailored yoga-based mindfulness program designed specifically for older Thai adults. Grounded in the principles of the neuroplasticity model of Buddhist mindfulness and observational learning, the study aimed to assess the preliminary effectiveness of the program in enhancing cognitive flexibility and emotion regulation in older Thai adults and to explore their learning processes through a Buddhist-informed framework that integrated the neuroplasticity model of mindfulness and observational learning.

Methodology: A quasi-experimental design was employed. Twenty-three Thai adults were recruited. Thirteen were assigned to the intervention group to complete 16 sessions (60 minutes each). The sessions integrated gentle yoga, mindful breathing, mindfulness meditation, and reflective group discussions. Quantitative outcomes were measured using Thai versions of Cognitive Flexibility Inventory and Emotion Regulation Questionnaire, before and after the intervention. Multivariate Analysis of Variance (MANOVA) was used to assess changes in cognitive flexibility and emotion regulation. Complementary qualitative data were gathered through After-Action Review (AAR) at the end of each session on learning experiences. The mixed-methods approach strengthened the study by methodological triangulation, enhancing the validity and comprehensiveness of the findings. The qualitative study facilitated cultural engagement, elevating lived experiences and contextualizing changes within a Buddhist-informed learning process.

Main Results: Quantitative analysis revealed significant improvements in cognitive flexibility and emotion regulation, particularly in cognitive reappraisal. Qualitative analysis from the AAR revealed six learning processes: 1) Observation and modeling; 2) Focused attention; 3) Retention and habit formation; 4) Skill reproduction; 5) Intrinsic motivation, and 6) Neuroplasticity through repetition as cognition and behavior changed consistently with increased mindfulness and adaptability. These results corresponded with the study's objective by showing how psychological improvements were supported by a Buddhist-informed approach. Learning processes also reflected some key

elements of the noble eightfold path. Increased awareness and calmness allowed participants to reflect wisely and be more mindful in regulating emotions.

Involvement to Buddhadhamma: This study reflected applied Buddhism, integrating Buddhist principles with modern health approaches under the theme of "Buddhism and the development of wisdom and morality." The program embodied the foundations of mindfulness (Satipatthāna) and the noble eightfold path (Ariyamagga), right effort (Sammā-Vāyāma), right concentration (Sammā-Samādhi) and right mindfulness (Sammā-Sati). Reflections from AAR revealed enhanced loving-kindness (Mettā) and wholesome thinking (Kusalā Vitakkāvitakkā). The program served as a spiritual and psychological resource, bridging traditional Buddhadhamma with modern approaches.

Conclusions: The study showed that the program significantly improved cognitive flexibility and emotion regulation among older Thai adults. Beyond measurable outcomes, the program fostered experiential learning and inner transformation through embodied mindful practices. These findings highlighted the promise of integrating traditional contemplative practices with modern wellness strategies as a non-pharmacological model for supporting healthy aging. The study achieved its objectives to assess the program's effectiveness in enhancing both cognitive and emotional domains and to explore how older adults engaged in learning processes rooted in mindfulness and repetition. The incorporation of culturally relevant practices based on Buddhist principles, right mindfulness (Sammā-Sati), and wise attention (Yoniso Manasikāra) provided a significant, community-oriented method for older Thai adults. These results indicated broader implications for health promotion in Thailand, advocating for the integration of mind-body practices in aging-related wellness intervention.

Keywords: Yoga, Mindfulness, Cognitive Flexibility, Emotion Regulation, Older Thai Adults

Introduction

Twenty percent of Thailand's population was elderly. Global aging affected health and social policies. Depression and anxiety in the elderly were rising. This demographic had challenges to move from rumination and seclusion to adaptation. Elderly faced emotional distress due to psychosocial stressors like death, retirement, poor health, and limited social roles. In older adults, life adjustment decreases, contributing decreases, contributing to emotional dysregulation and mental health decline (Schwaba et al., 2018). A study found that living constraints and social isolation significantly impacted elderly (Sungprakorn & Tangwongchai, 2019). A study also noted that living alone older adults were depressed due to isolation and less social interaction (Choi et al., 2021); (Huang et al., 2023). Late-life depression and social disengagement had increased, requiring context-specific interventions to move from despair or loneliness to acceptance with social participation.

Age-related mental health issues were growing in Thailand. National statistics showed rising memory loss, cognitive decline, depression, and anxiety. Thai elderly population were growing rapidly. Petchburi was one of the fastest-aging provinces, the majority were in the young-old stage. Further, Petchburi had the highest rate of elderly living alone (12.4%) in 2020. In 2022, 5% of older adults were depressed, up from 1% in 2021. These statistics suggested social isolation, emotional sensitivity,

and mental health issues. In light of these challenges, Thai health promotion and aging programs, with support from the Department of Older Persons and the Ministry of Public Health, underlined psychological resilience, social interaction, and community-based mental health to improve these issues. The Active Aging framework promoted physical activity, emotional health, and socialization. Culturally relevant, non-pharmacological aging approaches were underscored in the National Plan for this demographic. This study was guided by an observational learning and neuroplasticity concept aimed to enhance cognitive flexibility and emotion regulation in the Thai elderly. It presented an intervention approach and learning process linked with Buddhist-informed principles as well as Thailand's national health plans by incorporating these into a culturally relevant program. Cognitive flexibility, the ability to adapt to new situations, and to switch between cognitive sets or mental frameworks (Dennis & Vander Wal, 2010), was vital for later-life emotional well-being (Diamond, 2013). Age was correlated with emotion regulation and problem-solving (Buitenweg et al., 2019). Neuropsychological studies of cognitive strategy switches often showed deficits. Neurodegenerative diseases like Alzheimer's and Parkinson's reduced cognitive flexibility by altering brain plasticity, neurogenesis, and executive function (Skaper et al., 2017); (Winner & Winkler, 2015). Poor emotion regulation and cognitive impairments related to anxiety and depression in older adults (Joormann & Gotlib, 2010); (Loevaas et al., 2018). Cognitive reappraisal, and expressive suppression were two common strategies in regulating emotions (Gross & John, 2003). According to Preece et al. (2020), expressive suppression caused psychological distress, but cognitive reappraisal prevented mood disorders. Cognitive flexibility allows individuals to reinterpret emotional situations. Further, executive function could improve emotional well-being and psychological resilience. Therefore, mind-body interventions to train the mind in shifting, reframing, and regulating emotions were needed.

The Study found that mindfulness improved emotion regulation, attention, and meta-cognition (Goldin & Gross, 2010). Mental training, mindfulness meditation improved mood and cognition (Zeidan et al., 2010). Physical activity boosted synaptic connectivity, and neurotransmitter balance, improving mental health and neuroplasticity (Cotman & Berchtold, 2002). Yoga components included poses, breathing exercises, meditation, and relaxation, considered as gentle, low impact intervention and suitable for elderly. By increasing hippocampus gray matter and decreasing amygdala size, yoga could improve mood, stress, and emotion control (Gothe et al., 2019); (Van Aalst et al., 2020). Malhotra et al. (2023) found that six weeks of yoga reduced depression, anxiety, and stress in older adults, suggesting its mental health benefits. Yoga-based, culturally grounded, Buddhist-informed cognitive and emotional interventions for this population were understudied.

To address theoretical and empirical gaps, this study examined a Thai elderly yoga-based mindfulness program. Mindfulness and cognitive training studies were mostly Western, thus there was a growing awareness of the need to adapt it to local cultures and experiences. Kabat-Zinn's (1990) concept of mindfulness emphasized present, non-judgmental awareness, while Langerian framework emphasized novelty, cognitive engagement, and flexibility (Pirson et al., 2012). Emotion regulation was well-studied since the past (Silk et al., 2003); (Zagaria et al., 2023), but later-life development,

especially in integrated mind-body activities like yoga was less investigation. Another theoretical gap was only concentrative meditation increased cognitive flexibility (Müller et al., 2016). Neuroplasticity, the brain's ability to adapt and restructured across the lifespan (FitzGerald et al., 2002), supported Bandura's (1977) learning theory, suggesting that teacher-modeled, group-based intervention could improve psychological and cognition. Though type of promising programs in older adults to enhance cognition and emotion had not been studied. This study opted to fill the gap and offered a method that met national health goals. It aimed to assess a yoga-based mindfulness program's effects on cognition and emotion, and to examine learning process of older Thai adults.

Objectives

The study aimed assess the preliminary effectiveness of a yoga-based mindfulness program in enhancing cognitive flexibility and emotion regulation among older Thai adults and to explore their learning processes through a Buddhist-informed framework that integrated the neuroplasticity model of mindfulness and observational learning.

Methodology

Research Design

A mixed-methods research design was employed. A quantitative method using a pretest-posttest control group design was used to assess the effects of a program on cognitive flexibility and emotion regulation. In addition, AAR was conducted following each session to explore participants' learning processes and reflective experiences. The AAR constituted the qualitative component of the study, providing in-depth insights into how the program facilitated behavioral and cognitive changes. This combination of quantitative and qualitative methods allowed for methodological triangulation and a more comprehensive understanding of the program's impact.

Population and Samples

This study targeted Thai adults aged 60-69 years as research participants, classified as the "young-old" age group. Participants resided in Petchburi, Thailand. They were selected based on the inclusion criteria. To determine the sample size, G*Power version 3.1 was used based on a relevant study, a significance level of α = .05, and power set at 0.80, a minimum of 20 participants was needed 30 were recruited to allow for dropouts. To ensure equality as well as decrease sampling bias, the sample was stratified by gender and age. Participants in each stratum were assigned to experimental or control groups. In total, 23 participants completed the study: 13 in the experimental and 10 participants in the control group (See Table 1).

Table 1 Participants Utilized in the Study

Gender	Experimental (n = 13) Control (n = 10)				Total Number (%)	Total Age range (years)
	Number (%)	Age range (years)	Number (%)	Age range (years)		
Male	2 (15.4%)	61-62	2 (20.0%)	63-64	4 (17.4%)	61-64
Female	11 (84.6%)	60-69	8 (80.0%)	60-67	19 (82.6%)	60-69

Table 1 presented that the majority of participants were female (82.6%, n = 19), while only 17.4% (n = 4) were male. Gender distribution was consistent across both groups. In terms of age, the age distribution is similar and comparable, ensuring a balanced study design.

Research Instruments

Four validated instruments were reviewed and verified by research advisors and specialists. A demographic questionnaire collected participants' age, gender, physical limitations, and health issues. The second and third tools were the Thai Cognitive Flexibility Inventory (CFI) and the Emotion Regulation Questionnaire (ERQ) translated by Chulalongkorn University's Faculty of Psychology, and minor language changes were applied to maintain good content validity. The rating scale in neutral response was removed because the previous internship study participants often chose midway, reducing score sensitivity. The Thai CFI showed high internal consistency, with a Cronbach's alpha (α) of 0.873, 0.84 for Thai ERQ in cognitive reappraisal strategy and 0.72 for expressive suppression. Lastly, the yoga-based mindfulness program, three independent gerontology, learning psychology, and mindfulness specialists examined this. Program goals, theory, implementation, evaluation, and instruction had been reviewed with 0.94 IOC the content was valid. The program was developed and pilot tested with four older adults from a nearby town using specialist feedback to ensure conciseness, cultural appropriateness, and practicality. AAR questionnaires were used in qualitative research. These questionnaires were validated by three experts in psychology using semi-structured learning reflection questions. The items investigated learning processes and further intervention-related cognitive, emotional, and behavioral changes. The IOC score of 0.80 confirmed content validity.

Data Collection

The program was 16 sessions over 8 weeks, each week for two 60-minute sessions. The session consisted of gentle yoga poses, breathing exercises, guided meditations, and relaxation facilitated by a certified yoga teacher. Participant recruitment was conducted in collaboration with local administrative authorities. An official university letter was submitted to the Subdistrict Administrative. Interested individuals gathered at the village community pavilion. The head of the village and the deputy assisted in recruiting processes as the information center. Despite using the stratified random sampling, the assignment could not be performed in full randomization due to the uneven and small sample size. The experimental group engaged in a 10-minute AAR to facilitate insight into learning processes to support qualitative insights that

complemented the quantitative data obtained from CFI and ERQ. Quantitative data were collected at pre-post intervention in both groups.

Data Analysis

Quantitative data were analyzed with SPSS. Means and standard deviations were examined. Normality test was assessed with the Shapiro-Wilk test, linearity and homogeneity of variance covariance were tested with Levene's and Box's M tests. Skewness ranged from -1.204 to 1.015 and kurtosis from -1.942 to 1.838 all reached the criteria. A P-value of Shapiro-Wilk was greater than .05, meeting the normal distribution assumption. MANOVA was conducted. The significance level was at $p < .05$. The assumption of multicollinearity was examined using Pearson correlation coefficients. A significant negative correlation was found between CF pre-test and CF post-test scores ($r = -0.719$, $p < .01$), and a correlation was found between CF pre-test and ER pre-test scores ($r = 0.779$, $p < .01$). As correlations were below the threshold of $r = 0.85$, multicollinearity was not a concern. AAR data was analyzed by thematic analysis, which enabled identification of participants' learning processes, cognitive, emotional, and behavioral changes.

Results and Discussion

Results were in line with the objectives: To evaluate program's effectiveness, and to explore participants' learning processes. The quantitative results revealed improvements in cognitive flexibility and emotion regulation. As shown in Table 2 and further statistic findings.

Table 2 Results of the analysis of the mean (M) and Standard Deviation (S.D.) (n = 23)

Variable	Experimental group (n = 13) M / S.D.	Control group (n = 10) M / S.D.	Total (n = 23) M / S.D.
CF			
Pre-test	103.00 / 6.49	122.20 / 7.74	111.35 / 11.93
Post-test	129.15 / 5.68	111.35 / 6.87	118.00 / 14.35
ER			
Pre-test	38.23 / 3.06	49.50 / 4.95	43.13 / 6.91
Post-test	46.00 / 1.68	44.90 / 6.81	45.52 / 4.56

In Table 2, the control group scored higher in CFI (M = 122.20) and ERQ (M = 49.50) than the experimental group at pre-test (CF: M = 103.00; ER: M = 38.23). At post-test, the experimental group had significantly higher CFI (M = 129.15) and ERQ (M = 46.00) scores. Further, a repeated measures MANOVA showed that the pre-test and post-test time affected cognitive flexibility and emotion regulation in the experimental group. Wilks' Lambda = .029 for CFI and.139 for ERQ, both $p < .001$ on $F(1, 12) = 395.66$ and 74.55 and $\eta^2 = .971$ and .861, Experimental group members improved in both categories. Group comparisons showed significant differences in CFI pre-post test $F(1, 21) = 41.84$ and 96.18 both $p < .001$, $\eta^2 = .666$ and = .821 respectively. There were significant differences in the cognitive reappraisal (CR) strategy

of emotion regulation between groups at both pre-test ($F(1, 21) = 164.71$, $p < .001$, $\eta^2 = .887$) and post-test ($F(1, 21) = 23.92$, $p < .001$, $\eta^2 = .533$. The expressive suppression resulted in significant differences between groups both pre-test and post-test: $F(1, 21) = 61.79$, $p < .001$, $\eta^2 = .746$, and $F(1, 21) = 60.61$, $p < .001$, $\eta^2 = .743$. These results suggested the large effect size, indicating the high level of the variance scores were explained by the intervention. Even the effect size was very large, the consistency of improvements and strength were in line with previous studies (Pandya, 2020); (Field, 2016), especially among the Buddhist female elderly. Cultural resonance, high program fidelity, and practice engagement could magnify the program's impact. In emotion regulation, the results showed that participants in experimental group used cognitive reappraisal more. The results agreed with Gross & John (2003), healthy emotion regulation required cognitive reappraisal. Reducing expressive suppression aligned with equanimity (Upekkhā), emphasized acceptance over avoidance.

AAR findings provided insights into 6-stage learning processes to support the quantitative data. This supported repetition, the key element in neuroplasticity, resonated with the Buddhist teachings emphasizing mental cultivation (Bhāvanā). Cousins (2006) reviewed the perspective of mindfulness (Satipatthāna), describing the components echoed in participants' awareness and emotion regulation. It explored the mental cultivation process, observation (Sati), concentration (Samadhi), and perfection of wisdom, representing insight (Vipassana), to understand the nature of reality as interconnected stages that facilitated deeper understanding and realization in Buddhist practice.

Moreover, AAR findings linked neuroplasticity to Buddhist learning. It showed structured learning from observation and focused attention to internalized practices. Neuroplasticity allows consistent and purposeful engagement with mindfulness, breathwork, and gentle movement to reshape neural pathways for attention, emotion, and cognition. Referring to participant reflections, repeated mindfulness-based experiences reinforced mental habits and cognitive-emotional responses, crucial brain adaptation outcomes. A study found that regular practice and dual body-breath training reduced limbic reactivity and strengthened prefrontal control, which underpins mindfulness (Laukkonen et al., 2020). The mental cultivation (Bhāvanā) emphasized transformation through practice, introspection observation (Mindfulness), concentration (Focused Attention), and insight. Incorporating daily skill reflection and application aligned with the Buddhist practice of wise attention (Yoniso Manasikāra) emphasized discerning experience. Participants became active through repeated practice, social interaction, and self-reflection. This aligned with Hebbian learning ("neurons that fired together wired together") and Buddhist mental cultivation through the right effort (Sammā-Vāyāma).

Integrated discussion on Buddhist-informed learning and cultural relevance, a study found that mindfulness meditation improved attention and cognitive flexibility (Moore & Malinowski, 2009). Research participants showed positive thought and behavior flexibility, suggesting the mindfulness aspect improved perspective-shifting and focus-sustaining. The positive findings could be because the cognitive reappraisal, with mindful breathing, contributed to being active, reflective, and

regulating emotions. Mindfulness supports the brain area responsible for cognitive reappraisal, mindfulness meditation improves the view of negative emotions and supports emotional responses (Garland et al., 2015). A study founded that resonance frequency breathing improved autonomic nervous system flexibility (Lin et al., 2021). Keute & Gharabaghi (2021) revealed that vagal nerve stimulation improved synaptic plasticity and cognitive flexibility (Borges et al., 2020). Another study indicated that older adults preferred emotional content and better-managed emotion with cognitive function (Growney & English, 2022). Thus, this program could improve behavioral change and neurocognitive adaptation, suggesting neuroplasticity-supporte demotion regulation. According to Bodhi (2011), the Buddhist principle of the right effort (Sammā-Vāyāma) encouraged cultivating wholesome thought (Kusalā Vitakkā). Analayo (2019) stated that modern mindfulness-based interventions fall short of the depth of mindfulness (Satipaṭṭhāna). This study suggested that an organized, cultural, meditative program could help this challenge.

In terms of methodological strength and implications, quantitative statistics indicated the program's effects. Qualitative data revealed a Buddhist-aligned process to inform that health promotion should include these relevant activities. Neuroplasticity-based learning created a repeatable, non-pharmacological, and sustainable model that was scientifically and spiritually grounded. These findings suggested that other countries with similar cultures should use more culturally grounded practices.

Originality and Body of Knowledge

Yoga-based mindfulness met Thai Buddhist ethics and culture in this pilot study. The program incorporated secular Hatha yoga and holistic Buddhist teachings, including the four foundations of mindfulness (Satipaṭṭhāna), which focused on body awareness, feelings, mind, and mental elements. This approach developed a four-domain Cognitive-Emotional Resilience Model for Older Adults (CERMO) that fostered cognitive flexibility and emotion regulation. The first domain was bodily awareness (Kāyānupassanā Satipaṭṭhāna), which was cultivated through yoga poses, coordinated breathing, and gentle rhythmic movement. The embodied awareness raised interoceptive awareness and attentional control for self-regulation. The second domain was mindful awareness of feelings and emotions or present-centered emotion regulation (Vedanānupassanā Satipatthāna). It emphasized equanimity in emotional observation (Upekkhā), or a state of mental balance, remaining neutral, calm, or mindful in all situations. Participants practiced mindful breathing (Ānāpānasati) to reduce emotional reactivity. This concept showed the connection between these two domains. Being aware of the body helps to observe and regulate emotions without reacting. In general, the connection between the two domains lay in the role of embodied breath-based practices, which cultivated interoceptive awareness and attention. This concept was supported by enabling the equanimous observation of affective experiences.

The third domain was awareness of mind (Cittānupassanā Satipatthāna), which focused on developing meta-cognitive awareness of mental states. Often underemphasized in contemporary mindfulness models, this domain encouraged participants to observe fluctuations in clarity and

distraction to identify cognitive habits, as the metacognitive shift was essential for promoting cognition. The fourth domain was wisdom-oriented reflective practice (Dhammānupassanā Satipatthāna), it involved contemplative engagement with core Buddhist teachings, including impermanence (Aniccā), non-self (Anattā), and the right intention (Sammā-Saṅkappa). Reflection enhanced existential resilience, protecting older adults' mental health.

The CERMO (Shown in Figure 1) operated in four domains: 1) Body and breathing awareness: Interoception, attention, and emotion regulation developed; 2) Equanimity feeling in emotion and sensation: Breath awareness decreased reactivity and regulated emotions; 3) Mental awareness: Recognized shifting emotions by improving metacognition and emotion clarity, and 4) Insight reflection: Explored impermanence and non-self. Overall, reappraisal value increased cognitive flexibility in the first domain of breathing, and body awareness led to positive emotion regulation in the second domain shown by the arrows. Options arrows stated that the third and fourth domains indirectly improved cognitive flexibility. In the cycle, mindfulness enhanced cognitive flexibility and mindfulness involvement. Cognitive flexibility in CERMO and school setting both involved changing perspectives, but paths and goals differed. School setting aided academic learning and problem-solving, but CERMO promoted resilience and adaptation in elderly through embodied awareness. They were in the same core capacity but designed to meet different needs. For applicability and contribution, although CERMO was only designed for Thai elderly, it blended contemplative wisdom and modern psychology, which was suitable for all ages and cultures.

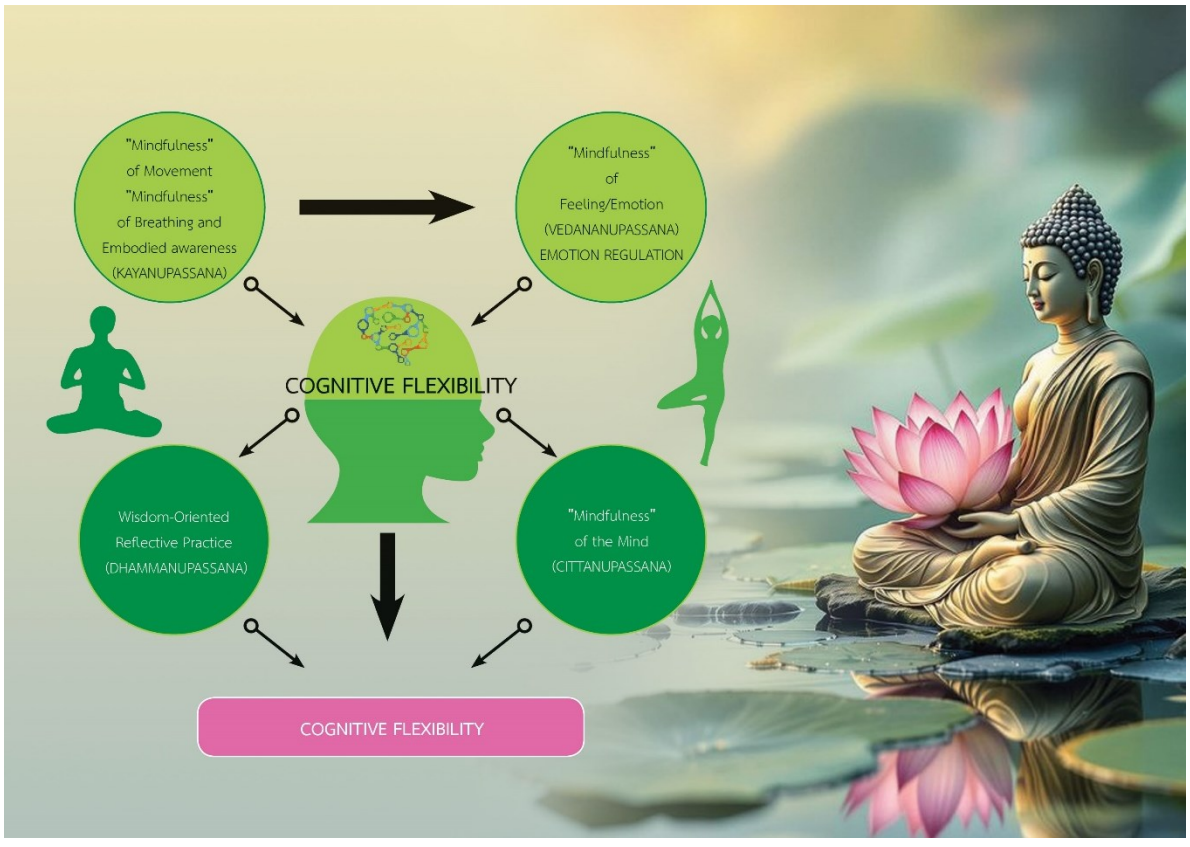

Figure 1 Cognitive-Emotional Resilience Model for Older Adults

Conclusions and Recommendations

This study concluded that a Buddhist-informed, yoga-based mindfulness could enhance cognitive flexibility and emotion regulation in Thai elderly. Conclusions were: 1) Improvement in cognitive flexibility, participants could shift perspectives and respond to challenges; 2) Strengthen emotion regulation, specifically through the embodied awareness of body and breath, and 3) Suitable for Thai culture, the Buddhist foundation enhanced acceptance, broad-mindedness, and engagement. These outcomes showed the potential of Buddhist training, bolstering spiritual and psychological enhancement. For recommendations, The CERMO model should be integrated into elder care and community health centers. Second, future studies should aim for randomized design, larger sample sizes, and follow-up on long-term impact and lifelong practice. On the limitation, the small sample size and non-randomized design in this study limit generalizability hence, large effect sizes should be cautiously interpreted. However, results from this study were not anomalies. They were meaningful signs of the cultural strength and profoundness of the CERMO model. In general, this study displayed more than a health intervention program. It offered a vision of aging supported by ethical discipline, self-awareness, and communal care. The study reclaimed the power of Buddhist training as a source of personal change and public health innovation in an aging society. The CERMO model established itself as a promising, culturally based contribution to elder care that should be expanded and sustained.

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