The Distinct Effects of Mind-Body Modalities on Health Outcomes in Nursing Students

Study Protocol

Date: July 1, 2019

NCT Number: Not issued yet

Introduction

Stress has been recognized worldwide as a prevalent health issue in nursing education [1]. Nursing students generally reported moderate to high levels of stress, sometimes higher than students from other disciplines [1,2]. The reason is that undergraduate nursing students are not only influenced by academic and social stressors, but also clinical stressors during their long clinical training that require emotional and personal maturity [1,3]

Although acute stress works to maintain bodily hemostasis, repeated exposures to stress over time can affect students' physical, emotional, and cognitive health, academic performance, attrition, and ability to care for patients and themselves [4,5]. However, previous literature has showed that the negative effects of stress on health and wellbeing may be mediated by the activation of the hypothalamic-pituitary—adrenal (HPA) system (e.g. cortisol), and the sympathetic-adrenal-medullary (SAM) system (e.g. norepinephrine, epinephrine, and dopamine [6,7,8].

Because of stress, the hypothalamus releases a corticotrophin-releasing factor (CRF) that stimulates the release of adrenocorticotropic hormone (ACTH) from the anterior areas of the pituitary gland. ACTH stimulates the adrenal cortex to secrete cortisol, described as a stress hormone that affects mainly metabolic processes. Cortisol increases the concentration of blood glucose through gluconeogenesis, reduces glucose uptake in cells, suppresses immune system and inflammatory functions, increases amino acids, lipids, and fatty acids in the bloodstream, stimulates and increases gastric-acid secretion, and decreases formation of bone [6,7,8]. Increased cortisol resulting from stress usually impairs executive function abilities, which refers to the higher cognitive processes that enable planning, forethought, and goal-directed action [9].

There are numerous potentially beneficial stress-reduction strategies that have been found to help college students effectively deal with stress and its negative health consequences worldwide [10]. Benson's (1975) relaxation response hypothesis states that all stress-reduction techniques have the same impact on health outcomes through evoking similar relaxation responses. Based on the relaxation response hypothesis, relaxation trainers are often contented to apply one general approach to relaxation to all clients. However, the specificity theories of relaxation claim that each approach of relaxation is associated with different health benefits [11,12]. For example, PMR, classified as somatic technique, works better to improve physical health. Guided imagery is more effective in improving emotional health. Mindfulness meditation is categorized as a cognitive technique, which should work better for improving cognitive health. These benefits of all relaxation techniques are mediated by increased parasympathetic activity [11]. However, research offers conflicting support for this notion. This study will investigate and compare the empirically defined effects of three common mind-body modalities, including progressive muscle relaxation (PMR), guided imagery, (GI) and mindfulness meditation (MM), on cognitive, emotional and physical health in nursing students. In other words, this study is an attempt to rigorously map the emotional, physical, and cognitive effects of these mind-body modalities among Jordanian nursing students.

Significance of Study

Despite the potential benefits of using PMR, GI, and MM, their effects have not been studied among Jordanian nursing students. Specifically, the current study intends to offer information about the effect of PMR, GI, and MM on health outcomes in the target population. Practically, results from the study may inform the decision-making of faculty and administrators about adopting PMR, GI, and MM in nursing colleges. The expected results will hopefully give clinicians and relaxation trainers tools for intelligently tailoring

techniques to students based on stress symptoms or health problems they experience [13]. Theoretically, the current study also extends the body of nursing knowledge and fill the theoretical gap in the literature regarding the effects of PMR, GI, and MM on health in nursing students and potentially support specificity theories of relaxation.

Methods

Design

This study uses a blocked randomized controlled design. The study subjects will be selected using a convenience sampling method. When selected, the subjects will be randomly assigned to either one of the 4 study groups using a stratified random strategy (stratifying variable= academic year of study). The study groups (PMR, MM, GI, Control group) will received 5 30-minute weekly sessions of their assigned intervention over 5 weeks. However, there will be a 4-hours workshop explaining the purposes and techniques of the study interventions before introducing the actual session. The subjects will be asked and encouraged to practice their assigned intervention for 30 minutes daily at home. The dependent variables will be measured three times for the 4 groups: at baseline, at the middle (after the second session), and at the end of intervention.

Participants

Participants are undergraduate nursing students who will be selected using a stratified random sampling method from Jordan University of Science and Technology. Jordanian undergraduate nursing students will be asked to participate in the current study if they are at least 18 years old and taking a clinical course. Exclusion criteria include students who are 1) practicing of any type of relaxation techniques, such as yoga, guided imagery, meditation, cognitive behavioral therapy, or 2) taking hypnotics, sedatives, anxiolytic, anti-depressant, anti-inflammatory drugs.

Determination of Sample Size

Using G* Power software 3.1, mixed-design (within groups-between groups) repeated measures ANOVA, an alpha of .05, a power of 0.8, the number of measurements of 3, the number of groups of 4, and a moderate effect size of 0.25, the sample size of 180 was generated. A 15 % attrition rate was reported in a previous study with variables similar to the present study [14]. Considering an expected attrition rate of 15 %, the required final total sample size 210.

Intervention

In the current study, the ABC standardized versions of PMR, MM, and GI will be used, including 5 30-minute weekly sessions of each version [11]. Each group will be encouraged to practice once at home daily. An additional educational 4-hour workshop about each intervention will be provided before the actual training session to enhance the subjects' understanding of their assigned intervention. Especially such interventions are rarely practiced and little known about them in Jordan. In the initial educational session, the PI will separately provide a power point presentation to participants in each experimental group about the rationale and procedures of their assigned intervention and a demonstration of the entire intervention protocol. Participants will be asked briefly to practice their assigned intervention and then evaluated by the PI to make sure the interventions have been done correctly. The PI will give the participants the opportunity to ask questions during the educational session

During the actual training sessions, the interventions will be introduced to subjects in the experimental groups using an audio CD designed and produced by the PI based on the Smith's (2005) guidelines and protocols [11]. All groups will be given identical instructions; only the specific instructions regarding the intervention will be different. The participants in

all groups will be asked to close their eyes. All of the groups will be meet in an academic classroom, where the interventions will be provided. Participants will sit in hard chairs behind a desk. Floors will be hard tile. Lights will be dimmed during relaxation phases, and turned on when measures will be filled out. The study groups will be given a CD about their assigned intervention and encouraged to practice their assigned intervention daily over the study. They will be asked to document their practices of the assigned intervention at home. The PI will randomly select sessions to evaluate the delivery of intervention using checklists produced according to the Smith's protocols. PI is an experienced practitioner who received a stress management training at the Psychology Department, Kent State University 7 years ago. Since then, PI has been practicing the stress management techniques daily, especially used in the current study.

Progressive Muscle Relaxation. PMR (Smith Version) involves a tense-let go exercise of 11 muscle groups including hand, arm, arm and sides, back, shoulder, face, front of neck, stomach, chest, leg, and foot. This tense-let go exercise is performed twice for each muscle group. The tensing up phase for each muscle group should last for 5 to 10 seconds and the letting go phase for 20-30 seconds. Simultaneously, the subjects will be asked to pay attention to the sensations of muscle tension and relaxation. After the tense-let go exercise, subjects are asked to systematically scan the muscle groups to notice and let go any remaining muscle tension. The entire exercise should take around 30 minutes, not counting instructions and times of measurement [11].

Guided Imagery. Guided imagery (Smith Version) involves creating in one's mind or imagining a passive relaxing places or activities. In sense imagery, one simply imagines sensations associated with a relaxing setting or activity. The relaxation approach involves the sense of sight, sound, touch, and smell. The categories of stimuli consist of: (1) Travel such as boats, plains, trains, balloons, horses, (2) outdoor nature settings such as mountains,

gardens, and forest, (3) water such as rivers, lakes, ocean, beach, rain, and (4) indoor settings such as childhood home, castle, religious institution, and cabin [11].

Mindfulness Meditation. Smith version of the mindfulness meditation will be used in the current study. The mindful mediators are neutral observers who view the world as it is, without reactions, judgments, and evaluations. They quietly attend to, note, and let go of every internal external stimulus such as thought, feeing, sensation, sound, idea that enters awareness. They do not try to think about, push away, and do anything with these stimuli experienced and do not have to figure out the connections between each stimulus. They simply let each stimulus come and go and wait for the next stimulus. They do not have to be concerned about distractions. Each time they are distracted, they note it as yet another passing stimulus (Ah, a distraction… how interesting") [11].

Control Group. Participants in the control condition will be instructed to sit with their eyes closed during the intervention periods. Participants in the control group will follow an identical time period as the experimental groups. For instance, when the experimental groups will practice for 30 minutes, the participants in the control group will be asked to sit with eyes closed and relax for 30 minutes.

Procedure

First, approvals from the JUST institutional review boards will be obtained. After that, a translation from English to Arabic and pilot testing of the English versions of the scales used in the current study will be performed. The scales used in the study will be introduced for 30 Jordanian undergraduate nursing students, and then the construct validity, reliability (internal consistency), readability of these scales will be examined.

After taking the permission of the dean of nursing college and class's instructors, the PI will visit students in their classrooms. As the lecture finishes, The PI will announce the

title and objectives of the study and ask the students who would like to participate to contact him using a business card including the PI's contact information (his name, phone number, and email) given for each one. The contact information will be used only for the purpose of the study. The PI will arrange an initial meeting to meet with students who would like to participate on another day in a private room at the university. At this meeting, the PI will inform the students the study's objectives, risks, benefits, and confidentiality and answer questions that they have about the study. Also, they will be assured that they have the full right to refuse or discontinue the participation at any time and that such refusal or discontinuation will not affect their academic achievements in any way. If agree to participate and eligibility criteria are met, informed consent will be obtained at the meeting. After that, the participants will be randomly assigned equally to the study groups using a stratified random assignment method (stratifying variable= academic year of study). Finally, dates and times for sessions will be set up and sent to the participants using their e-mails.

In the 4-hour education session, the baseline measurements of the study variables will first be obtained. Then the PI will separately provide a power point presentation to participants in each experimental group as explained previously. At the end of the workshop, to avoid experiment contamination, the participants in each experimental group will be asked not to share any information related to the intervention with subjects in other groups.

The actual training will be introduced to subjects in the experimental groups, using an audio CD designed and produced by the PI based on the Smith's (2005) guidelines and protocols. Based on the ABC Relaxation Theory (Smith, 2005), at least two, and preferably five sessions of actual mind-body training should be provided to evoke relaxation and optimize health [15]. In the proposed study, the dependent variables will be measured at the middle and at the end of intervention to see whether further health benefits occur between these two measurements. The sessions will be provided to the study groups in a private, quiet,

comfortable, and spacious room at the university. The dependent variables will be measured three times for the groups: at baseline, after 2nd actual training session, and at the end of intervention (after 5th session), as mentioned previously.

Various strategies will be followed to decrease measurement errors potentially affected by variations of data collection procedure. For example, filling out the questionnaire may be stressful for some subjects and, in turn, influences objective measures. Therefore, the self-reports measures will be completed after taking the objective measures such as biological markers. Also, all study measurements in the intervention and control groups will be undertaken in the same conditions (i.e., same room temperature and environment) by well-trained nurses as much as possible. The ELISA protocol, including blood sampling will strictly be followed. The neurotransmitters/hormones will be measured between 8:30 am and 9:30 am for all subjects at sitting position. Drinking coffee, tea, and having should be avoided 6 hours before the measurement of neurotransmitters/hormones. To decrease venipuncture-related pain during blood sampling, EMLA cream will be used, which has been found effective in decreasing venipuncture-related pain in different populations [17]. In addition, quiet environments, free from distraction, will be maintained with a “Do Not Disturb” sign on the door of the rooms during the intervention and data collection.

Instruments

The study data will be collected using self-reported and physical measures. For the self-reported variables, the study will use a self-reporting questionnaire in 6 main parts. The first part includes questions about smoking behaviors and demographic characteristics including: age, religion, gender, marital status, academic year of study, nationality, history of medical or psychiatric illnesses, and smoking behaviors. The second part includes scales used to measure cognitive responses such as executive function, mindfulness, and perceived stress.

The third part involves scales used to measure emotional health such as anxiety and depression. The fourth part includes a scale used to measure physical symptoms. The fifth part includes scale used to measure coping behaviors. The sixth part includes a scale used to measure fear-related injection. The seventh part includes open-ended questions focusing on the students' experiences of practicing their assigned intervention. The last three parts will be measured to examine the confounding effects of coping behaviors and fear associated with blood sampling on the study outcomes.

For the physical variables. The Enzyme-linked Immunosorbent Assay (ELISA) procedure will be used to measure serum biomarkers such as cortisol, melatonin, C-reactive protein, interleukin 1, and Leptin.

Cognitive Responses

Executive Functioning. Executive functioning is a set of inter-related higher-order cognitive abilities involved in self-regulatory functions that organize, direct, and manage cognitive activities, emotional responses, and overt behaviors (Barkley, 2011). The Barkley Deficits in Executive Functioning Scale- Short form (BDEFS-SF) (Adult version) will be used to measure executive functions including self-organization, self-restraint, self-motivation, self-regulation of emotion, and self-management to time. It is a self-reported scale consisting of 20 items measured using a 4-point Likert-type scale, ranging from Never or rarely (1) to Sometimes (2), Often (3), and Very often (4). The BDEFS-SF internal consistency was reported at an alpha of .92 in adult population. A confirmatory factor analysis supported the 5-factor structure of BDEFS in college students (19).

Mindfulness. Mindfulness is defined as open or receptive awareness of and attention to what is taking place in the present (20). Mindful Attention Awareness Scale (MAAS) will be used to measure dispositional mindfulness. It is one-dimensional scale including 15 items

measured on a six-point Likert type scale, ranging from 1 (almost always) to 6 (almost never). The score range is between 15 and 90, with higher score indicting higher levels of mindfulness. The scale has shown strong psychometric properties when validated in college students. It showed acceptable levels of reliability and validity in university students (20).

Perceived Stress. The Perceived Stress Scale (PSS) is used to measure the degree to which situations in one's life are appraised as stressful (unpredictable, uncontrollable, and overloaded). It includes 10 items measured on a 5-point Likert scale (0=never, 4= very often), which are relatively free of content specific to any subpopulation group. The scores range from 0 to 40 with higher score indicating higher levels of perceived stress (21). PSS has been validated for use with college students (21).

Emotional Responses

Depression. Depression will be measured by the General Health Questionnaire-9 (PHQ-9) (22). It is reliable self-administered tool to evaluate the frequency of depressive symptoms in nursing students (23). It includes 9 items measured on a 4 likert scale (0= not at all, 3= nearly every day). The scores range from 0 to 27, with the higher scores indicated higher levels of depression (22).

Anxiety. Anxiety will be measured using the General Health Questionnaire-7 (PHQ-7) (24). It is a valid and reliable self-report questionnaire for assessing the frequency of symptoms of anxiety in nursing students (23). It includes 7 items measured on 4-point Likert scale that ranges from 0 (not at all) to 3 (nearly every day0. The scores range from 0 to 21, with higher the total score indicates higher levels of anxiety (24).

Negative Emotions: The negative emotions will be measured by the valid and reliable Depression, Anxiety and Stress Scale - 21 (DASS-21). It includes 3 self-administered subscales developed to assess the negative emotional states of depression, anxiety, and stress

(PFA, 2014). The total scores for each subscale ranges from 0 to 42, with higher scores indicating more depression, anxiety and stress (25).

Physical Responses

Physical symptoms. The PHQ-15 is a self-reported somatic symptoms subscale, derived from the full Patient-Health-Questionnaire. It is a 15-item instrument that assesses 15 common somatic symptoms. Subjects are asked to rate the severity of symptoms as 0 ("not bothered at all"), 1 ("bothered a little"), or 2 ("bothered a lot"). The score ranges from 0 to 30 and scores of ≥5, ≥10, ≥15 represent mild, moderate, and severe levels of somatization respectively. Evidence supports reliability and validity of the PHQ-15 as a measure of physical symptoms in the general population (26).

Biomarkers. The procedure and protocol of ELISA will be followed to measure the concentrations of the neurotransmitters and hormones in plasma that include cortisol, c-Reactive protein, Interleukines, Melatonine, and Liptin (27).

Covariates

Coping Behaviors. Nursing students' self-directed coping behaviors included in the current study as a covariate were assessed by the Coping Behaviors Inventory (CBI) (28). The CBI is used to identify nursing students' coping behaviors. It includes nineteen 5-point Likert-type items divided into four factors: avoidance behavior (efforts to avoid a stressful situation), 6 items; problem-solving behavior (efforts to manage or change the stress arising out of a stressful situation), 6 items; optimistic coping behavior (efforts to keep a positive attitude toward the stressful situation), 4 items; and transference behavior (efforts to transfer one's attention from the stressful situation to other things), 3 items. Higher scores for each factor indicate more frequent use and greater effectiveness of a certain type of coping behavior. It showed acceptable levels of reliability and validity in nursing students (28)

Experiences of practicing the study interventions

Open-ended questions asking about the students experiences of practicing the PMR, GI, or MM?" will be added to the questionnaire packet at the end of study. The objective of these questions is to explore the narratives as provided by the subjects in the experimental groups. Findings from this question will help the principal investigators to understand any positive and/or negative reactions on the study interventions based on the subjects' feedback, thus, benefiting a plan for future larger research. Examples of these questions includes (29):

1. What did you think about the (assigned intervention)?

2. What did not like most about (assigned intervention)?

3. What did like most about (assigned intervention)?

4. Do you think (assigned intervention) were effective and worked for you?

a. If no, please could you explain why it did not work for you?

b. If yes, please could you explain how it worked for you?

5. Was the length okay? Would you have preferred longer, shorter, or the same?

6. Were there any obstacles of practicing (the assigned intervention) at home?

Statistical Analysis

Statistical analysis will be conducted using SPSS software (version 23). Descriptive statistics will be used to describe the sample. The sample and variables will be described by measures of central tendency and dispersion appropriate to the level of measurement. Initial analyses will be conducted to ensure that the randomization across covariates was successful. The gender, marital status, employment, nationality, and smoking behavior variables will be all tested at baseline using Chi-square to demonstrate that they are not significantly different

between groups. Independent t-tests will be run at baseline measurements of dependent variables to make sure the study groups will be not significantly different on these variables before introducing the study intervention. One-way- ANOVA will be used to test the study hypotheses. Post hoc t-tests will be run to examine if the study groups will be significantly different on the dependent variables at end of the intervention. In case of having confounding effects of some variables, ANCOVA will be used.

Ethical consideration

Physical or psychological harm or risks that might be associated with the measurement activities or intervention employed in the current study will be minimal. One risk that might have resulted from the study was making demands on the subject's time and venipuncture-related pain. Thus, the subjects were provided with compensations (10 Jordanian Dinars) for their times spent in the study and ELMA cream will be used before blood sampling to decrease venipuncture-related pain. Moreover, trained nurses will draw blood from participants, following the Blood Sampling Guideline of the European Federation of Clinical Chemistry and Laboratory Medicine, 2017.

Potential benefits of the measurement activities and intervention to study subjects included increased knowledge and awareness about their health and mind-body modalities. For society, potential benefits included a greater understanding of the effects of mind-body modalities on stress reduction and the potential improvement of the study population's health. In this study, potential benefits are believed to exceed risks.

To protect the ethical principle of respect for subjects, all subjects will be informed about the purpose and nature of the study, and informed consent will be obtained from all. Students will be assured that they have the full right to refuse to participate in the study, and that such refusal will not affect their academic achievements in any way. They will also be

assured that their information would not be made available to others without prior consent, the study data will be locked in a secured storage area in a locked locker and that their names will be replaced by numbers to avoid their identification. Also, the meetings with students will be conducted in a private room at JUST and at convenient times for subjects. Moreover, to meet the ethical principle of justice, no student will be excluded from the study because of gender, ethnicity, or nationality.

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