Physiological Response to Cognitive Stress and the Effect of Power Poses

Abstract

Effective management of stress and anxiety is a goal shared by all. Body language is thought to play an important role in determining how well people manage stress and anxiety levels. In this study we examined the effects of strong and weak power poses on blood pressure, respiratory rate, and heart rate after a cognitive stressor. We assessed the effects of the poses by imposing various stressors on subjects and comparing results across different power poses. Results showed no significant change in measurements after exposed to a cognitive stressor, and no difference between power pose, weak pose, and control groups. Further testing is needed to determine whether poses have an effect on stress management.

Introduction

Test anxiety is a prevalent aspect of many college students’ everyday lives. Activation of the anxiety response from academic stressors can cause many physiological responses that can modulate a student’s cognitive appraisal of a situation, and can greatly affect his/her success. For example, studies have shown that acute academic stressors cause an increase in systolic blood pressure (Conley & Lehman, 2012). Much of this stress and anxiety can occur in apprehension of a future event. This feed forward response may be associated with the “fight or flight” response arising from the activation of the sympathetic nervous system in response to a threatening stimulus. The sympathetic response to a
naturalistic stressor involves acceleration of heart and lung activity, constriction of blood vessels, and the rise of hormones including adrenaline and cortisol (Robinson et al., 2008).

Certain aspects of sympathetic activation can also occur in response to a stressful mental test. Webb et al. (2011) found an increase in individual cortisol levels after completing such a test. Cortisol can have many effects on the body that are associated with stress and anxiety. During a sympathetic response, cortisol is released from the adrenal gland and distributes glucose to the brain and muscles, enhances metabolism, and suppresses the immune system. It is also associated with increased blood pressure and can cause hypertension (Kelly, 1998). These findings suggest that when students appraise future tests as a threat stimulus there is potential for a negative physiological response.

Though academic anxiety is a very serious problem, there may be simple methods in which an individual can reverse their physiological response to the stressor. Students that are susceptible to academic stress can feel powerless and feel that they have a lack of control. Sherman et al. (2012) found that people in a position of leadership and power have lower reports of anxiety and lower levels of cortisol. It may be possible to induce a feeling of power and confidence into individuals simply by changing their posture. Animals, including humans, show their power with large, open postures. Studies have shown that having individuals take these positions experience greater levels of testosterone and lower levels of cortisol (Cuddy et al., 2010). If an individual uses these poses before a stressful event, the individual can change the physiological response to the stressor by decreasing the sympathetic response, and potentially stay more calm and confident.

Previous research has shown that mental tasks, such as taking a test, can enhance the sympathetic response and increase cortisol levels. This anticipatory response to a threatening, future
event may be deterred by a physical posture that changes the individual’s physiological response. With
the use of high-power poses, an individual who is about to take a test can elicit a mindset of power and
control that increases testosterone and decreases cortisol. This effect would then decrease the feed
forward sympathetic response of heart rate, blood pressure, and respiratory volume. We hypothesize
that individuals who are told they will be taking a stressful test will have an increase in their heart rate,
blood pressure, and respiratory volume. We also hypothesize that individuals who hold high-power
poses before taking the exam have a smaller increase of heart rate, blood pressure, and respiratory
volume as compared to individuals who do not engage in any poses before the exam. Finally, we
hypothesize that individuals who have weak, closed postures have a larger increase in heart rate, blood
pressure, and respiratory volume as compared to individuals who do not engage in poses before the
exam.

Materials and Methods

Participants

Seventeen UW-Madison students were recruited randomly for participation of this study. Participants did not receive compensation. The study conformed to the ethical standards of the University of Wisconsin-Madison.

Methods

Each participant performed the experiment individually. Three aspects of feed forward anxiety
response were tested with physiological measurements. Upon arrival, participants were asked to sit
down and were equipped with all relevant measuring devices. Participants were told they would be taking a short survey. After waiting 2 minutes experimenters measured participants’ blood pressure with a blood pressure cuff, their resting heart rate over a period of 30 seconds with a pulse oximeter, and their respiratory volume over a period of 30 seconds with a respiratory transducer band. Participants then took the survey of demographics.

Experimenters then told the participants that they would be taking a timed intelligence test that would be graded immediately. They were also told that their score would be compared to other classmates, and specifically to the opposite sex.

Participants were then randomly selected to participate in one of three groups. The first group sat for 2 minutes (See photo 1). The second group was asked to sit in a high-power pose for two minutes (See photo 2). The third group was asked to sit in a low-power pose for two minutes (See photo 3). Power poses were taken from previous work of Cuddy et al, (2010). All participant then had their blood pressure, heart rate, and respiratory volume measured again. Participants then filled out a final survey where they self-reported their stress response to the upcoming test.

Group 1
Tell about survey → measure baseline → take survey → tell about test → sit → measurement → final survey

Group 2
Tell about survey → measure baseline → take survey → tell about test → high-power pose → measurement → final survey

Group 3
Tell about survey → measure baseline → take survey → tell about test → low-power pose →
measurement → final survey

The proportional change in physiological responses of individual participants was measured to
observe any potential differences between groups. Blood pressure was averaged to the mean arterial
pressure (MAP) and change in MAP was calculated as percent change to normalize for each individual.
Respiratory volume was calculated using the A t test function in Excel was used to generate p values. If
the p value did not reach p < .05, we were unable to reject the null hypothesis. Graphical
representations of the data were created using the average change in each physiological response for
each group.
Photo 1: Control/Normal Pose
Photo 2: High-Power Pose
All data that was collected was analyzed using a two-tailed t test. There was a slight increase in heart rate (2.2 bpm $\pm$ 5.5) in participants after being told that they would be taking an IQ test, but it was not significant ($p = .68$). There was not a change in mean arterial blood pressure (-1.14 mm Hg $\pm$ 7.6) after participants were told that they would be taking an IQ test ($p = .67$). There was no change in respiratory volume (-4.49 mV-sec $\pm$ 13.4) after participants were told that they were taking an IQ test.
There was a slight increase in heart rate in control (3.4 bpm ± 4.5) and weak-power pose (3.0 bpm ± 6.6) participants while the heart rate of strong-power pose participants decreased (-2.2 bpm ± 3.9). There were no significant differences in change in heart rate between the control group and weak-power pose group (p = .90) or control group and strong-power pose (p = .23). There was also no significant difference between change in heart rate between the weak-power pose and the strong-power pose (p = .23) (see figure 1). There was a slight increase in mean arterial pressure in control (.16 mm Hg ± 5.5) and weak-power pose (.51 mm Hg ± 9.3) participants while the mean arterial pressure of strong-power pose (-1.50 ± 9.2) participants decreased. There were no significant differences in change of blood pressure between control group and weak-power pose group (p = .90) or control group and strong-power pose (p = .52). There was also no significant difference between change in blood pressure between the weak-power pose and the strong-power pose (p = .64) (see figure 2). There was an increase in respiratory volume for control (3.4 mV-sec ± 14.1), weak-power pose (5.9 mV-sec ± 8.8), and strong power-pose (3.9 mV-sec ± 18.2) participants. There were no significant differences in change in respiratory volume between the control group and weak-power pose group (p = .72) or control group and strong-power pose (p = .95). There was also no significant difference between change in respiratory volume between the weak-power pose and the strong-power pose (p = .82) (see figure 3).
Figure 1 - A graph displaying the average change in heart rate for each group.

Figure 2 - A graph displaying the average change in mean arterial pressure for each group.
Discussion

The results of this study are inconclusive for an effect of feed forward physiological response to anxiety of taking an exam. There was no significant change in physiological responses after participants were told that they would be taking an IQ test. There are several factors that may have played a role in these results, but without a significant value for the manipulation, these results are unable to reveal the complete effects of feed forward anxiety or power poses on physiological responses. A stronger manipulation should be used to determine physiological response and power poses effect.

Though there were no significant differences between power pose groups, there is slight evidence that would support further research for power poses in reducing physiological stress to feed
forward cognitive stressors. Participants who took a strong-power pose had a decrease in heart rate and blood pressure after the stressor, which opposes the increase in heart rate and blood pressure in low-power pose and control groups.

Several limitations could have had an effect on the results of the study. The significance of the results were hampered by the low power of the study. The lack of sufficient time led to a low participation number which caused outliers to greatly impact each group of participants.

The lack of time and resources also affected the reliability of the manipulation. Within surveys given to the participants after the study, some individuals stated that they doubted that they would need to take an IQ test because of time constraints on the study and resources available. This may have negatively impacted the legitimacy of the feed forward responses for participants who did not believe that they would be taking a stressing IQ test.

The lack of resources also led to inconsistent conditions between participants in the study. The movement between different testing facilities and the necessary testing of participants in noisy settings were not conducive to the reliability of the study.

With the knowledge of these limitations, further thorough experimentation could lead to a better picture of whether cognitive stressors and power poses have an effect on feed forward physiological responses. In future studies a larger population of students could lead to more statistically significant results and it would be beneficial to apply this study to a class of students for a semester. The effect of poses on a student’s physiology and performance could be measured in a real life situation with exams as a more realistic stressor. These results could aid in the increasing problems of stress management utilization and treatment of anxiety disorders. Experiments have shown a link between behavioral and
mindfulness interventions such as meditation and emotional journaling and the reduction in stress among university students (Regehr et. al., 2013). With continued studies on the effects of power poses, this technique could be used in the future as a common practice to reduce stress.

References


