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# Deep Diaphragmatic Breathing: A “Portable Intervention” for Stress Reduction among University Students

*Katarzyna (Kate) Rygiel*

## Abstract

Students are at risk for daily stress, often caused by an increasing load of the material to study, limited time and resources necessary to fulfill assignments, personal or family demands, high expectations, pressures, and frustrations. All these factors can create distress, decreased learning abilities, and psychosomatic disorders or diseases. To mitigate such negative biopsychosocial effects of stress, different types of relaxation techniques can be used. Addressing these issues early (e.g., among the 1st and 2nd year university students) seems particularly important, due to possible prevention of the long-term adverse health consequences of stress (compared to no intervention). To fulfill this important need, a “portable intervention,” such as stress management brief training (SMBT), focused on the reduction of the perceived stress levels among students will be briefly outlined. The SMBT consists of a short review of stress and coping approaches, followed by the instruction of a simple stress management relaxation/technique [e.g., deep diaphragmatic breathing (DDB)]. Practical considerations regarding the DDB will be highlighted. The feasibility and usefulness of the DDB training for stress management among the 1st and 2nd year university students should encourage implementation of this innovative, safe, inexpensive, and friendly technique.

**Keywords:** distress, stress reduction, coping, relaxation techniques, deep diaphragmatic breathing (DDB), university students

## 1. Introduction

Students are at risk for daily stress, often caused by the increasing load of the material to study, limited time and resources necessary to fulfill assignments, personal demands, high expectations, as well as socioeconomic pressures, and frustrations. In some cases, the above problems can be aggravated by difficulties in adjusting to the new environment and lack of support from family and friends. All these factors can create distress and subsequently may contribute to decreased ability to learn, impaired academic performance, psychosomatic disorders or diseases, and decreased quality of life among many students. There is no doubt about the fact that dealing with multiple negative biopsychosocial consequences of daily stress is very difficult and expensive. Therefore, addressing these issues early,

among 1st and 2nd year university students seems particularly important. A review of the literature on reducing stress, and preventing its damaging consequences in student population, indicates that person-focused interventions, such as different types of relaxation techniques, can be effective in reducing anxiety, irritability, sadness, depressed mood, insomnia, and many other general symptoms of distress, compared to no intervention. The beneficial results of various stress reduction programs may last from 6 months to 2 years, after their formal ending [1]. For instance, beneficial effects of one specific relaxation technique, mindfulness-based stress reduction (MBSR), developed by Kabat-Zinn, have been documented in various populations (both among healthy individuals, exposed at high level of a daily stress, and among patients, suffering from different psychosomatic diseases) in diversified medical and psychological contexts [2–7]. In particular, some studies related to students and professionals in the medical field have revealed positive effects of mindfulness on stress reduction, health condition, quality of life, empathy, and quality of patient care [8, 9]. Furthermore, a small recent study, conducted among university students, provided data, which support the possibility that a deep breathing technique is able to induce some improvements in mood and control of stress (e.g., illustrated in the form of self-reports and objective parameters, like heart rate and cortisol levels, measured in saliva) [10]. Although MBSR has been successfully used for the last 40 years in the USA, Canada, and Western Europe in many psychosomatic disorders related to stress [11–13], it is still little known as a relaxation technique in Eastern or Central Europe. Due to some logistic obstacles, the entire MBSR program may be too difficult to implement at the universities in this location. However, an important component of the MBSR, the deep diaphragmatic breathing (DDB) technique, has also been separately studied as a stress reduction modality, and convincing evidence exists that DDB is useful in stress management [14]. For instance, a recent study has demonstrated a beneficial influence of DDB on mental functions and normalization of stress-induced cortisol levels. This indicates that such a simple and easily available technique has enormous implications for the promotion of mental hygiene and prevention of adverse health consequences of stress [14]. However, the specific advantages of DDB on stress reduction, cognitive abilities, and mood among students still remain largely unknown. To explore this topic in more details and fulfill the unmet needs, a “portable intervention,” such as stress management brief training (SMBT), focused on the reduction of the perceived stress levels among students will be outlined. The SMBT consists of a short review of stress mechanisms and coping approaches, followed by the instruction of a simple stress management relaxation/technique [e.g., deep diaphragmatic breathing (DDB)]. Practical considerations regarding the DDB will be emphasized.

## **2. Review of the literature on stress and coping: a focus on the student population**

A review of the literature was conducted using PubMed. The following keywords: stress, stress management, perceived stress, coping, relaxation, and students were utilized. The review was limited to full-text articles, in English language, which were published within the last 15 years. After this search, the following study-specific areas were determined: the hypothalamic-pituitary-adrenal (HPA) axis; the HPA axis dysregulation from stress; impact of chronic stress on memory and cognition; stress perception; stress-related maladaptive behaviors; appraisal of the stressors; coping with stress among students; relations between stress, coping strategies, academic performance, and quality of life; managing stress in the

students; relaxation techniques; deep diaphragmatic breathing; and the effects of stress management programs.

## **2.1 Stress and the hypothalamic-pituitary-adrenal (HPA) axis**

Human stress is the psychophysiological reaction of a person, who confronts a situation, in which there is an imbalance between the demands (e.g., real or imagined) and the ability to fulfill them [15]. When a person confronts a stressor (e.g., an internal or external, physical, or psychological factor, which creates disequilibrium), the body activates a series of reactions to enhance coping with the stressful situation. In particular, when an individual experiences different stressors, the hypothalamus (the main hormone-regulating brain “station”) releases corticotrophin-releasing hormone (CRH), which stimulates the release of adrenocorticotrophic hormone (ACTH) from the pituitary gland [16]. ACTH stimulates the production of glucocorticoids (e.g., cortisol) by the adrenal glands. In this manner, the hypothalamic-pituitary-adrenal (HPA) axis is “in charge” of the systemic adaptive changes that are induced by stressors [17]. Simultaneously, catecholamines are being secreted from the adrenal glands.

## **2.2 The HPA axis dysregulation from stress: negative consequences for health**

In the case of the prolonged HPA axis activation (e.g., due to some undesirable, cumulated stressors, such as difficult tasks and personal, family, or financial problems), the chronically increased stress hormone levels can cause negative psychosomatic consequences [18]. An adaptation to stress initially includes the physiological mobilization of resources, such as an increased catecholamine’s release [19]. This is often followed by the resistance stage, which represents a prolonged adaptation to stressful challenges (e.g., increased cortisol levels) [19]. Finally, decompensation of the HPA axis, which is often characterized by decreased cortisol and catecholamine production, can cause serious disorders and diseases in each organ or system of the human body [19]. In particular, chronic stress elevates the risk for central obesity, metabolic syndrome, type 2 diabetes mellitus (T2DM), cardiovascular disease (CVD) [e.g., arterial hypertension, coronary artery disease (CAD), myocardial infarction (MI), heart failure (HF), and stroke], neoplastic, degenerative, or inflammatory diseases, allergies, asthma, gastroesophageal reflux disease, peptic ulcer disease, osteoporosis, and mental disorders (e.g., major depression and insomnia) [19, 20]. In addition, several studies have revealed associations between stress and maladaptive behaviors (e.g., increased alcohol consumption, tobacco smoking, or substance abuse) and increased anxiety or depressive symptoms [21, 22]. Due to such detrimental consequences of chronic stress, it is imperative to prevent them as early as possible, by introducing helpful nonpharmacological stress management interventions [23].

## **2.3 Impact of chronic stress on memory and cognition**

Everyone has an inherited ability to deal with stress. For instance, after a person confronts a stressful event, the “fight-or-flight” response occurs, which is characterized by elevated catecholamine’s level. However, in the chronic phase of stress, cortisol levels are usually high and can lead to impaired neurogenesis and cause structural and functional changes in the central nervous system (CNS) (e.g., in the brain areas responsible for short-term memory, cognition, affect, and impulse control) [21, 23]. In addition, sleep deprivation can negatively influence the abilities to learn due to decreased clarity of the thought process, poor creativity, or problem-solving skills, which are often linked with impaired scholarly performance among



students [24]. In particular, the rapid eye movement (REM) sleep phase is crucial for processing the information that has been stored in the short-term memory reservoir (e.g., hippocampus) and consolidating the memory traces in the long-term memory reservoir (e.g., the temporal lobes of brain cortex) [24]. Furthermore, a person's working memory can only contain approximately seven units of information, and thus, when a student is under stress, and her/his mind is being occupied with several stressors, the student's learning capabilities can be deteriorated [25]. In addition, since a student's attention is often not focused on the learning task, the relevant memory trace will be difficult to retrieve in the future. Moreover, stress in students has also been found to contribute to avoidant coping behavior and depressed mood [26]. In this light, the modulation of stress response seems to be particularly important in students, who are exposed to chronic stressors. It should be noted that high levels of the perceived stress and the inefficient adaptation to stressors have been correlated with increased rates of anxiety and depression [23, 27]. Unfortunately, in the case of chronic stress, a desynchronization of the HPA axis contributes to various stress-related conditions and impaired cognitive performance [23, 27].

#### **2.4 Stress perception: different intellectual and emotional aspects**

In general, stress can be caused by challenge stressors (e.g., that allow someone to have sufficient motivation to accomplish a certain task) and threat stressors (e.g., that evoke fear, such as a signal of imminent danger) [28]. In fact, all stimuli that are perceived as harmful can have devastating effects on one's psychosomatic health [27]. For instance, if a given situation is perceived as a threat, the organism's response is identical, regardless of whether the stressor is a wide animal ready to attack or an upcoming exam. Thus, a person's specific perception and interpretation of given circumstances, regardless of their real danger, represent a key factor indicating how much stress the person is actually experiencing [28]. Furthermore, stress may also stem from situations that are subjectively viewed as positive. For instance, some students may have positive feelings about their assignments and like being busy, yet they may be under considerable stress that they are not fully aware of having. In contrast, a situation is considered to be stressful, when students think that they do not have the abilities or sufficient resources to deal with it [28]. On the other hand, a higher level of one's confidence can modify the perception of stressors, so that a person's appraisal (e.g., intellectual and emotional) of the stressful situation can alter her/his level of subsequent stress-induced response [28].

#### **2.5 Stress-related maladaptive behaviors: common presentations and long-term risks**

In essence, if a situation is viewed through the lens of negative emotions, the perceived stress level is higher, compared to observing the identical situation, from the perspective of positive emotions or mental connotations [23, 26]. In addition, verbal complaining and "ruminating" about the difficulties can perpetuate and "disseminate" stress, so every negative emotional response to a similar stressor becomes incorporated into the brain's neural networks [23, 26]. This, in consequence, may become the automatic response to such a stressor in the future, leading to an undesirable habit formation [18, 27]. There are some dangerous habits that university students are especially prone to acquire during examination sessions (e.g., frequent lack of sleep, which can adversely affect their physical, mental, and emotional health) [24, 26]. Unquestionably, restful sleep is necessary for proper mental hygiene and the

immune system functioning [26, 29]. Fortunately, it appears that by proactive recognition of the stressful situations, and modification of the stress response effects, students could possibly avoid maladaptive coping behaviors and learn helpful stress reduction interventions (e.g., at the beginning of their academic career), in order to protect their psychophysical health in the future. Some other common habits that students often acquire include excessive drinking of coffee and other beverages, containing a high content of caffeine or similar stimulants (e.g., which can elevate blood pressure and heart rate or exacerbate anxiety) [26]. An analysis of other risk behaviors that students often demonstrate while under stress (e.g., tobacco smoking and alcohol or substance abuse) causing potential detrimental health consequences is beyond the scope of discussion in this chapter.

## **2.6 The key role of appraisal of the stressors**

Stress reflects a bi-directional process, which consists of the creation of stressors by the environment and the individual's response to them. As a consequence, when there is a real or imagined imbalance between demands and resources, in which the demands outweigh resources, a person experiences stress [23, 27]. During this process, a cognitive appraisal is an initial step in the coping mechanism, which varies individually. It occurs when a person knows the reason why a given interaction creates stress [21, 23, 30]. It should be underscored that both the past experiences and the present events influence the way a person reacts to a current situation [21, 23, 30]. Also, it is important to point out that the stress reaction takes place after a certain meaning has been attached to a current situation, evoking an emotional response [21, 23, 30]. As a consequence, cognitive appraisal influences how a person will cope with a given event and how she/he will most likely react to analogous circumstances in the future [21, 23, 30]. According to a current model of stress, the primary appraisal of a stressful situation relates to the initial perception of the stressor (e.g., as negative, positive, or neutral), and the secondary appraisal refers to the coping strategies and resources (e.g., how to overcome or adapt to the stressor) [21, 23, 30]. At this point, an individual's coping approach can be positive (e.g., addressing a stressor as a challenge) or negative (e.g., viewing a stressor as a threat, especially if an adverse outcome is expected, which is associated with anxiety, anger, or fear) [21, 23, 30]. In addition, the repeated negative appraisal may lead to maladaptive behaviors and long-term negative consequences [21, 23, 30]. Overall, it appears that modifying the perception of stressors can help students to enhance their learning skills and academic achievements [28, 31]. For instance, assessing stressful situations as being challenging (and thus appraised as helpful) rather than as being threatening (and thus appraised as harmful) changes the stress physiology [32]. In particular, if the students perceived certain stressors as motivating them to overcome some obstacles, their learning skills and academic performance were positively correlated with the increased motivation [32]. Conversely, if the students perceived a dangerous situation (e.g., in which the demands were exceeding their resources), their motivation to learn was decreased, leading to impaired scholarly performance [33].

## **2.7 Coping with stress: important considerations regarding the student population**

It should be highlighted that coping is the process of confronting adversities, in an attempt to overcome them or to adapt to the stressful situations [34]. “Positive coping” includes some basic knowledge of factors that underlie personal

coping strategies, which are related with the individual's strengths and effective coping techniques, and offers meaningful solutions to ineffective or even harmful stereotypical behaviors [35]. In essence, coping with stress relates to the way how an individual is able to achieve the balance between different life demands and the ability to deal with them. In fact, daily stress is an inevitable and natural part of everybody's life. However, extreme, chronic, or psychological stress can cause adverse health consequences and poor academic performance for every university student [34]. Therefore, there is a growing need to implement feasible stress management intervention programs in the academic setting [35]. Two main coping styles, which are being applied to deal with the ongoing demands, include problem-focused (e.g., that consists of defining problems, generating solutions, and evaluating results) and emotion-focused (e.g., that occurs when a person feels helpless upon confronting the stressful events) methods. The most effective and available stress management approaches for students include relaxation techniques and goal-oriented, positive coping strategies [34–37].

## **2.8 Interrelations between stress, coping strategies, academic performance, and quality of life: lessons learned from recent research studies**

Unquestionably, effective coping strategies are critically important for reducing elevated stress levels among students. In general, successful coping involves managing the interactions between the environment, and the perceived stress levels, where the accompanying emotions are essential parts of this process [23, 30]. Since stress is multifactorial and impacts each person in a different way, a diverse spectrum of coping methods is required [23, 38]. Therefore, providing “well-targeted” tools, necessary to effectively cope with different stressors, is critically important to students, who are under stress. It should be pointed out that on the one hand, short-term stress can play a role of the positive motivator for learning [21, 23]. On the other hand, however, excessive or long-term stress can adversely influence the learning process and deteriorate academic performance [39]. Furthermore, a plethora of stressors, especially in students, who use poor coping techniques, can adversely influence many aspects of their health and scholarly performance [40]. For instance, the prevalence of stress, anxiety, and depression in nursing students was recently explored, and correlations between ineffective coping methods (e.g., avoidance, denial, and substance abuse) and high-risk lifestyles (e.g., in terms of busy study/work schedule, family obligations, poor support systems) were found in those students, who had significantly elevated scores in the depression, anxiety, and distress categories [41]. Furthermore, in a study investigating relations between stress and quality of life (QOL), among nursing students in Norway, one-third of the students reported moderate to high levels of experienced stress, which were impaired QOL [42].

## **3. Relaxation techniques: nonpharmacological interventions to reduce stress**

According to the National Center for Complementary and Alternative Medicine (NCCAM), meditation is a mind-body process, which has been scientifically explored as an intervention to reduce stress [43]. It is a cognitive practice, focused on calming the mind and observing intrusive thoughts, without judging them [44]. In this state of consciousness, the mind is focused on the moment-to-moment experience of one's internal (e.g., thoughts, feelings, and sensations) and external (e.g., events or situations) environment [33]. Individuals who focus

their attention on “here and now” and become fully aware (mindful) of their thoughts’ processes and emotions are able to create calm, relaxed, and balanced psychophysical condition [43]. Studies have revealed that many people, who have been practicing meditation (even for a short time), have decreased their perceived stress levels, improved health status, and increased QOL [44, 45]. However, classical meditation programs are usually long or expensive and, thus, inconvenient or unavailable for a majority of students. This inspired a new research direction, aimed at exploring whether or not similar benefits can be achieved via shorter-time interventions [46]. For instance, a brief meditation training program (that also incorporated therapeutic breathing), which investigated the effects of this technique on perceived stress, anxiety, and negative emotions, has revealed that the healthy participants experienced significant reductions in negative affect, distress, and anxiety [46]. A similar study has revealed that participation in a single-paced breathing meditation training session resulted in improved QOL and reduced perceived stress levels [47]. Research aimed at exploring stress reduction should combine a few stress management strategies that can be effective in different contexts, among various populations of students [33]. As an illustration of this concept, one of the online stress management programs (e.g., Stress-Free Now) has incorporated meditation and therapeutic breathing. This study was examining the program’s effectiveness in decreasing stress and improving psychological well-being by exploring the effects of a 2-month online stress reduction program in three groups, including two intervention groups (that participated in the online program and were receiving a different stress management technique every week, based on mindfulness meditation, visualization, and therapeutic breathing) and one control group [33]. The results of this study have revealed that the online stress reduction program, which incorporated diversified activities, such as mindfulness, relaxation, and meditation techniques, was effective in decreasing the perceived stress levels and improving well-being, among the participants in two intervention groups [33].

### **3.1 Deep diaphragmatic breathing: a “spotlight” on a “portable intervention”**

Relaxation technique, such as deep diaphragmatic breathing (DDB), is feasible and can be practiced anywhere. In essence, DDB includes controlled deep (abdominal) breathing that enables the individual to enter a relaxed state, in an effortless manner. Simultaneously, this simple technique has been found to be very effective in stress reduction among students [48]. In addition, some relaxation techniques have been revealed to reduce stress levels, even after a single session [19]. Therefore, a proposed “portable intervention” for an effective coping with stressors should be universal and safe strategy for numerous university students. An early introduction of this simple and helpful technique can result in desirable health-related habits and long-term beneficial psychophysical conditions.

### **Conflict of interest**

There is no “conflict of interest” to declare.



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