PERSONALITY CORRELATES OF CARDIOVASCULAR REACTIVITY

by
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ABSTRACT

SARA PATRICIA BOLEN: Personality Correlates of Cardiovascular Reactivity
(Under the direction of Dr. Michael T. Allen)

Neuroticism is a personality trait characterized by one's susceptibility to experience negative emotions, such as loneliness, self-consciousness, sadness, and worry. Neuroticism also has been found to be linked to blunted cardiovascular reactivity, which in turn has been shown to be associated with negative health outcomes, such as stroke or heart disease. The present study examined 50 undergraduate females at the University of Mississippi in order to examine the relationship of neuroticism and cardiovascular reactivity rates during a stressful speech task. Heart rate (HR) and blood pressure (BP) levels were recorded during rest and the stress periods, and neuroticism levels were measured by the NEO-FFI. No significant relationships between neuroticism and cardiovascular reactivity levels were found.

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Introduction

Neuroticism is a personality trait characterized by the tendency to experience negative emotions, such as guilt, worry, loneliness, anger, embarrassment, and sadness. Individuals with high neuroticism are more likely to experience negative emotions surrounding the events of their everyday life. The six key facets of neuroticism are anxiety, angry hostility, depression, self-consciousness, impulsiveness, and vulnerability (Jonassaint et al., 2009).

Neuroticism also has been found to be a personality risk factor for poor health in individuals. Everyone has some level of neuroticism, and the degree of neuroticism in individuals varies from person to person (Thompson, 2008). As mentioned above, neuroticism has been linked to many negative outcomes, such as depression and anxiety (Jonassaint et al., 2009). Also, neuroticism has been associated with vulnerability in sensitive individuals that results in a high level of self-consciousness.

In addition to these negative outcomes, high neuroticism is linked to blunted (low) cardiovascular reactivity (Bibbey et al., 2012; Hughes et al., 2010; Jonassaint et al., 2009). Cardiovascular reactivity is traditionally measured as the amount of heart rate, blood pressure, or other cardiovascular variable change from rest when exposed to some type of challenge or stressor. According to the traditional reactivity hypothesis, low or blunted cardiovascular reactivity has been considered to be beneficial to one’s health while elevated cardiovascular reactivity has been thought to be detrimental to health, indicating potential cardiac disease or stroke. High reactivity is indeed predictive of later cardiovascular issues, but low or blunted reactivity more recently has been linked to negative outcomes resulting in poor health as well, such as depression, anxiety, and obesity (Phillips, et. al., 2013). Blunted reactivity has been found to be linked to high neuroticism and, as a result, indicates the potential of an individual to experience negative outcomes such as depression, anxiety, and obesity (Bibbey et al., 2012). Given the relationships described above for both low and high cardiovascular reactivity, it is now thought that moderate cardiovascular reactivity is desired for optimal indicators of good cardiovascular and physiological flexibility.

As mentioned above, neuroticism has been linked to blunted cardiovascular reactivity. In one study examining individual differences in the adaptation of cardiovascular responses to stress, high neuroticism was found to be linked to blunted initial stress responses while low neuroticism was linked to high initial stress responses (Hughes et al., 2010). Another study examined the effects of neuroticism during a physical and emotional stress task, namely a mental arithmetic task and anger recall task respectively. Similar to the previous study, high neuroticism was linked to low diastolic blood pressure, indicating a blunted stress response (Jonassaint et al., 2009). A third study focusing on the relationship between personality and physiological stress reactions also found high neuroticism to be linked to smaller cardiovascular stress reactions. This study made use of the Stroop task, mirror tracing task and a speech task to gather information on the rates of cardiovascular changes in each participant (Bibbey et al., 2012).

With these studies' findings in mind, the present study sought to replicate these types of studies in order to further elucidate the relationship of neuroticism to cardiovascular stress responses. The present study examined this relationship in female college students specifically when undergoing a speech test to elicit cardiovascular stress responses from the participants. We were limited to testing around 50 participants due to time and resource restrictions. Given that males are much more difficult to recruit than females, we decided to focus only on females.

The present study predicted that neuroticism would be negatively linked to cardiovascular reactivity; that is, we predicted that increasing neuroticism would be associated with decreasing amounts of cardiovascular reactivity (blunted reactivity). Although systolic blood pressure, diastolic blood pressure, and heart rate reflect difference aspects of cardiovascular functioning, differing results in past studies did not allow us to specify whether reactivity differences would be found in one cardiovascular variable versus the others.

Methods

Participants

Participants were 50 undergraduate students at the University of Mississippi who were recruited from the participant pool of general psychology. They received credit in their psychology course for participation in the research study. Each student read and signed a consent form for the study, which was approved by the Institutional Review

Board of the University of Mississippi. Smokers and anyone who had a history of cardiovascular disorders were removed from the study.

Psychological Recording Apparatus

Blood pressure (BP) was monitored using a model Tango automated blood pressure monitor (SunTech Medical Instruments, Raleigh, NC, USA). An occluding cuff was placed on the nondominant arm so that the sensor was placed over an area on the inner aspect of the upper arm where the brachial artery could be palpated. The monitor measured systolic (SBP) and diastolic blood pressure (DBP) using the oscillometric method. The monitor also determined heart rate (HR) during periods of cuff inflation.

Experimental Tasks

A. Speech Preparation

Participants were given a scenario where they were to imagine that they were applying for a scholarship, but they had to prepare a speech in order to potentially receive the scholarship. The speech had to consist of qualities that would make them the best candidate for the scholarship. Points to consider in the speech were given in order to help the participant formulate a response. The participant was given 3 minutes to prepare the response. The participants were told that the better their speech the better their chance of receiving extra credit. In reality, all of the participants received the extra one-half hour of credit.

B. Speech Task

Participants were given 3 minutes to deliver their prepared speech. If the participant stopped talking before the 3 minutes elapsed, specific suggestions were given to elicit more responding.

Questionnaires

NEO-Five Factor Inventory -3 (NEO-FFI-3)

Neuroticism was measured using the NEO-FFI-3, Form S (McCrae and Costa, 2007). The NEO-FFI-3 is a 60-item, shortened version of the original NEO Personality Inventory-3 that assesses the five personality factors of neuroticism, extraversion, openness, agreeableness, and conscientiousness. Only the neuroticism measure was used in the current study. Internal consistency (coefficient alpha) of the neuroticism scale has been reported as ranging from .79 in middle school children to .86 in an adult sample (McCrae and Costa, 2007).

Procedure

Participants reported to the testing site and were asked to read and sign an informed consent form. They then were asked to fill out a health screening form and complete the NEO. The participants' height and weight were measured, and they were seated in a comfortable lounge chair. The blood pressure cuff was applied on their nondominant arm and they were given instructions to rest for 8 minutes. During this and subsequent rest periods, participants were instructed to watch a calming Yoga video. This was utilized to focus attention on non-arousing stimulus while keeping them from getting sleepy. Following this initial rest period, subjects were given time to prepare a speech.

After this, the participants immediately delivered their speech in front of a video camera to try to heighten the stress level. Although the camera was turned on and appeared to be recording, no recording was actually done. They were given a final resting period of 8 minutes. The blood pressure cuff was removed at end of the rest period.

Data Reduction

BP and HR readings for the two rest periods were taken at the first, third, fifth, and seventh minutes of the rest periods. The readings from the fifth and seventh minutes were averaged to form the mean resting levels for each rest period. For the speech preparation and speech task period, BP and HR levels were taken at the 50-second mark, the 1:50 mark, and the 2:50 mark of the three-minute periods. The three readings of each period were averaged together to form a mean level of speech preparation period and speech task period.

We determined the change scores for HR and BP by subtracting the mean resting value from the task mean. For example, the speech preparation period mean was found by subtracting the average rest value from the speech preparation mean.

Data Analysis

In order to verify that the speech task did significantly raise cardiovascular levels above resting levels, we examined the levels of cardiovascular variables during the rest, speech preparation and speech periods. Therefore, we ran one-way repeated measures analyses of variances (ANOVAs) using SPSS on each cardiovascular variable with period as the within-subject factor with 3 levels (rest, speech preparation, speech).

Contrasts between rest versus speech preparation as well as speech preparation versus the speech period itself were also computed as post-hoc comparisons.

Our primary research question was whether the cardiovascular reactivity levels seen during the speech preparation period and speech task period were related to the level of neuroticism as measured by the NEO. Our analytical strategy was to run multiple regressions that regressed cardiovascular change scores (SBP, DBP, HR) on height, weight and neuroticism for the speech preparation and speech periods separately. This resulted in six regression analyses. We entered height and weight along with neuroticism to control for body size parameters that could be related to cardiovascular reactivity.

Results

Anthropometric and questionnaire variables

The means and standard deviations of age, height, weight, and neuroticism are presented in Table 1.

Table 1

Variable	Mean	Standard Deviation
Age (years)	18.56	.8369
Height (inches)	64.31	2.862
Weight (lbs.)	142.0	36.30
Neuroticism	20.84	6.485

Analyses of Cardiovascular Levels at Rest and during Stressor

Before examining the relationships between cardiovascular reactivity and neuroticism, we wanted to verify that the speech task did significantly elevate cardiovascular levels above resting levels. As indicated above, we ran one-way repeated measures analyses of variances (ANOVAs) with period as the within-subject factor with 3 levels (rest, speech preparation, speech). Contrasts between rest versus speech preparation as well as speech preparation versus the speech period itself were also computed as post-hoc comparisons. The means and standard deviations for each cardiovascular measure and period are given in Table 2.

Table 2

Cardiovascular Variables	Rest	Speech Preparation	Speech
Systolic Blood Pressure (mm Hg)	109.1 (9.7)	116.8 (10.0)	126.8 (12.5)
Diastolic Blood Pressure (mm Hg)	64.3 (5.3)	68.6 (6.2)	75.6 (9.3)
Heart Rate (beats/min)	77.0 (11.1)	87.8 (13.0)	94.7 (14.5)

The ANOVA examining SBP levels revealed a significant effect for period differences ($F(2, 98) = 98.9$, $p<.001$). The contrast between rest and speech preparation was significant ($F(1, 49) = 80.9$, $p<.001$), as was the contrast between the speech preparation period and the speech itself ($F(1, 49) = 69.3$, $p< .001$). For DBP levels, the period main effect was once again significant ($F(2,98) = 58.6$, $p<.001$). The contrast between rest and speech preparation was significant ($F(1,49) = 39.5$, $p<.001$), as was the contrast between the speech preparation period and the speech period ($F(1,49) = 44.9$, $p<.001$). Finally, the ANOVA examining HR levels also indicated a significant period effect ($F(2, 98) = 79.8$, $p<.001$); the contrast comparing rest and the speech preparation period was significant ($F(1,49) = 90.2$, $p<.001$), as was the comparison of the speech preparation period and the speech period ($F(1,49) = 28.1$, $p<.001$).

Thus, the levels of blood pressure and heart rate were significantly higher during the speech preparation period than during rest, and the levels during the speech itself were significantly higher than during the speech preparation period. The speech stressor clearly produced sufficient stress to significantly elevate blood pressure and heart rate over resting levels.

Regressions of Neuroticism with Cardiovascular Reactivity

As described in the Data Analysis section, we ran multiple regressions that regressed cardiovascular change scores (SBP, DBP, HR) on height, weight and neuroticism for the speech preparation and speech periods separately. Change scores were computed by subtracting the rest period level from the corresponding speech preparation or speech levels. This resulted in six regression analyses. We entered height and weight along with neuroticism to control for body size parameters that could be related to cardiovascular reactivity.

Table 3 displays the results of the regression analyses for the speech preparation period. The column label B is the unstandardized regression coefficients for each independent variable, whereas the column labeled Beta is the standardized coefficients. T-tests for significance of each variable and the resulting p-values are also reported in the table.

Table 3

Variable	Predictor	B	Beta	t	Significance
SBP Change	Height	.243	.115	.703	.486
	Weight	-.015	-.086	-.528	.600
	Neuroticism	.198	.211	1.448	.155
DBP Change	Height	.315	.185	1.148	.257

	Weight	.009	.070	.434	.666
	Neuroticism	.115	.153	1.065	.293
HR Change	Height	-.503	-.179	-1.134	.263
	Weight	-.031	-.138	-.877	.385
	Neuroticism	-.250	-.201	-1.425	.161

As can be seen in Table 3, neuroticism was not a significant predictor of any of the cardiovascular change scores with height and weight also in the models. Although not reported here, neuroticism was not significantly correlated with the change scores even when height and weight were not taken into account. Interestingly, neither weight nor height alone predicted cardiovascular reactivity.

Table 4 summarizes the results of the regressions done for the period of the actual speech presentation. The information reported in the table is exactly parallel to that presented in Table 3 for the speech preparation period.

Table 4

Variable	Predictor	B	Beta	t	Significance
SBP Change	Height	-.184	-.046	-.276	.784
	Weight	.012	.037	.221	.600
	Neuroticism	.071	.040	.270	.788
DBP Change	Height	.257	.078	.469	.641
	Weight	.005	.020	.117	.907
	Neuroticism	.069	.047	.318	.752
HR Change	Height	-.161	-.038	-.231	.819
	Weight	-.069	-.204	-1.254	.216
	Neuroticism	-.084	-.044	-.305	.762

Similar to the results seen for the speech preparation period, there were no significant relationships between neuroticism and cardiovascular reactivity for either blood pressure measure or heart rate. This was true when holding height and weight constant in the regression analyses, and was also true when not taking height and weight into account (not shown). As in the previous table, weight or height alone also did not significantly predict reactivity. Thus, we were unable to find evidence of neuroticism significantly predicting cardiovascular change during either the speech preparation or actual speech periods.

Discussion

The primary goal of the study was to explore whether the personality trait of neuroticism had an effect on cardiovascular reactivity during acute laboratory stressors. Our interest in this was due to the fact that previous studies had found that high neuroticism was associated with blunted initial stress responses (Bibbey et al., 2012; Hughes et al., 2010; Jonassaint et al., 2009).

To examine this goal, we performed a series of regressions. We wanted to examine the effect of neuroticism on cardiovascular change during stress, and we also wanted to control for height and weight, given that these may influence cardiovascular levels.

Although high neuroticism was previously found to be associated with blunted initial stress responses, the present study did not find any significant correlations between neuroticism and cardiovascular stress responses. No relationships between neuroticism, as measured by the NEO, and cardiovascular reactivity were found during a speech preparation or a speech task even though the speech task clearly produced a significant amount of stress as indexed by cardiovascular reactivity.

There are a number of reasons why we may not have found a significant relationship between neuroticism and cardiovascular reactivity. The present study only examined the effects of neuroticism in 50 participants. Perhaps a greater number of participants could have improved the power of the experiment and revealed stronger correlations between neuroticism and SBP, DBP, and HR. In the findings of Bibbey, et. al., 2414 men and women were used as participants. This high number of participants surely impacted their results and greatly increased their power. However, the fact that the present study had good reactivity and no significant correlations whatsoever reveals that perhaps there is nothing of significance occurring at all. Not even one of the correlations was significant out of all of the correlations that we ran.

Another possibility is that the task we used was not significantly potent to elicit significant cardiovascular reactivity. However, we did have good reactivity that showed significant changes between HR and BP from rest. An alternate possibility is that the task was too stressful and did not allow for differences in reactivity due to neuroticism to emerge. Possibly, if we had used a subtler stressor task that elicits more frustration, such as a mental arithmetic task, which was used in Jonassaint, et. al., it might have produced more significant relationships between cardiovascular reactivity and neuroticism.

In the majority of previous studies that found a relationship between neuroticism and cardiovascular stress responses, males were examined only or they were included as part of the participant pool (Bibbey et al., 2012; Jonassaint et al., 2009). Our study had the limitation of only examining the reactivity levels of females, so it is possible that there could have been some relationships found for males that were not found for females. For example, an earlier study done in our lab (Allen, Hogan and Laird, 2009) found that greater impulsivity predicted lower SBP reactivity during a speech preparation period for males but not females. Given that impulsivity is sometimes considered to be one aspect of neuroticism, it is possible that we could have found more of a link with neuroticism and blunted reactivity if we had included males in the study. A replication of this study using males would be instructive. Clearly, further research should be performed to better examine the correlation between neuroticism, as well as other personality traits, on cardiovascular reactivity levels during stressors.

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