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Aanapanasati Meditation and Stress Reduction Among Health Science University Students

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Abstract:

Background: Stress is a key psychological issue that affects the physical and mental health of health science university students. The aim of this study was to investigate the effects of stress reduction by AM among health science university students.

Methods: This quasi-experimental study was conducted at Thammasat University's Faculty of Dentistry from August to December 2023. The subjects were first-year dental students who had an initial Perceived Stress Scale (T-PSS-10) between 1 and 26 and participated in the Anapanasati meditation training program (AMTP) focused on concentration meditation. Participants attended four AMTP workshops in weeks 1, 4, 8, and 14. Stress levels were assessed using T-PSS-10 one week before the study, in week 14 and week 18. Data analysis included descriptive statistics (frequency, percentage, mean, standard deviation) and repeated measures ANOVA. Effect size and Bonferroni statistic were used for mean difference evaluation.

Results: A total of 28 participants were recruited for the study. The results demonstrated a significant decrease in stress levels among participants following the AMTP program. T-PSS-10 scores decreased from 17.7 to 9.8 and 8.4 at 14 and 18 weeks, respectively (t= 0.79 and 0.93, p<0.001). Qualitative feedback also indicated positive effects on academic focus, stress reduction, physical relaxation, and interpersonal relationships.

Conclusion: AMTP helps healthcare science students reduce stress and enhance overall well-being.

Keywords: Stress reduction, Meditation, Anapanasati meditation training program, Mental Health, Psychological issue, Interpersonal relationships.

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1. INTRODUCTION

Stress is a natural human defense mechanism in times of challenge or duress [1, 2], which can manifest in the form of emotional and physical tension. Stress is related to and can be exacerbated by many risk factors, from personal demographics and socioeconomic status to environmental conditions and uncontrolled externalities. According to the American

College Health Association's 2020 study, 80.9% of U.S. college students reported experiencing moderate to high levels of stress, which is much higher than other age cohorts [3].

Studies have shown that individuals undergoing high levels of stress may show signs of allergic response, headache, gastrointestinal disturbance, diminished working memory, and other cognitive problems [4-10]. If left untreated, chronic stress can lead to serious long-term health problems in multiple body systems, including high blood pressure, obesity, Alzheimer's disease, and insomnia [11-14]. A high prevalence of stress was reported among health science university students [15, 16]; this is largely due to rigorous academic demands, including frequent exams and high expectations, which often lead to heavy workloads and poor time management [17-21]. Previous studies have explored the impact of mindfulness meditation on student well-being [22-26]. Untreated, the physical and psychological impact of stress will impact students' social lives and academic performance [10, 16, 27], necessitating strategies for stress management [28, 29].

Stress management techniques can be categorized into positive and negative strategies. Harmful stress-coping methods include self-isolation, over/undereating, and substance abuse [30]. Positive techniques allow an individual to lower tension through exercise, diet, social interaction, and mindfulness activities [18]. Of all the positive strategies for coping, mindfulness-based interventions, specifically meditation, are becoming increasingly popular among university students [31].

Meditation, a practice with roots in ancient yoga, has evolved into a broad term covering many different techniques. These techniques vary in their focus and cultural origins, but all aim to cultivate mindfulness and inner peace. Examples of contemporary meditative techniques include transcendental meditation (TM), body scan meditation (BCM), guided visualization (GV), and mindfulness meditation (MM) [32]. TM is a method whereby practitioners silently recite a mantra to attain profound relaxation and transcendence. In contrast, BCM entails the systematic focus of attention across the body, observing physical sensations and alleviating tension. Certain techniques necessitate third-party involvement, such as GV, wherein the practitioner is directed by a live guide to visualize scenes, images, or scenarios [33]. Each technique involves different practices and techniques but shares the same goals of achieving relaxation, healing, body awareness, and enhanced mindfulness for the practitioner [25, 26, 31, 34-38].

MM is achieved through paying attention to the present moment without judgment. Mindfulness-based meditation focuses on observing the breath, bodily sensations, thoughts, and emotions, cultivating awareness, clarity, and a non-reactive mindset. Mindfulness, deeply rooted in Buddhist culture, is the most prevalent form of meditation in contemporary research and has been shown to effectively reduce stress, manage pain, and improve overall emotional well-being through increasing self-compassion and mindful awareness [35, 39, 40]. Anapanasati meditation (AM), or mindfulness of breathing, has been one of the more recognized forms of mindfulness meditation in the past few decades. As the term is derived from the Pali words "anapana," meaning inhalation and exhalation, and "sati," meaning mindfulness, the heart of this form is for practitioners to focus on their breathing. When the attention is fully focused on the natural breathing rhythm without the urge to control, the breath acts as an anchor for awareness in the present moment. It helps the practitioner let go of distractions and worries [41, 42]. Through consistent practice, practitioners cultivate a deeper sense of calm (*samatha*) and concentration (*samadhi*) [43]. AM is also considered a preliminary step in deeper forms of MM, like vipassana meditation (VM). VM or insight meditation, where practitioners can develop an understanding of the impermanent (*anicca*) and non-self (*anatta*) nature of all experiences, eventually leading to liberation from suffering (*dukkha*) [44].

In university settings, AM is considered as a cost-effective, low-stigma, and accessible way to improve physical and mental well-being among students [34]. In a 2019 US study, Zollars reported that mindfulness breathing could decrease stress and maintain mental well-being in pharmacy students [45]. In a Chinese study in 2023, AM was effective in reducing stress, suicidal ideation, and salivary cortisol, including improved sleep efficiency for college students with high suicidal tendencies [38]. Bhutekar reported from India in 2019 that AM could reduce stress from learning among students aged between 14 and 20 years old [46]. The current study site was in students in the central region of Thailand. Most subjects were Buddhist. AM was closely related to Buddhist religion and Thai culture. AM was easily accepted to practice in daily life. The aim of this study was to investigate the effects of stress reduction by AM among health science university students.

2. METHODS

2.1. Study Design and Setting

This research utilized a quasi-experimental design with a meditation group. The studied population were first-year Thai dental students from Thammasat University, consisting of 30 students in the regular program and 20 in the bilingual program, making a total of 50 students. The period of the study was from August to December 2019.

2.2. Sample Size

To determine the appropriate sample size, a power analysis was conducted using. G*Power software (UCLA, LA, USA). A power of 0.80, a significance level of 0.05, and an effect size of 0.25 were specified. The analysis, using Repeated Measures ANOVA, indicated a required sample size of 28 participants. To account for potential attrition during the study, the sample size was increased by 10%, resulting in a final sample size of 31 participants. Participants were selected based on specific criteria. Thirty-one individuals were then randomly chosen through

a lottery system to participate in the study, adhering to the predetermined sample size.

2.3. Inclusion and Exclusion Criteria

Inclusion criteria were composed of subjects 18 years old and older with volunteers to participate in the study. The initial screening tool was a personal questionnaire and the Thai version of the Perceived Stress Scale (T-PSS-10). Subjects who exhibited moderate stress (T-PSS-10 between 1 and 26 points) from self-assessment questionnaires were recruited. The exclusion criteria included diagnosed major psychiatric disorders.

2.4. Data Collection

Data collection involved a personal questionnaire and the Thai version of the Perceived Stress Scale (T-PSS-10). The T-PSS-10 consists of 10 questions assessing perceived stress frequency within the past month. These questions cover both positive and negative aspects of stress, using a 5-point Likert scale (0 = never, 1 = almost never, 2 = sometimes, 3 = often, 4 = very often). Cronbach's alpha coefficient for the T-PSS-10 in this study was 0.76. Participants who had stress were recruited. The self-test questionnaire was filled out by students using the Thai version of the perceived stress scale (T-PSS-10) [47].

The T-PSS-10 was applied to all participants for baseline data. Participants also provided contact information, including phone numbers and Line IDs, for the researchers to conduct random monitoring and encourage adherence to the daily meditation schedule. Participants were assigned to a daily AM training program (AMTP) that consisted of walking and sitting steps. The steps were performed in a comfortable setting where participants wore loose clothing and ensured a suitable room temperature to avoid distractions. Walking steps involved walking slowly over 5 to 10 meters in a quiet and comfortable environment. Participants walked forward, stopped, turned around, and repeated these steps for 30 minutes. Throughout the practice, they focused on their breathing, slowly inhaling and exhaling while mentally reciting the mantra "Budho" in silence. Participants were instructed to direct their attention to one of three focal points: the forehead, heart, or navel. They were encouraged to keep their eyes open and focus ahead while walking. At the end of the walking path, participants mindfully turned to the right, stopped, stood straight, and restarted the process. The walking step concluded with a short prayer to spread kindness.

For the sitting part of the AMTP, participants sat cross-legged, with the right leg over the left and placed their hands on their laps. The posture required participants to relax their muscles and keep their body straight. During the practice, participants were instructed to close their eyes lightly, inhale and exhale gently, and silently recite "Budho" to calm their minds and enter a meditative state. Participants were encouraged to let go of any mental distractions, such as outside noises or thoughts, and refocus their attention on the mantra if their concentration wavered. The sitting meditation also ended with a recitation of the loving-kindness prayer. This final step took around 30 minutes. Details of AMTP were instructed by the research team and the participants could later access more information via a YouTube® video [48]. Each session required participants to engage in 60 minutes of meditation practice daily, divided into two 30-minute segments dedicated to each of the techniques.

At the first visit, participants were asked to attend AMTP 4 mini-workshops in the first, fourth, 8th, and 14th weeks. The content included greetings, relationship-building activities, introductions, an overview of the objectives, benefits of the program, information about the causes of stress, and how suffering affects the mind and body.

During weeks 1-14, participants were encouraged to practice AM daily at a place of their convenience. They were instructed to log their AM progression daily via Google form or Line app monitoring to ensure consistency of at-home practice. The record included the date and duration of their AM sessions, as well as any cognitive, emotional, and physical reflections following each session.

On the 14th week, post-stress evaluation was conducted using the T-PSS-10.

Participants attended a group discussion and were encouraged to identify any changes after the 14-week AM practice and discuss how AM experiences affected their daily lives. A follow-up stress evaluation was conducted on the 18th week to assess the long-term effects of the meditation program. Researchers used the Line group application and phone check-ins to maintain engagement throughout the program. A 10-minute video recording was requested from each individual to ensure correct AM practice during the 14th week.

2.5. Ethical Approval

This quasi-experimental study received ethical approval from the Human Research Ethics Committee of Thammasat University (Science), Pathum Thani, Thailand (Approval Number: COA. 110/2565). Adult participants (over 18 years old) provided informed consent after understanding the study. Confidentiality was maintained. Research activities adhered to the approved protocol and ethical guidelines from the Human Research Ethics Committee of Thammasat University (Science), Thailand. The study complied with the Declaration of Helsinki, the Belmont Report, CIOMS guidelines, and Good Clinical Practice (ICH-GCP) standards.

2.6. Analyses

Statistical analysis was performed using the Statistical Program for Social Science.

(SPSS version 28, IBM Corp, NY, USA). Continuous variables, the socio-demographic, descriptive data, and stress levels were expressed as percentages, means, and standard deviations. A repeated measures ANOVA was conducted to evaluate changes in stress levels over time, determining the overall effectiveness of the AM practice in reducing stress levels during the intervention and the follow-up period.

3. RESULTS

A total of 28 participants completed the AMTP course, as shown in Fig. (1). The average age of participants was 18.4 years old. The percentage of female participants was 67.9 (19/28). One-third (11/28) of participants stayed with their families during the study. Few subjects (2/28) had extra employment during the study, as shown in Fig. (2).

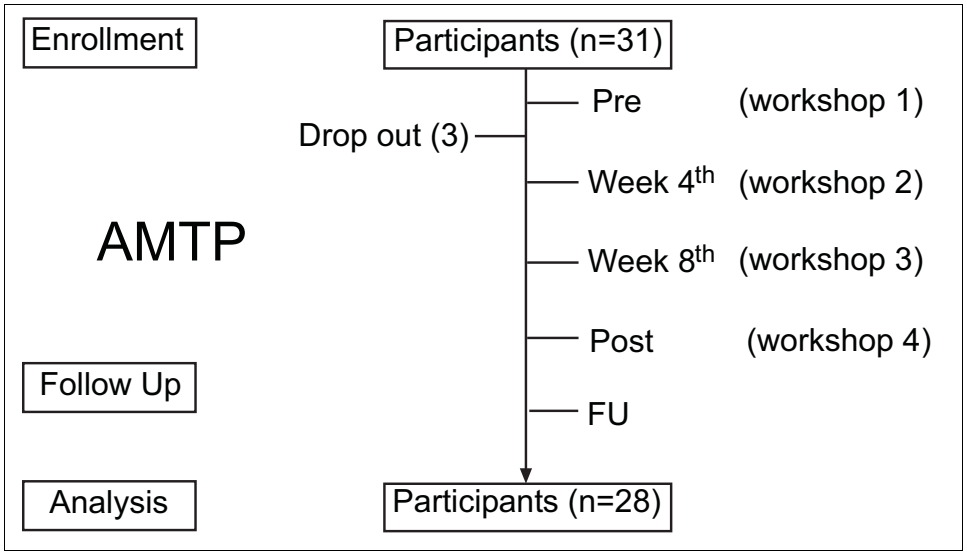

Fig. (1). Flow of study.
T-PSS-10: Thai version perceived stress scale, AMTP: anapanasati meditation training program, Pre: stress evaluation before AMTP by T-PSS-10, Workshop: AMTP workshop, Post: stress evaluation after AMTP 14 weeks by T-PSS-10, FU: stress evaluation after post 4 weeks by T-PSS-10.

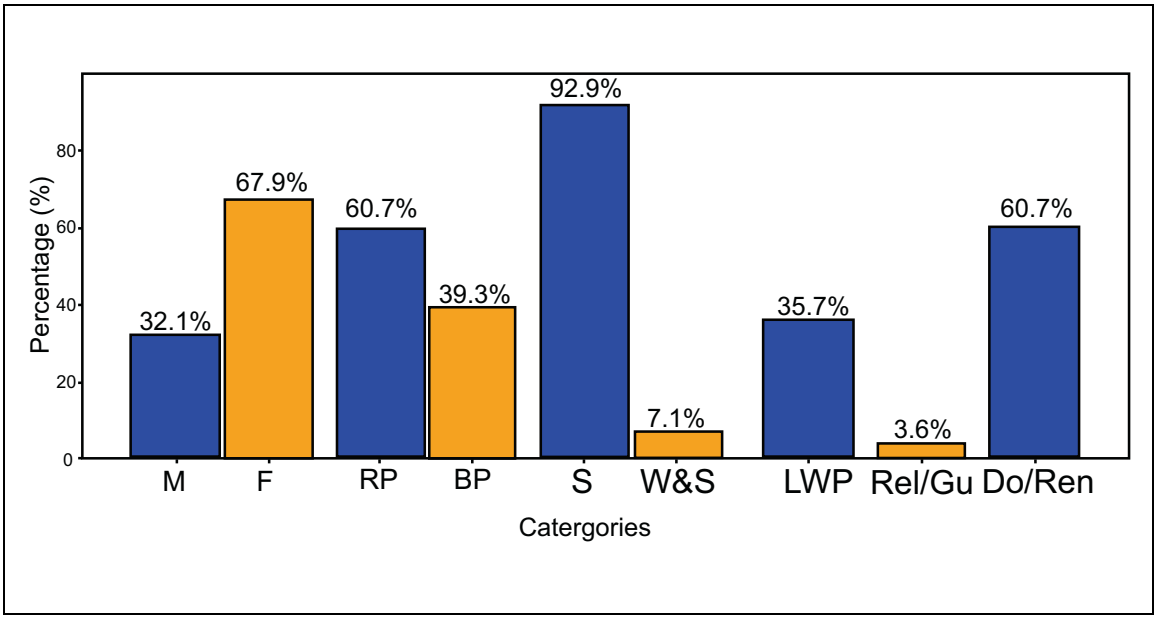

Fig. (2). Demographic characteristics of participants, n (%).
M: Male, F: Female, RP: Regular Program, BP: Bilingual Program, S: Study only, W&S: Work and study, LWP: Living with parents, Rel/GU: Relatives/Guardians, Do/Ren: Dormitory/Rented.

Table 1. Evaluation of perception and stress levels of undergraduate students measured by T-PSS-10.

S.No.	In the last month, how often have you	Pre*	Post*	d1	FU*	d2
1	been upset because of something that happened unexpectedly?	2.3±0.8	1.3±0.7	1.33	1.0±0.7	1.73
2	felt that you were unable to control the important things in your life?	1.6±1.1	1.0±0.7	0.65	1.0±0.6	0.68
3	felt nervous and stressed?	1.9±0.9	1.2±0.7	0.87	1.0±0.8	1.06
4	felt confident about your ability to handle your problems?	1.4±1.0	0.7±0.7	0.81	0.5±0.6	1.09
5	felt that things were going your way?	1.6±0.8	0.7±0.7	1.2	0.7±0.7	1.2
6	found that you could not cope with all the things that you had to do?	1.5±0.8	1.0±0.6	0.71	0.8±0.6	0.99
7	been able to control irritations in your life?	1.9±1.0	1.0±1.0	0.9	1.0±1.0	0.9
8	felt that you were on top of things?	1.6±0.9	0.6±0.6	1.31	0.8±0.6	1.05
9	been angered because of things that happened that were outside of your control?	1.8±0.9	1.1±0.7	0.87	1.0±0.7	0.99
10	felt difficulties were piling up so high that you could not overcome them?	2.0±1.3	1.3±0.8	0.65	0.7±0.7	1.25

*mean ± standard deviation (SD), Pre: stress evaluation before AMPT by T-PSS-10, Post: stress evaluation after AMP 14 weeks by T-PSS-10, FU: stress evaluation after post 4 weeks by T-PSS-10, d1: effect size between Pre and Post, d2: effect size between Pre and FU. Bonferroni between Pre and Post (t=0.79, p<0.001). Bonferroni between Post and FU(t=0.93, p<0.001).

Stress evaluation between pre and post-AMTP was analyzed by effect size statistics as shown in Table **1**. Only question 2 and 10 showed moderate stress reduction (d 0.5-0.8). While the answers to the rest of the questions reported great stress reduction (d>0.8). At the follow up period, the answer to question 10 showed more stress reduction in conjunction with the rest of the questions. Only 2 questions yielded moderate stress reduction. Bonferroni between Pre/Post and Post/ FU were 0.79 and 0.93, respectively (p<0.001).

Based on an evaluation of AM training through recorded logs, participants all meditated daily. Analysis of home AM video recordings revealed that participants were able to follow the meditation audio guide effectively. It was noted that 24 participants (86%) meditated at night before sleep, while 4 participants (14%) meditated before dawn.

During group discussion, there were three major themes related to mindfulness meditation's impact on students' stress levels and academic experiences. The first is “enhanced academic focus,” which leads to improved academic engagement. Participants reported improved concentration and attentiveness, leading to more productive study sessions and fewer mistakes made during examinations. One student remarked, “I was able to concentrate on assigned tasks with undivided attention.” Others shared, “Meditation brought me calmness, increasing my attention and focus during study periods,” and “I am more attentive when listening, less distracted, and focused better on learning.” These statements suggest that AM meditation supports academic engagement by fostering a focused, mindful approach to learning tasks.

Furthermore, an improved mind led to more satisfactory work outcomes that involved fewer errors and consumed less time. For example, one student said, “I applied it in my studies, becoming more cautious and mindful, leading to fewer mistakes.” Other students noted, “It enhanced mindfulness and focus, reducing errors at work,” and “I avoided negligence, which helped me complete tasks quickly.”

The second theme pivots around “reduced stress and physical relaxation”. Many students experienced markedly reduced stress and felt mentally and physically relaxed after meditation sessions. For instance, one participant noted, “It made me feel relaxed, both mentally and physically.” At the same time, another said, “Meditation stopped unnecessary thoughts, preventing stress.” This sense of calmness helped them manage stress and enhanced their comfort and restfulness, as seen in statements like, “I had better rest after sleep.”

Beyond academics, participants reported greater self-awareness and consideration for others, touching on the theme of “improved interpersonal relationships.” One student explained, “I became more considerate of others, calmer, and more self-aware,” reflecting mindfulness meditation's personal and social benefits. Overall, the 14-week AM intervention supported academic performance and improved participants' emotional and physical well-being, highlighting its potential as a holistic tool for emotional management and growth development.

4. DISCUSSION

After 14 weeks of AMTP, participants reported a moderate-to-high reduction of stress. After group discussion, participants were satisfied that daily one-hour AMTP for 14 weeks effectively reduced stress and enhanced their academic performance. From this work, AM has shown the potential to improve mental health, academic performance, and stress management. These statements suggested that AM meditation supports academic engagement by fostering a focused, mindful approach to education tasks.

Multiple studies across various countries have shown that mindfulness practices could significantly improve mental and physical well-being as well as enhance the academic performance of college students. Previous studies in the United States demonstrated the effectiveness of mindfulness practices in enhancing the mental and physical well-being of college students. Meditation was performed either via a smartphone meditation application or by attending a meditation program from one to three months. Those works reported that meditation significantly reduced stress, improved overall well-being, and elevated quality of life among college students [22, 26, 36, 45, 49, 50].

Table 2. Comparison of the current study and the previous literature.

	Country	Year	Participants	Age	WE	n	Type	Intervention
Patarathipakorn	Thailand	2024	Dent	18-21		28	QE	APM
Truhlar	USA	2022	Phar			89	QE	MMA
Zollars	USA	2019	Phar			65	QE	MMA
Heinrich	USA	2024	Nurs	18-61		145	RCT	CMMP
Miller	USA	2022	Col			38	QE	CMMP
St. Martin	USA	2024	Col			236	QE	MMC
Dorais	USA	2021	Col			100	RCT	CM
Schulte-Frankenfeld	Netherland	2022	Col		>20	64	RCT	MMA
Oró	Spain	2020	Med			143	QE	CMMP
Alhawatmeh	Jordan	2022	Nurs	>18		108	RCT	CMMP
Wu	China	2023	Col	18-30		64	RCT	APM
Liu	Taiwan	2024	Nurs	<20		94	QE	CMMP
Gupta	India	2023	Col	>18		187	QE	HM

WE: working experience (hours/week), QE: Quasi-experimental study, RCT: randomized controlled trial, APM: anapanasati meditation, MMA: mindfulness meditation application, CMMP: custom mindfulness meditation program, MMC: mindfulness meditation class, CM: centering meditation, APM: anapanasati meditation, HM: heartfulness meditation, Dent: Dental students, Phar: Pharmacy students, Col: College students, Med: Medical students, Nurs: Nursing students.

Apart from research from the USA, mindfulness practices demonstrated positive effects on mental health across diverse populations. In Spain, Oró and colleagues (2021) found that mindfulness training reduced stress and psychiatric symptoms in medical students [51]. Similarly, Alhawatmeh *et al*. (2022) reported regular practice of MM decreased stress and improved mindfulness in Jordanian nursing students [37]. In Taiwan, Liu *et al*. showed that an eight-hour mindfulness program led to sustainable stress reduction in nursing students [31]. Furthermore, Wu and College found that a brief MM reduced stress, sleep disturbances, and suicidal ideation in high-risk Chinese young adults [38]. A study by Gupta *et al*. (2023) revealed that Indian female students who engaged in Heartfulness meditation had lower stress levels and higher life satisfaction [52]. Additionally, a study by Schulte from the Netherlands revealed that application-based MM was effective in reducing perceived stress and enhancing self-control among university students who were also working [25]. The current study supported the result of previous studies that meditation could be used to reduce stress and improve mental and physical health, as well as well-being. The meditation type in the current study was Buddhism-based and was easy and comfortable to practice among Thai or Asian subjects who believed in Buddhist religion. A comparison of the present to previous studies was summarized and is presented in Table **2**.

It is known that factors such as curiosity, effective emotion management, and adequate sleep also play crucial roles in academic success [53-56]. The practice of mindfulness has been linked to better academic performance, as those who practiced gained enhanced metacognitive skills, self-regulation, and emotional intelligence [57, 58]. Moreover, there was a positive correlation between mindfulness and academic performance [59].

Based on insights from the group discussion, a critical factor for successful mindfulness programs is a calm environment with minimal disturbance during practice. To achieve a successful AM, participants needed faith, persistence, dedication, and discipline for regular practice. Night meditation was preferred primarily due to the peaceful and uninterrupted atmosphere, allowing longer meditation sessions. Participants generally chose suitable times for meditation in the morning or at night. Those who preferred morning sessions believed it provided a positive start to the day. At the same time, those who meditated at night found it was helpful in relaxing the mind and improving sleep quality as part of their bedtime routine.

Furthermore, the feedback from participants highlighted AM's potential as a holistic tool for emotional management and growth development. Studies have shown that emotional intelligence, psychological well-being, and mindfulness practices positively impact academic performance [59, 60]. This is in line with the concept of "metacognition," or the ability to understand and control one's thinking processes. Metacognitive skills, enhanced by mindfulness practices like AM, are skills that can contribute to effective learning and self-regulation [61-63]. Emotional management, on the other hand, is an essential skill to possess during stressful periods. Emotional management supports the learning process. It also plays a critical role in maintaining curiosity which then drives a desire to explore and understand, fostering a growth mindset. Emotional management also better equips individuals to cope with challenges and stress, promoting resilience and mental health [64, 65].

Participants further mentioned that AM led them to a sense of calmness that helped them manage stress and enhanced their comfort and restfulness. Similar to AM's mindfulness enhancement, there was evidence for how moving meditation exercises improved sleep quality and reduced depression [66, 67]. Adequate sleep is crucial for cognitive function that directly affects an individual's professional outcomes like academic performance [55, 56].

Lastly, several statements from the group discussion suggested that AM meditation supported academic

engagement by fostering a focused, mindful approach to learning tasks. Beyond reducing stress and improving overall well-being, theoretical models proposed that MM could enhance attention focus and emotional regulation by cultivating a non-judgmental mindset [41]. Meditation can lead to improved cognitive and emotional processing and, ultimately, better brain health. Prakash's work supported this idea, suggesting that mindfulness could be used to enhance attention control and reduce emotional disturbances [41].

5. STRENGTHS, LIMITATIONS, AND SUGGESTIONS FOR FUTURE RESEARCH

Previous research on mindfulness meditation training had primarily focused on short-term outcomes [68]. This study explored the long-term impact on the stress levels of healthcare science students, a population known for high stress. Despite relying on self-reported stress measures, the study incorporated group discussions to dive deeper into participants' experiences and perceptions of the training's benefits and drawbacks.

However, the study's limitations, such as a small sample size and the lack of a control group, warrant caution in interpreting the findings. Future research should involve a larger number of participants, including faculty, and a control group to establish stronger evidence. To foster a culture of health and well-being, healthcare science institutions should consider offering mindfulness meditation training in private settings.

CONCLUSION

The findings of this study indicate that Anapanasati meditation was a feasible intervention for most participants to practice nightly before sleep, resulting in a significant reduction in stress levels. Moreover, its implementation may contribute to improved academic performance and decreased psychological distress among healthcare science students. These results suggest that Anapanasati meditation could be a viable adjunctive strategy for stress management and cognitive enhancement in academically demanding environments.

AUTHORS' CONTRIBUTION

O.P. and K.K.P. designed the study. O.P., K.S., and K.T. analyzed the data. O.P., K.S., P.S., and K.B. interpreted the findings, and drafted, and revised the manuscript. All authors reviewed and approved the last version.

LIST OF ABBREVIATIONS

The T-PSS-10	=	Thai version perceived stress scale.
AMTP	=	Anapanasati Meditation Training Program
TM	=	Transcendental Meditation
BCM	=	Body Scan Meditation
GV	=	Guided visualization
MM	=	Mindfulness Meditation
AM	=	Anapanasati meditation
VM	=	Vipassana meditation
AMTP	=	AM Training Program

ETHICS APPROVAL PARTICIPATE AND CONSENT TO PARTICIPATE

This study received ethical approval from the Human Research Ethics Committee of Thammasat University (Science), Pathum Thani, Thailand (Approval Number: COA. 110/2565).

HUMAN AND ANIMAL RIGHTS

This research with human participants followed our protocol and Thammasat University's ethical guidelines, adhering to the 2013 revision of the Helsinki Declaration (1975) (http://ethics.iit.edu/ecodes/node/3931).

CONSENT FOR PUBLICATION

Informed written consent was obtained from all adult participants (aged 18 and older) after they received a comprehensive explanation of the study's purpose and procedures.

STANDARDS OF REPORTING

STROBE guidelines were followed.

AVAILABILITY OF DATA AND MATERIALS

The data and supportive information are available within the article.

FUNDING

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CONFLICT OF INTEREST

The authors declare no conflict of interest, financial or otherwise.

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