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Original Article

Loving-kindness moderates the association between neuroticism and anxiety symptoms among Thai older adults

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Abstract

The global population is experiencing rapid aging, and the mental health needs of older adults have become an urgent public health concern, with anxiety levels becoming increasingly prevalent among older adults. In Thailand, stress and anxiety among older adults are anticipated to double in the next decade. Neuroticism, characterized by emotional instability and an impulse for negative feelings, is a significant psychological characteristic associated with anxiety. Older adults with higher neuroticism have heightened sensitivity to stress and frequently struggle with emotional regulation, hence increasing their vulnerability to anxiety and other mental health disorders. Loving-kindness, a core Buddhist principle, has been shown to benefit mental health by reducing stress, anxiety, and depression, primarily in Western or short-term settings. However, there is limited research assessing its role among older adults in Buddhist cultural contexts, such as Thailand. This study investigated whether loving-kindness moderated the relationship between neuroticism and anxiety symptoms among 232 Thai adults aged 60 and above, using secondary data collected between December 2019 and September 2022. Measures included the Neuroticism Inventory, Core Symptom Index for anxiety, and the Inner Strength-Based Inventory for loving-kindness. Multiple regression analysis evaluated potential moderating effects. The results revealed that anxiety had a positive correlation with neuroticism and a negative correlation with loving-kindness and education; nevertheless, an unexpected pattern occurred in the moderation analysis. Loving-kindness specifically enhanced the correlation between neuroticism and anxiety at high levels, rather than mitigating it. Older adults exhibiting higher levels of neuroticism and loving-kindness reported increased anxiety symptoms. Education was identified as a protective factor, exhibiting a negative correlation with anxiety. Loving-kindness did not mitigate the effect of high neuroticism on anxiety in Thai older adults. Rather, it intensified this correlation, indicating that robust prosocial characteristics lacking sufficient emotional regulation may exacerbate stressful emotions. These findings contradict prevailing theories regarding the universal advantages of loving-kindness and underscore the necessity for therapies that incorporate loving-kindness with emotional regulation and self-care in older adults.

Keywords: Loving-kindness, neuroticism, anxiety, Buddhist meditation, mental health

Introduction

The global population is aging rapidly, with forecasts predicting that 1.4 billion individuals aged 65 and above will be by 2030, increasing to 2.1 billion by 2050 [1]. This demographic shift creates

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considerable mental health challenges that require urgent attention. In older adults, mental health issues such as cognitive impairments, anxiety disorders, depression, chronic stress, loneliness, social inhibition, and sleep disruptions are significant concerns that, without early intervention, may develop into severe conditions [2,3]. These mental health challenges rarely manifest in isolation; instead, they interact in intricate, mutually reinforcing patterns that can drastically deteriorate the psychological well-being and functional autonomy of older individuals [4].

Thailand is facing one of the most rapid aging processes in Southeast Asia, with projections indicating that the population aged 60 and older will rise significantly from 16% in 2015 to 33–40% by 2050 [5]. Thailand's healthcare system faces constraints in geriatric mental health resources, with roughly nine professionals per 100,000 individuals [6], which is below the global median and significantly lower than in high-income nations [7]. Thailand's transforming social fabric, where traditional family arrangements that historically provided elder care and emotional support are changing, often exacerbates mental health challenges among older adults.

Among the many factors contributing to mental health challenges in older adults, neuroticism is a significant personality trait that has been well-documented as a primary vulnerability factor [8-10]. Neuroticism, defined by emotional instability and a tendency towards negative emotional states, considerably affects the mental health of older individuals [11]. Research continually indicates that neuroticism serves as a transdiagnostic risk factor, affecting several mental health disorders concurrently [11-13]. Neuroticism serves as a prevalent factor in anxiety and depression, creating complex comorbid relationships [12] and significantly affecting stress responses [14].

Neuroticism profoundly influences multiple domains of older adults' mental health, including stress responses and cognitive functioning. Research on psychophysiological stress responses in healthy older adults indicates that those with higher neuroticism scores show increased stress reactivity and diminished recovery abilities, which may increase sensitivity to anxiety and depression [14]. This increased stress sensitivity was evident during the coronavirus disease 2019 (COVID-19) pandemic, in which neuroticism strongly moderated the relationship between fear of COVID-19 and perceived stress [2]. Additionally, neuroticism significantly influences cognitive functioning in older populations, with research indicating that neuroticism affects cognitive functioning through perceived stress as a mediating variable, impacting areas such as perceptual speed, working memory, and fluid intelligence [15]. The subjective experience of cognitive impairments, in addition to objective impairment, considerably affects mental health, as neuroticism influences memory self-assessment, with higher levels associated with consistently negative self-evaluations due to increased health-related anxiety and self-criticism [16]. Such negative self-perceptions can lead to diminished confidence, social isolation, and hesitance to participate in cognitively stimulating activities, potentially worsening cognitive decline and creating a self-perpetuating cycle.

Anxiety disorders are a highly prevalent but often overlooked mental health issue among older populations. In Thailand, over 3 million patients obtained treatment for anxiety between 2015 and 2023 [17]. The COVID-19 pandemic exposed this vulnerability, as 22% of Thai citizens reported significant anxiety symptoms, with rates varying by psychological resilience, 35.2% among those with low resilience, versus 15.1% in those with high resilience [18]. Many factors contribute to the prevalence and intensity of anxiety in older adults, including genetic predisposition [19], environmental stressors [20], chronic medical disorders [21], adverse childhood experiences [22], and sociocultural influences [23]. In older populations, additional factors such as low socioeconomic status, lack of social support, and maladaptive coping mechanisms further contribute to the development and persistence of anxiety symptoms [24,25].

While neuroticism represents a significant vulnerability factor for anxiety and other mental health challenges, research has increasingly recognized that protective factors can moderate its negative effects [26,27]. Identifying these protective factors is crucial for developing effective interventions that buffer against the impact of neuroticism and promote psychological well-being in older populations. Research has identified several key protective factors that mitigate the risk of anxiety, including mindfulness, cognitive behavioral therapy (CBT), loving-kindness meditation (LKM), and social connectedness [28-31].

Loving-kindness (*metta*), a core Buddhist principle in Thai society, may constitute a potentially advantageous psychological intervention. It involves fostering hospitality, generosity, and compassion for oneself and others [30]. In Theravada Buddhism, loving-kindness is one of the four sublime states (*brahmavihāras*), along with compassion (*karuṇā*), appreciative delight (*muditā*), and equanimity (*upekkhā*) [32], which has a strong hold on Thai culture and daily life. The four *brahmavihāras*, also known as the "immeasurables" (*appamaññā*), represent interconnected attitudes that promote psychological well-being for all sentient beings [33]. Within this framework, *metta* is the foundational element for achieving other sublime states, representing the disposition of kindness that supports compassion, appreciative joy, and equanimity [33]. A study demonstrated that LKM improves mental well-being and social connectedness while reducing anxiety and depression [28]. Meta-analyses indicate LKM significantly reduces anxiety through mechanisms promoting non-judgmental awareness and acceptance [34-36].

Beyond LKM, several evidence-based interventions demonstrate potential for mitigating neuroticism and anxiety symptoms in older populations. Mindfulness-based therapies have been successful in diminishing neuroticism and anxiety across several demographics, with brief mindfulness training resulting in notable decreases in anxiety and stress reactivity [37]. Cognitive-behavioral therapy is the primary approach for addressing anxiety disorders, supported by significant evidence demonstrating its effectiveness across a wide range of anxiety symptoms [29]. Moreover, social connectedness has been identified as a vital protective factor, with studies demonstrating that robust social ties mitigate the adverse impacts of personality vulnerabilities on mental health outcomes [2,3].

Recognizing the protective mechanisms by which these interventions operate is especially crucial in the Thai context, where research has revealed complex mediation and moderation pathways affecting mental health outcomes in senior citizens. In Thailand, devotion to Buddhist precepts against killing, stealing, sexual misconduct, lying, and alcohol consumption profoundly influences the interplay between neuroticism, stress, and depressive symptoms [38], suggesting that culturally and spiritually aligned practices may offer protective mechanisms against the adverse effects of neuroticism in Buddhist communities. Thai elders specifically draw on traditional values, family connections, and spiritual resources, such as LKM and other *brahmavihāra* practices, to sustain psychological resilience [39].

A systematic study of Buddhist-derived loving-kindness and compassion meditation for addressing psychopathology demonstrated significant advantages across several illnesses, including anxiety, depression, and stress-related disorders [40]. Research on older Thai populations indicates that social inhibition mediates the connection between neuroticism and depression, implying that neuroticism predisposes individuals to social disengagement, hence intensifying depressive symptoms [41]. This finding underscores the importance of interventions that specifically target social connectivity and mitigate social inhibition, presumably by cultivating the *brahmavihāra*. In the context of the COVID-19 pandemic, neuroticism was identified as a mediator between fear and perceived stress, while perceived social support acted as a protective moderator [2]. These findings highlight the importance of analyzing both direct and conditional impacts to understand mental health outcomes, as well as the protective role of social resources.

Despite this promising evidence, structured implementation among older Thai populations remains inadequately studied. Most studies focus on short-term results in organized therapy environments [31], with less research exploring how loving-kindness influences mental health in older adults' lived experiences. This study aimed to investigate whether loving-kindness moderates the relationship between neuroticism and anxiety in Thai older adults.

Methods

Study design and setting

This study was part of a larger cross-sectional survey entitled "Psychometric validation of the Zuckerman, Kuhlman, and Aluja (ZKA) Personality Questionnaire". The original survey was conducted in Thailand between December 2021 and September 2022 and included participants

aged 15–90 years from the general population [42]. In this present analysis, we focused exclusively on older adults aged ≥60 years to examine the moderating effect of loving-kindness on the association between neuroticism and anxiety symptoms in this age group. The study was conducted in Chiang Mai Province, northern Thailand, with ethical approval from the Ethics Committee of the Faculty of Medicine, Chiang Mai University.

Participants were Thai-speaking individuals who could read and write Thai, ensuring the cultural and linguistic appropriateness of the assessment instruments. Data were collected using a cross-sectional design through an online survey platform (Google Forms), enabling broad geographic coverage while requiring basic digital literacy and access to electronic devices such as smartphones, tablets, or laptops.

Study participants

The study's participants included Thai older adults aged 60 years and above. This is a non-clinical population of males and females from all over Thailand. The inclusion criteria also included Thai nationality, ability to comprehend Thai questionnaires, and provision of informed consent. No exclusion criteria were applied to maximize inclusivity and enhance the representativeness of the study population.

Sample size and sampling

The sample size was calculated using a power analysis for multiple regression with the G*Power tool, version 3.1.9.7 [43,44]. The estimated effect size was 0.10, with an alpha error probability of 0.05 and a statistical power of 0.80, resulting in a minimum sample size of 81. The final analytical sample comprised 232 participants, exceeding the minimum requirement. A convenience sampling approach was used to recruit the participants.

Study instruments

The Inner Strength-Based Inventory, a subscale of the loving-kindness scale, was used to assess the presence and intensity of loving-kindness in individuals. Cronbach's alpha was not applicable, as the measure consists of a single item with five response options. The stem question is: "When I encounter people who are in trouble…." and the respondents were asked to respond, with responses ranging from "I feel nothing" to "I always feel sympathetic toward everyone, even if I do not like them."

The Neuroticism Inventory, used to measure neuroticism, is a self-report measure consisting of 15 items, each rated on a 4-point Likert scale (1=never like me to 4=always like me) [38]. Total scores range from 15 to 60, with higher scores indicating greater neuroticism. In the present study, Cronbach's alpha was 0.84.

Anxiety symptoms were assessed using the Core Symptom Index (CSI), which includes four items specifically targeting anxiety. Responses are rated on a 5-point Likert scale (0=never to 4=very constantly). Possible scores range from 0 to 16, with higher scores indicating greater severity of anxiety. The CSI has demonstrated adequate one-dimensionality and psychometric validity, supporting its use as a reliable measure of anxiety [45]. In the present study, Cronbach's alpha was 0.82.

Data collection

Participants were recruited using a convenience sampling strategy through multiple outreach channels, including website banners, departmental Facebook postings, and printed flyers distributed within the surrounding community. Individuals interested in the project could access the link via the QR code provided on the flyer or contact the researcher listed on the flyer for further details before making a decision. Eligible participants received a secure link to an online electronic survey. Before survey initiation, all participants provided electronic informed consent.

The self-administered questionnaire was completed online and consisted of sequential sections, including sociodemographic characteristics (sex, age, years of education, living arrangement, and monthly income), followed by standardized Thai-language instruments: the Inner Strength-Based Inventory, the Neuroticism Inventory, and the CSI Questionnaire. All responses were collected electronically and securely stored within the online survey platform.

Data analysis

Descriptive statistics were used to report demographic data, including frequency, percentage, mean, and standard deviation (SD). The mean and SD were calculated for continuous data, especially the measurement scores. The data were reviewed to confirm the normality of data residuals using histogram and p-plot, linearity and homoscedasticity with scatterplot to confirm a random distribution of points around zero, and a check for multicollinearity with variance inflation factor (VIF) values (all near 1) and an absence of outliers.

Pearson's correlation was used to assess the correlation between neuroticism and anxiety, as both variables are continuous. Phi coefficient analysis was used to analyze relationships between dichotomous variables (sex, marital status, and education), and point-biserial analysis was used to analyze relationships between dichotomous and continuous variables.

Moderation analysis

The moderation model examined how loving-kindness, as measured by the Inner Strength-Based Inventory, may mitigate the association between neuroticism and anxiety symptoms. We illustrated the relationship between neuroticism and anxiety at different levels of loving-kindness, visualizing the interaction effects by exhibiting predicted anxiety values based on neuroticism scores across different levels of loving-kindness. This method allowed us to find out if loving-kindness diminishes the generally positive correlation between neuroticism and anxiety symptoms.

Results

Participant characteristics

Overall, 232 older Thai adults were involved in the study, and their sociodemographic data are presented in **Table 1**. The mean age of the participants was 67.96 years, with females constituting the majority of the sample (59.9%, n=139). Most participants had completed basic education (74.6%, n=173), whereas 25.4% (n=59) had attained higher education. More than half of the participants were partnered (59.1%, n=137), while 40.9% (n=95) reported having no partner. The majority of participants (74.6%, n=173) reported earning less than 20,000 Thai baht, whereas 25.4% (n=59) reported a monthly income of 20,000 Thai baht or higher.

Table 1. Sociodemographic data of older Thai adults included in the study (n=232)

Variables	Frequency (%)
Age (mean±SD)	67.96±6.83
Sex	
Female	139 (59.9)
Male	93 (40.1)
Education	
Basic education	173 (74.6)
Higher education	59 (25.4)
Marital status	
No partner	95 (40.9)
With partner	137 (59.1)
Income (Thai Baht)	
Less than 20,000	173 (74.6)
20,000 and more	59 (25.4)

Level of loving-kindness, neuroticism, and anxiety

The means and standard deviations (SDs) of the three psychological variables assessed in older Thai adults—loving-kindness (as an indicator of inner strength), neuroticism, and anxiety symptoms—are presented in **Table 2**. The mean loving-kindness score was 3.52±1.08 on a 1–5 scale, indicating a moderately high level of compassionate attitudes toward oneself and others. The mean neuroticism score was 31.36±8.11 on a scale ranging from 15 to 60, reflecting a moderate tendency toward emotional instability and negative affect. Anxiety symptoms had a mean score of 3.63±3.03 on a 0–16 scale, suggesting generally low to moderate levels of anxiety symptoms in the study population.

Table 2. Mean scores of loving-kindness, neuroticism, and anxiety among older Thai adults included in the study (n=232)

Psychological variables	Mean score ± standard deviation
Loving kindness (1–5)	3.52±1.079
Neuroticism (score ranges 15–60)	31.36±8.111
Anxiety (score ranges 0–16)	3.63±3.032

Participants' responses to a measure of loving-kindness, specifically regarding how they feel when encountering people in trouble, are presented in **Table 3**. Responses were categorized into five ordered levels, ranging from minimal emotional response to universal sympathy, with frequencies and percentages calculated for the total sample (n=232). Most participants demonstrated moderate to high levels of loving-kindness, with nearly one in five expressing high loving-kindness. These data suggest a high level of concern for others' outlook among the older adults in this Thai sample, a finding consistent with cultural and Buddhist values that promote loving-kindness. However, a small group remained for whom sympathy for others was either conditional or infrequent.

Table 3. Detailed responses of the older Thai adults on loving-kindness as measured using the Inner Strength-Based Inventory

Inner Strength-Based Inventory (loving-kindness) (1–5)	Frequency (%)
When I encounter people who are in trouble	
Frankly, I feel nothing about it. I think that is the way it is	16 (6.9)
I feel sympathetic for them, but not always	16 (6.9)
I always feel sympathetic for them if they are people I know	72 (31.0)
I always feel sympathetic for everyone, even if I do not know him or her	87 (37.5)
I always feel sympathetic for everyone, even if I do not like them	41 (17.7)

Correlation of variables

The correlation coefficients among eight variables in a sample of 232 older adults are presented in **Table 4**. Higher education stands out as a consistent protective factor, associated with lower neuroticism and anxiety, and higher loving-kindness. Higher income and higher education were associated with higher loving-kindness. Loving-kindness was associated with lower anxiety. Neuroticism posed the highest risk for anxiety among the variables measured. Income and education were strongly paired, and gender was meaningfully related to both marital status and neuroticism.

Table 4. Correlation matrix of the variables

Items	Gender	Age	Marital status	Income	Education	Loving-kindness	Neuroticism	Anxiety
Gender	-							
Age	-0.073[b]	-						
Marital status	0.350[c**]	-0.056[b]	-					
Income	-0.034[c]	-0.028[b]	-0.029[c]	-				
Education	0.038[c]	-0.072[b]	-0.017[c]	0.424[c**]	-			
Loving-kindness	0.032[b]	-0.088[a]	-0.051[b]	0.152[b*]	0.162[b*]	-		
Neuroticism	-0.166[b*]	-0.023[a]	0.030[b]	-0.063[b]	-0.189[b**]	-0.071[a]	-	
Anxiety	-0.053[b]	-0.099[a]	0.115[b]	-0.100[b]	-0.234[b**]	-0.141[a*]	0.441[a **]	-

[a]Analyzed using Pearson's correlation (between continuous variables)
[b]Analyzed using point-biserial correlations (between continuous and dichotomous variables (sex, marital status, and education))
[c]Analyzed using phi coefficient (between dichotomous variables)
[*]Statistically significant at $p<0.05$
[**]Statistically significant at $p<0.01$

The results of the moderation analysis with anxiety as the outcome are presented in **Table 5**. The interaction term X (neuroticism) * W (loving-kindness) was found to be significant ($p=0.0165$), indicating that the relationship between neuroticism and anxiety is moderated by the level of loving-kindness (**Table 5**). Notably, a higher level of loving-kindness was found to

be correlated with higher neuroticism and anxiety. That is, among individuals with higher loving-kindness, neuroticism showed a stronger relationship with anxiety symptoms. The model explained 23.4% of the variance in anxiety symptoms, a satisfactory result for a psychological study. The regression model was statistically significant, $F(8, 223)=8.5114$, $p<0.0001$, an indication that the variables collectively explain a substantial percentage of the variance of the anxiety symptoms of this population.

Table 5. Moderation analysis results in anxiety as the outcome

Variable	Coeff.	SE	T	*p*-value	LLCI	ULCI
Constant	3.3698	3.0404	1.1083	0.2689	-2.6218	9.3615
Neuroticism	-0.0116	0.0675	-0.1713	0.8641	-0.1446	0.1215
Loving-kindness	-1.4630	0.6049	-2.4187	0.0164	-2.6550	-0.2710
Interaction	0.0439	0.0182	2.4150	0.0165	0.0081	0.0798
Gender	0.1790	0.3967	0.4513	0.6522	-0.6027	0.9607
Age	0.0209	0.0264	0.7922	0.4291	-0.0311	0.0730
Marital status	0.4161	0.3900	1.0670	0.2871	-0.3524	1.1847
Income	-0.3057	0.2419	-1.2639	0.2076	-0.1228	0.1710
Education	-0.0653	0.0292	-2.2408	0.0260	-0.1228	-0.0079

Coeff: regression coefficient; LLCI: lower limit of the 95% confidence interval; SE: standard error; T: t value; ULCI: upper limit of the 95% confidence interval
$R^2=0.2339$
$F(8, 223)=8.514$, $p<0.0001$

The interaction effect of loving-kindness on the correlation between neuroticism and anxiety in Thai older individuals is demonstrated in **Figure 1**. The lines illustrate the anticipated anxiety levels at varying degrees of Loving-Kindness (3.00, 4.00, and 5.00). Higher levels of loving-kindness are associated with a stronger positive association between neuroticism and anxiety.

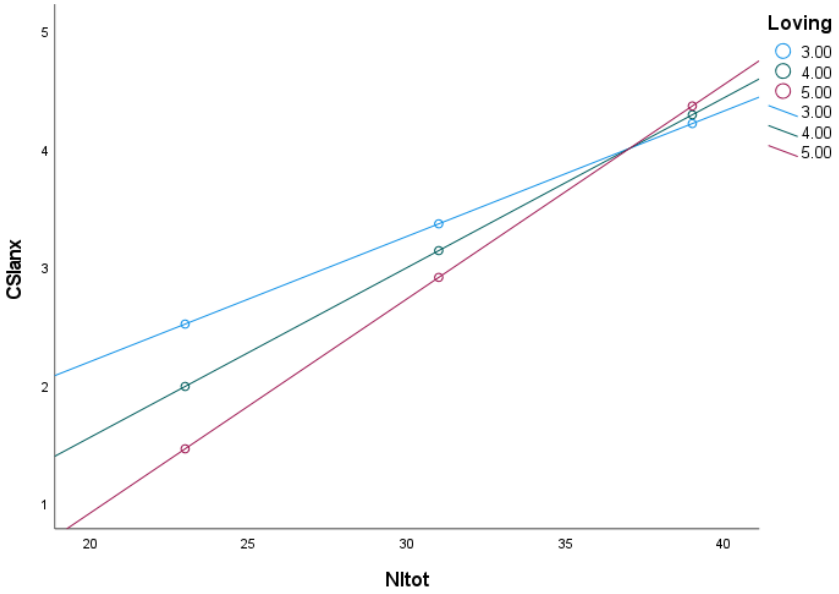

Figure 1. Moderating effect of loving-kindness on the correlation between neuroticism and anxiety symptoms.

Discussion

The study aimed to understand the moderating effect of loving-kindness on the neuroticism and anxiety relationship to contribute to the evidence-based incorporation of Buddhist practices into mental health interventions. The results may inform the development of culturally attuned mental health practices for older Thai individuals, integrating traditional Buddhist practices with modern psychological principles. This is particularly essential due to Thailand's fast-aging demographic and scarce mental health resources, where culturally informed interventions based

on the *brahmavihāra* tradition may provide accessible and acceptable methods for enhancing psychological well-being in older adults facing neuroticism and anxiety.

The findings surprisingly revealed that in this sample of older Thai adults, loving-kindness was inversely related to higher levels of neuroticism and anxiety. In other words, high loving-kindness in the most neurotic and anxious people appears to have become a risk factor, opposed to a protective factor. The assumption on which this research began was that all levels of loving-kindness would benefit anxiety outcomes. This finding might seem counterintuitive and could be necessary for theory and intervention.

Contrary to our initial hypothesis, high levels of loving-kindness may have amplified rather than buffered the association between neuroticism and anxiety symptoms among older Thai adults. Individuals who were both highly neurotic and reported greater loving-kindness experienced higher levels of anxiety. This counterintuitive result challenges the widely held view that loving-kindness and related prosocial traits typically serve as protective factors against psychological distress. Several interrelated explanations may account for this finding. Within Thai and Buddhist contexts, loving-kindness (*metta*) is highly valued and closely linked to empathy, compassion, and universal goodwill [30,46,47]. Yet cultural and social pressures to consistently express kindness, regardless of personal feelings [48], may intensify stress and internal conflict for individuals high in neuroticism. For such individuals, loving-kindness may be experienced as an obligation, and any perceived failure to meet such ideals can lead to heightened self-criticism, guilt, or shame [48,49], thereby exacerbating anxiety [25,48,49]. At the same time, those with both high neuroticism and high loving-kindness may be especially emotionally sensitive, leaving them vulnerable to empathy overload or compassion fatigue [50,51]. This heightened sensitivity can result in worry, guilt, or anxiety when confronted with others' suffering, particularly if they feel unable to help, and emotional contagion may further lead them to absorb others' anxieties or feel responsible for alleviating others' distress [52-54].

Measurement considerations may also be relevant, as the loving-kindness scale used in this study focuses on the tendency to feel sympathetic emotional responses toward anyone in distress, including unfamiliar or even disliked individuals. This approach highlights a broad, inclusive sense of empathy and concern for others [55], which, especially among individuals high in neuroticism, could be associated with heightened emotional involvement and increased vulnerability to anxiety [56]. Older adults may also feel social pressure to have such characteristics regardless of their internal state, inadvertently increasing psychological stress. Furthermore, high neuroticism is associated with greater self-focus, emotional reactivity, and vulnerability to negative mood states [11,14,57]. When combined with a strong external orientation toward others' suffering, this may generate internal conflict [11]. Individuals may harshly judge their own negative emotions, suppress natural worries, or ruminate about their inability to live up to compassionate ideals, thereby worsening anxiety. Finally, contextual factors unique to this sample, such as the lived experiences of older Thai adults, traditional values, and current social or economic stressors, may further exacerbate the interaction between neuroticism and loving-kindness. Taken together, these considerations suggest that loving-kindness, as measured and experienced in this context, may not always be protective, particularly for individuals with high neuroticism. Instead, it may function as empathic distress rather than resilient, skillful compassion. This pattern underscores the importance of distinguishing between universal empathy, which can lead to emotional exhaustion, and healthy compassion, which integrates warmth, wisdom, and self-care.

Our findings highlight the need to carefully consider both the measurement and application of loving-kindness and related prosocial traits. Psychological interventions that promote compassion, particularly for individuals high in neuroticism, may be most effective when they incorporate emotion regulation, self-compassion, and strategies for maintaining healthy emotional boundaries. Future research should clarify distinctions between compassion and empathic distress and examine whether different loving-kindness interventions or measurement tools yield differential effects across personality factors and cultural contexts.

It is important to consider several limitations when interpreting these results. It is difficult to determine the directionality of the relationships because the cross-sectional design precludes causal inferences regarding the relationships among neuroticism, loving-kindness, and anxiety.

Given the cultural importance of loving-kindness in Thai Buddhist society, all variables were based on self-report surveys, which are susceptible to social desirability bias. Data collection during the COVID-19 pandemic (December 2021 – September 2022) may have affected anxiety levels and the observed connections, as the sample was primarily female (59.9%) and had a basic education level (74.6%). The study did not examine additional relevant variables, such as emotional regulation techniques, self-compassion, or prosocial traits. Furthermore, the model explained only 23.4% of the variance in anxiety symptoms, suggesting that there are significant unmeasured factors. Hence, future studies should employ longitudinal designs with comprehensive multi-item measures, larger and more diverse samples, and analyses of additional moderators and mediators to better understand when and how loving-kindness may mitigate or intensify the relationship between neuroticism and anxiety across contexts.

Conclusion

This study found that loving-kindness strengthened, rather than reduced, the relationship between neuroticism and anxiety symptoms among older Thai adults. Contrary to expectations, those with high levels of both neuroticism and loving-kindness experienced the most significant anxiety. This finding suggests that, in individuals and cultural contexts, universal sympathy and emotional responsiveness may increase emotional burden rather than provide psychological protection. It highlights the importance of considering how prosocial traits interact with personality and social expectations. Future research and interventions should not only cultivate loving-kindness but also incorporate emotion regulation and self-care strategies to better support the mental health of older adults.

Ethics approval

The survey was approved by the Institutional Review Board (Ethics Committee) of the Faculty of Medicine, Chiang Mai University (PSY-2562-06395). The current analysis was approved by the Research Ethics Committee, Faculty of Medicine, Chang Mai University (PSY-2568-0570).

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Competing interests

All authors declare no conflicts of interest.

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Underlying data

Upon reasonable request, the derived data supporting the findings of this study are available from the corresponding author.

Declaration of artificial intelligence use

We hereby confirm that no artificial intelligence (AI) tools or methodologies were utilized at any stage of this study, including during data collection, analysis, visualization, or manuscript preparation. All work presented in this study was conducted manually by the authors without the assistance of AI-based tools or systems.

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