



Research Article

# Effects of Neurosculpting<sup>®</sup> Meditation on Stress, Anxiety and Sleep in a group of undergraduate college students

Kathleen K. Kelley<sup>1\*</sup>, Rachel Pata<sup>1</sup>, Sarah Acevedo<sup>2</sup>, Casey Bayne<sup>2</sup>, Lyndsey Thompson<sup>2</sup>, Lisa Wimberger<sup>2</sup>

<sup>1</sup>Physical Therapy, Quinnipiac University, Hamden, Connecticut, USA

<sup>2</sup>The Neurosculpting Institute, USA

\*Corresponding authors: Kathleen K. Kelley, Physical Therapy, Quinnipiac University, Hamden, Connecticut, USA

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## Abstract

The purpose of this study was to examine if 11 weeks of Neurosculpting<sup>®</sup> meditation improved sleep and other variables in fifteen undergraduate college students. Subjects were evaluated at the beginning and end of the semester using two tools: The Pittsburg Sleep Quality Index and the Depression Anxiety Stress Scale. During each session, heart rate and heart rate variability were measured using a smartphone app, fingertip sensor, and HRV monitor. Subjects received 60 minutes of Neurosculpting<sup>®</sup> Meditation, one time per week, for 11 weeks. The average score of both the DASS and PSQI decreased ( $p = .54$ ) and ( $p = .08$ ) respectively. Within each session, average heart rate (HR) decreased and average heart rate variability (HRV) increased. However, neither variable showed significant changes from the beginning to the end of the semester. This study demonstrated that consistent Neurosculpting<sup>®</sup> meditation sessions may improve heart rate variability and sleep in college aged students.

**Keywords:** Meditation; Stress; Anxiety; Sleep; College students

## Introduction

The results from the American College Health Association-National College Health Assessment [1] indicate that the top three factors that negatively impact college student success are stress (31.8%), anxiety (23.2%) and sleep difficulties (20.7%). Additionally, 9.5 – 31.3% of college students report suffering from depression, 5.1% report suffering from chronic illness (eg: cancer, diabetes) and 7% report being diagnosed with ADHD. Students, however, may be hesitant to seek professional help for these problems due to negative attitudes toward mental health care [2-4]. Therefore, campuses around the nation are turning to alternative means to provide students with relief from stress and anxiety [5,6].

Meditation has been shown to reduce anxiety and depression, [7,8] activate many areas of the brain as shown by functional

magnetic resonance imaging, [9-12] reduce baseline cortisol levels [8] and increase attention [13]. Since college students suffer from a variety of problems and may be reluctant to seek formal mental health care, a weekly meditation class may improve sleep, and reduce anxiety and stress.

A search for synonyms of the word meditation using MSWORD (Version 14.1.0) reveals words such as “thought, consideration, deliberation, contemplation, reflection, introspection and concentration.” Ancient Buddhists define meditation as the primary tool we use to see the world and mind clearly [14]. Smalley and Winston [15] define meditation as: “Mindful awareness....an idea that implies an awareness of self and a capacity to reflect...”(p. 1). Other authors define meditation as “A form of mental training that aims to improve an individual’s core psychological capacities...” [10] (p. 213). Mindfulness meditation has also been defined as an ability to regulate the attention. [16] Ludwig and Kabat-Zin [17] comment that “mindfulness” is a “Meditation practice that cultivates present moment awareness” (p. 1351). Although themes

emerge when evaluating the definitions of meditation, many practices and opinions exist. A variety of practices exist to compliment the wide array of definitions.

Popular practices include Mindfulness Based Stress Reduction (MBSR), Mindfulness Based Cognitive Therapy (MBCT), T'ai Chi, Sudarshan Kriya Yoga (SKY) and Yoga [7,18]. Each form has its own signature practices and potential benefits. MBSR was founded by Jon Kabat-Zinn at the University of Massachusetts Medical School in 1979 [18] and is the most studied form of meditation. Neurosculpting® meditation is perhaps the least studied.

Neurosculpting® is a practice designed to quiet the primitive brain, activate the prefrontal cortex and ultimately use the entire brain to engage the practitioner [19]. Initially, students begin by learning the 5-step Neurosculpting® meditation process and practicing meditation. This practice may be useful for college students struggling with stress, anxiety, depression and sleeplessness. However, no studies of the effect a Neurosculpting® practice on college students have been performed. To that end, this study was performed to assess the impact of Neurosculpting® on stress, anxiety, depression, sleep and heart rate variability of one group of undergraduate college students. The authors expected that Neurosculpting® would reduce stress, anxiety and depression and potentially improve sleep and heart rate variability (HRV).

## Materials and Methods

At the beginning of the Fall Semester, 2017, all students enrolled in the one credit course FLW 103: Introduction to Meditation, were asked to participate in the study. All students were assured that participation (or not) in no way would impact either their grade or their ability to succeed in the class. The study was approved by the Quinnipiac University IRB prior to the beginning of class in the Fall of 2017. Twenty-nine students enrolled in FLW 103 and fifteen students agreed to participate in the study (9 females and 6 males). See Table 1 for full demographics. No students were excluded from the study. However, if a student chose not to participate in the study portion of the class, they continued to participate in FLW 103 with no penalty or deviations from the coursework.

On day one of class, all students were informed of the potential to participate in the study. The study was thoroughly described, and students had the opportunity to ask questions of the faculty member. Students who chose to participate remained after class for approximately 30 minutes to sign the informed consent and fill out the two questionnaires: The Pittsburg Sleep Quality Index (PSQI) and the Depression Anxiety Stress Scale (DASS). Those who agreed to participate were also given a \$10 iTunes card to download the *ithlete™* app onto their personal smartphones. This application uses a finger sensor attached to a smart phone to determine heart rate (HR) and Heart Rate Variability (HRV).

During each meditation session, HR and HRV were measured pre-and post-meditation. Subjects received 60 minutes of Neurosculpting® Meditation, one time per week, for 11 consecutive weeks. Sessions were conducted every Monday morning during the regular class time in the same classroom each week. At the end of each class, students transcribed HR and HRV data onto a log which was then given to the instructor. The meditation program was taught by a Certified Neurosculpting® Meditation Teacher.

Finger sensors were provided by the faculty member each session. The last 30 minutes of the final class were used for the participants to retake the PSQI and the DASS. The faculty member who taught Neurosculpting® was blind to the results of all Pre- and Post-tests (DASS, PSQI, HR and HRV). All tests were kept in a locked cabinet in a locked office.

## Measures

### Pittsburg Sleep Quality Index (PSQI)

The Pittsburg Sleep Quality Index (PSQI) is a self-report questionnaire designed to measure both the quality of a participants' sleep and possible disturbances to sleep. The questionnaire contains ten main questions with sub-questions under numbers five and ten. The questionnaire is scored based upon seven components. Researchers can derive a "global score" from adding all seven sections together [20]. Test-retest reliability is reported as .87 and validity analysis shows that a score of greater than 5 correlates with sleep disturbances in subjects with established insomnia [21].

Previous studies [20,22] using the PSQI have indicated the importance of studying the sleep quality of individuals. Sleep disturbances can be a symptom of sleep and/or medical disorders and may correlate with mortality. The PSQI allows researchers to examine the effects of weekly meditation on sleep by quantifying both the changes in sleep and sleep quality [20,22].

### Depression Anxiety Stress Scale (DASS)

The Depression Anxiety Stress Scale (DASS) is a 42-item self-report instrument designed to measure depression, anxiety, and stress [23,24]. The DASS contains a set of three self-report scales, each with 14 items. This scale discriminates the differences among the emotional states of depression, anxiety, and stress [25]. Test re-test reliability of the DASS has been reported as .71 for depression, .79 for anxiety and .81 for stress [26]. This self-report measure was selected for this study to examine the effects of Neurosculpting® on depression, stress, and anxiety in college students.

### Heart Rate Variability

Heart rate variability (HRV) is defined as "the quantification of beat-to-beat variability in the cardiac cycle over time [27]. Different than a heartbeat, which is the number of times the heart muscle completes a period of contraction and relaxation per minute, HRV tracks the time between each heartbeat to measure both

the function of the autonomic nervous system (ANS) and its ability to communicate with the heart. This measurement monitors how the heart copes with various external factors.

Previous methods of collecting HRV data involved assessing a subject's electrocardiograph (ECG). ECG collection is both cumbersome and time consuming. Current methods used to measure HRV employ the use of a finger sensor along with the *ithlete*™ smart phone application. This smartphone application was created to objectively measure stress levels in athletes [28]. This technique is a reliable measurement technique to determine short term HRV in healthy adult subjects. Short term measurements of 60 seconds in duration have been shown to be adequate for measuring HRV in collegiate athletes [29]. To ensure the *ithlete*™ smartphone application's validity, Flatt & Esco [28] collected data comparing a conventional ECG setup with data collected using the *ithlete*™ application. Researchers showed that the *ithlete*™ application provides a time domain of HRV index, known as root mean square of successive R-R intervals (RMSSD), which reflects parasympathetic modulation of the heart.

The RMSSD is an indicator of both physical and non-physical stressors [28]. Flatt & Esco [28] determined that HRV values obtained via the *ithlete*™ smartphone application provide an accurate measure of HRV when compared to measures obtained with ECG.

### Overview of the Neurosculpting® Program

Neurosculpting® is a 5-step meditation process that may encourage an individual to release the grip of old patterns and entrain their brain to new and more supportive patterns, habits and behaviors. Neurosculpting® was developed as a method to support self-directed neuroplasticity of the brain. Neurosculpting® employs a unique methodology by intentionally engaging the whole-brain through specific language and focused imagery. This unique methodology was developed in response to both years of meditation practice and study of the neuroscience of brain function by its founder, Lisa Wimberger [19].

### Neurosculpting® uses a unique, specific 5-step process to re-train the brain:

**Step One:** Down-regulates hyperactive stress activity via an engagement with the parasympathetic response.

**Step Two:** Enhances focused attention to support with emotional regulation.

**Step Three:** Increases the activity between our analytical self and

our intuitive feeling self via engaging the whole brain (Right and Left sides)

**Step Four:** Links somatosensory, bodily sensation-based, engagement to perceptual shifts in patterns.

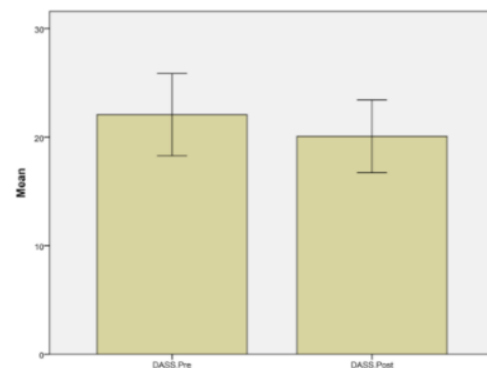
**Step Five:** Enables the user to easily identify and replicate the process in day-to-day activities

During the meditation (immediately prior to initiating the practice and immediately after), HR and HRV were monitored as described above. Each student recorded pre-meditation and post-meditation HR and HRV on a personal log. Logs are collected by the primary investigator each week and stored in a locked cabinet in locked office.

### Results

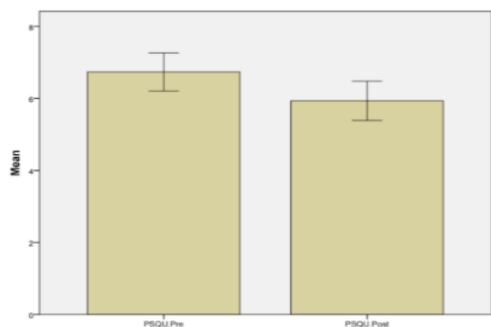
PSQI and DASS data were analyzed using a paired t-test. HR and HRV data were analyzed using a mixed model analysis with fixed effects. All data were analyzed using SPSS v24. After 11 weeks of meditation, the average score for the DASS decreased from 22.07 to 20.07 ( $t = .626$ ;  $p = .542$ , not significant) (Figure 1) and the average PSQI score decreased from 6.37 to 5.93 ( $t = 1.87$ ;  $p = .08$ ) (Figure 2).

After 11 weeks of meditation, overall resting heart rate showed no significant reduction. HR was noted to decrease within sessions each week ( $p = .00$ ), from pre- to post- meditation (except Week 7, see Figure 3). HRV increased after each session ( $p = .00$ ) except weeks 6 and 9 (see Figure 4).



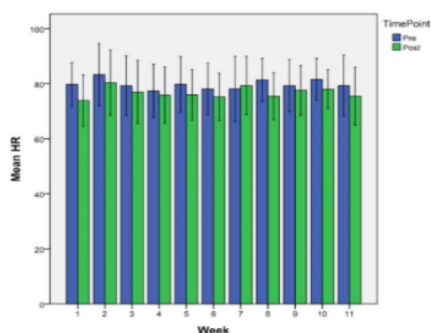
The average score for the DASS decreased from 22.07 to 20.07 ( $t = .626$ ;  $p = .542$ )

**Figure 1:** DASS Pre and Post Test Data.



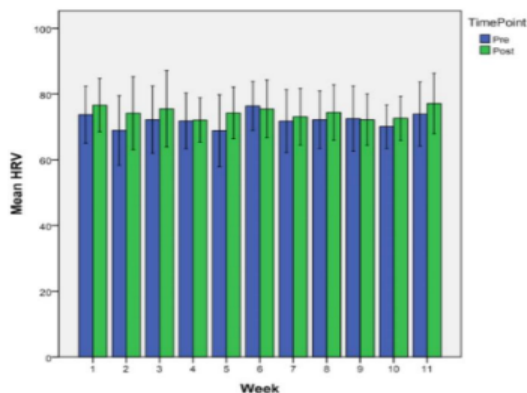
The average score for the DASS decreased from 22.07 to 20.07 ( $t = .626$ ;  $p = .542$ )

**Figure 2: PSQI Pre and Post Test Data**



For all weeks except week 7, mean HR reduces from pre- to post- meditation ( $p = .00$ )

**Figure 3: HR Data over time**



**Figure 4: HRV Data over time**

## Discussion

This study revealed that a weekly Neurosculpting® Meditation class may improve sleep but does not appear to impact on stress, anxiety, or depression in one group of college students. Neurosculpting® Meditation also has short-term but not long-term impact on HR and HRV.

## Meditation and Sleep

Over twenty percent of college students report experiencing sleep difficulties [1]. In addition, 50% of college students report daytime sleepiness [30], 70% report getting less than eight hours of sleep per night and 60% are considered to have poor quality sleep [31]. Poor quality sleep and sleep deprivation can lead to decreased grade point averages, impaired academic performance, impaired ability to drive safely and, in a small percentage of students, suicidal thoughts [32]. Other authors have shown that meditation improves sleep [33,34]. In this study, 93.3% of participants exhibited poor sleep quality (as measured by the PSQI) at the pre-test. However, at post-test, this number decreased to 66.6%, indicating that a weekly meditation practice may have improved sleep quality. These results confirm what other authors have found, that meditation may improve sleep quality [33-35].

Given the prevalence of sleep disturbances in college students and the plethora of detrimental consequences, any program that improves sleep even a slight amount is beneficial. Further studies are needed with more subjects and more frequent meditation sessions to determine the full benefit of a Neurosculpting® Meditation practice on sleep disorders in college students.

## Meditation and Autonomic Regulation

HR and HRV are indicators of autonomic regulation of the cardiovascular system [35]. Acceleration of HR is caused by sympathetic regulation and change in HRV is caused by parasympathetic regulation [36]. HRV increases in a more parasympathetic or relaxed state. Our results indicate that after each Neurosculpting® session, the sympathetic system down regulated HR and the parasympathetic system upregulated HRV. Therefore, a short term, but not long- term effect was seen on both HR and HRV after a meditation session. This short-term decrease in HR and increase in HRV from pre- to post- meditation session demonstrates successful inhibition of sympathetic tone and activation of parasympathetic tone [8]. The lack of significant long -term effects may be secondary to the class time constraints of 1 hour, 1X per week and/ or the short duration of the class (11 weeks). However, the short-term changes seen indicate that the subjects' have healthy, adaptable cardiovascular systems. A long-term effect may be seen if the subjects continued Neurosculpting® meditation either at a higher weekly frequency or a longer duration.

## Limitations

There were several limitations to the study. The sample group was small (15 subjects) and the majority of participants who did complete the study missed at least one class. Anecdotally, the participants who had perfect attendance had greater, but not significantly different, changes on both the DASS and PSQI, indicating dose may be an important variable that impacts success of a

mediation program. Dose was also limited by the constraints of the college semester, allowing for only 11 weeks of data collection. A longer study may result in larger and more permanent behavioral changes. Finally, the sample population was a group of generally healthy, well-educated young college students and therefore may not be universally generalizable to all college students.

## Conclusion

This study demonstrated that 11 weeks of a one-hour long Neurosculpting® meditation session can reduce stress and anxiety and improve sleep in college students. In addition, Neurosculpting® meditation has a positive temporary effect on resting heart rate and heart rate variability.

## Author Contributions

“Conceptualization, Kathleen Kelley, Rachel Pata, Lisa Wimberger; methodology, Kathleen Kelley and Rachel Pata; formal analysis, Kathleen Kelley; investigation, Sarah Acevedo, Casey Bayne, Lindsey Thompson; data curation, Kathleen Kelley, Sarah Acevedo, Casey Bayne, Lindsey Thompson; writing-original draft preparation, Sarah Acevedo, Casey Bayne, Lindsey Thompson; writing-review and editing, Kathleen Kelley, Rachel Pata, Lisa Wimberger; project administration, Kathleen Kelley, Rachel Pata; funding acquisition, Kathleen Kelley, Rachel Pata. All authors have read and agreed to the published version of the manuscript.”

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**Conflicts of Interest:** The authors declare no conflict of interest

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