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# Cortisol and ACTH Responses to the Dex/CRH Test: Influence of Temperament

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## Abstract

Temperament and personality traits such as neuroticism and behavioral inhibition are prospective predictors of the onset of depression and anxiety disorders. Exposure to stress is also linked to the development of these disorders, and neuroticism and inhibition may confer or reflect sensitivity to stressors. Several lines of research have documented hyperactivity of the hypothalamic-pituitary-adrenal (HPA) axis in some patients with major depression, as well as in children and non-human primates with inhibited temperaments. The present investigation tested the hypothesis that stress-reactive temperaments would be predictive of plasma adrenocorticotropin (ACTH) and cortisol concentrations in the dexamethasone/corticotropin-releasing hormone (Dex/CRH) test. Sixty adults completed diagnostic interviews and questionnaires assessing the temperament domains of novelty seeking and harm avoidance and symptoms of anxiety and depression. All subjects were free of any current or past Axis I psychiatric disorder. The Dex/CRH test was performed on a separate visit. A repeated measures general linear model (GLM) showed a main effect of harm avoidance in predicting cortisol concentrations in the test ($F(1, 58) = 4.86$, $p < .05$). The GLM for novelty seeking and cortisol response also showed a main effect ($F(1, 58) = 5.28$, $p < .05$). Higher cortisol concentrations were associated with higher levels of harm avoidance and lower levels of novelty seeking. A significant interaction of time with harm avoidance and novelty seeking ($F(4, 53) = 3.37$, $p < .05$) revealed that participants with both high levels of harm avoidance and low levels of novelty seeking had the highest cortisol responses to the Dex/CRH test. Plasma ACTH concentrations did not differ as a function of temperament. The results indicate that temperament traits linked to sensitivity to negative stimuli are associated with greater cortisol reactivity during the Dex/CRH test. Increased adrenocortical reactivity, which previously has been linked to major depression and anxiety disorders, may contribute to the association between temperament/personality traits and these disorders.

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Cortisol; Dex/CRH test; HPA axis; temperament; personality; inhibition

## INTRODUCTION

Temperament and personality traits such as neuroticism and behavioral inhibition are closely linked to the development of mood and anxiety disorders. Neuroticism has been defined as the tendency to experience negative affect, and behavioral inhibition is characterized by the tendency to withdraw, particularly in the face of novel stimuli. Neuroticism and inhibition occur at higher rates in families in which members have been diagnosed with a mood or anxiety disorder, respectively (Fanous et al., 2002; Kendler et al., 2006b; Rosenbaum et al., 1988), they share genetic risk factors with mood and anxiety disorders (Fanous et al., 2002; Hettema et al., 2006; Hettema et al., 2004; Kendler et al., 1993a; Nash et al., 2004; Sen et al., 2004; Smoller et al., 2003; Smoller et al., 2005), and they are prospective predictors of the development of these disorders (Angst and Clayton, 1986; Hirschfeld et al., 1989; Kendler et al., 2006a; Kendler et al., 2004; Kendler et al., 1993b; Prior et al., 2000; Schwartz et al., 1999).

Exposure to stressors and sensitivity to stress have been strongly implicated in the etiology of major depression and anxiety disorders (Heim and Nemeroff, 2001; Kendler et al., 1993a; Kendler et al., 2004; McFarlane et al., 2005). The hypothalamic-pituitary-adrenal (HPA) axis is activated following exposure to stressors; this response is excessive in a substantial portion of patients with major depression and in some anxiety disorders (Barden 2004; Risbrough and Stein, 2006; Shea et al., 2005). Personality is associated with the likelihood of exposure to stressors (Kendler et al., 2003), as well as with the sensitivity to negative stimuli or stressors (Bolger and Schilling, 1991; Kendler et al., 2004; Ormel and Wohlfarth, 1991; Rijsdijk et al., 2001; Van Os and Jones, 1999). These associations may be bi-directional, with effects of temperament or personality on stress reactivity, as well as differences in sensitivity to stress leading to stable tendencies in personality.

Several studies have examined basal or stress-induced cortisol concentrations in relation to temperament or personality in adults, but these studies have employed widely varying personality measures, sampling approaches, and different methods to assess HPA axis function and, not surprisingly, results have been mixed (Grossi and Lundberg, 1998; Kirschbaum et al., 1992; Mangold and Wand, 2006; Morgan et al., 2001; Nicolson, 2004; Oswald et al., 2004; Oswald et al., 2006; Portella et al., 2005; Rosenblitt et al., 2001; Roy et al., 2001; Schommer et al., 1999; Van Eck et al., 1996; Wang et al., 1997; Zorrilla et al., 1995). A number of factors are known to influence HPA axis function, including a history of early life stress (Carpenter et al., 2005; Gunnar and Vazquez, 2001; Heim et al., 2000; Shea et al., 2005) as well as mood and anxiety disorders. These potential confounds have rarely been systematically assessed or controlled. In addition, very few studies have assayed adrenocorticotropic hormone (ACTH) in relation to personality or temperament, so that the literature cannot address which components of the HPA axis may be compromised.

Three recent investigations used the dexamethasone/corticotropin-releasing hormone (Dex/CRH) test to examine HPA function in relation to temperament or personality. The Dex/CRH test, which combines dexamethasone pretreatment with CRH administration, probes the response to CRH stimulation under conditions of suppressed cortisol secretion and reduced feedback regulation by cortisol. This test has been shown to be very sensitive with respect to major depression (Heuser et al., 1994), and one study found that individuals at-risk for depression based on a family history of mood disorders had abnormally elevated cortisol

responses to the test (Holsboer et al., 1995). We recently conducted a pilot study of adults with no current or prior psychiatric history and found that elevated plasma cortisol concentrations in the Dex/CRH test were associated with low levels of the temperament trait novelty seeking (Tyrka et al., 2006); a related construct, harm avoidance, was not a significant predictor of cortisol concentrations in this small sample. Zobel and colleagues studied healthy adults with no history of treated psychiatric disorder using the Dex/CRH test and found a positive association of cortisol concentrations with neuroticism and depressive temperament (2004). However, another previous study of adults found that those with high levels of neuroticism had lower cortisol responses to the Dex/CRH test (McCleery and Goodwin, 2001).

The present investigation extended our previous pilot work and tested the hypothesis that stress-reactive temperaments would be linked to increased plasma ACTH and cortisol responses to the Dex/CRH test in an expanded sample of healthy adults. Specifically, we sought to determine whether individuals with inhibited temperaments characterized by low levels of novelty seeking and high levels of harm avoidance would have elevated plasma neuroendocrine responses to this test.

## METHODS

### Subjects

A total of 60 adults, 28 men and 32 women, aged 18–50, participated in this study. Most participants were Caucasian (N = 44); the rest were Black (N = 4), Hispanic (N = 1), Asian (N = 4), and “other” (N = 4), and three subjects did not identify their race. Subjects were recruited from the community via flyers and advertisements. The study was approved by the Butler Hospital Institutional Review Board, and subjects gave voluntary written informed consent to participate. Participants completed a clinical interview and self-report measures, and on a separate occasion underwent complete physical and neurological examinations. An electrocardiogram and laboratory tests, including a complete blood count, serum chemistries, liver and thyroid function tests, urine toxicology, and urine pregnancy test for women, were conducted.

Subjects were excluded if they had any significant acute medical illness or any chronic medical condition involving HPA axis function. All subjects were free of antidepressant, neuroleptic or anxiolytic medications for at least 2 weeks (6 weeks for fluoxetine). Use of medications thought to affect HPA function, including beta blockers, angiotensin-converting enzyme inhibitors, ketoconazole, metyrapone, and corticosteroids also resulted in exclusion. Oral contraceptives were allowed. Subjects were selected for the present investigation from a larger study of neuroendocrine function in relation to stress and psychiatric disorders if they had no past or present Axis I diagnosis, excluding specific phobia, based on the Structured Clinical Interview for DSM-IV Axis I Disorders (First et al., 1996).

In order to test for possible effects of menstrual cycle phase or oral contraceptive use on the cortisol summary variables, women (N=32) were categorized as to whether they were using oral contraceptives (N=13); if not using oral contraceptives, they were grouped based on timing of their last menstrual period. Four women were not included in these analyses because they had missing data for menstrual phase (N=3) or an irregular cycle (N=1). Six women were in the follicular phase (defined as days 1–13) and nine women were in the luteal phase (days 15–28). None of the women were tested on day 14, corresponding to ovulation, and none of the women were peri- or post-menopausal. A second classification allowed a larger window for ovulation from days 12–16. This resulted in the same number of women in the luteal phase, but three women who were initially categorized in the follicular phase were re-classified as in the ovulation phase.

## Measures

A battery of self-report measures was used to assess personality traits, experiences of childhood abuse and neglect, symptoms of depression and anxiety, and recent perceived stress. The following questionnaires, all of which are known to have good psychometric properties, were used: (1) Tridimensional Personality Questionnaire (TPQ; Cloninger et al., 1991), (2) Childhood Trauma Questionnaire (CTQ; Bernstein, 1998), (3) Inventory of Depressive Symptomatology-Self Report (IDS-SR; Rush et al., 1996), (4) State-Trait Anxiety Questionnaire (STAI; Spielberger, 1983), and (5) Perceived Stress Scale (PSS; Cohen et al., 1983).

The TPQ has three subscales: harm avoidance, novelty seeking, and reward dependence. Cloninger and colleagues (1993) posit that these "temperament" factors represent biologically-based biases in information processing. The harm avoidance scale consists of four facets: Anticipatory Worry and Pessimism, Fear of Uncertainty, Shyness with Strangers, and Fatigability. Individuals with a high score on the harm avoidance subscale can be characterized as vigilant, nervous, reserved, and inhibited (Cloninger et al., 1993; Kose, 2003). The novelty seeking subscale also has four subscales: Exploratory Excitability vs. Stoic Rigidity, Impulsiveness vs. Reflection, Extravagance vs. Reserve, and Disorderliness vs. Regimentation. High levels of novelty seeking are correlated with extraversion (De Fruyt et al., 2000) and low levels are indicative of a more introverted personality style. Harm avoidance is positively correlated with measures of neuroticism (De Fruyt et al., 2000; Stallings et al., 1996) and negatively correlated with novelty seeking (De Fruyt et al., 2000). Because of their associations with negative affect, anxiety, inhibition and introversion, high harm avoidance and low novelty seeking were hypothesized to be associated with elevated cortisol concentrations in the Dex/CRH test.

## Dex/CRH Test

On a subsequent visit, subjects completed the Dex/CRH test. On the night before the test, a single oral dose of dexamethasone 1.5 mg was self-administered at 11 p.m. The following day, the subjects were given lunch, and were queried about their habits and life events over the preceding week. Subjects who reported significant physical or emotional stressors did not complete the test on that day and instead had the visit rescheduled. A topical anesthetic cream containing lidocaine 2.5% and prilocaine 2.5% (EMLA®) was applied to the subject's forearm and an indwelling intravenous (IV) catheter was inserted by a research nurse with extensive experience with IV catheter placement between 1:00 and 1:30 p.m. Subjects then remained in a semi-recumbent position throughout the procedure except to use the bathroom. They were permitted to read or watch pre-selected films that did not contain emotionally-charged material. Vital signs were monitored throughout the test. At 2:30, 3:30 and 4:30 p.m., subjects completed visual analogue rating scales (VAS) that assessed the degree to which they felt a number of mood states, including "anxious," "depressed," "fearful," "irritable," "nervous" and "sad." All scales were anchored from 0 = not at all to 100 = most ever.

At 3:00 p.m., 100 μg CRH (corticorelin ovine triflutate, Acthrel®, Ferring Pharmaceuticals, Inc.) reconstituted in 2 ml 0.9% sodium chloride was infused intravenously over 30 seconds. Blood samples were drawn at regular intervals, centrifuged, and then stored at −80° C. ACTH assay was performed on samples drawn at 2:59 p.m., 3:30 p.m., 4:00 p.m., and 4:30 p.m. Plasma ACTH was assayed in duplicate 200 μl plasma samples using an immunoradiometric assay (Wilkinson and Raff, 2006) according to the manufacturer's instructions (Scantibodies Laboratory, Santee, CA). The minimum detectable ACTH concentration was 2 pg/ml, and the intra- and inter-assay coefficients of variation for this series of assays were 4.6% and 5.3%, respectively. Plasma cortisol assay was performed on samples drawn at 2:59 p.m., 3:30 p.m., 3:45 p.m., 4:00 p.m., and 4:15 p.m. The GammaCoat cortisol I-125 coated-tube

radioimmunoassay (RIA) kit (INCSTAR Corp., Stillwater, Minn.) was used. The intra-assay and inter-assay CVs observed for quality assessment samples (5 and 20 μg/dl) were less than 5% and 10%, respectively.

### Statistical Analysis

Data were analyzed using SPSS version 14.0 for Windows. All statistical tests were two-tailed, and alpha was set at 0.05. Area under the curve (AUC) was calculated using the trapezoidal method for both ACTH and cortisol with Origin Scientific Graphing and Analysis Software version 7.5 (2003) for Windows. T-tests and correlation coefficients were conducted to examine the bivariate relationships between the ACTH and cortisol summary variables and the other measures. Repeated-measures general linear models were used to assess the change in ACTH and cortisol over time and whether mood states assessed with the VAS changed over time during the test. Repeated measures general linear models were also used to test the effects of novelty seeking, harm avoidance, and the interaction of novelty seeking and harm avoidance to ACTH and cortisol concentrations over time in the Dex/CRH test.

## RESULTS

### Sample Characteristics

Characteristics of the sample are shown in Table 1. AUC values for ACTH and cortisol did not differ with respect to sex or age in this sample. Among women, oral contraceptive was not predictive of ACTH or cortisol AUC, and neither classification of menstrual cycle phase was predictive of ACTH or cortisol AUC. The summary values for ACTH and cortisol were highly correlated (AUC r=.62, p<.001).

### Bivariate Associations of ACTH and Cortisol with Assessment Measures

The summary variables for ACTH and cortisol were not significantly correlated with reports of anxiety (STAI state and trait), childhood trauma (CTQ total score) or recent perceived stress (PSS) (Table 2). ACTH was not significantly related to any of the temperament variables or the measure of sub-clinical depressive symptoms (IDS-SR). Cortisol AUC was inversely correlated with novelty seeking and positively correlated with both harm avoidance and IDS-SR scores (Table 2). Scores on the IDS-SR were strongly correlated with harm avoidance (r=.49, p<.001), and partial correlations controlling for harm avoidance showed that IDS-SR was not correlated with cortisol AUC. Novelty seeking and harm avoidance were inversely related (r=−.29, p<.05). Novelty seeking was not significantly related to IDS-SR scores (r=−.17, p=.19).

### Neuroendocrine Responses over Time and Relation to Mood State

The repeated measures models examining the overall change in ACTH and cortisol over time in the Dex/CRH test were significant (ACTH, F(3, 57)=52, p<.001; cortisol, F(4, 56)=14.3, p<.001), reflecting increases in these hormones over time in response to the test. The repeated measures models assessing mood state over time did not reveal any changes over time for any of the VAS variables.

### Temperament and Neuroendocrine Response to the DEX/CRH Test

In the repeated measures general linear model testing the effects of harm avoidance on cortisol response to the test, there was a main effect of harm avoidance ($F(1, 58) = 4.86$, $p < .05$) with higher levels associated with higher cortisol concentrations; the interaction of harm avoidance with time did not reach significance (p=.08). For novelty seeking, there was a main effect ($F(1, 58) = 5.28$, $p < .05$), with lower levels associated with higher cortisol concentrations, and there was no interaction with time (p=.11). When novelty seeking and harm avoidance and

their interaction were tested simultaneously, in addition to an interaction of time and harm avoidance ($F(4, 53) = 4.12$, $p < .01$), there was an interaction of time with harm avoidance and novelty seeking ($F(4, 53) = 3.37$, $p < .05$). The interaction of time and novelty seeking did not reach significance ($F(4, 53) = 2.48$, $p = .055$), there was no main effect of novelty seeking, and the main effect of harm avoidance did not reach significance ($F(1, 56) = 3.62$, $p=.063$). The general linear model with harm avoidance and novelty seeking and their interaction as predictors was repeated controlling for effects of IDS-SR, STAI, CTQ, and PSS. There was an interaction of harm avoidance over time ($F(4,48) = 3.32$, $p<.05$) and the interaction of harm avoidance by novelty seeking over time remained ($F(4, 48) = 3.01$, $p<.05$).

In order to visually depict the interaction found with the continuous temperament variables, a composite variable (NS/HA) was created which involved dichotomizing novelty seeking and harm avoidance via median split. Given that higher cortisol responses were associated with higher levels of harm avoidance and lower levels of novelty seeking, subjects with both high harm avoidance and low novelty seeking were grouped together (N=14) and those with low harm avoidance and high novelty seeking were grouped together (N=12). Subjects with either high harm avoidance or low novelty seeking but not both comprised a third group (N=34). A repeated measures general linear model testing the effects of this composite NS/HA variable on cortisol concentrations showed a significant main effect ($F(2, 57) = 360.7$, $p = .05$). As shown in Figure 1, individuals who had both high levels of harm avoidance and low levels of novelty seeking had the highest cortisol concentrations in response to the test.

For ACTH, the repeated measures general linear models testing the effects of novelty seeking and harm avoidance did not reveal any significant effects of novelty seeking, harm avoidance, or the interaction of novelty seeking and harm avoidance (Figure 2).

## DISCUSSION

Results of this investigation confirm and extend our recent finding that low levels of novelty seeking are associated with elevated cortisol concentrations in the Dex/CRH test. In this expanded sample, we additionally found that harm avoidance was a positive predictor of the cortisol response to this test, and that novelty seeking and harm avoidance interacted such that those with the high levels of harm avoidance and low levels of novelty seeking had the highest increase in cortisol concentration in response to the test. In addition, this is one of only a few investigations that have examined ACTH in relation to personality or temperament. We did not find significant associations of these temperament measures and ACTH in the Dex/CRH test. This pattern of findings is similar to our previous findings with ACTH and cortisol in a small subset of the present sample who completed a psychosocial stress test (Tyrka et al., 2007), as well as those of a recent study by Mangold and Wand (2006) which found elevated cortisol, but not ACTH, responses to naloxone challenge in relation to neuroticism. Similarly, there is evidence that increases in plasma cortisol concentrations in depressed patients are not proportional to changes in plasma ACTH (Linkowski et al., 1985; Rubin et al., 1996). However, the Dex/CRH test is thought to be sensitive to abnormalities of glucocorticoid receptor (GR) signaling at the level of the pituitary as well as to increased secretion of CRH and vasopressin that are hypothesized to result from impaired central GR signaling in major depression (Holsboer, 2000). Given that we did not find increases in ACTH that correspond to the cortisol findings, our findings are not likely due to central or pituitary abnormalities. Rather, there appears to be enhanced adrenocortical responsiveness among individuals with this inhibited temperament phenotype, which could possibly be due to adrenocortical hypertrophy or increased sensitivity of the adrenal cortex. Alternatively, if an ACTH effect is less robust than that for cortisol, a larger sample might be required for sufficient power.

Our results are not consistent with some reports that would appear to indicate an effect in the opposite direction, namely, that cortisol reactivity is increased in association with openness and extraversion and decreased with neuroticism (McCleery and Goodwin, 2001; Oswald et al., 2006; Phillips et al., 2005). These discrepancies may in part be due to the use of different measures of temperament or sample effects, with possible influences of past psychiatric disorders, childhood trauma, or adult stress. The present study carefully excluded individuals with current or past Axis I disorders, so that neuroendocrine effects associated with mood or anxiety disorders such as major depression or post-traumatic stress disorder cannot explain our findings. It is interesting to note that subclinical depressive symptoms on the IDS-SR were correlated with both harm avoidance scores and with cortisol responses. That the association with cortisol response was no longer present after controlling for harm avoidance scores, however, indicates that depressive symptoms did not have an independent effect on neuroendocrine response in this healthy sample. The results are also not accounted for by differences in perceived stress or reported childhood maltreatment, as there was no association of cortisol or ACTH with scores on the PSS or CTQ in this sample.

Findings of this study suggest that excessive cortisol reactivity may be a neurobiological mechanism for the association between temperament and risk for mood and anxiety disorders. The neuroendocrine challenge test used in this study is administered under conditions designed to be psychologically neutral and, indeed, we found no changes in mood state during the test. Thus, psychological responses to the test that could be associated with temperament are not likely to explain our findings; rather, a more direct neurobiological mechanism is supported. Inhibited individuals may have more exaggerated physiological responses to stress and, in such persons, excessive activation of stress-responsive physiological systems may lead to the development or worsening of their inhibition (Kagan et al., 1987).

An accumulating body of evidence demonstrates that enhanced or prolonged cortisol activation can lead to neuronal cell loss, altered synaptic pruning, and inhibition of neurogenesis and myelination; these neuronal changes may be involved in the pathogenesis of major depression (Duman and Monteggia, 2006; Gould et al., 1998; McEwen, 2000; Sapolsky, 2001). Excessive cortisol activation may be related to differences in temperament as well. A recent study found that postnatal maternal cortisol concentrations were predictive of infants' distress in response to novel stimuli in breastfed, but not formula-fed, infants, suggesting that exposure to cortisol in breast milk influenced infant temperament (Glynn et al., In Press). In addition, endogenous CRH may be involved: behavioral inhibition in non-human primates is associated with increased cerebrospinal fluid concentrations of CRH (Kalin and Shelton, 2003), and in humans has been linked to genetic markers at the CRH locus (Smoller et al., 2003; Smoller et al., 2005). Central administration of CRH in rodents and non-human primates produces increases in physiological reactivity to novel stimuli as well as behavioral effects including neophobia, suppression of exploratory behavior, and social withdrawal (Dunn and Berridge, 1990; Owens and Nemeroff, 1991).

This study is limited by the cross-sectional nature of the design, which prevents us from drawing conclusions regarding the stability of the association and whether HPA hyperactivity precedes the development of depression or anxiety disorders in individuals with this temperamental trait. In addition, the sample was mainly composed of young adults, so that the results may not reflect processes operating in older individuals. We included females who were at various stages of their menstrual cycle and those on oral contraceptives; while we did not find significant effects of these factors on cortisol or ACTH responses, gonadal hormones are known to influence HPA activity (Kajantie and Phillips, 2006; Symonds et al., 2004). Finally, the sample was carefully screened for psychiatric disorders in order to rule out the possibility that current or past disorders could account for the findings. This reduces the generalizability of the findings, but if we had included individuals with psychiatric disorders or selected on the

basis of stress exposure, these other factors could complicate or override effects of temperament. Further work is necessary to replicate these findings and determine whether hyperactivity of CRH and HPA axis function is a mechanism by which temperament is linked to the development of mood and anxiety disorders.

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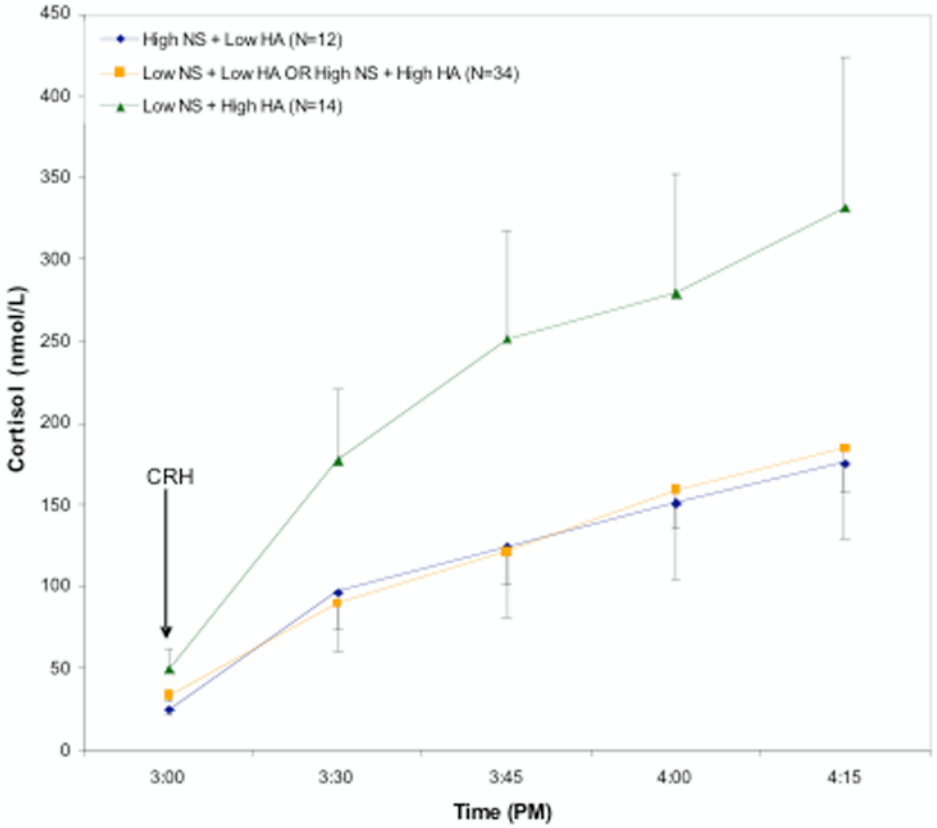


**Figure 1.**

Cortisol Concentrations in the Dex/CRH Test According to the Composite NS/HA variable

Note. NS refers to novelty seeking and HA refers to harm avoidance. High and Low were designated for scores that were above and below the median, respectively. A repeated measures general linear model showed a significant main effect of this NS/HA variable on cortisol concentrations in the Dex/CRH test ($F(2, 57) = 360.7$, $p = .05$).

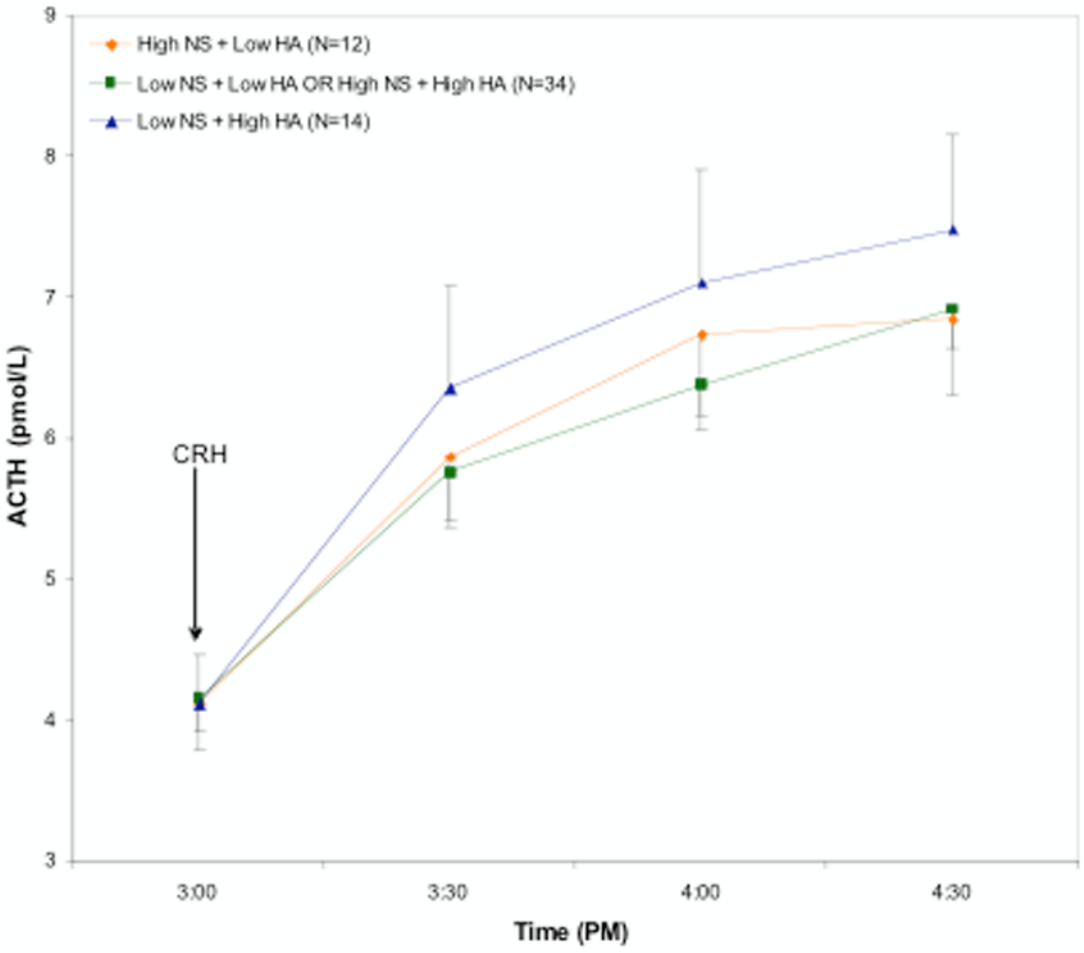


**Figure 2.**

ACTH Concentrations in the Dex/CRH Test According to the Composite NS/HA variable Note. NS refers to novelty seeking and HA refers to harm avoidance. High and Low were designated for scores that were above and below the median, respectively. A repeated measures general linear model testing effects of the NS/HA variable on cortisol concentrations was not significant.

**Table 1**

Characteristics of Participants (n=60)

| Variable | Mean (SD) |
|---|---|
| Age | 24.18 (6.90) |
| Novelty Seeking (TPQ) | 18.93 (4.76) |
| Harm Avoidance (TPQ) | 9.78 (5.12) |
| Reward Dependence (TPQ) | 15.72 (4.42) |
| Depressive Symptoms (IDS-SR) | 6.25 (4.42) |
| State Anxiety (STAI) | 27.92 (5.98) |
| Trait Anxiety (STAI) | 29.13 (6.82) |
| Childhood Maltreatment (CTQ) | 6.60 (2.12) |
| Perceived Stress (PSS) | 18.05 (5.42) |

**Table 2**

Correlations of Study Measures with ACTH AUC and Cortisol AUC

| Variable | ACTH | Cortisol |
|---|---|---|
| Novelty Seeking (TPQ) | −0.13 | −0.30* |
| Harm Avoidance (TPQ) | 0.17 | 0.28* |
| Reward Dependence (TPQ) | −0.14 | −0.12 |
| Depressive Symptoms (IDS-SR) | 0.11 | 0.28* |
| State Anxiety (STAI) | −0.18 | −0.09 |
| Trait Anxiety (STAI) | 0.20 | 0.21 |
| Childhood Maltreatment (CTQ) | −0.05 | −0.12 |
| Perceived Stress (PSS) | −0.10 | 0.09 |

Note. AUC refers to the area under the curve.

* $p < .05$.