Short Term Physiological Effects of Meditation on Induced Task-Related Stress

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Abstract

Stressful stimuli can lead to serious health consequences when not managed correctly; however, meditative practices have shown to be an effective management technique in reducing the body's physiological response to stress. Although the focus of many past studies have involved long-term meditation, this study investigated the impact of short-term meditation prior to involvement in a stress inducing task. We hypothesize that meditation prior to task-induced stress will reduce physiological measurements of stress. Physiological measurements of blood pressure, heart rate, and respiratory rate were taken for a meditative group and non-meditative group, and percent changes were calculated for mean blood pressure and respiratory rate to measure the quantitative effects of meditation. In this case, stress was defined as a change from homeostatic or baseline levels. The effect of meditation on blood pressure and heart rate were not significant and did not strongly support the experimental hypothesis. The effect of meditation on respiratory rate, however, was significant, and did support the experimental hypothesis. This displayed that a short meditation session prior to participating in a mental, stress-inducing task aided in minimizing some physiological responses to stress.

Introduction

The demands of everyday life universally present stress that could potentially damage one's health. Chronic stress can lead to fatigue, sleep issues, headaches, high blood pressure, and heart disease, among other negative consequences (Pruthi, 2013). Increased activation of the sympathetic nervous system is thought to contribute to the physiological responses associated with stress (McEwen & Stellar, 1993). Recent investigations have found reductions in both heart rate and blood pressure during short meditative practices in response to isoproterenol as a stressor (Dimsdale & Mills, 2002), seemingly alleviating some of the associated outcomes of stress that could potentially negatively affect mental capacity and performance. Thus, there is some evidence that meditative practices could aid the body's response to stressful stimuli.

Stressful stimuli is defined as anything that is a perceived threat to homeostasis (Goldstein & McEwen, 2002), and consequently, what is characterized as stress has extensive variation. Mental stress involving arithmetic and Stroop tests (characterized as a list of words spelling out names of colors and written in font colors different from the written color, with the participant identifying the font color) resulted in notable increases in systolic and diastolic blood pressure, mean arterial pressure, and heart rate (El Sayed et al., 2016). Retesting measures have consistently shown elevated blood pressure under stress (Fonkoue et al., 2015). In other studies, tasks that involve executive function raised the heart rate variability (a measured variation of the beat to beat interval) in test subjects (Pendleton et al., 2016), suggesting increased cardiovascular work. In rats, it was found that prolonged stress caused an inability for the heart to recharge between beats, causing irregular heart rhythms (Park et al., 2017). Physical stressors are also correlated with cardiovascular ramifications, such as the cold pressor test (a physical stressor in which the subject placed their dominant hand in ice cold water for 2 minutes) that produced significant increases in blood pressure (El Sayed et al., 2016).

These results have important implications for managing cardiovascular health and hypertension and support a necessity for stress management techniques. Although it is unclear the exact mechanism by which stress impacts cardiovascular health, it is evident that chronic stress can have damaging effects. Ernesto L. Schiffrin, M.D., Ph.D. described how stress "can contribute to everything from high blood pressure to asthma" (Schiffrin, 2014). Developing a way to manage this stress has become imperative in limiting negative consequences to one's health.

Meditation has been shown to have several positive effects on how the body handles stress. One study discussed the effects of medication regarding decreased levels of perceived stress as reported by college students (Oman, 2008). Additionally, research has shown the benefits of meditation transcending types of stress, as observed in the field of professional sports. Players in the NFL on the Seattle Seahawks utilize 6-minute meditative practices aiming to prepare their bodies and minds for challenges involving stressful activities (Neporent, 2016). Some studies have also illustrated reduced physiological parameters, such as blood pressure, with the aid of meditation in response to acute stress (Nyklíček, 2013). Thus, meditation has been observed to reduce perceived stress, reduce physiological responses to stress, and potentially even improve performance under stress.

While some studies have found that short term meditation prior to a stress-inducing task does not have any physiological effect on the heart (Azam et al., 2016), exact implications still remain unclear. Decreased heart rate in individuals when exposed to guided concentration and paced breathing-based meditation has been observed (Park & Park, 2012). Participants with harm avoidance, novelty-seeking, persistent, self-directed behavior showed greater change than those without these traits (Park & Park, 2012). This suggests that personality traits affect the impact of meditative practices and that different meditative practices may benefit individuals uniquely.

Another factor of consideration is the duration of the meditation, as there is an observed difference between short-term and long-term meditation. Long-term meditation in previous studies has been described as having experience with meditation in varying degrees, and short term meditation would be a novice to this form of stress relief. For this study, however, due to time constrains, short-term meditation was considered to be meditating for a short period of time (such as 10 minutes or less) as opposed to long-term being for an extended period of time (greater than 10 minutes). Those long-term meditators who hold more experience have shown different brain activity than short-term or inexperienced meditators in certain sleep cycles (Dentico et al., 2016). Additionally, meditating over long periods of time has been shown to increase some forms of brain activity and cognitive function (Dentico et al., 2016). This is displayed in increased gamma waves of NREM sleep, suggesting deeper sleep and increased neuroplasticity (Dentico et al., 2016). While it is understood that long-term meditation could potentially produce more significant effects than short-term meditation, the study duration did not allow for an accurate representation of the effects of long-term meditation on stress. It is furthermore beneficial to consider a reasonable, time-sensitive technique that people can easily incorporate into their lives, such as short length meditation.

We hypothesize that meditation prior to participation in a stressful task will reduce physiological measures including blood pressure, heart rate, and respiratory rate. When compared to non-meditative groups, it was postulated that meditative groups would exhibit a smaller percent increase in blood pressure, respiratory rate, and heart rate.

Materials and Methods

Participants

Participants in this study consisted of 30 student volunteers at the University of Wisconsin-Madison enrolled in Physiology 435. Participants ranged from 19-26 years of age and received no compensation in any form for their time; however, they were informed of an incentive prior to beginning the assigned task to be awarded if they correctly completed their single attempt within two minutes, though none completed the task. Participants signed a consent form outlining any and all risks involved.

Equipment

Physiological measurements were obtained through a blood pressure monitor, pulse oximeter, and respiratory monitor. An Omron 10 series + blood pressure monitor (Model BP791IT, Serial Number 20150310130LG, manufactured by Omron Healthcare, Inc., Lake Forest, IL) was utilized to measure blood pressure in mmHg. A Nonin Pulse Oximeter/Carbon Dioxide Detector (Model 9843, Serial Number 118103096, manufactured by Nonin Medical, Inc., Minneapolis, MN) was used to measure heart rate in beats per minute (BPM). Respiration rate was measured in breaths per minute by Biopac BSL Respiratory Effort Xdcr (Model SS5LB, Serial Number 1602007568, manufactured by Biopac Systems, Inc., Goleta, CA) connected to Biopac Student Lab 4.0 software (Model MP36E-CE, Serial Number MP36E41204002789, manufactured by Biopac Systems, Inc., Goleta, CA).

Procedure

Participants were arbitrarily split into two groups, one of which completed the assigned task without any prior meditation and sat quietly (Group 1, n=15; 6 males, 9 females), while the other group (Group 2, n=15; 8 males, 7 females) completed 6 minutes of meditation prior to completion of the task. Every participant was given one attempt to finish the task within two minutes. Each subject was informed of an incentive of a $25.00 Amazon gift card prior to beginning the task if it was completed in its entirety without any errors. In the absence of any correctly completed division tests, no gift card was awarded.

Monitoring equipment was attached to subjects. The blood pressure monitor was placed on the subject's non-dominant arm, which remained attached for the duration of the experiment. The choice of placing the blood pressure monitor on the subject's non-dominant arm was parallelled by the study done by the Royal College of Physicians (2011). The pulse oximeter was attached to the index finger of the subject's dominant hand and also remained attached throughout the experiment. This was chosen to avoid potential interference from blood pressure measurements on recording pulse (Basaronuglu, 2011). Measurements of blood pressure and heart rate were taken once for baseline values. A respiration belt was then attached to the subject's chest, placed slightly below the armpit with the monitor on the subject's back, and remained on for the duration of the experiment. Baseline measurements of respiration rate were recorded for thirty seconds, then multiplied by two to find the value in breaths per minute.

Subjects from Group 1 were asked to sit quietly for six minutes and were not examined if they had prior meditation experience. Following the six-minute quiet period, subjects were informed that they would be completing a two-minute test consisting of 20 long division problems with increasing difficulty every five problems (Appendix A). Subjects were to report their answers to one decimal place. The problem set was distributed and subjects were asked to begin. Whether or not these subjects had prior experience with meditation could affect the results in how each subject dealt with the silent period.

Heart rate and blood pressure were recorded promptly upon completion of the task, directly after the two minutes had passed. Two minutes was given for the subject to complete the long division test to maintain consistency and to ensure that the subject experienced significant stress to truly test the effects of meditation by giving them a shorter amount of time to complete a difficult task. Respiration rate was recorded by counting the number of peaks in each 30 second time interval of the two minutes, calculating the average from each interval, and multiplying by 2 to find the average breaths per minute throughout the duration of the task. After this recording, the blood pressure cuff, the pulse oximeter, and the respiration belt were removed and subjects were free to leave.

Subjects from Group 2 completed six minutes of meditation prior to completion of the long division timed trial. Subjects were instructed to sit and close their eyes as they were lead through a guided, breathing-focused meditation exercise. A guided meditation video by Freedom of Movement (Six Minute Guided Meditation - Breathing Mindfully) was utilized. Upon completing the meditation, subjects were given the same long division test to complete in two minutes and heart rate, blood pressure, and respiration rate were recorded in the same fashion as the first group. In both meditation and non-meditation groups, comfort levels may have varied between subjects in completing the stress-inducing math task depending on their arithmetic ability as opposed to doing a physical task. Equipment was removed and subjects were free to leave. A detailed timeline of these events can be found in Figure 1.

Data Analysis

Mean arterial pressure (MAP) was calculated from final and initial blood pressures using the following equation:

$$MAP = (SBP + 2 (DBP))/3.$$

From that data, percent change was calculated of mean arterial pressure. The individual subject data for percent change in MAP was processed with a one-way ANOVA test to determine mean percent change in MAP in meditation versus non-meditation groups, along with standard deviation and standard error of the data.

Heart rate between the baseline values and the final values at the end of the experiment were calculated as change in heart rate in change in beats per minute. ANOVA tests were run on the individual subject data for change in heart rate. In our study, stress was defined as anything that causes the body to deviate from homeostatic or baseline levels. This definition was chosen due to the diverse population that is represented in the cohort, and the different physical fitness levels and potential responses to mental stressors that different people may have.For respiration rate, the percent change was calculated between baseline and the final averaged value in breaths per minute.

Positive control measurements were taken by an experimenter who first took baseline measurements of heart rate, blood pressure, and respiration rate (Figure 2). Heart rate and blood pressure were taken without any prior physical activity, and baseline respiration was measured for thirty seconds, then multiplied by two to find the baseline in breaths per minute. The experimenter left the respiration belt on for the entirety of the positive control data collection. Following measurements, the experimenter completed jumping jacks for two minutes.

Physiological measurements were then repeated using the previously mentioned method, illustrating drastic changes in the positive control and minimal changes in the control. The positive control had a heart rate increase of 113%, while the negative control had just 2.5% (Figure 2, Panel A). For blood pressure, there was not a significant difference in the change between the two groups (Figure 2, Panel B), and for respiratory rate the positive control increased 157% while the negative control actually decreased by 5% (Figure 2, Panel C).

Results

Mean Arterial Pressure

For average percent change of MAP between the meditation (n=15) and non-meditation group (n=15), there was a greater percent decrease in MAP in the non-meditation group (Figure 3, Panel B). In the non-meditation group, subjects on average experienced a -5.99 percent change in their mean arterial pressure after completing the stress-inducing activity, whereas the meditation group experienced a -0.89 percent change in their mean. In our individual subject data of initial and final MAP in the meditation group, there appeared to be greater disparity in initial and final MAP compared to non-meditation subjects (Figure 4). Percent change in MAP was individually calculated for each subject in meditation versus non-meditation groups (Figure 5). However, these values and differences between meditation and non-meditation groups were deemed to be statistically insignificant (p=0.07) (Figure 6).

Heart Rate

Heart rate in beats per minute was documented from final and initial time points before and after the stress-inducing task, followed by changes in heart rate between meditation and non-meditation groups (Figure 7). In the meditation group, we previously defined physiological stress as a deviation from homeostatic, or baseline, levels. Five of 15 meditative subjects demonstrated physiological stress, whereas 9 of 15 subjects of the non-meditation group exhibited physiological stress (Figure 8). Our statistical analysis showed that these differences were not statistically significant (p=0.195) (Figure 9).

Respiratory Rate

In our representative data, it shows the respiratory rate in breaths per minute as one volunteer completed the two minute stress-inducing task after completing a six-minute meditation exercise (Figure 3, Panel A).

There was greater variation in data amongst the non-meditation group than the meditation group (Figure 13). Thirteen of the subjects in the non-meditation group experienced an increase in respiratory rate while twelve of the subjects in the meditation group experienced an increase in respiratory rate (Figure 12). Furthermore, there was a greater percent change of the non-meditation group (n=15) than the meditation group (n=15) in the respiratory rate from baseline measurements to average measurements (Figure 10). These results were found to be significant (p=0.037) (Figure 13).

Discussion

Meditation, especially over long periods of time, has provided health benefits in decreasing physiological stress, as evident by decreases in heart rate and blood pressure. This could be due to decreased activation of the sympathetic nervous system as previously discussed or how one's personality responds to stress; however, it is evident that there exists variation in how the body handles stress. From this evidence, we hypothesized that a six-minute meditation session prior to a stress-inducing test will show a smaller percent increase in blood pressure, respiratory rate, and heart rate when compared to non-meditative groups.

While developing our procedure, we had to determine the duration of meditation to test our subjects with what could show measurable change. One major assumption we had to make was that all subjects had the same level of experience in meditation practices. However, experience with meditation could vary from subject to subject. Entering a relaxed state could require greater amounts of time for a subject with little experience whereas a subject with greater experience could control their bodily response more readily. In order to account for natural physical differences among subjects, the measurement of percent change in physiological effects in individual subjects was favored, since baseline stress levels varied from subject to subject. While doing the stress-inducing task, blood pressure (BP) in mmHg, heart rate (HR) in beats per minute, and respiratory rate (RR) in breaths per minute could be confounded by environmental factors and stress prior to entering the study that could contribute to skewed results that did not necessarily support the hypothesis. Additionally, our results could have been impacted due to the placement of the pulse oximeter and blood pressure monitor depending on if the subject was right or left handed. This difference between dominant versus nondominant placement may have resulted in variability in measuring the heart rate and blood pressure of subjects.

When examining the data, location must be taken into consideration in how it may have altered our measurements, considering the varied levels of distraction given the nature of these experiments being conducted in close proximity of other experiments and students. Environmental distraction during the meditation study in forms such as conversation, movement of others, or lack of focus may have also reduced effectiveness of the meditation video. On a similar note, had there been more time to carry out this investigation, our meditation session would have been longer, but due to time constraints of this lab, six minutes was the agreed upon timeframe. This may not be enough time for a participant to become fully immersed in meditation and relaxed. The data contains a total of 30 participants, with 15 each in the meditation group (8 males, 7 females) and non-meditation group (6 males, 9 females), but once again, it was limited by time to complete the desired number of experiments. Within this age group of college students aged 19-26, percent changes in respiratory rate were deemed statistically significant in the decrease in respiratory rate seen in meditation groups. Although mean arterial blood pressure differences were statistically insignificant (p=0.07), these differences are close to potentially being statistically significant, and the limitations in sample size in this study could have affected this value. Since the cohort was additionally limited with respect to variability of age (only college age students aged 19-26 were studied), this provided little insight into age-related benefits of meditation.

While definitive, conclusive data is lacking, future studies comparing the effects of short-term meditation versus long-term meditation are a possibility in modifying this current experiment or replicating certain aspects of it. The current studies available regarding effects of short term meditation are extremely conflicting. For example, it has been found that there are no cardiovascular physiological effects (Azam et al., 2016), while a prior study demonstrated reductions in both heart rate and blood pressure during short meditative practices (Dimsdale & Mills, 2002).

In future research, there is a need for larger sample sizes and potentially more frequent meditation sessions to more effectively evaluate the physiological effects of meditation and how that may affect physiological responses to stress. In addition, different kinds of meditation could be used, such as a meditation led by an experimenter instead of a video that may seem impersonal and potentially more difficult for the subject to take seriously. These results shed a light on a possible correlation between meditation and having smaller changes in physiological stress response experienced by subjects when compared to non-meditation groups, but there is still much research and modification to be done before drawing stronger conclusions about short term meditation and reduced physiological stress. Greater implications for this work could be used in both academic and professional settings to better serve the interests and health needs of members of these communities during stressful events with the intentions of bettering the health of these populations improving stress management on its most primitive level.

Tables and Figures

Figure 1: Timeline of experiment. Following the signing of the consent form, baseline measurements of blood pressure (BP), heart rate (HR), and respiration rate (RR) were taken by the experimenter. Participants were then subject to 6 minutes of meditation guided by the video, or sat quietly for 6 minutes. Subjects were then informed of a gift card incentive if they completed the following task completely and correctly. A long division problem set was distributed to subjects, who had 2 minutes to complete it. Respiration rate was continuously measured, and immediately upon completion of the task BP and HR were obtained. Recording equipment was then removed and subjects were free to leave.

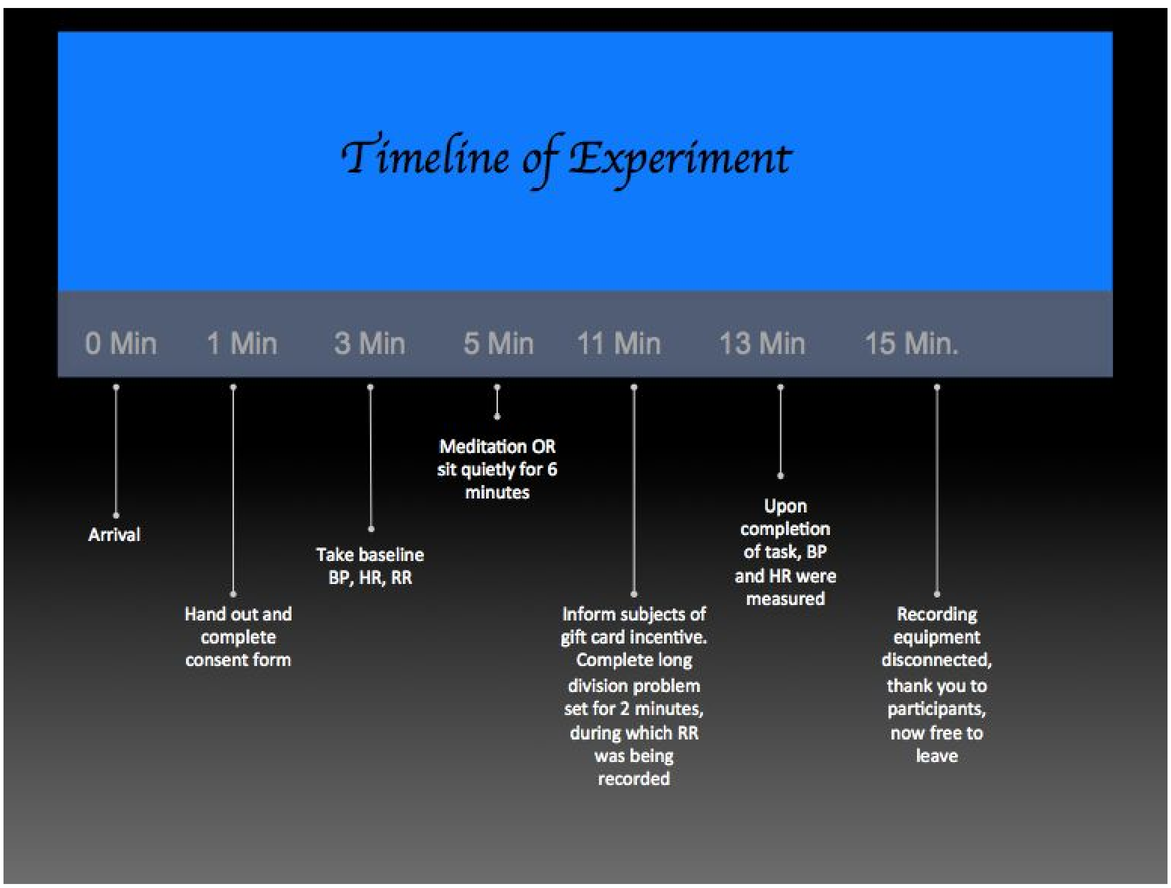
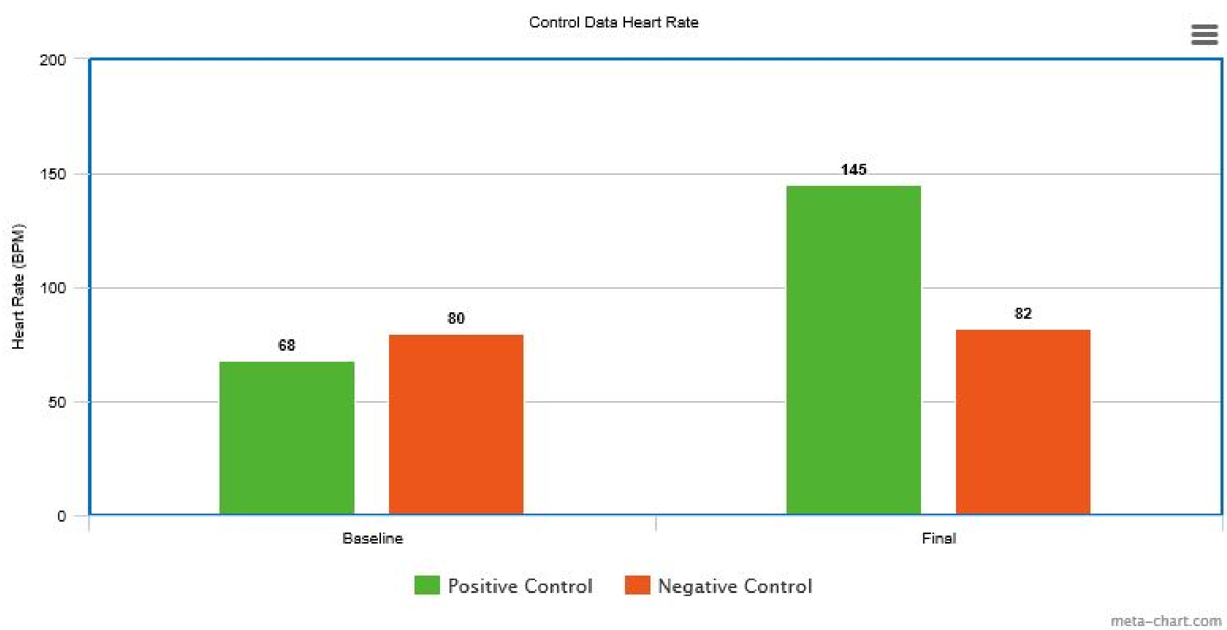
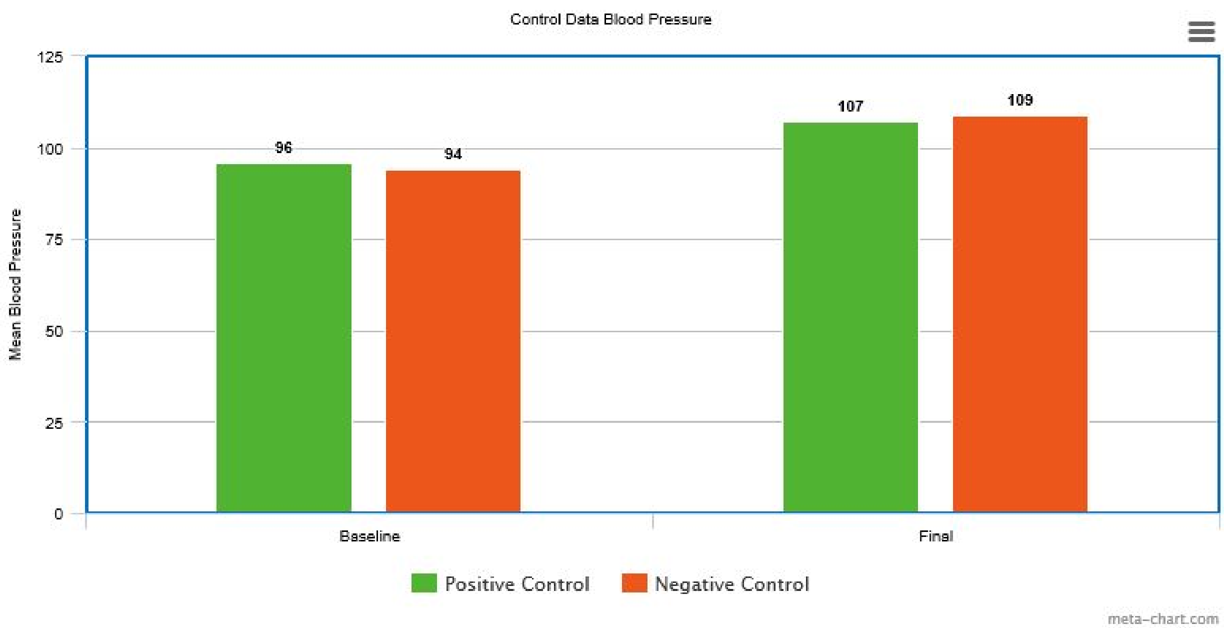


Figure 2: Positive control and negative control data to demonstrate the ability to collect data on heart rate, mean arterial pressure, and respiration rate.

Panel A: The graph shows the difference in heart before and after the control procedures. The positive control underwent 2 minutes of jumping jacks. The negative control underwent 2 minutes of sitting quietly.



Panel B: The blood pressure of the experimental control measured before the experimental period (baseline) and after completion of the task (final). A comparison of exercise (positive control) to rest (negative control) between 2 participants.



Panel C: The baseline measurements of respiratory rate recorded over 30 seconds prior to the control experiment (baseline) compared to the average respiratory rate of 30 second intervals over the 2 minutes of experiment (final).

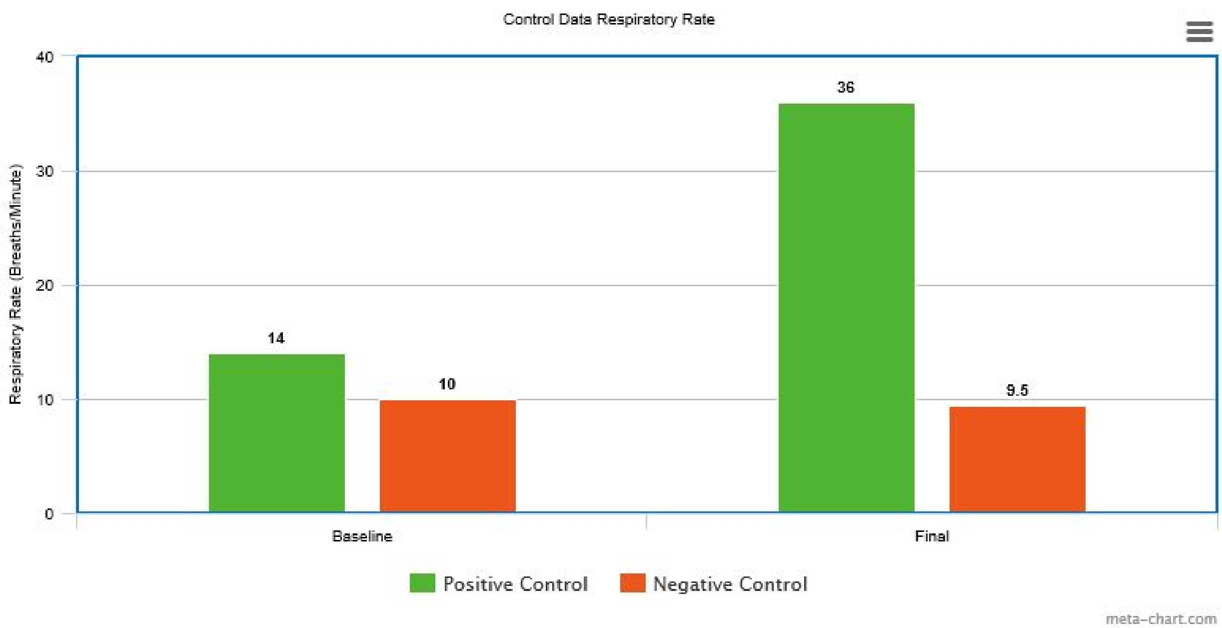
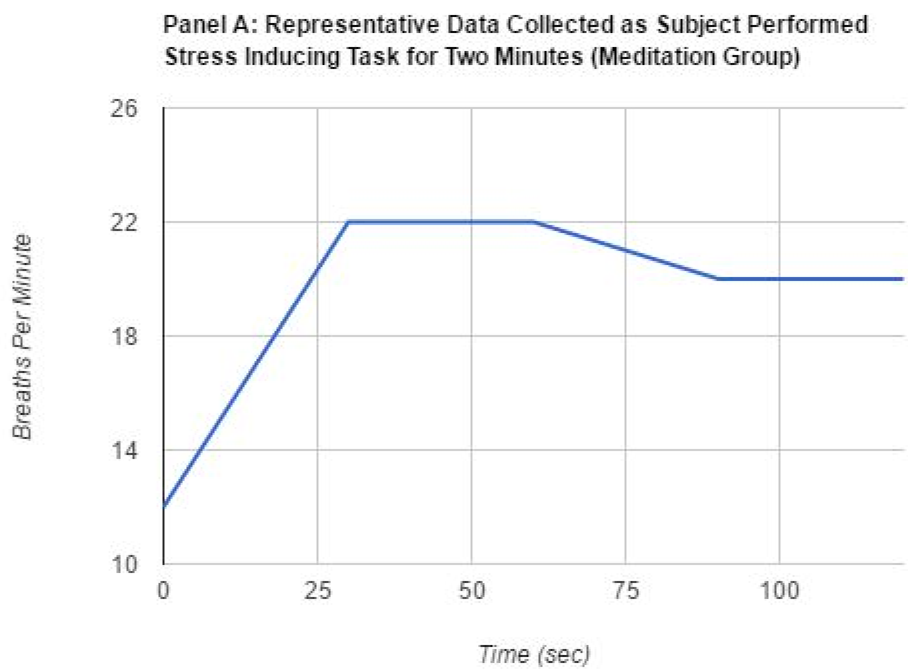


Figure 3: Representative data and average percent change in mean arterial blood pressure between meditation and non-meditation groups.



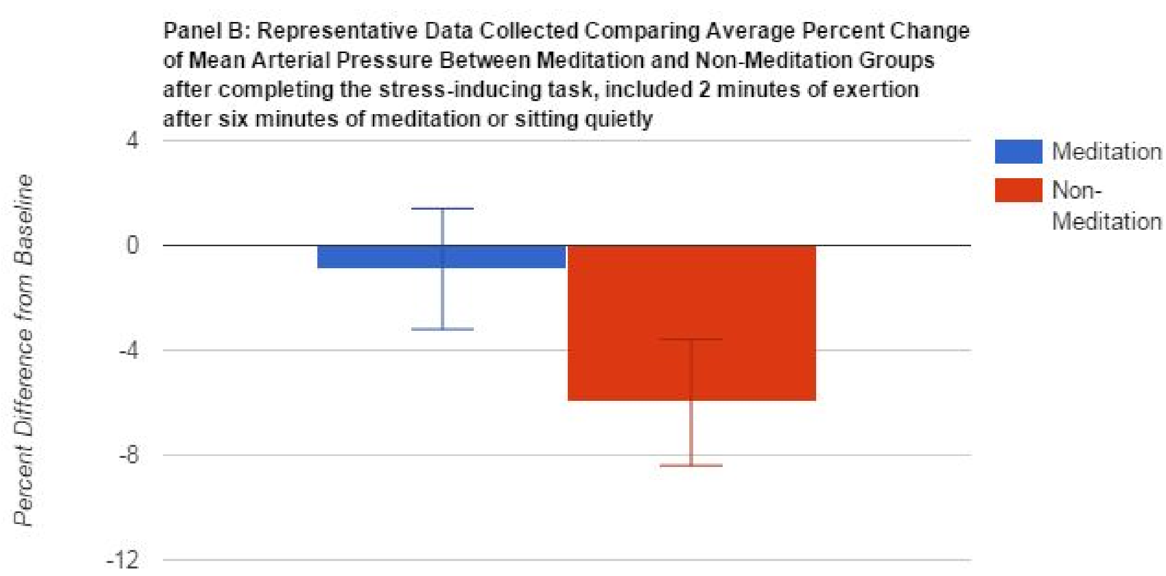
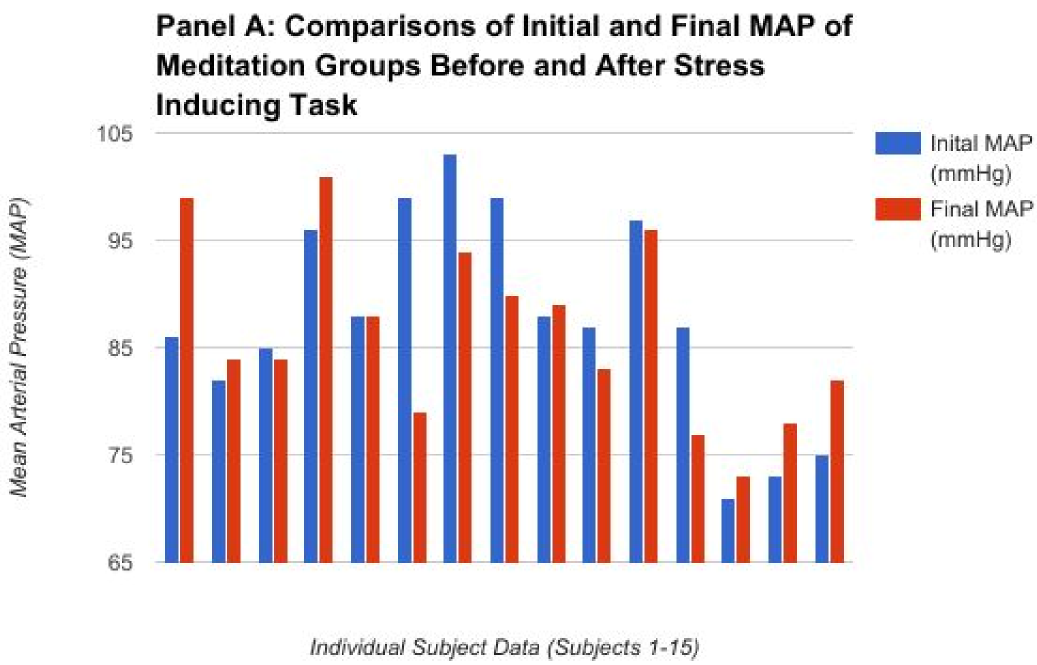


Figure 4: Individual subject data of meditation versus non-meditation groups demonstrating initial and final mean arterial pressure before and after the stress inducing task.



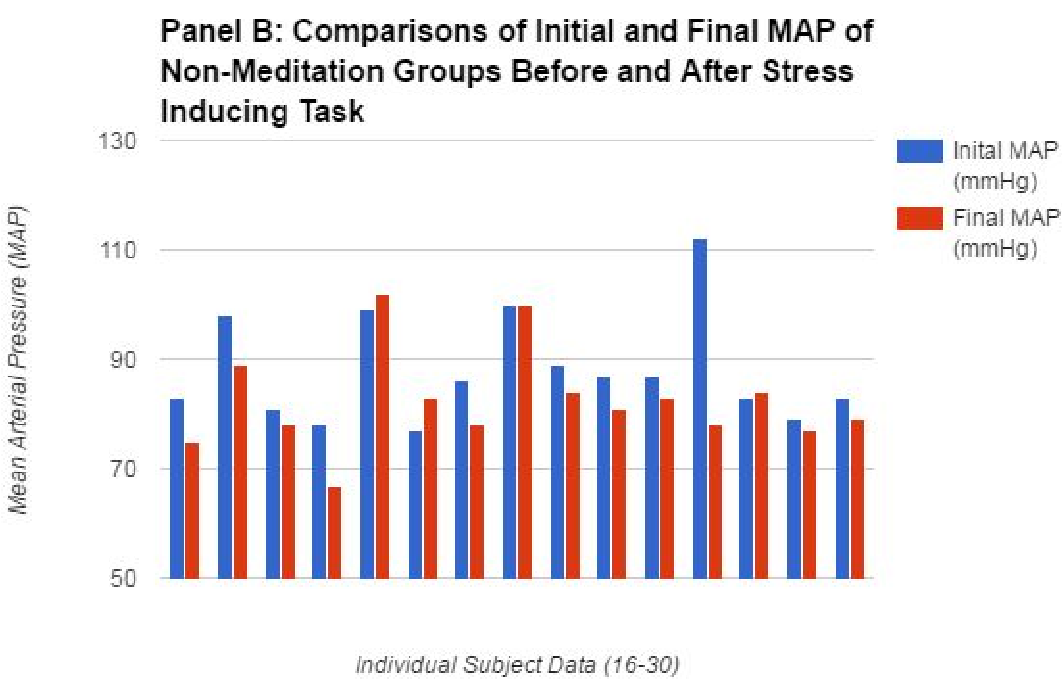


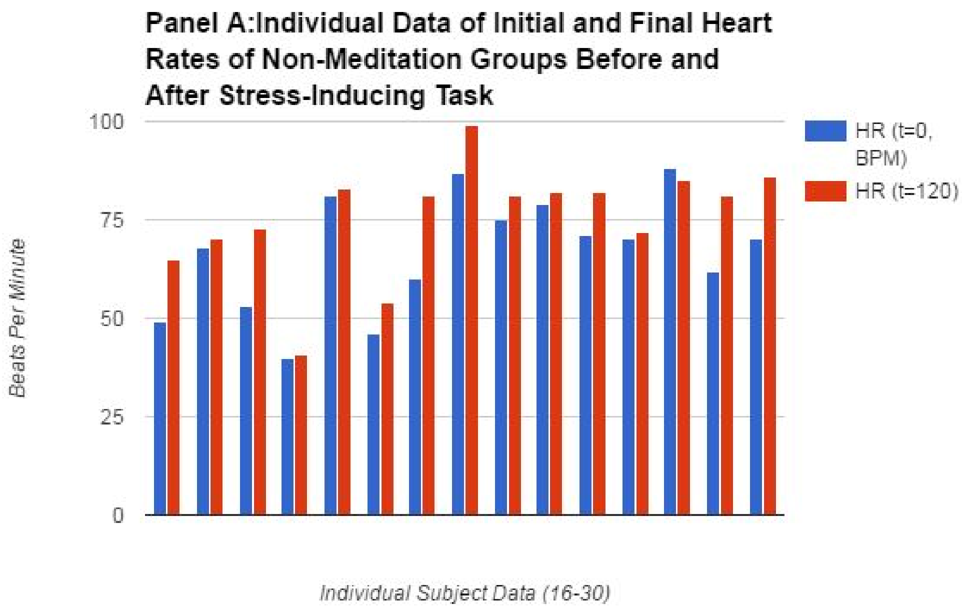
Figure 5: Individual data meditation versus non-meditation groups exhibiting individual percent change in mean arterial pressure, derived from data from Figure 4.

	Meditation		Non-Meditation
Subject	% Change in MAP	Subject	% Change in MAP
1	-8	16	-9.64
2	-9	17	-9.18
3	-3	18	-3.7
4	-11	19	-14.1
5	3	20	3.03
6	6	21	7.79
7	-8	22	-9.3
8	0	23	0
9	-5	24	-5.62
10	-6	25	-6.9
11	-4	26	-4.6
12	-34	27	-30.36
13	1	28	1.2
14	-2	29	-2.53
15	-4	30	-4.82

Figure 6: Averages of the mean arterial blood pressures between meditation and non-meditation groups, standard error, and standard deviation from ANOVA of % change in MAP data from Figure 5.

	Meditation	Non-Meditation
Mean (μ) % Change in MAP	**-0.8953**	**-5.9153**
Standard Error of % Change in MAP	**2.305**	**2.262**
Standard Deviation of % Change in MAP	**8.622830058758 1**	**8.76008306114**
P-value between mediation and non-meditation	**0.069703**	

Figure 7: Individual subject data of meditation versus non-meditation groups demonstrating initial and final heart rates before and after the stress inducing task



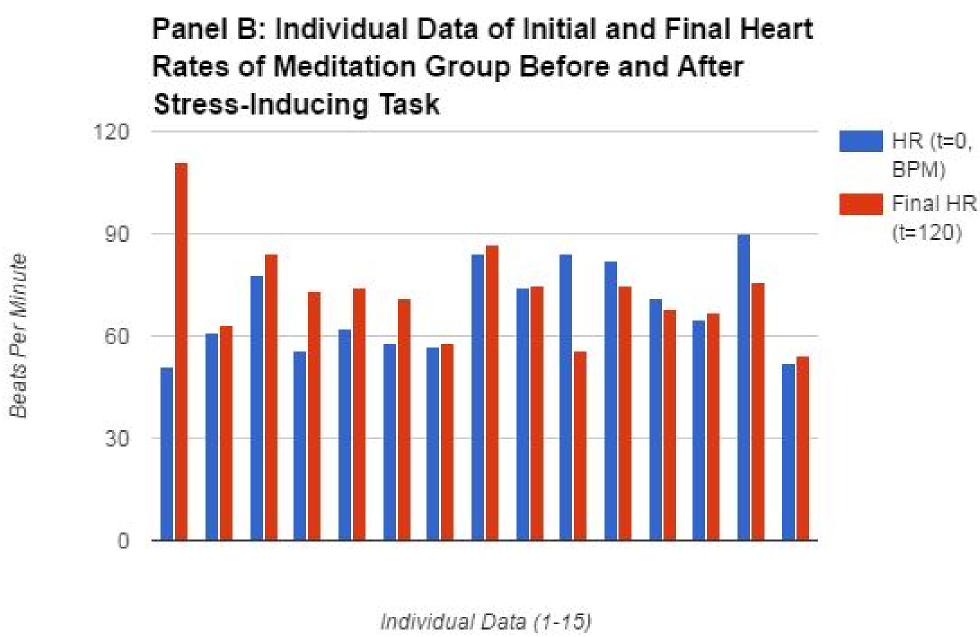


Figure 8: Individual data meditation versus non-meditation groups exhibiting individual change in heart rate, derived from data from Figure 7.

	Meditation		Non-Meditation
Subject	**Change in HR (BPM)**	**Subject**	**Change in HR (BPM)**
1	**60**	**16**	**17**
2	**2**	**17**	**2**
3	**6**	**18**	**20**
4	**17**	**19**	**2**
5	**12**	**20**	**2**
6	**13**	**21**	**8**
7	**1**	**22**	**21**
8	**3**	**23**	**12**
9	**1**	**24**	**6**
10	**-18**	**25**	**3**
11	**-13**	**26**	**11**
12	**-3**	**27**	**2**
13	**2**	**28**	**-3**
14	**-14**	**29**	**19**
15	**2**	**30**	**16**

Figure 9: Averages of the change in heart rates between meditation and non-meditation groups, standard error, and standard deviation from ANOVA of change in heart rate data from Figure 8.

	Meditation	Non-Meditation
Mean (μ) Change in HR	**4.7333**	**9.2**
Standard Error of Change in HR	**18.1717**	**7.912**
Standard Deviation of Change in HR	**4.692**	**2.043**
P-value between mediation and non-meditation	**0.195**	

Figure 10: Average percent change from baseline of respiratory rate to average respiratory rate over 2 minutes of induced stress between meditation and non-meditation groups.

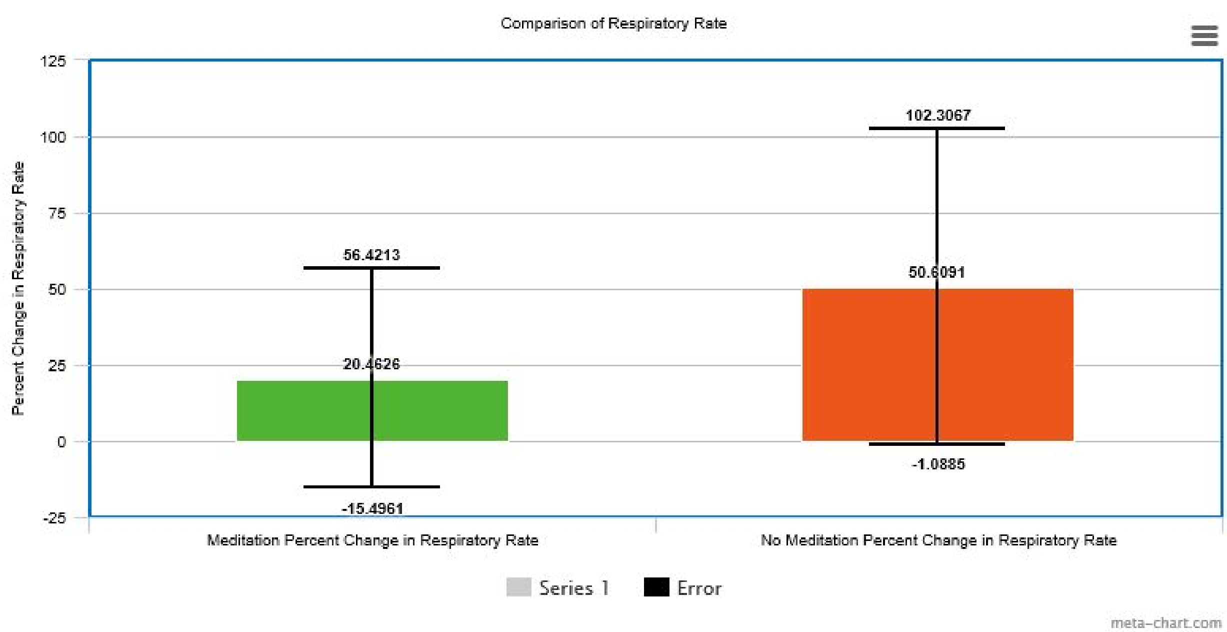
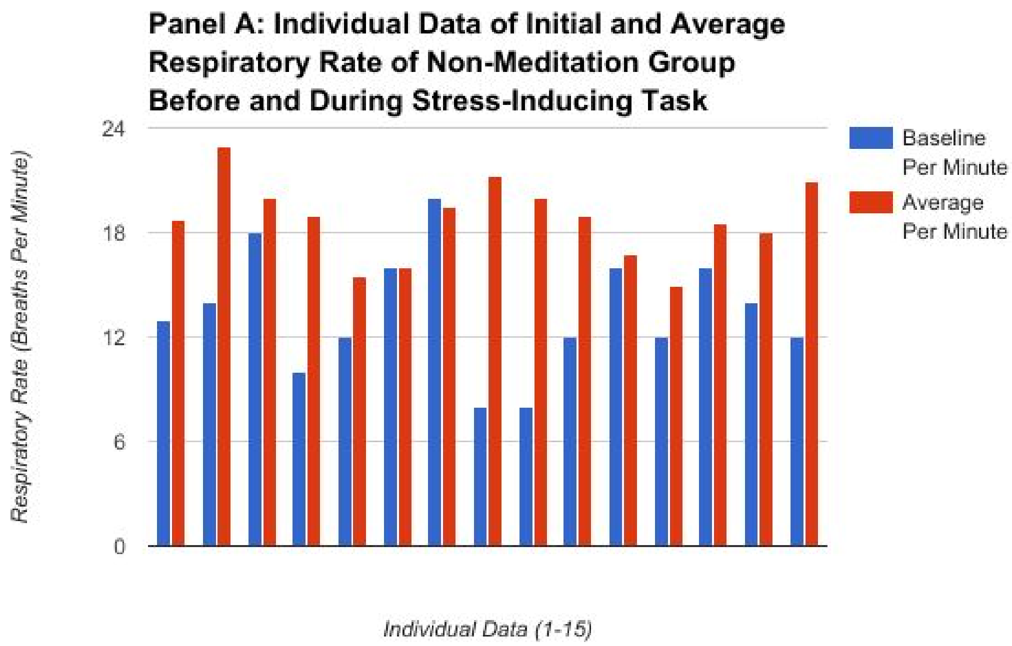


Figure 11: Individual subject data of meditation versus non-meditation groups demonstrating respiratory rate in breaths per minute comparing baseline respiratory rate to average respiratory rate.



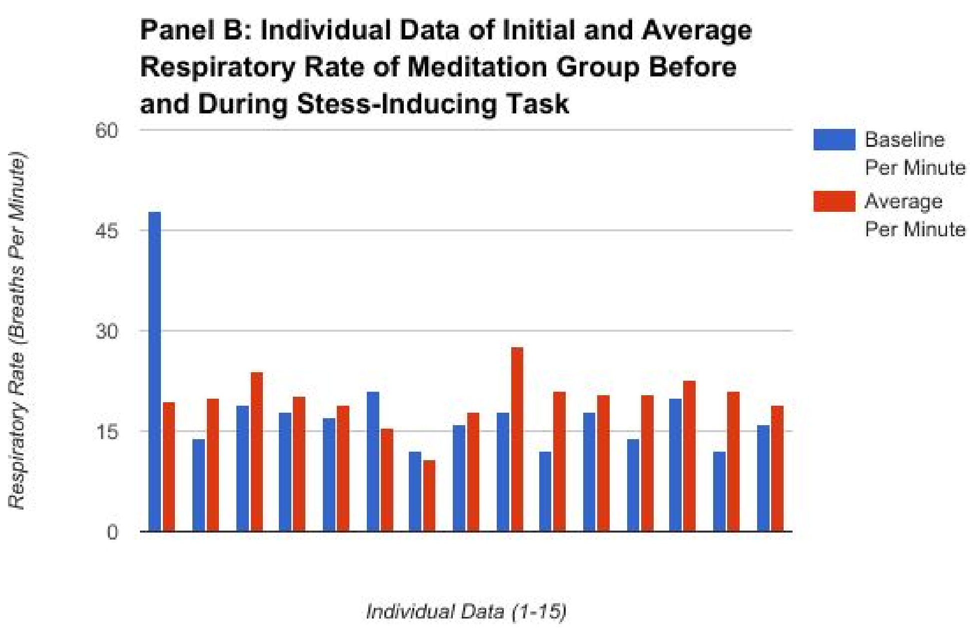


Figure 12

	Non-Meditation		Meditation
Subject	**Respiratory Rate Percent Change**	**Subject**	**Respiratory Rate Percent Change**
1	44.23076923	16	-59.375
2	64.28571429	17	42.85714286
3	11.11111111	18	26.31578947
4	90	19	12.5
5	29.16666667	20	11.76470588
6	0	21	-26.19047619
7	-2.5	22	-10.41666667
8	165.625	23	12.5
9	150	24	54.16666667
10	58.33333333	25	75
11	4.6875	26	13.88888889
12	25	27	46.42857143
13	15.625	28	13.75
14	28.57142857	29	75
15	75	30	18.75

Figure 13

	Meditation	Non-Meditation
Mean (μ) Change in RR	20.4626	50.6091
Standard Error of Change in RR	9.282	13.348
Standard Deviation of Change in RR	35.9587	51.6976
P-value between mediation and non-meditation	0.037	

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19. Freedom of Movement. 6 Minute Guided Meditation - Breathing Mindfully https://www.youtube.com/watch?v=hvxd_qbuSz0&t=50s

Appendix A

UNIVERSITY OF WISCONSIN-MADISON
Research Participant Information and Consent Form

Title of the Study: Short Term Physiological Effects of Meditation
Principal Investigators: Cat Phouybanhdyt, Indi Yeager, Zach Voelker, AJ Hill

DESCRIPTION OF THE RESEARCH

You are invited to participate in a research study about the effects of meditation on how people deal with stress on a physiological level.

You have been asked to participate because you are enrolled in Physiology 435.

The purpose of the research is to find out whether or not meditation helps reduce physiological responses in a scenario that potentially induces stress on an individual.

This study will invite the participation of all students enrolled in Physiology 435.

This research will take place within Physiology 435 laboratory sections.

WHAT WILL MY PARTICIPATION INVOLVE?

If you decide to participate in this research you will be asked to engage in a short meditation activity, followed by a short examination assessing cognitive problem solving abilities. Before, during, and after the examination there will be observations of your physiological condition being recorded.

After the semester is completed, the results will be presented in a lab report which will maintain anonymity for you, the subject. The only information being presented about your identity being the fact that you are enrolled in Physiology 435, your gender as a statistic, and your age as a statistic.

No credit will be assigned for your complete and voluntary participation. If you do not wish to participate, simply return this blank consent form.

ARE THERE ANY RISKS TO ME?

I, the undersigned participant, agree to indemnify and hold harmless The University of Wisconsin-Madison and any of its agents, employees, or representatives for any injury or loss suffered by me due to my participation in the activities associated with the Physiology 435 laboratory project. I hereby agree that I have been fully advised of the nature and extent of the activity that may take place and represent to you that I am physically and mentally able to participate in the activity without special accommodations or additional supervision. I understand that the activity may present the risk of injury, or even death, to me, and I have been fully advised of those possibilities. I represent to you that I fully assume the risk of any such injury or death, and I hold you, your agents, employees, and representatives harmless from any liability or death to me while engaged in this activity that is caused or contributed to by my conduct or the conduct of any other participants. If I am not able to be consulted for any reason in the case of an emergency or necessity arising during the course of the activity or as a result of the activity, I authorize you to arrange for such medical and hospital treatment as you may deem to be advisable for my health and well-being..

ARE THERE ANY BENEFITS TO ME?

Outside of the euphoria associated with helping some of your classmates in their research, you will also potentially learn the art of meditation. When results are produced, you may also learn how meditation can have physiological benefits, while attending the University of Wisconsin-Madison.

HOW WILL MY CONFIDENTIALITY BE PROTECTED?

While there may be printed reports as a result of this study, your name will not be used. Only group characteristics will be reported – that is, results with no identifying information about individuals will be used in any reported or publicly presented work.

WHOM SHOULD I CONTACT IF I HAVE QUESTIONS?

If you are not satisfied with response of research team, have more questions, or want to talk with someone about your rights as a research participant, you should contact Dr. Andrew Lokuta, 608-263-7488, ajlokuta@wisc.edu.

Your participation is completely voluntary. If you decide not to participate or to withdraw from the study it will have no effect on your grade in this class.

Your signature indicates that you have read this consent form, had an opportunity to ask any questions about your participation in this research and voluntarily consent to participate.

Name of Participant (please print):______________________________

_____________________________________ _________________________

Signature Date

Appendix B

9| 144   6| 252   4| 932   7| 637   8| 832

23| 687   82| 926   35| 714   99| 317   47| 562

21| 1873   43| 3652   99| 6427   72| 9331   68| 4523

60.27| 986.34   8.51| 37.762   50.11| 65.384   12.5| 7.49   45.1| 0.26

Appendix C

Freedom of Movement. 6 Minute Guided Meditation - Breathing Mindful
https://www.youtube.com/watch?v=hvxd_qbuSz0&t=