Mindset And It's Effect On The Body's Stress Response

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Abstract

In general, most people have either a "stress-is-debilitating" mindset, a "stress-is-enhancing" mindset, or something in between. Stress can affect the body in different ways depending on a person's mindset. For our experiment, we wanted to see how students' mindsets affected their stress response leading up to an exam. Fifteen participants in a chemistry class were asked to complete a survey measuring their mindset about stress before taking an exam, then record their heart rate both before and after. The control groups before and after the exam were students at Case Center not taking an exam to serve as a baseline. Eight students in Case Center during the time before the exam, and 11 students in Case Center during the time after the exam were asked to fill out the same survey and measure their heart rates. A higher score on the SMM-G survey indicated that the participant had a more positive mindset towards stress, whereas a lower score indicated that the participant had a more negative mindset. Results showed that those in the experimental group with a higher score on the SMM-G survey generally had a lower heart rate than those with a lower score. These results suggest that a student's mindset towards stress has an effect on their stress response leading up to an exam.

Introduction

Oftentimes when one thinks about stress, they think about it as a bad thing that should be avoided or reduced as much as possible. Society has developed a very negative stigma around the word "stress" because many people do not understand it's true purpose or how it actually works. Stress can be described as "a biological and psychological response experienced on encountering a threat that we feel we do not have the resources to deal with" (McLeod, 2010).

The stress response is activated when homeostasis is threatened because it is the body's way of improving one's performance at any task. The Yerkes-Dodson Law describes the relationship between arousal (stress) and performance. The relationship is presented in a parabolic curve, showing how little-no stress leads to poor performance, and an increase of stress leads to increased performance, but only to a certain point. Too much stress also leads to poor performance. Since the law defines stress as "an inner motivating tension" (Changing Mindsets, 2016), it is important to strike a balance and find the appropriate amount of stress necessary to increase performance.

The process by which the body's stress response occurs is the hypothalamic-pituitary-adrenal (HPA) axis. When exposed to a stressor, the body must first perceive it as a threat in order to activate the hypothalamus. The hypothalamus is considered the link between the endocrine and nervous systems. Even though it is small in size, it plays an extremely important role in maintaining homeostasis by producing different hormones that are necessary to keeping the body balanced. Once the hypothalamus has been activated, it releases corticotropin-releasing hormone (CRH), which stimulates the pituitary gland. Upon stimulation, the pituitary gland releases adrenocorticotropic hormone (ACTH). ACTH then stimulates the adrenal glands, causing them to release cortisol, which sends negative feedback back up to the pituitary gland and the hypothalamus. Cortisol is the body's stress hormone which helps maintain steady supplies of blood sugar in the body, releases stored glucose from the liver to be used for energy, and suppresses the immune system so that the body can focus on the stressor at hand. "It is important to support healthy cortisol levels in order to ensure the hypothalamus and pituitary glands maintain the appropriate level of sensitivity to the negative feedback of cortisol"

(Alschuler, 2016). The hormones released during the stress response are beneficial to the body, but only when necessary. An excess of these stress hormones in the body can have negative effects on one's health.

It is important to recognize the difference between acute stress and chronic stress. Acute stress is short-term stress, often referred to as the fight-or-flight response. It is crucial to our survival because it allows us to defend ourselves against threats and keep ourselves safe. However, *Harvard Health Publications* says, "chronic activation of this survival mechanism impairs health" (2011). When we abuse our body's stress response for a prolonged period of time, it becomes chronic stress, which is long-term. "Chronic stress comes when a person never sees a way out of a miserable situation. It's the stress of unrelenting demands and pressures for seemingly interminable periods of time. With no hope, the individual gives up searching for solutions" (Miller & Smith, 2016). Chronic stress is what gives the word "stress" such a bad reputation because it has been linked to many different health issues, and even some causes of death. However, lots of research has been done to explore whether or not mindset plays a part.

There are many different kinds of stress mindsets. Someone with a negative or "stress-is-debilitating" mindset views stress as a bad thing that should be reduced or avoided. They have been blinded by society's misleading portrayal of stress. Those with an extremely negative stress mindset may also have a fixed mindset, which "believes that our talents and abilities are fairly fixed at birth. This means that each of us has a hidden upper limit to what we can accomplish" (Meacham, 2014). On the other hand, someone with a positive or "stress-is-enhancing" mindset looks at stress as a good thing. They may have a growth mindset, which believes that we never stop learning and forming new neural pathways. The more we

learn, the more our brain grows. Not every skill will come naturally to us, they must be learned. People with fixed mindsets limit themselves in life and it will only hurt them in the long run. In general, people's stress mindsets fall somewhere on the spectrum between these polar opposite views of stress. Researchers have been trying to figure out how these different mindsets affect the actual stress response.

The prefrontal cortex is in charge of executive functions (thinking, planning, problem solving, decision making, impulse control, etc.) Essentially, it is what allows us to make rational decisions. However, cortisol released during the stress response can limit access to the prefrontal cortex, and the emotional brain can start to take over instead. This explains why people often make irrational or impulsive decisions during times of extreme stress. It is important to be able to recognize your stress, take a step back and evaluate the situation. A person with a stress-is-enhancing mindset would have an easier time with this than a person with a stress-is-debilitating mindset. Stanford psychologist Kelly McGonigal believes that embracing stress is more important than reducing stress. In her book "The Upside of Stress", she argues that having a positive stress mindset does not mean a person is denying that stress can have harmful effects. Seeing the upside of stress is about balancing our mindset to reduce the overwhelming and hopeless feelings about the stress in our lives that we can not avoid. We gain nothing by fearing our own, inevitable stress. "Psychologists have found that the ability to embrace stress requires a high tolerance for ambiguity and uncertainty. You have to be able to understand that two seemingly opposite things can be true at the same time. It can be true that going through something stressful can make you sick or depressed, and it can also be true that the same stressful experience can ultimately make you stronger, more compassionate and more resilient

over time" (Parker, 2015). The phrase really is true, what doesn't kill you makes you stronger, but only if you let it. By choosing to see the upside of stress, we allow ourselves to learn from and even strive off of our stress, rather than letting it break us down.

Rethinking Stress: The Role of Mindsets in Determining the Stress Response (Crum, Salovey and Achor, 2013) describes three separate studies researching the effects of stress mindset on perceived stress and the stress response. Study 1 was to develop and test the validation of the Stress Mindset Measure (SMM) survey, which we used in our experiment as well and can be found in Appendix A. Study 3 was testing the effect of one's stress mindset on cortisol response under acute stress. Our study tested the same concept, except we measured heart rate rather than cortisol and our participants were in a different, more specific condition (about to take an exam).

We selected a chemistry class that was scheduled to take an exam, and 16 students were willing to participate in our experiment. Before the exam, they were asked to fill out the SMM-G survey from Crum, Salovey and Achor (2013) and measure their heart rate. After the exam, they were asked to measure their heart rate again. For the control group, we selected students in a neutral setting (Case Center) who were not taking an exam to take the survey and measure their heart rates to serve as a baseline. We wanted to see if stress mindset affected the students' stress response (heart rate) before an exam. Our hypothesis was that those with a "stress-is-enhancing" mindset before an exam would have a lower heart rate than those with a "stress-is-debilitating" mindset.

Method

In order to determine the mindset of each individual, we used the Stress Mindset Measure-General (SMM-G) from *Rethinking Stress: The Role of Mindsets in Determining the Stress Response* (Crum, Salovey, and Anchor, 2013). This particular survey concerns beliefs about the nature of stress in general. The two possible mindsets were either a "stress-is-enhancing" mindset or a "stress-is-debilitating" mindset. The SMM-G survey was administered to both the control group (Skidmore students in Case Center) and the experimental group (students about to take a chemistry exam). In the experimental group, there were 16 participants, whereas in the control group before the exam there were 8, and in the control group after the exam there were 11. In regards to the experimental group, surveys were administered randomly to the first students to come to the exam site. In regards to the control group, the surveys were distributed randomly to students in Case Center. The scales, along with all instructions and items of the survey, are in Appendix A. As stated in Crum's study, "SMM scores were obtained by reverse scoring the four negative items and then taking the mean of all eight items. Higher scores on the SMM represent the mindset that the effects of stress are enhancing" (p. 719).

In order to measure heart rate, we provided participants with directions on how to measure their own heart rates. The directions were as follows: "Place two fingers on either your wrist or neck. Count the number of beats (pulses) for 15 seconds. Take this number and multiply by 4 to find heart rate in beats per minute." Participants, in the experimental group, were asked to measure their heart rate in this manner both before and after the exam.

Participants

35 students from Skidmore College participated in our research. 16 students from a chemistry class were chosen to represent the experimental group because they were going to take an exam. 19 students were randomly picked at Case Center as our control group to serve as a baseline. 8 of them took the SMM-G survey and measured their heart rate around the same time that the exam would be beginning. The other 11 of them took the same survey and measured their heart rates around the time the exam would be ending. This design was to avoid the effect of time of day on heart rate.

Procedure

The 16 students in the chemistry class were scheduled to take an exam from 6:00-8:00 P.M. On their way into the classroom, they were asked if they wanted to participate in our experiment. If they agreed, they were given a consent form to sign and the SMM-G survey (included in Appendix A) and directions for how to record their heart rate were located on the back of the consent form for the participants to fill out. When they sat down in their seats, they filled out the survey and measured their heart rates before taking the exam, then gave the papers to their professor when the exam was handed out. Their professor had a separate sheet of paper to record the students' heart rates once they had completed their exam. They were then given candy as a reward. For the control groups, students were selected at random to fill out the SMM-G survey and record their heart rate in the space below.

Results

The SMM value in the exam group ranged from 0.25 to 2.5. For the control group before the exam, the SMM value ranged from 0.5 to 2.375, and the SMM value for the control group after the exam ranged from 0.75 to 2.375. The mean value of SMM value for the exam group is

1.2667. The mean value of SMM value for the control group before the exam is 1.359 and the mean value of SMM value for the control group after the exam is 1.51. The overall SMM value for the control group is 1.447. The overall SMM value for both the control group and the exam group is 1.367.

Comparison of heart rates before and after the exam. In figure 3, the heart rate for the exam group generally decreased after the exam and only 18% of students had an increasing or unchanged heart rate.

Comparison of heart rates between control group and exam group before the exam. In figure 1, in the exam group, the heart rate had a negative correlation with SMM value. Students with a higher value tended to have a lower heart rate before the exam. The control group in the case center didn't have to deal with the stress from the exam. The correlation between heart rate and SMM value was too moderate to see any relationship between heart rate and SMM value.

Comparison of heart rates between control group and exam group after the exam. In figure 2, in the exam group, the trendline derived from the plots was similarly decreasing as the trendline for the exam group before the exam but the slope was much smaller. Since the slope was too moderate, it was not enough to prove any relationship between heart rate and SMM values. Additionally, the correlation was not clear for the control group.

Comparison of change of heart rates for exam group before and after the exam. If we excluded the data that showed increasing or unchanged heart rates and just compared the data which only showed negative heart rate changes after the exam. In figure 6, the spots were too dispersive to prove any correlation between heart rate change and SMM value.

Overall, the only evident correlation we found was decreasing heart rate for exam group with a higher SMM value. Therefore, students with a more "stress-is-enhancing" mindset would have a lower heart rate.

Discussion

The data supported our hypothesis: that a person with a positive mindset leading up to an exam will have a lower heart rate before the exam. The SMM-G survey score correlated with heart rate. Overall, participants with a more "stress-is-enhancing" mindset had a lower heart rate, while on the other hand, participants with a "stress-is-debilitating" mindset had a higher heart rate.

Compared to Crum, Salovey, and Anchor's results in their article *Rethinking Stress: The Role of Mindsets in Determining the Stress Response*, our results generally support their findings. Two of their findings that our results support are Study 1 and Study 3. In Study 1 they found that SMM is related to self-reported symptoms of mood. Our findings support the results of Study 1 because there was a correlation, in the experimental group, between SMM-G scores and heart rate (which was self-reported by the participants). In Study 3, they demonstrated the extent to which stress is psychologically experienced (cortisol response). Our findings support the results of Study 3 because, based on our data, we found that participants with a more stress-is-debilitating mindset had higher heart rates when compared to those with a more stress-is-enhancing mindset. This result shows that the type of mindset you have affects the extent to which stress is psychologically experienced. In our case, we used heart rate instead of the cortisol response used in Study 3. In Study 2, they found that "eliciting a stress enhancing mindset is accompanied by corresponding changes in participants' self-reported psychological

symptoms" (Crum, Salovey & Achor, 2013). However, our data did not support this because our objective was simply to see how mindset affects the stress response (heart rate). The findings in Study 2 led us to question whether a high heart rate during the stress response is actually bad. When is a heart rate considered a positive change in a participant's psychological symptoms to stress?

If we were to redo this study we would have: looked at the correlation between mindset and grades, had a larger pool of applicants, and used the same people for the control group (before and after). Ultimately, our study showed that having a positive mindset leading up to an exam has an effect on the stress response. This is significant because it, ultimately, relates to society's stigma about stress and supplies the idea that perhaps people should not fear stress as much as they do.

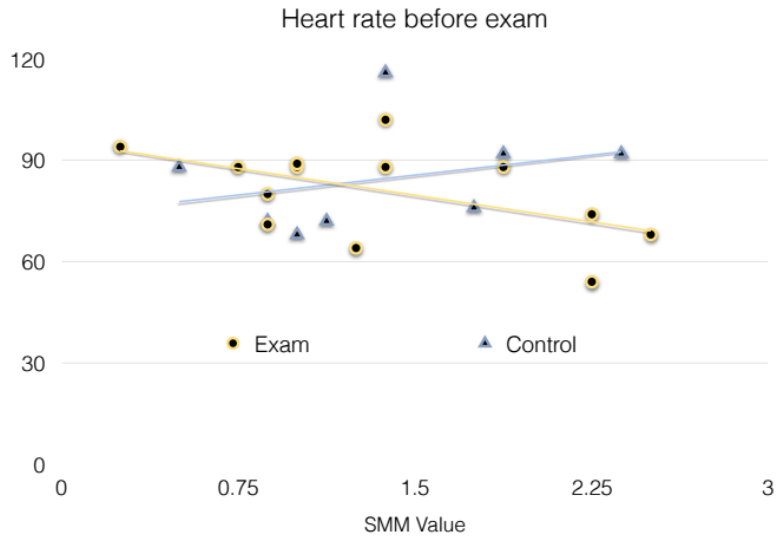

Figure 1 represents a comparison of heart rates before the exam between the exam group and control group. The exam group showed a general decline of heart rate with the increase of SMM based on the trend line measured by Keynote. People with a higher SMM value generally had a

lower heart rate before the exam (y=-10.525x+95.426). The control group showed a slight increase of heart rate with the increase of SMM according to the trend line (y=7.8861x+73.78). However, the slope is too small to say there is an actual relationship between SMM value and heart rates.

Figure 2 represents a comparison of heart rates after the exam between the exam group and control group. The exam group shows a similar decline of heart rate with the increase of SMM based on the trend line, but the slope is smaller than the slope of the trend line before the exam (y=-5.43x+81.95). The control group after the exam also shows a increasing trend of heart rate with SMM (y=4.7984x+65.839), but the correlation is not significant enough to explain the increasing trend.

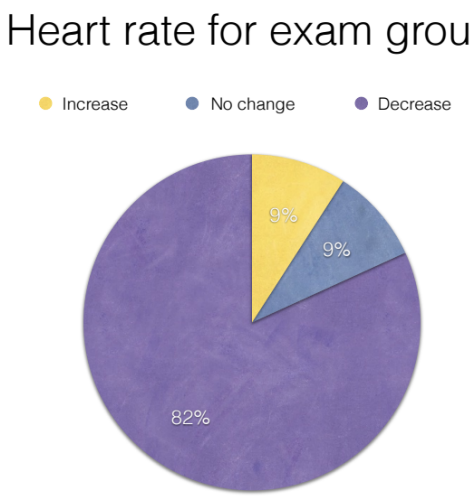

Figure 3 shows that two participants in the exam group showed no change in their heart rate, two showed a slight increase in heart rate, and the others all showed a decrease in heart rate.

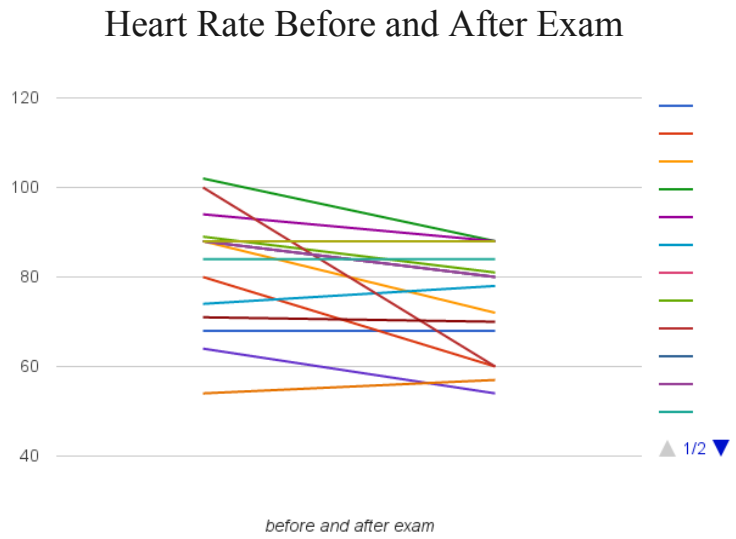

Figure 4. Each line represents a single participant in the exam group. The left side stands for heart rate before exam and the right side stands for heart rate after the exam. Generally, the heart rate decreases from left to right, which means the exam influenced the participant's heart rate.

Right before the exam, people will more or less feel stressed out about the exam and after the exam the heart rate decreases because they are no longer stressed out.

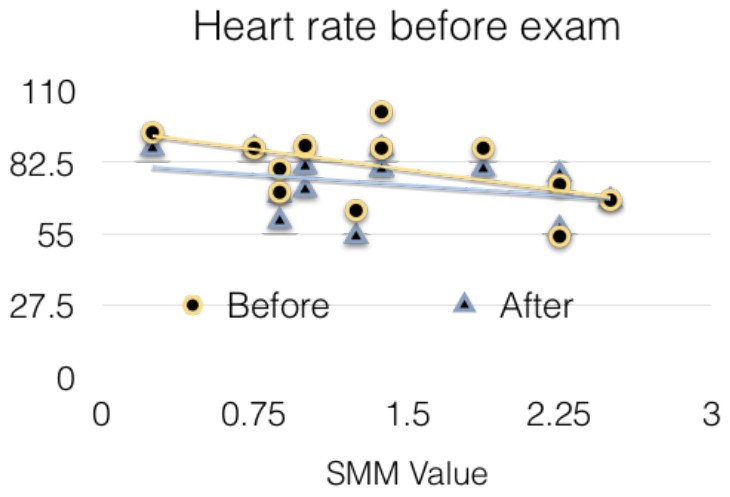

Figure 5 shows the relationship between heart rate and SMM value in the exam group. The yellow circle stands for the spots before the exam and the blue square stands for the spots after the exam. The trend line are both downwards and this means people with a higher SMM value generally have a lower heat rate. The trend line before the exam decreases more compared with the trend line after the exam, so we conclude that before the exam the SMM value has a great effect on heart rate.

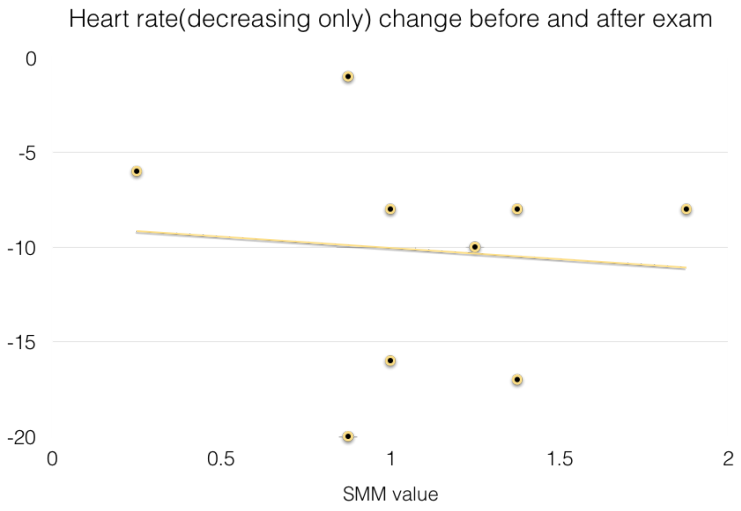

Figure 6 shows that the correlation between heart rate change and SMM value is too weak to prove the decreasing trendline, meaning it is not statistically significant.

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Appendix A

Stress Mindset Measure–General (SMM-G)

Please rate the extent to which you agree or disagree with the following statements. For each question choose from the following alternatives:

0 Strongly Disagree
1 Disagree
2 Neither Agree nor Disagree
3 Agree
4 Strongly Agree

1. The effects of stress are negative and should be avoided.
2. Experiencing stress facilitates my learning and growth.
3. Experiencing stress depletes my health and vitality.
4. Experiencing stress enhances my performance and productivity.
5. Experiencing stress inhibits my learning and growth.
6. Experiencing stress improves my health and vitality.
7. Experiencing stress debilitates my performance and productivity.
8. The effects of stress are positive and should be utilized.