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A quasiexperimental study of assessing the impact of stress management program on health science students at Kuwait University

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The purpose of this research was to study the effectiveness of a stress management program among students at the Health Science Center (HSC), Kuwait University. This study utilized a quasiexperimental research design in which the participants were randomly assigned to one of two groups: (1) the control group or (2) the experimental (intervention) group. The participants received a comprehensive educational seminar relevant to stress management (i.e., a presentation, written hand-outs and a structured home program). The program addressed nine topics pertaining to stress management strategies: breathing and imagery techniques; self-care routines; planning for success; meditation strategies; monitoring mechanisms for coping; seeking help for mental health, exercise and health; cognitive behavioral therapy tips (CBTs); and psychoeducation. The demographic data along with using two validated tools were collected through online google form; the validated tools were: (1) the Perceived Stress Scale and (2) the Depression, Anxiety, and Stress Scale-21. Nonparametric tests, including Wilcoxon signed-rank tests and Kruskal–Wallis tests, were used to investigate statistically significant differences between the median scores of the control and intervention groups (p values < 0.05). Ninety-eight participants participated in the stress management program (56 participants in the intervention group and 42 in the control group). There was a significant improvement in stress and depression in the intervention group compared with the control group (p values < 0.05). With respect to the value of the stress management program, additional online postintervention survey questions were filled out by the intervention group; 82.1% (*n* = 46) of the intervention group agreed that the stress management program was useful, and 89.3% (*n* = 50) agreed that they would recommend that other students utilize this program regularly in the future. In conclusion, in this study, we developed, implemented, and evaluated the effects of a stress management program among HSC students. The program improved HSC students' mental health while reducing their depression and stress levels. Most importantly, the study findings presented here were feasible and could provide important information that can be applied to future studies and used as invaluable mental health resources for students at different university programs. Thus, future studies with larger representative samples and true randomized controlled trials are needed to consolidate our findings concerning the value of such scientifically driven and culturally relevant stress management program.

Keywords Stress management, Culture, Depression, Anxiety, Coping, Meditation, Cognitive behavioral therapy

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Mental health is a condition of mental well-being that allows individuals to cope with life's challenges, achieve their goals, perform well in their studies/jobs, and contribute to society[1]. Mental health problems are the main reason for disability and a major worldwide public health issue[2]. The prevalence of stress within a community is a key factor of mental health problems. Regrettably, not acknowledging or treating these emotional issues increases psychological morbidity, impacting both professional and personal aspects of individuals' lives[3]. Stress arises when an individual's perceived ability to adjust or cope is outweighed by internal or external demands[4]. The American Psychological Association defines stress as an emotional response that causes symptoms such as restlessness, exhaustion, tense muscles, and irritability[5].

University students face unique stress factors, such as transitioning from home, gaining independence, managing new responsibilities, and meeting high academic expectations[6]. Health science students experience additional stressors such as a challenging curriculum, regular exams, exposure to illnesses and deaths, and academic stress. Additionally, many students face personal, familial, social, emotional, and health-related challenges outside of their academic responsibilities[7,8]. How stress is perceived and managed can determine whether it positively or negatively affects a person's life. Stress can motivate students to improve their academic performance, but it can also lead to mental, social, and physical problems of varying severity depending on the situations and obstacles faced[9].

Stress can negatively impact decision-making and memory, resulting in significant declines in mental well-being, including anxiety, depression, and substance addiction. In terms of social interactions, stress can strain students' relationships with friends and family. In terms of health, stress can lead to problems such as heart attack and stroke[10]. In 2018, research carried out in Saudi Arabia revealed that 34.3% of university students faced stress, while 65.7% dealt with anxiety issues[11]. Furthermore, a study conducted in Mumbai in 2021 revealed that 91% of respondents experienced elevated stress levels[12].

Kuwait University students encounter a range of psychological disorders, such as depression, anxiety, and symptoms of stress[8]. Stress plays a major role in other psychological issues, such as anxiety and depression, and has a detrimental effect on academic performance[8,13]. Another study revealed that students at the Health Science Center (HSC) experienced elevated stress levels[14].

The literature provides strong evidence for the effectiveness of stress management programs for university students, which help them manage challenges, improve their well-being, and achieve their academic goals[15–18]. Research has shown that different stress management interventions effectively decrease stress, anxiety, and depression in university students. For example, a systematic review and meta-analysis reported that stress management interventions effectively decrease distress in high-stress and general student populations[19]. Another study emphasized the importance of tailored stress management strategies to aid in the mental well-being of university students[20].

Mindfulness-based interventions have also demonstrated encouraging outcomes. Dvořáková et al.[21] studied the effectiveness of learning with the BREATHE program for college students and reported significant increases in stress, depression, and anxiety levels. Additionally, different studies have assessed the effectiveness of the Koru Mindfulness program and reported favorable results regarding decreased stress and improved mental well-being[22,23]. Even though these interventions are accessible, programs that are culturally suitable to address the specific stressors experienced by students in diverse areas are needed. Hence, we believe that introducing a stress management program for students at Kuwait University is crucial. The objective of this research is to address this gap by creating, implementing, and assessing a stress management program designed exclusively for students at Kuwait University's Health Science Center (HSC), including students from various faculties such as medicine, pharmacy, dentistry, and allied health sciences. Our program aims to offer stress management strategies that are impactful for Kuwaiti students by including elements relevant to their culture. We hypothesize that introducing a stress management program tailored to the culture of Health Science Center (HSC) students at Kuwait University will significantly decrease stress and depression levels compared to a control group.

Methods

Study design

The study used a quasiexperimental design conducted at Kuwait University, Kuwait. Hence, a quasiexperimental design was used, as a true randomized process was not performed. In other words, not all HSC students had the same chance of being selected because we did not have the complete list of all HSC students to choose from. This led to selection bias based only on the available HSC students, where random assignment was used only within a preexisting cohort.

Participants

The inclusion criteria of the study participants were as follows: (1) students from the HSC faculties, including medicine, dentistry, pharmacy, and allied health; (2) male and female; (3) 18 years of age and older; and (4) had studied for two to seven years. The exclusion criteria included students from other faculties at Kuwait University and first-year students. Notably, the focus of this study was only health science students, as they are more likely to experience stress due to their heavy course loads and competitive learning environment[8]. Additionally, the rationale for excluding first-year students was arbitrary, mainly due to their limited educational experience at the HSC compared to other students with extensive experience and who are more prone to a stressful academic atmosphere. The participants who met the inclusion criteria and agreed to participate in the study were considered approved study participants. Hence, the participants were randomly assigned to (1) the control group (no intervention) or (2) the experimental (intervention) group. The participants received a comprehensive educational seminar (presentation, written hand-outs and structured home program) relevant to the stress management program. The process of randomization was conducted by the first author through an

electronic computer-generated program while ensuring completely random assignment of the study participants into the intervention and control groups. The recruitment process of the study participants is illustrated in Fig. 1.

Instrumentation

In our study, we utilized three components for data collection as follows:

1. ***The demographic data*** included 11 items: age, sex, nationality, marital status, major, year of study, medical condition, family support, friend support, faculty member support, and source of stress.
2. ***The Depression, Anxiety and Stress Scale-21 (DASS-21)*** comprises three subscales: stress, anxiety, and depression. Each subscale has seven items, for a total of twenty-one items on the entire scale. The NRS-2002 assesses the frequency of symptoms related to stress, anxiety, and depression. The scale's components are scored on a four-point Likert scale, with 0 indicating "does not apply to me at all" and 3 indicating "applies to me most of the time"; each subscale's maximum sum is 21. Higher scores indicate greater psychological discomfort. The scores for each subscale are established by adding the scores of the individual items and multiplying the result by two. The scale was translated into Arabic and has good psychometric properties[24].
3. ***The Perceived Stress Scale (PSS-10)***: This scale comprises 10 items and asks participants to score how much they thought life was stressful, overwhelming, or uncontrollable within the previous month. A 5-point Likert scale was used to record the responses (0 = never, 1 = almost never, 2 = sometimes, 3 = fairly often, 4 = very often). All the PSS-10 items are negatively worded, with the exception of only four items (Items 4, 5, 7, and 8), which are positively worded. The total PPS-10 score was calculated by summing all the item scores after reverse coding the positively worded items. Higher scores indicate higher levels of perceived stress. The official PSS website (Scales - Laboratory for the Study of Stress, Immunity, and Disease - Department of Psychology - Carnegie Mellon University (cmu.edu) is where this Arabic version was obtained; this version has sound psychometric properties[25].

Intervention program (stress management program)

The intervention involved self-administration of the stress management program for 4 weeks. The stress management program was developed by three faculty members from the occupational therapy and physical therapy departments. An orientation session and an educational seminar for the participants were provided

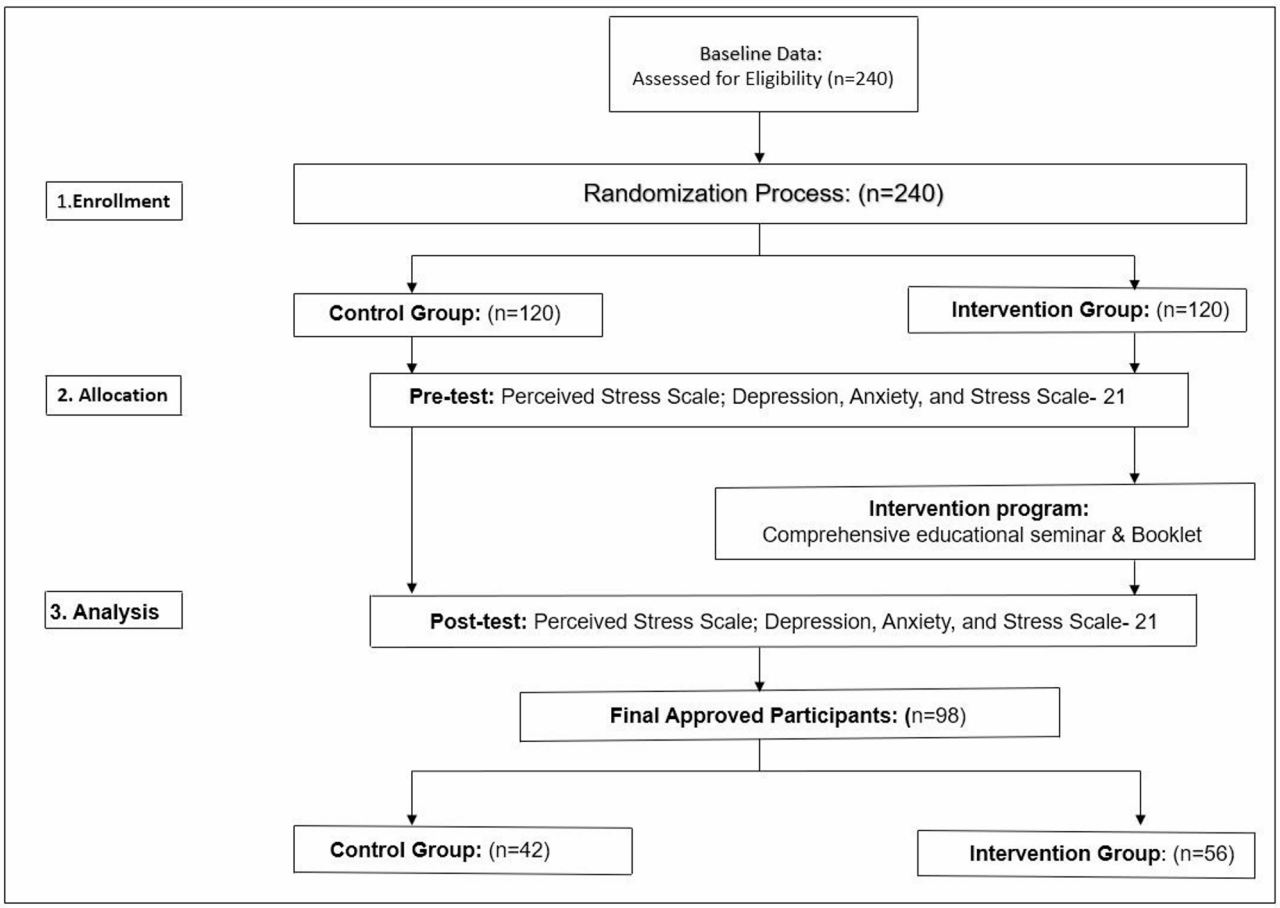

Fig. 1. Study flow diagram.

before starting the program, which was thoroughly explained and elaborated upon by the faculty members to the experimental group. Specifically, the stress management program addressed three main components: (1) oral presentation and demonstration of specific techniques, (2) written handouts, and (3) a structured home program. This program was conducted for the intervention group participants at the Health Science Center auditorium at Kuwait University on March 17, 2024. The seminar lasted approximately 45 min and included education on the entire stress management program to ensure its proper use and desired outcomes, particularly its daily application at home.

The program content included the following **sub**-components (intervention strategies):

A. **Breathing and Imagery Techniques**: This consists of two strategies: (1) ***Breathing exercises*** enable individuals to regulate their ventilation and oxygenation. The method includes inhaling through the nose and exhaling slowly and deliberately via the mouth[26]. Regular deep breathing exercises can help individuals lower their blood pressure at rest and decrease anxiety and stress[27]. (2) ***Relaxation-guided imagery*** is a technique for reducing anxiety and stress and involves substituting pleasant mental imagery for upsetting memories. This involves offering direction during training that involves sensory perceptions and behavioral and physiological reactions[28].
B. **Self-Care Routine**: Self-Care interventions are those that one can choose and implement on one's own without the guidance of a professional or practitioner[29]. A previous study revealed that the significant interaction term indicated a significant decrease in the strength of the association between perceived stress and psychological quality of life when self-care activities were reported[30].
C. **Planning for Success**: The capacity for planning enables the establishment of objectives and the means of achieving them[31]. It is seen as a coping strategy approach connected to the research by Francisco Taboada in 2015, where "planning" was one of the most common strategies employed by students[32]. Prioritization, an invaluable part of planning, is assigning resources (time, energy, attention) to tasks and goals depending on their priority and urgency. Effective Prioritization is crucial for students' academic success and to maximize learning outcomes[33].
D. **Meditation strategies**: To enhance overall health as well as emotional and social well-being, meditation is frequently utilized in health, educational, and social community contexts[34]. Meditation is described as a family of self-regulation practices that focus on training attention and awareness to bring mental processes under greater voluntary control and thereby foster specific capacities such as calmness, clarity, concentration, and general mental well-being and development[35]. With respect to culture, we focused on the Holy Quran and Athkar. According to previous studies, the Holy Quran reduced stress, anxiety, and depression[36].
E. **Monitoring mechanisms for coping**: The relationship between academic programs and perceived stress is influenced by coping mechanisms, environmental risk factors, and personal characteristics[37]. How individuals cope is determined by their abilities and the help of others. Additionally, it may trigger a range of maladaptive or health-harming behaviors, such as substance abuse. Gender, education, age, health, well-being, type of stressful context, personality traits, and other factors influence how people cope with stress. While denying reality and expressing rage and irritation are potentially harmful responses to stress, controlling emotions effectively promotes better problem-solving[38].
F. **Seeking help for mental health**: Studies have shown that students may refuse to ask for help if they feel worse, ashamed, or stigmatized. On the other hand, seeking help can lead to better coping mechanisms, having a confidant, feeling better, and receiving support[39,40]. Therefore, college students who practice self-help may be more inclined to seek expert assistance[41].
G. **Exercise and health**: Compared with medicine, psychology and sports programs are associated with a decreased perceived risk of stress[37]. Research has shown that regular physical exercise, as suggested by the World Health Organization (WHO), can help individuals avoid and reduce stress[42]. There was a high prevalence of using exercise as a coping mechanism, with 75% of respondents reporting that they were exercising more. Reduced stress and exercise are often correlated[43].
H. **Cognitive behavioral therapy tips**: Cognitive behavioral therapy is a type of psychotherapy that helps people recognize and alter harmful or disturbing mental habits that negatively impact their behaviors and feelings[44]. It eliminates avoidant and safety-seeking behaviors that inhibit self-correction of false beliefs, leading to better stress management, reduced stress-related disorders, and improved psychological manifestations such as stress, anxiety and depression symptoms[45]. One of the CBT techniques we used in our program is the Activating Event-Belief-Consequence (ABC) model. The ABC model, which was developed by Ellis[46–48], is a cognitive theoretical model that may be directly applied to our understanding of grief and bereavement. The CBT-REBT model highlights the importance of cognitive processes in understanding emotional distress following a negative event, much like other cognitive models. However, it distinguishes between two types of cognition—rational and irrational—and their corresponding emotional and behavioral consequences, which differ qualitatively and distinguish healthy and unhealthy adaptations to adverse events[49]. The ABC model of CBT-REBTs is based on several principles[49] the origins of emotional disturbances are cognitive, emotional, and behavioral; and cognition is a bridge between an event and its emotional consequences. According to the CBT-REBT model, people's beliefs (B) about an activation event (A) have a greater influence on people's emotional consequences (C) than the activating event (A)[50].

I. **Psychoeducation**: Psychoeducation is an intervention that offers knowledge, educational resources, or feedback[51]. Psychoeducation is an independent intervention within a cognitive–behavioral approach[52]. Psychoeducational interventions for stress attempt to reduce perceived stress as well as other psychological symptoms, including anxiety and depressive symptoms[53].

For the readers' convenience, benefits and possible future application or replication of stress management programs by academicians, health care professionals, and/or researchers, the complete stress management program applied with students is found in Supplementary File 1.

Postintervention survey questions

Following the intervention program, the participants in the experimental group were asked five questions through an online google form. The first four questions asked about their perceptions of the intervention (stress management) program. The first four questions pertained to the following: (1) I found the stress management program to be useful; (2) I will use this stress management program regularly in the future; (3) I recommend that other students utilize this program regularly; and (4) I recommend that my patients in the future use this stress management program regularly. The responses to the questions are given on a 3-point Likert scale (1 = disagree, 2 = neutral, 3 = agree).

The fifth question pertained to the following: (5) Which program components were most useful? The response to the fifth question was, "You can choose more than one response if needed", with nine components (intervention strategies) to choose from: (1) breathing and imagery technique, (2) self-care routine, (3) planning for success, (4) meditation strategies, (5) monitoring mechanism for coping, (6) seeking help for mental health, (7) exercise and health, (8) cognitive behavioral therapy tips (CBT) and (9) psychoeducation.

Data collection procedure

Ethical approval was obtained from the local institutional review board. Students were invited to participate in the study through a QR code and a WhatsApp group. The purpose of the study was explained to the students, and informed consent was obtained. Confidentiality was assured. Prior to random allocation, the participants were asked to fill out an online google form relevant to their demographic data along with the Depression, Anxiety and Stress Scale-21 (DASS-21) and Perceived Stress Scale (PSS). After answering all questions, the participants were asked if they were willing to participate in the stress management program.

With regards to the intervention group, after participating in the stress management program for four weeks, participants were asked to complete both the Depression, Anxiety, and Stress Scale-21 (DASS-21) and the Perceived Stress Scale (PSS) again. Additionally, they were asked to fill out an online Google form related to the post-intervention survey questions about their perception of the program's value. The control group, who did not participate in the stress management program and did not receive any intervention, were asked to complete only the scales. The re-assessment process for both the intervention and control groups was completed within the fifth week.

Statistical analysis

We analyzed the collected data using STATA version 16.0; for the subsequent statistical analysis, we used four outcomes, namely, the DASS-21 depression, anxiety, and stress subscales, as well as the PSS. To evaluate each outcome's internal consistency, we calculated Cronbach's alpha reliability coefficient (a). We assessed the normality of the outcome scores via the Shapiro–Wilk test and found they did not follow a normal distribution (p values >0.05). Therefore, nonparametric tests were used to assess the statistically significant relationships between the outcomes and baseline characteristics of the participants. We also used counts and percentages to summarize the baseline characteristics as well as postintervention survey questions. The Wilcoxon signed rank test (i.e., nonparametric statistical test used to compare two paired samples) or the Kruskal–Wallis test (i.e., nonparametric statistical test used to compare more than two medians) was used to determine statistically significant differences between the median scores of the control and intervention groups. Additionally, we assessed the statistical significance of the relationships between the outcome scores and the baseline characteristics.

Results

The final sample consisted of 98 participants. Initially, 240 students were randomly assigned to either the intervention ($n = 120$) or control ($n = 120$) groups. However, some participants did not complete the program, possibly due to their course loads and conflicting class schedules. It is important to note that no participants were explicitly excluded by the research team. This attrition led to the reduction in the sample size. In addition, there weren't any missing date in the study because study participants, using a google form, were required to answer all questions.

Most participating students were females (91.8%), with a mean age of approximately 21 years. Most students were Kuwaitis (70.5%), married (91.8%), or majoring in physical therapy (67.3%). Only 20% of the students had medical conditions, and most received support from family and friends. We found that overthinking (81.6%) and a college course load (77.6%) were the major sources of stress for most students, as indicated in Table 1.

All the subscale values were estimated to be greater than or equal to 0.79, indicating acceptable internal consistency for the subscales used to investigate our study outcomes[54]. Figure 2 shows the score distributions of the study outcomes. Except for anxiety, we found remarkably significant differences in the median scores for all of the outcomes between the control and intervention groups (p values <0.05) (Table 2). In other words, our study hypothesis was supported, as implementing a culturally tailored stress management program significantly reduced stress and depression levels among the intervention group of HSC students at Kuwait University compared with the control group. The median scores and interquartile ranges were substantially different between the control and intervention groups (Fig. 2; Table 2). Moreover, except for depression, no significant differences were found between the precontrol and preintervention groups (Table 2). Additionally, with the exception of anxiety, no significant differences were found between the pre- and postcontrol groups

Characteristic	*n* (%)
Age (Mean ± SD)	21.17 ± 2.43
Group Control Intervention	 42 (42.8) 56 (57.2)
Sex Female Male	 90 (91.8) 8 (8.2)
Nationality Kuwaiti Non-Kuwaiti	 69 (70.4) 29 (29.6)
Marital Status Single Married	 90 (91.8) 8 (8.2)
Major Pharmacy Occupational Therapy Physical Therapy Radiologic Science Health Information and Management	 1 (1.02) 26 (26.5) 67 (68.3) 3 (3.1) 1 (1.0)
Study year 2nd 3rd 4th	 33 (33.7) 31 (31.6) 34 (34.7)
Do you have any medical condition? Yes No	 20 (20.4) 78 (79.6)
Do you receive family support? Never Rarely Sometimes Frequently Always	 2 (2.0) 4 (4.1) 26 (26.5) 20 (20.4) 46 (46.9)
Do you receive support from your friends? Never Rarely Sometimes Frequently Always	 0 (0.0) 11(11.2) 34 (34.7) 18 (18.4) 35 (35.7)
Do you receive support from faculty members at your department? Never Rarely Sometimes Frequently Always	 9 (9.2) 41(41.8) 26 (26.5) 14 (14.3) 8 (8.2)
Source of Stress (n = yes) None Exposure to traumatic event Relationship and Communication with others Lack of family support Lack of support from faculty members Health issues Financial issues Psychological disorder Lack of self esteem Overthinking Bad personal habits Course load A lot of assignments Teaching style of course coordinators Lack of classmates support Future career expectations Difficulty sleeping	 1 (1.0) 35 (35.7) 39 (39.8) 17 (17.4) 18 (18.4) 24 (24.5) 13 (13.3) 13 (13.3) 31 (31.6) 80 (81.6) 36 (36.7) 76 (77.6) 33 (33.7) 39 (39.8) 16 (16.3) 45 (45.9) 42 (42.9)

Table 1. Baseline characteristics of the participants ($n = 98$).

(p values >0.05) (Table 2). However, statistically significant differences were detected between the pre- and postintervention groups (p values <0.05; Table 2).

The results revealed no significant relationships between the study outcomes and the participants' demographics (p value >0.05) (Table 3). However, we detected significant relationships between multiple sources of stress and the study outcomes (Table 3). Our results revealed that relationships and communication with others (p value <0.001) were the major contributors to depression and stress (Table 3). A lack of family support was a major source of depression (p value $=0.05$), whereas a lack of support from faculty was a major source of depression (p value $=0.03$) and stress (p value $=0.04$) (Table 3). Financial issues were a major source of depression (p value $=0.03$), whereas a lack of self-esteem was a major source of stress (p value <0.01) (Table 3). The results indicated that course load and teaching style were significantly related to anxiety and stress (p value

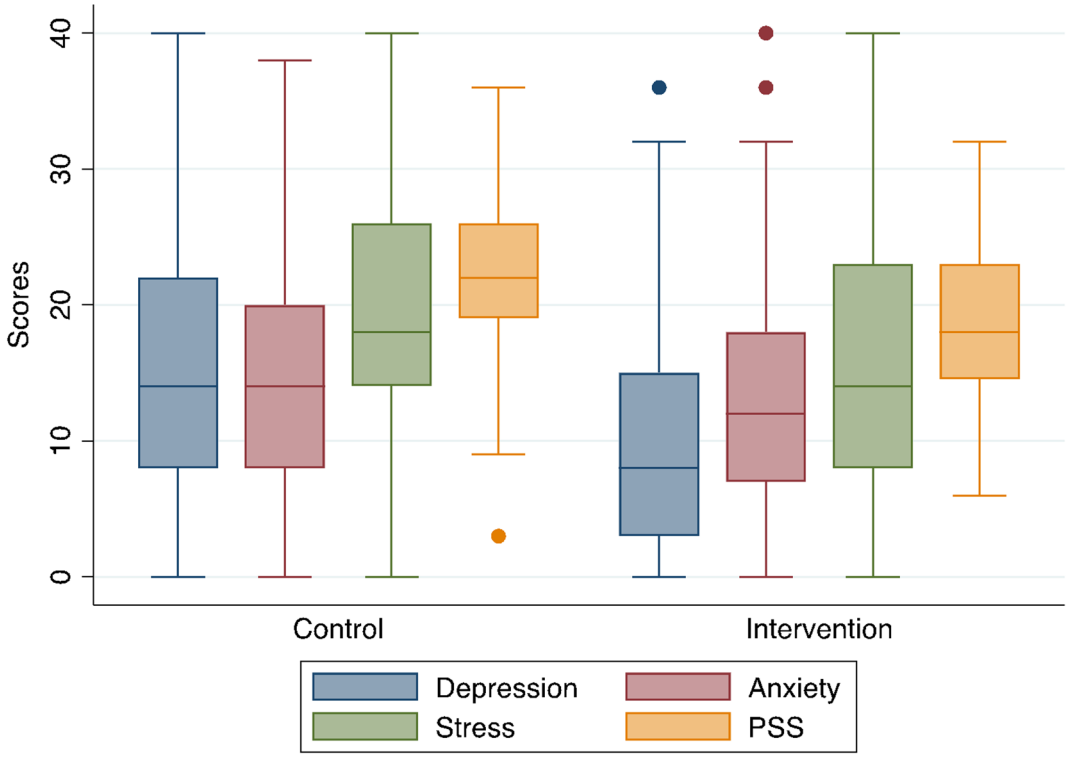

Fig. 2. Boxplot for the study outcomes showing the distribution of their scores between the postcontrol and postintervention groups.

Outcome	Alpha	Pre-Control median [IQ]	Post-Control median [IQ]	Pre vs. post control *p* value	Pre-Intervention median [IQ]	Post-Intervention Median [IQ]	Pre vs. post Intervention *p* value	Pre Control vs. Intervention *p* value	Post Control vs. Intervention *p* value
DASS-21									
Depression	0.86	16 [8, 22]	14 [9, 22]	0.78	12 [6, 20]	8 [3, 15]	< 0.01*	**0.05***	**< 0.01***
Anxiety	0.79	17 [12, 24]	14 [8, 20]	0.04*	18 [11, 26]	12 [7, 18]	< 0.01*	**0.80**	**0.56**
Stress	0.85	20 [14, 27]	18 [14, 26]	0.79	19 [12, 28]	14 [8, 23]	0.02*	**0.60**	**0.03***
PSS	0.82	22 [19, 25]	22 [19, 26]	0.57	21 [18, 24]	18 [15, 23]	< 0.01*	**0.46**	**< 0.01***

Table 2. Interreliability and univariate statistical comparisons of the study outcome scores. * Statistically significant difference according to the Wilcoxon signed-rank test.

< 0.05) (Table 3). Finally, future career expectations and difficulty sleeping were consistently significantly related to depression, anxiety and stress (p values < 0.05; Table 3).

With regards to answering the postintervention survey questions, a total of 82.1% ($n = 46$) of the participants agreed that a stress management program was useful, and 78.5% ($n = 44$) of the participants agreed to use the program regularly in the future (Fig. 3). Additionally, 89.3% ($n = 50$) agreed that they would recommend that other students utilize this program regularly, and 87.5% ($n = 49$) agreed that they would recommend that their patients use this program regularly in the future (Fig. 3). Further details regarding the perceptions of the experimental group about the usefulness of the stress management program are presented in Fig. 3. Finally, concerning the questions about which components (intervention strategies) were most effective at reducing stress, most experimental group participants reported that breathing and imagery techniques ($n = 42$, 75%), self-care routines ($n = 36$, 64.3%) and planning for success ($n = 31$, 55.4%) were the most effective strategies utilized (Fig. 4). Further details of the effective strategies for reducing stress are illustrated in Fig. 4.

Discussion

The purpose of this study was to evaluate the effectiveness of a stress management program among HSC students at Kuwait University via a quasiexperimental research design. The rationale for conducting this study is the high prevalence and susceptibility to mental health problems among students (e.g., anxiety, depression, and stress) secondary to academic pressures, social challenges, and future career concerns[55]. Several studies conducted in the Middle East and North African (MENA) region, including Egypt, Saudi Arabia, Kuwait and the United Arab Emirates, reported high levels of psychological stress, anxiety, and depression among students[8,56–58]. Hence, an emphasis on using comprehensive stress management programs is essential not only for individual well-being

Characteristic	Depression	Anxiety	Stress	PSS
Sex Female Male	0.29	0.50	0.52	0.08
Nationality Kuwaiti Non-Kuwaiti	0.46	0.62	0.12	0.83
Marital Status Married Single	0.21	0.21	0.21	0.21
Major Pharmacy Occupational Therapy Physical Therapy Radiologic Science Health Information and Management	0.24	0.26	0.46	0.18
Study year 2nd 3rd 4 th	0.52	0.47	0.55	0.65
Do you have any medical condition? Yes No	0.20	0.23	0.47	0.87
Do you receive family support? Never Rarely Sometimes Frequently Always	0.07	0.81	0.23	0.27
Do you receive support from your friends? Never Rarely Sometimes Frequently Always	0.26	0.79	0.40	0.53
Do you receive support from faculty members at your department? Never Rarely Sometimes Frequently Always	0.06	0.10	0.60	0.33
Source of Stress (n = yes) None Exposure to traumatic event Relationship and Communication with others Lack of family support Lack of support from faculty members Health issues Financial issues Psychological disorder Lack of self esteem Overthinking Bad personal habits Course load A lot of assignments Teaching style of course coordinators Lack of classmates' support Future career expectations Difficulty sleeping	0.11 0.07 < 0.01* 0.05* 0.03* 0.95 0.03* 0.13 0.12 < 0.01* 0.08 0.35 0.36 0.15 0.17 < 0.01* 0.03*	0.12 0.25 0.23 0.48 0.13 0.96 0.15 0.13 0.26 0.14 0.20 0.14 0.58 < 0.01* 0.45 0.01* < 0.01*	0.10 0.72 0.06 0.41 0.04* 0.10 0.09 0.25 < 0.01* 0.12 0.10 0.05 0.46 0.09 0.56 0.03* 0.03*	0.67 0.22 0.01* 0.76 0.22 0.26 0.17 < 0.01* < 0.01* 0.12 0.25 < 0.01* 0.12 0.02* 0.66 0.13 0.16

Table 3. Univariate statistical relationships between the study outcome scores and the baseline characteristics of the participants. * Statistically significant difference according to the Wilcoxon signed-rank test or Kruskal–Wallis test.

but also for fostering a supportive and productive academic community[55,59–61]. As researchers, to overcome the challenges facing university students' psychological symptoms and ongoing stressful issues, we utilized a stress management program to promote positive mental health outcomes.

Congruent with research, increased worrying and overthinking can lead to mental health issues, creating a cycle of negative thoughts[60–62]. To overcome stress among students, the stress management program provided for the HSC students at Kuwait University included nine areas that are important for potential improvement in mental health, academic performance, skills development, and physical health[63–66]. Hence, the primary strategies considered useful by the intervention group were breathing exercises (75%) and self-care (64.3%), which were significant components in reducing stress, anxiety, and depression among students. Similar findings support the hypothesis that deep breathing techniques can help students minimize study-related stress and tension, reduce anxiety and worry and improve concentration[63–65]. Additionally, self-care activities can further influence positive habit formation, desired behavioral changes, and promoting resilience during stressful life events[66]. It

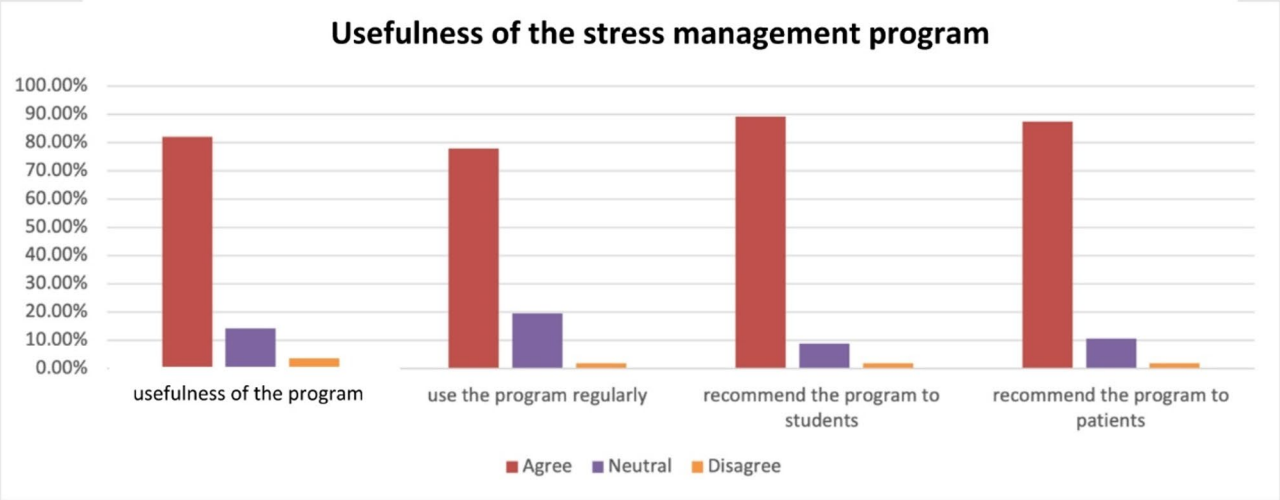

Fig. 3. Perceptions of the experimental group about the usefulness of the stress management program ($n = 56$).

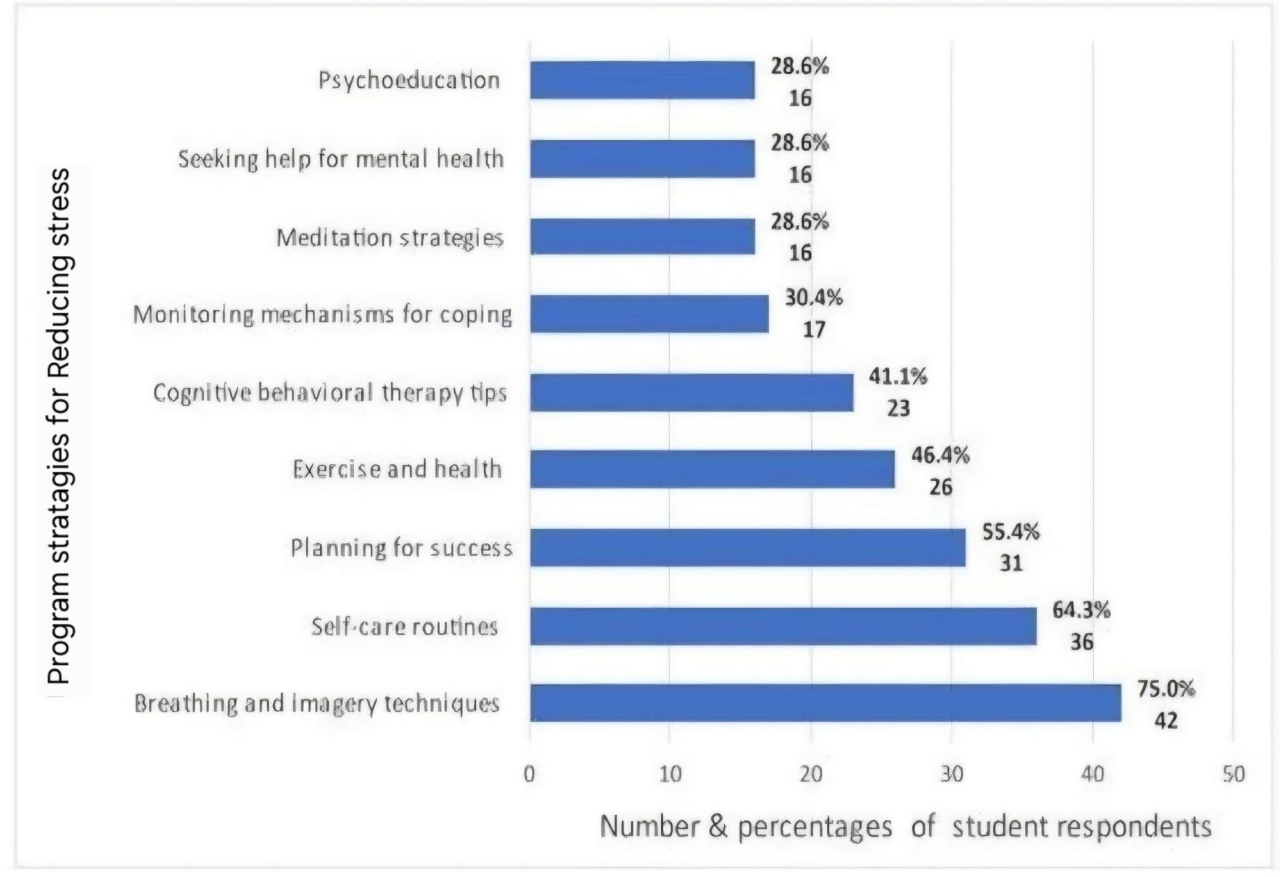

Fig. 4. Effective program strategies for reducing stress ($n = 56$).

was also found to be an ethical imperative for psychology students, as it can mitigate the adverse effects of stress on professional functioning and health during the later stages of their careers[62].

As demonstrated in this study, the high frequency of lack of interpersonal skills (i.e., relationships and communication with others), lack of family support and lack of psychological symptoms associated with this stage of education interfered with well-being and one's own realization of true potential. Further research has

shown that incorporating resilience and mindfulness techniques, along with other methods, should concentrate on acquiring knowledge and highlight a human-centered interpersonal aspect of personal development[59,67]. Our research included these interventions, such as coping strategies and psychoeducation, and emphasized the importance of mindfulness interventions in these programs. Mindfulness is associated with decreased maladjustment and heightened adaptive social behaviors[67,68]. Additionally, mindfulness programs have been shown to enhance students' resilience and help them adopt effective coping strategies[68,69]. Resilience remains consistent across different situations and environments, regardless of individual variations. Positive thoughts, problem-solving strategies, and seeking support are all closely connected, making it the most significant factor in mental well-being[69].

This program demonstrated effectiveness in the experimental group, as our results revealed improvements in the intervention group, with reduced stress (p value $=0.02^*$), depression (p value $<0.01^*$) and anxiety (p value $=< 0.01$) after completing the program. Additionally, compared with those in the control group, except for anxiety, we found statistically significant differences in the median scores for all outcomes between the control and intervention groups (p values <0.05). We believe that such a significant difference between the intervention and control groups is because the stress management program could be considered evidence-based and scientifically driven in the future. Therefore, we emphasize the need for HSC students (i.e., all majors) to be taught the importance of stress management programs during their undergraduate training. However, research indicates that it is important for programs to be ongoing and help promote resilience through demonstrating personal competence, self-reliance, independence, and perseverance[59,69]. University students showed increased resilience after participating in a curriculum that combined traditional teaching with experiential workshops. Implementing mindfulness and resilience strategies in educational settings not only addresses mental health concerns but also promotes a proactive approach to student well-being[70]. Furthermore, the study findings demonstrated that through planning and prioritizing, students were able to strategize effectively for successful outcomes in what one wanted to accomplish and attain. Thus, more than half of the intervention group (55.4%) reported using planning as an effective strategy to address their mental health problems. These findings are in line with the literature, thus emphasizing its value and effectiveness[33]. Therefore, faculty members are encouraged to incorporate planning and prioritization as useful learning strategies for their students throughout their educational curriculum due to the desired outcomes. Additionally, approximately one-third of the intervention group (30.4%) supported using positive coping strategies to address their psychological problems. In contrast, when healthy coping mechanisms are absent, students may experience excessive negative emotions and be unable to live healthy lives, thereby impacting their educational outcomes[71].

Nevertheless, utilizing positive coping mechanisms for students during their studies is a key factor in reducing stress, promoting better problem-solving skills and leading to enhanced academic performance; this is a well-documented and recognized strategy supported by research[38,72,73]. However, some students' personalities, particularly introverts, do not usually seek help when needed. Students tend to underestimate the influence it may have on their psychological status and its effect on academic performance. Thus, positive coping strategies are an invaluable technique when individuals seek help, which consequently increases their confidence levels, improves their emotions and results in receiving guidance and support[39,40]. Hence, seeking help was one of the main intervention strategies taught to the intervention group participants, who perceived its effectiveness accordingly (28.6%). In turn, motivating students to seek guidance and help whenever needed can contribute significantly to developing better coping strategies for them as students and as future health care professionals.

Additionally, a useful intervention strategy used in our program was psychoeducation (28.6%), as indicated by the experimental group[39,50]. Hence, such a strategy has been strongly emphasized in the literature, as it encourages students to acquire knowledge about their own needs, identify their priorities and understand their own weaknesses and strengths[50–52]. Students are encouraged to utilize mental health effectively, particularly those presented with emotional difficulties, who therefore exhibit maladaptive coping skills[53,74]. Additional components of the stress management program, which contributed to the interventions' positive health and addressed their psychological problems, included engaging in exercise (46.4%) and benefiting from cognitive behavioral therapy tips (41.1%). As cited in the literature, these components are proven to promote health and wellness; minimize stress, anxiety and depression; and improve quality of life[75–80]. Thus, we recommend including these components as major parts of future student counseling services received from faculty members as well as from student affairs centers.

Our findings show that the stress management strategies used in the program incorporated cultural norms and rituals, thus making the program culturally appropriate. For example, students utilized meditation strategies (28.6%) from the program, as the participants were encouraged to combine certain strategies, such as exercise and prayer (i.e., engaging in ten sit-to-stand repetitions after each prayer as Muslims pray five times a day). Additionally, our study focused on reading the Holy Quran as a strategy to reduce psychological symptoms, including stress, anxiety and depressive symptoms, which was also supported by the literature[36]. A culturally appropriate stress management program was tailored for university students and considered both the unique academic challenges and the cultural backgrounds of the students. The inclusion of cultural components motivated participants to readily and actively engage in the program. As shown in the study results, many respondents indicated that this program was useful and that they would be willing to use it regularly. Contextually relevant indices of positive adaptation must be considered to contextualize the resilience process[69]. Interestingly, owing to its culture appropriateness, the students indicated the recommended use of the program even well after graduation. Such confidence in and support for this program from the experimental group are clear signals of its utility, appropriateness and value. Notably, after the data collection and analysis, the control group received the stress management program as an online booklet.

Research continues to enhance stress management strategies and programs, resulting in progress within the field[59]. These findings indicated that many students view overthinking (81.1%) and the college course load (77.6%)

as major sources of stress. Despite these findings, the intervention group showed significant improvements in stress ($p = 0.02$*), depression ($p < 0.01$*), and anxiety ($p < 0.01$*) after program completion. The students used a variety of strategies to address mental health problems. Breathing techniques and taking care of oneself were the primary effective methods employed by the intervention group, with 75% and 64.3%, respectively. Additionally, different students found success with a variety of strategies, such as planning and prioritizing, coping strategies, seeking help, meditation, and psychoeducation. Considering the effectiveness of these self-reported approaches, as illustrated in study results, establishing ongoing support in educational settings could help mitigate rising levels of stress[66,68]. These programs must be accessible, inclusive, and frequently evaluated to meet the diverse requirements of students, aiding in their success both academically and beyond.

Study limitations

This research study has several limitations that deserve attention. Lack of blindness among the groups is a limitation in the study which could have caused bias in the study finding. Hence, Given the nature of the intervention, which is a stress management program involving educational session and behavioral techniques, and this was not feasible to blind the participants or the facilitators, as both were aware of the intervention being delivered. However, we took several steps to minimize potential biases associated with the lack of blinding: (1) Use of validated self-report measures (e.g., Perceived Stress Scale) to standardize outcome assessment and reduce measurement bias; (2) Pre- and post-intervention assessments were conducted using the same tools and conditions for both groups to ensure consistency; (3) Data analysis was conducted by a researcher not involved in the delivery of the intervention, helping to limit analytical bias.

In addition, one of the key design choices in this study was not providing any intervention to the control group. This decision was made to isolate the effects of the stress management program. However, it is important to acknowledge the limitations this introduces. The participants were students living their academic lives without recognizing they had psychological issues such as stress or depression due to educational pressure. As such, providing an alternative intervention was not deemed necessary, and the control group continued their usual activities without any additional intervention.

This approach, while beneficial for isolating the intervention's effects, may impact the accuracy and generalizability of the results. The lack of a placebo or alternative activity for the control group means that external factors influencing the results cannot be entirely ruled out. Additionally, this design choice may reduce the generalizability of the findings to real-world scenarios where some form of placebo or alternative treatment is often provided. These limitations should be considered when interpreting the study's outcomes and have been clearly discussed to ensure a comprehensive understanding of the study's design and its implications.

Moreover, the baseline depression score on the DASS-21 was significantly different between the intervention and control groups ($P = 0.05$), thus causing baseline imbalance. This could be due to the natural variability of the data among the study participants, particularly with the large drop of study participants after the randomization process. To illustrate, since there are a lot of drop-outs of the study participants making the sample less and likely influenced the study findings and analysis; this could possibly be due to the timing of data collection closer to the mid-term examination period where students were quite busy with examinations or homework assignments. Therefore, the study findings relevant to depression between the groups could be biased and thus interpreted with caution. However, the pre- and postintervention depression subscale scores for the intervention group were significantly different ($P < 0.01$), supporting the value of the stress management program utilized by the intervention group in improving depressive symptoms. Additionally, the program's outcomes may not be as broadly applicable to a larger population because of the relatively small sample size of HSC students. Notably, it is of importance to indicate that there could be a potential for inflated Type I error due to multiple testings. However, many of the outcomes (e.g., DASS-21 subscales) are conceptually and statistically related, and strict corrections such as Bonferroni may be overly conservative in such contexts, increasing the risk of Type II errors (missing real effects). On the other hand, future studies with larger sample sizes and confirmatory objectives are recommended to apply appropriate corrections for multiple comparisons in the design phase.

Furthermore, as most of the participants involved in the research were students studying physical therapy, there is a potential for bias that could hinder the generalizability of the findings to other health science fields. Therefore, future studies should include larger random samples, which are equally representative samples of students from all majors of the HSC, to ensure more inclusive and generalizable findings. Furthermore, the program's limited and short duration (4 weeks) may have hindered the development of more significant positive effects. Hence, such short duration could have contributed to the impact of intervention on the level of anxiety among the intervention group. Having said that, future studies conducting stress management programs are recommended to scrutinize the specific rationale for the limited improvement of students' anxiety; the need for longer duration of stress management program could mitigate the students' anxiety accordingly. Finally, we provided information on only one orientation session and educational seminar before the program was implemented, and there was no follow-up during the program, thus limiting the measurement of its long-term effectiveness and outcomes.

Study implications and future directions

This study has notable implications and future directions that are worth mentioning. To our knowledge, this is the first intervention study at Kuwait University in which a stress management program was provided for health science students. This study hopes to guide future research on students' mental health in implementing scientifically driven and culturally appropriate programs. Therefore, university administrations should prioritize mental health and stress management by allocating budgets and resources to stress management programs. Moreover, KU needs to collaborate with mental health professionals, counselors, and wellness coaches to design and deliver such programs. Furthermore, to ensure that counseling services are readily available and promoted to

students who need them, faculty and staff should be trained in recognizing signs of stress as an early intervention approach. Following through with supporting steps is crucial for implementation, including examining models that integrate academic advice with mental health counseling to provide holistic and culturally sensitive support for all students.

Additionally, our findings suggest the implications may extend beyond graduation; many of the experimental group participants indicated that they would recommend this stress management program to their future patients. Doing so can improve patients' psychological symptoms, particularly those who present with high levels of stress or depressive symptoms. Thus, the detailed program is fully accessible for faculty members and health care professionals, allowing its application within educational and clinical settings and leading to beneficial and desirable outcomes. Furthermore, when applying stress management strategies, it is essential to consider the use of evidence-based strategies. To prioritize students' mental health and well-being, we support integrating stress management into university courses, which is essential for improving students' academic outcomes and fostering a positive campus environment. However, considering that the cultural context is also invaluable and promotes desired consequences, these programs must be accessible, inclusive, and continuously evaluated to effectively meet the diverse needs of the student population during their academic careers and future endeavors.

Specifically, our findings have implications for stress management programs for HSC students and identify areas for future investigations. Our findings are similar to those of other studies indicating the effectiveness of stress management programs on students' stress levels[23,81]. However, further studies may need to investigate the effects of stress management programs on HSC students based on the requirements for each year. It might also be necessary to assess whether the program's content needs to be changed to better meet the educational needs of the students while considering the necessity of follow-up sessions[82]. We propose conducting longitudinal randomized controlled trials concerning the effectiveness of stress management programs in the future to validate the results of this study. Standardized and culturally relevant self-reports were used to assess outcome variables thus supporting the validity of the study findings.; hence, additional objective measures for measuring the study outcomes in future studies will minimize bias and ensure more robust study findings.

It would be possible to include this program as an elective course in the university curriculum, giving students the chance to gain knowledge of useful stress reduction strategies. As part of the program, counseling services on campuses are also recommended to assist students in identifying stressors and creating useful coping mechanisms[8]. Finally, we encourage future studies to replicate the study with a balanced sample (e.g., equal gender representation, broader majors). Thus, in order to minimize the baseline imbalances which could affect the internal validity of the findings, we recommend that future studies adopt true randomized controlled designs to better address this limitation. In addition, we advise future studies to provide a manual or protocol for cultural adaptation to guide future studies, particularly with participants presented with diverse cultural background.

Conclusion

This study developed, implemented, and evaluated the effect of the Stress Management Program on HSC students. The program improved HSC students' mental health while reducing their depression and stress levels. The students also reported high levels of satisfaction with the program. To guarantee a long-lasting positive effect, additional students and long-term follow-up are needed in future research. Higher education institutions are highly encouraged to use holistic approaches to promote students' mental health by developing counseling services throughout all of their faculties while addressing students' social, psychological and academic issues. Most importantly, the findings presented here provide important information that can be applied to future studies and used as invaluable mental health resources for students at different university programs. In other words, while addressing the study limitations, we recommend future studies to replicate this study with larger representative samples and true randomized controlled trials using such scientifically driven stress management program with the need to address the students' cultural relevance and assuring sufficient time frame for its application. Doing so facilitates the students' health and wellness thereby promoting desired academic performance.

Data availability

The data that support the findings of this study are not openly available due to reasons of sensitivity and are available from the corresponding author upon reasonable request.

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References

1. WHO. *Mental health* (World Health Organization). https://www.who.int/news-room/fact-sheets/detail/mental-health-strengthening-our-response. Accessed 15 Jul 2024.
2. Ramón-Arbués, E. et al. The prevalence of depression, anxiety and stress and their associated factors in college students. *Int. J. Environ. Res. Public. Health*. **17**, 7001 (2020).
3. Teh, C. K., Ngo, C. W., Zulkifli, R. A. B., Vellasamy, R. & Suresh, K. Depression, anxiety and stress among undergraduate students: a cross sectional study. *Open. J. Epidemiol.* **5**, 260–268 (2015).
4. Liu, J. et al. Stress and coping styles among nursing students during the initial period of the clinical practicum: a cross-section study. *Int. J. Nurs. Sci.* **9**, 222–229 (2022).
5. APA. *What's the difference between stress and anxiety?* (American Psychological Association, 2019).
6. Ahuja, V., Ranjan, V., Passi, D. & Jaiswal, R. Study of stress-induced temporomandibular disorders among dental students: an institutional study. *Natl. J. Maxillofac. Surg.* **9**, 147–154 (2018).
7. Periasamy, P., Vajiravelu, S., Gunasekaran, S., Balakrishnan, R. & Manivannan, J. Association between sleep quality and stress among medical students of a rural Indian tertiary care setting. *MGM J. Med. Sci.* **9**, 530–533 (2022).

8. Alotaibi, N. M. et al. Psychological disorders and coping among undergraduate college students: advocating for students' counselling services at Kuwait university. *Int. J. Environ. Res. Public. Health*. **21**, 245 (2024).
9. Sharma, N. & Kaur, A. Factors associated with stress among nursing students. *Nurs. Midwifery Res. J.* **7**, 12–21 (2011).
10. Adedamola, A. T., Akin, O. & Abiola, A. A. Stress among university students in Osun State, Nigeria. *Int. J. Health Sci. Res.* **12**, 8–24 (2022).
11. Al Bahhawi, T. et al. Depression, anxiety, and stress and their association with Khat use: a cross-sectional study among Jazan university students, Saudi Arabia. *Neuropsychiatr Dis. Treat.* **14**, 2755–2761 (2018).
12. Satpathy, P., Siddiqui, N., Parida, D. & Sutar, R. Prevalence of stress, stressors, and coping strategies among medical undergraduate students in a medical college of Mumbai. *J. Educ. Health Promot*. **10**, 318 (2021).
13. Jiang, Z., Jia, X., Tao, R. & Dördüncü, H. COVID-19: a source of stress and depression among university students and poor academic performance. *Front. Public. Health*. **10**, 898556 (2022).
14. Al-Sayegh, N., Al-Enezi, K., Nadar, M. & Dean, E. Health status, behaviors, and beliefs of health sciences students and staff at Kuwait University: toward maximizing the health of future health professionals and their patients. *Int. J. Environ. Res. Public. Health*. **17**, 8776 (2020).
15. Gülnar, E., Aşık, E. & Özveren, H. The effect of a stress management program on first-year nursing students' clinical stress: a randomized controlled experimental study. *Nurse Educ. Today*. **136**, 106131 (2024).
16. Yasmin, H., Khalil, S. & Mazhar, R. COVID 19: stress management among students and its impact on their effective learning. *Int. Technol. Educ. J.* **4**, 65–74 (2020).
17. Kunzler, A. M. et al. Psychological interventions to foster resilience in healthcare students. *Cochrane Database Syst. Rev.* **7**, CD013684 (2020).
18. Huberty, J. et al. Efficacy of the mindfulness meditation mobile app calm to reduce stress among college students: randomized controlled trial. *JMIR mHealth uHealth*. **7**, e14273 (2019).
19. Amanvermez, Y. et al. Stress management interventions for college students: a systematic review and meta-analysis. *Clin. Psychol. Sci. Pract.* **30**, 423–444 (2023).
20. Scribner, M., Sasso, P. & Puchner, L. Stress management and coping strategies in undergraduate students at a Midwestern state university. *N Y J. Stud. Aff.* **20**, 4–32 (2020).
21. Dvořáková, K. et al. Promoting healthy transition to college through mindfulness training with first-year college students: pilot randomized controlled trial. *J. Am. Coll. Health*. **65**, 259–267 (2017).
22. Greeson, J. M., Juberg, M. K., Maytan, M., James, K. & Rogers, H. A randomized controlled trial of Koru: a mindfulness program for college students and other emerging adults. *J. Am. Coll. Health*. **62**, 222–233 (2014).
23. Smit, B. & Stavrulaki, E. The efficacy of a mindfulness-based intervention for college students under extremely stressful conditions. *Mindfulness* **12**, 3086–3100 (2021).
24. Ali, A. M. et al. The Arabic version of the depression anxiety stress scale-21: cumulative scaling and discriminant-validation testing. *Asian J. Psychiatry*. **30**, 56–58 (2017).
25. Ali, A. M. et al. The Arabic version of the Cohen perceived stress scale: factorial validity and measurement invariance. *Brain Sci.* **11**, 419 (2021).
26. Nguyen, J. D., Duong, H. & Pursed-lip, B. Jul 25. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2024 Jan–. PMID: 31424873. (2023).
27. Tavoian, D. & Craighead, D. H. Deep breathing exercise at work: potential applications and impact. *Front. Physiol.* **14**, 1040091 (2023).
28. Toussaint, L. et al. Effectiveness of progressive muscle relaxation, deep breathing, and guided imagery in promoting psychological and physiological states of relaxation. *Evid. Based Complement. Altern. Med.* 5924040 (2021). (2021).
29. Pilkington, K. & Wieland, L. S. Self-care for anxiety and depression: a comparison of evidence from Cochrane reviews and practice to inform decision-making and priority-setting. *BMC Complement. Med. Ther.* **20**, 247 (2020).
30. Ayala, E. E., Winseman, J. S., Johnsen, R. D. & Mason, H. R. C. U.S. Medical students who engage in self-care report less stress and higher quality of life. *BMC Med. Educ.* **18**, 189 (2018).
31. Zamata, P. M. C., Saavedra, L. R. & López, R. M. G. Educational program to strengthen school coexistence and social skills in student. *Int. J. Instr*. **16**, 77–94 (2023).
32. Gómez, A. K. R. et al. Prolonged chronic academic stress and its relationship with cytokine dysregulation in health science students. *Stress Health*. **40**, e3363 (2023).
33. Calonia, J. T. et al. Time management and academic achievement: examining the roles of prioritization, procrastination and socialization. *Online Submiss.* **8**, 766–775 (2023).
34. Hwang, M. H., Bunt, L. & Warner, C. An eight-week zen meditation and music programme for mindfulness and happiness: qualitative content analysis. *Int. J. Environ. Res. Public. Health*. **20**, 7140 (2023).
35. Breedvelt, J. J. F. et al. The effects of meditation, yoga, and mindfulness on depression, anxiety, and stress in tertiary education students: a meta-analysis. *Front. Psychiatry*. **10**, 193 (2019).
36. Moulaei, K., Haghdoost, A. A., Bahaadinbeigy, K. & Dinari, F. The effect of the holy Quran recitation and listening on anxiety, stress, and depression: a scoping review on outcomes. *Health Sci. Rep.* **6**, e1751 (2023).
37. Neveu, D. et al. Students perceived stress in academic programs: consequences for its management. *Rev. Epidemiol. Sante Publique*. **60**, 255–264 (2012).
38. Babicka-Wirkus, A., Wirkus, L., Stasiak, K. & Kozłowski, P. University students' strategies of coping with stress during the coronavirus pandemic: data from Poland. *PLoS One*. **16**, e0255041 (2021).
39. Yzer, M. & Gilasevitch, J. Beliefs underlying stress reduction and depression help-seeking among college students: an elicitation study. *J. Am. Coll. Health*. **67**, 153–160 (2019).
40. Becker, M. A. S., Dong, S., Kronholz, J. & Brownson, C. Relationships between stress and psychosocial factors with sources of help-seeking among international students. *J. Int. Stud.* **8**, 1636–1661 (2018).
41. Amanvermez, Y. et al. Effects of self-guided stress management interventions in college students: a systematic review and meta-analysis. *Internet Interv*. **28**, 100503 (2022).
42. Monserrat-Hernández, M., Checa-Olmos, J. C., Arjona-Garrido, Á., López-Liria, R. & Rocamora-Pérez, P. Academic stress in university students: the role of physical exercise and nutrition. *Healthcare* **11**, 2401 (2023).
43. Garber, M. C. Exercise as a stress coping mechanism in a pharmacy student population. *Am. J. Pharm. Educ.* **81**, 50 (2017).
44. Hofmann, S. G., Asnaani, A., Vonk, I. J. J., Sawyer, A. T. & Fang, A. The efficacy of cognitive behavioral therapy: a review of meta-analyses. *Cogn. Ther. Res.* **36**, 427–440 (2012).
45. Nakao, M., Shirotsuki, K. & Sugaya, N. Cognitive-behavioral therapy for management of mental health and stress-related disorders: recent advances in techniques and technologies. *Biopsychosoc. Med.* **15**, 16 (2021).
46. Ellis, A. Reason and emotion in psychotherapy. (1962).
47. Ellis, A. RET abolishes most of the human ego. *Psychotherapy: Theory, research & practice* 13, no. 4 : 343. (1976).
48. Ellis, A. Expanding the ABCs of rational emotive therapy. In Albert Ellis Revisited, 78–85. Routledge, (2013).
49. Ellis, A. The revised ABC's of rational-emotive therapy (RET). *Journal of rational-emotive and cognitive-behavior therapy* 9, no. 3 : 139–172. (1991).
50. Malkinson, R. Cognitive-behavioral grief therapy: the ABC model of rational-emotion behavior therapy. *Psihol Teme*. **19**, 289–305 (2010).

51. Donker, T., Griffiths, K. M., Cuijpers, P. & Christensen, H. Psychoeducation for depression, anxiety and psychological distress: a meta-analysis. *BMC Med.* **7**, 79 (2009).
52. Bäuml, J., Froböse, T., Kraemer, S. & Rentrop, M. Pitschel-Walz, G. Psychoeducation: a basic psychotherapeutic intervention for patients with schizophrenia and their families. *Schizophr Bull.* **32**, S1–S9 (2006).
53. Bani Ahmad, T., Meric, M. & Ayasrah, M. The effect of psychoeducational stress management interventions on students stress reduction: systematic review. *J. Educ. Cult. Psychol. Stud.* 41–57. https://doi.org/10.7358/ecps-2022-025-hass (2022).
54. Birmaher, B. et al. The screen for child anxiety related emotional disorders (SCARED): scale construction and psychometric characteristics. *J. Am. Acad. Child. Adolesc. Psychiatry*. **36**, 545–553 (1997).
55. Schwartz, S. J. & Petrova, M. Prevention science in emerging adulthood: a field coming of age. *Prev. Sci.* **20**, 305–309 (2019).
56. Seedhom, A. E., Kamel, E. G., Mohammed, E. S. & Raouf, N. R. Predictors of perceived stress among medical and nonmedical college students, Minia, Egypt. *Int. J. Prev. Med.* **10**, 107 (2019).
57. Rayyan, M. R. et al. Stress levels among senior dental students in Saudi Arabia during fixed prosthodontics procedures. *J. Fam Med. Prim. Care.* **11**, 1716–1720 (2022).
58. Alomar, M., Palaian, S. & Shanableh, S. Perceived stress and quality of life among final-year pharmacy students in the united Arab Emirates during COVID-19 pandemic lockdown. *Adv. Med. Educ. Pract.* **12**, 1361–1369 (2021).
59. Freire, C. et al. Coping strategies and self-efficacy in university students: a person-centered approach. *Front. Psychol.* **11**, 841 (2020).
60. Bhargava, D. & Trivedi, H. A study of causes of stress and stress management among youth. *IRA Int. J. Manag Soc. Sci.* **11**, 108 (2018).
61. Redhwan, A. A. N., Sami, A. R., Karim, A., Chan, R. & Zaleha, M. Stress and coping strategies among management and science university students: a qualitative study. *IIUM Med. J. Malays.* **8**, 11–15 (2009).
62. Qasim, T. B., Sahar, A., Nihal, T. & Bashir, A. The effect of overthinking on mental health: a case study from university students in Multan district. *Rev. Appl. Manag Soc. Sci.* **5**, 255–262 (2022).
63. Perciavalle, V. et al. The role of deep breathing on stress. *Neurol. Sci.* **38**, 451–458 (2016).
64. Mahalakshmi, B., Ghemabhai, K. M., Gottlieb, A. S., Sivasubramanian, N. & Parthasarathy, P. Deep breathing exercises in easing educational stress among Indian high school students. *Bioinformation* **20**, 156–159 (2024).
65. Joshi, R. Stress, depression and anxiety and breathing exercise among college going late adolescents. *Int. J. Educ. Manag Stud.* **4**, 1 (2014).
66. Riegel, B. et al. Characteristics of self-care interventions for patients with a chronic condition: a scoping review. *Int. J. Nurs. Stud.* **116**, 103713 (2021).
67. Morales-Rodríguez, A. M. & Morales-Rodríguez, F. M. Effectiveness of a mindfulness-based intervention program to improve communication and stress coping skills in university students. *Eur. J. Investig Health Psychol. Educ.* **14**, 1927–1939 (2024).
68. Abulfaraj, G. G., Upsher, R., Zavos, H. M. S. & Dommett, E. J. The impact of resilience interventions on university students' mental health and well-being: a systematic review. *Educ. Sci.* **14**, 510 (2024).
69. Fullerton, D. J., Zhang, L. M. & Kleitman, S. An integrative process model of resilience in an academic context: resilience resources, coping strategies, and positive adaptation. *PLoS One.* **16**, e0246000 (2021).
70. Tran, V., McCall, C., Secules, S., Kali, M. B. & Van Dyke, G. From mind full to mindful: proposing mindfulness as a proactive strategy for safeguarding mental health in engineering education in *2024 ASEE annual conference & exposition proceedings* (2024).
71. Grab, J., Green, M., Norris, J., Pilchik, K. & Fisher, G. S. Exploring occupational therapy student stress: professor and student perspectives. *J. Occup. Ther. Educ.* **5**, 3 (2021).
72. Ganesan, Y., Talwar, P., Fauzan, N. & Oon, Y. B. A study on stress level and coping strategies among undergraduate students. *J. Cogn. Sci. Hum. Dev.* **3**, 37–47 (2018).
73. Haider, S. I. et al. Life satisfaction, resilience and coping mechanisms among medical students during COVID-19. *PLoS One.* **17**, e0275319 (2022).
74. Weiss, E. M. et al. Preventive effect of a 7-week app-based passive psychoeducational stress management program on students. *Behav. Sci.* **14**, 180 (2024).
75. Eneogu, N. D., Ugwuanyi, C. K. & Ugwuanyi, C. S. Efficacy of cognitive behavioral therapy on academic stress among rural community secondary school economics students: a randomized controlled evaluation. *J. Ration. Emot. Cogn. Behav. Ther.* **42**, 245–262 (2023).
76. Jafar, H. M., Salabifard, S., Mousavi, S. M. & Sobhani, Z. The effectiveness of group training of CBT-based stress management on anxiety, psychological hardiness and general self-efficacy among university students. *Glob J. Health Sci.* **8**, 47–54 (2015).
77. Changklang, P. & Ranteh, O. The effects of cognitive behavioural therapy on depression, anxiety, stress, and self-esteem in public health students, Thailand. *J. Educ. Health Promot.* **12**, 152 (2023).
78. de Vries, J. D., van Hooff, M. L. M., Geurts, S. A. E. & Kompier, M. A. J. Exercise as an intervention to reduce study-related fatigue among university students: a two-arm parallel randomized controlled trial. *PLoS One.* **11**, e0152137 (2016).
79. Rebar, A. L. et al. A meta-meta-analysis of the effect of physical activity on depression and anxiety in non-clinical adult populations. *Health Psychol. Rev.* **9**, 366–378 (2015).
80. Sharon-David, H. & Tenenbaum, G. The effectiveness of exercise interventions on coping with stress: research synthesis. *Stud. Sport Humanit.* **22**, 19–29 (2017).
81. Nguyen, T. et al. Transforming stress program on medical students' stress mindset and coping strategies: a quasi-experimental study. *BMC Med. Educ.* **23**, 587 (2023).
82. Lemay, V., Hoolahan, J. & Buchanan, A. Impact of a yoga and meditation intervention on students' stress and anxiety levels. *Am. J. Pharm. Educ.* **83**, 7001 (2019).

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Author contributions

NA developed the research idea, designed the study, reviewed, and wrote the manuscript. LA and FA assisted in the design of the study, reviewed, and wrote the manuscript. WA, DA, MaA and MoA assisted in the data collection process and write up.

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Declarations

Competing interests
The authors declare no competing interests.

Ethics approval and consent to participate
The study was approved by the Ethical Committee of the Health Science Center Institutional Review Board, Kuwait University (Ref/580). The study is registered in ISRCTN, a clinical trial registry recognized by WHO and ICMJE (registration number ISRCTN12883314); the date of registration is (12/11/2024). Informed consent was obtained from all the subjects. All procedures were performed in accordance with relevant guidelines and regulations (such as the Declaration of Helsinki).

Additional information
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