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Are Narcissists Hardy or Vulnerable? The Role of Narcissism in the Production of Stress-Related Biomarkers in Response to Emotional Distress

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Abstract

Does narcissism provide a source of hardiness or vulnerability in the face of adversity? The present research addressed this question by testing whether narcissism is associated with increased physiological reactivity to emotional distress, among women. Drawing on the "fragile-ego" account, we predicted that narcissists would show a heightened physiological stress profile in response to everyday frustrations. Results supported this prediction; across a three-day period, highly narcissistic individuals showed elevated output of two biomarkers of stress—cortisol and alpha-amylase—to the extent that they experienced negative emotions. In contrast, among those low in narcissism there was no association between these biomarkers and emotions. These findings suggest that narcissists' stress-response systems are particularly sensitive to everyday negative emotions, consistent with the notion that narcissism comes with physiological costs.

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Hardiness and an ability to cope with life's difficulties are important determinants of psychological and physical health. Personality characteristics such as dispositional hardiness, optimism, and conscientiousness have been found to predict one's ability to cope with and respond adaptively to risk, and may even promote long-term health and longevity (see Smith, 2006). One personality process that may bear relevance to health outcomes but has received limited empirical attention in this domain is subclinical, or "grandiose," narcissism (Cain, Pincus, & Ansell, 2008). Researchers have debated whether grandiose narcissism is likely to be a source of hardiness or vulnerability in the face of adversity (e.g., Sedikides, Rudich, Gregg, Kumashiro, & Rusbult, 2004), but this question remains unresolved. Do narcissists' aggrandized self-perceptions and self-enhancement tendencies protect them from the potential impact of emotional distress on health? Or, does narcissism put these individuals at greater risk?

The current research examined whether narcissists respond to everyday experiences of negative emotions with exaggerated or reduced hormonal stress activity. In doing, we drew on the *fragile-ego account* (Gregg & Sedikides, 2010; Kernberg, 1976; Kohut, 1976), which proposes that beneath narcissists' outward veneer of self-inflation and positivity lies an implicit negative sense of self, and corresponding insecurity and shame. According to this view, narcissistic individuals may be particularly vulnerable to adversity, as negative events can activate and make salient their underlying insecurities and deep-seated fragility. As a result, aversive events and corresponding emotions might generate increased activity in these individuals' stress-related hormonal systems, which, over the long-term, could have negative downstream health consequences. Based on this account, we predicted that highly narcissistic individuals would show exaggerated secretion of stress-related biomarkers in response to distressing life events.

Several lines of evidence suggest that an exaggerated physiological response to everyday distress is one potential pathway through which narcissism might influence long-term health. In particular, laboratory studies have found that when narcissists' performance in a valued domain is challenged, they respond with anger, anxiety, aggression, hostility, and reduced self-esteem, suggesting that narcissists' overly positive self views are somewhat fragile (e.g., Bushman & Baumeister, 1998; Konrath, Bushman, & Campbell, 2006; Rhodewalt & Morf, 1998; Twenge & Campbell, 2003). Supporting this interpretation, daily-diary studies have shown that narcissists' emotions and self-esteem are more unstable and reactive over time compared to those of individuals low in narcissism, and these fluctuations are generally driven by dissatisfying social events (e.g., Bogart, Benotsch, & Pavlovic, 2004; Rhodewalt, Madrian, & Cheney, 1998). Furthermore, in studies examining the biological consequences of narcissism, narcissists have been found to exhibit greater cardiovascular and cortisol reactivity in response to laboratory-based stressors (e.g., the Trier Social Stress Test; Edelstein, Yim, & Quas, 2010; Kelsey, Ornduff, McCann, & Reiff, 2001; Sommer, Kirkland, Newman, Estrella, & Andreassi, 2009). Together, these findings suggest that narcissistic individuals demonstrate greater psychological and physiological reactivity to distressing events, and thus that narcissism may have an adverse effect on health in the long-term.

The Present Research

The current research tested the hypothesis that narcissists would exhibit greater hormonal activity compared to those low in narcissism in response to emotional distress experienced in their day-to-day lives. In doing so, we extend prior research in four critical ways. First, we assessed physiological responses associated with two distinct neuroendocrine systems typically activated by psychological stress—the hypothalamic-pituitary-adrenal (HPA) axis and the

sympathetic nervous system (SNS)—which, respectively, produce the hormone cortisol and trigger secretion of the enzyme alpha-amylase (Miller, Chen, & Zhou, 2007; Rohleder, Nater, Wolf, Ehlert, & Kirschbaum, 2004). Cortisol and alpha-amylase profiles are relatively independent markers of vulnerability, as each indexes the activity of a distinct neuroendocrine system, thus providing two objective indicators of physiological responding that are both free of self-report biases. Whereas cortisol marks HPA axis activity, alpha-amylase secretion is thought to reflect influences of the sympathetic nervous system. Under most circumstances, levels of these markers are weakly correlated, reflecting relatively independent functions of the SNS and HPA. It is only under conditions of very high stress that activity in these systems tends to converge (see van Stegeren, Rohleder, Everaerd, & Wolf, 2006; Cacioppo et al., 1992; Nater & Rohleder, 2009; van Stegeren, Wolf, and Kindt, 2008). In fact, studies suggest that cortisol and alpha-amylase may respond to different kinds of stressors and arousing stimuli (van Stegeren et al., 2008). This asymmetry highlights the importance of assessing both markers in studies that seek to acquire a comprehensive understanding of individual differences in psychoneuroendocrinology, particularly because both cortisol and alpha-amylase profiles are linked to chronic psychiatric disorders and physical ailments—including chronic psychosocial stress, depression, diabetes, and obesity (e.g., McEwen, 2007; Parker, Schatzberg, & Lyons, 2003)—and thus provide a window into processes that may be important for subsequent health outcomes. The assessment of biological indicators of potential health problems is particularly important here, because narcissists are known to display self-enhancing biases that inflate their scores on self-reported measures of psychological well-being (Gramzow & Tangney, 1992; Paulhus, Robins, Trzesniewski, & Tracy, 2004), which could similarly lead to biased reports of physical health symptomology.

Second, whereas prior work examining the implications of narcissism on well-being has focused largely on *psychological* adjustment, the current research focuses on processes thought to be of importance for *physical* health. Previous studies have shown that narcissists score higher on explicit measures but lower on implicit measures of well-being (Bosson, Brown, Zeigler-Hill, & Swann, 2003; Jordan, Spencer, Zanna, Hoshino-Browne, & Correll, 2003; McGregor & Marigold, 2003; McGregor, Nail, Marigold, & Kang, 2005; Sedikides et al., 2004; Zeigler-Hill, 2006; see Gregg & Sedikides, 2010 for a review). This psychological profile has been widely interpreted as demonstrating the narcissistic pattern of combined self-inflation and ego fragility, thus linking narcissism to maladjustment (see Gregg & Sedikides, 2010 for a review). Although psychological and physical health are related, they are distinct facets of well-being, raising the possibility that they may be differentially affected by narcissism. Given the dearth of prior research examining the influence of narcissism on physical health outcomes, the question of whether narcissism is linked to processes relevant to physical health fragility remains open.

Indeed, a third novel contribution of the present research is that it addresses a major gap in the literature by examining whether emotional responses to distressing events modulate the link between narcissism and stress-related endocrinology. As prior research indicates, narcissism is characterized by inflated reactivity to distress and challenge, despite an otherwise generally favorable adjustment profile (Bogart et al., 2004; Bushman & Baumeister, 1998; Campbell, 2001; Campbell, Bosson, Goheen, Lakey, & Kernis, 2007; Campbell, Rudich, & Sedikides, 2002; Rhodewalt & Morf, 1998; Sedikides et al., 2004). This suggests that any adverse health consequences of narcissism are most likely to result from occasions of distress and adversity, and particularly those that occur regularly in daily life (as more frequent surges of stress hormones would presumably have the greatest negative impact on health).

Despite this suggestion, prior studies addressing this issue have focused largely on straightforward zero-order relations between narcissism and biological processes related to health. Reinhard, Konrath, Lopez, and Cameron (2012), for example, found that a small sample of men who scored highly on the most maladaptive (i.e., Entitlement/Exploitativeness) facet of narcissism showed higher basal (i.e., baseline) cortisol levels, suggesting they may have relatively increased HPA outflow on an ongoing basis. While this finding is suggestive of a zero-order relation, this study did not measure profiles of cortisol release in daily life, instead focusing on cortisol levels at two time points (spaced 30 minutes apart) in the laboratory. Thus, the results that emerged may have been due to narcissistic men showing an exaggerated cortisol response to the stress of arriving at the laboratory for an experiment. Given this ambiguity, as well as the theoretical expectation that the impact of narcissism on stress biomarkers should be particularly pernicious during times of distress, we more directly tested whether narcissism moderates the effect of everyday distressing emotions on physiological markers of health—an approach that is likely to be critical for understanding the health implications of narcissism. Indeed, consistent with this expectation, Edelstein and colleagues (2010) found a pattern of greater cortisol reactivity among narcissistic men following a laboratory stressor, but no increase in reactivity among narcissists in the control condition.

Fourth, by testing our hypothesis in an ecologically valid, naturalistic context (i.e., by assessing hormonal responses to everyday experiences of distress), we extend prior studies that examined narcissists' reactivity to experimentally induced stress (e.g., Edelstein et al., 2010; Kelsey et al., 2001; Sommer et al., 2009) to the real world. To our knowledge, no prior studies have examined how narcissism influences hormonal activity in response to real-world, everyday

emotional distress, despite the presumptively greater relevance of naturally occurring physiological activity to long-term physical health.

To test our hypothesis, we aggregated the daily output of each biomarker and participants' reports of their daily negative emotions across a three-day period. We then tested whether the association between these two composite variables is moderated by narcissism. By aggregating biomarkers and emotions across three days, we were able to reliably model between-person variation in the secretion of stress biomarkers. Compared to single day, disaggregated analytic methods that focus on intraindividual variation and short-term oscillations, this between-person approach indexes more stable, aggregated patterns of hormone activity, and thus allows for more reliable and precise assessments of trait-like cortisol and alpha-amylase profiles that bear greater relevance to long-term disease outcomes than short-term acute changes (Pruessner et al., 1997). In addition, given evidence of gender differences in psychophysiological responses to stress (Kudielka & Kirschbaum, 2005), which requires that data from men and women be analyzed separately, we focused exclusively on women. Our decision to include participants of only one gender is not an uncommon approach in neuroendorcrinology research, as it maximizes statistical power.

Method

Participants and Procedure

Sixty-seven female undergraduates at the University of British Columbia participated in exchange for course credit (see Table 1 for sample descriptives).[1] The study began with an initial in-lab session during which participants completed personality questionnaires. This session was always held on a Monday or Tuesday so that all 3 consecutive days were weekdays, filled with normal daily routines, to facilitate adherence to the saliva sampling schedule. Over the course of

the next 3 days, participants provided saliva samples at approximately 1, 5, 9, and 13 hours after waking (4 samples each day). Specifically, participants were instructed to place a small cotton roll in their mouths for at least one minute and saturate it before depositing it into a sterile Salivette collection tube (Sarstedt; Nuembrecht, Germany). They were instructed to store Salivettes in a refrigerator before returning them to the lab 1-3 days after collection was completed. To enhance compliance, participants were sent text messages on their mobile phones, prompting saliva collection at the scheduled times, which were determined according to their pre-reported waking times. After the final saliva collection on each day, participants completed a questionnaire retrospectively assessing the extent to which they experienced negative emotions during that day. Participants were also asked to record the actual times at which they completed this measure, as well as each saliva-collection, by time-stamping the label on the salivette and the emotions questionnaire sheet using an electronic stamping device with an unalterable automatic date and time stamp feature.

Measures

Grandiose narcissism. During the initial in-lab session, participants completed the Narcissistic Personality Inventory (NPI; Raskin & Terry, 1988), a 40-item forced-choice measure of grandiose narcissism ($\alpha = .89$).

Reports of negative affect. On each of the three sampling days, immediately after providing their fourth saliva sample of the day (i.e., 13 hours after waking) participants indicated the extent to which they "felt this way today" for each of the 5 adjectives on Watson, Clark, and Tellegen's (1988) Positive and Negative Affect Schedule (PANAS) negative affect sub-scale (i.e., afraid, ashamed, scared, distressed, upset), on a scale ranging from 1 (*Not at all*) to 5 (*Extremely*; αs = .89, .86, and .78 for Days 1, 2, and 3, respectively). These daily negative affect

scores were subsequently aggregated to index participants' mean negative affect across the three days ($\alpha = .77$).

Salivary cortisol and alpha-amylase. Saliva samples were centrifuged at 800 × *g* for 5 minutes until a clear, low-viscosity supernatant emerged, and then transferred to deep-well plates and stored at -30°c until assayed. Salivary cortisol was measured in duplicate using a commercially available chemiluminescence assay (IBL; Hamburg, Germany). Salivary alpha-amylase was measured with a quantitative enzyme kinetic method (Strahler, Mueller, Rosenloecher, Kirschbaum, & Rohleder, 2010). The inter-and intra-assay coefficients of variation were 4.57% and 7.73% for cortisol, and 5.48% and 7.21% for alpha-amylase, respectively.

Covariates. Factors that might influence cortisol and alpha-amylase levels were assessed at the initial in-lab session and included in analyses as covariates: age, cigarette smoking, use of oral contraceptives, and body mass index (BMI) computed from self-reported height and weight.

Analytic Approach

Cortisol and alpha-amylase data were first log-transformed to reduce skew. Daily total cortisol and alpha-amylase output were then each calculated with an area-under-the-curve (AUC) statistic using the trapezoidal method. Values were modeled as a function of hours since waking for each participant, based on actual sample collection times recorded by the electronic stamp. AUC values were averaged across the three days for cortisol ($\alpha = .81$) and alpha-amylase ($\alpha = .93$), respectively. Cortisol AUC was not available for 5 participants and alpha-amylase AUC was not available for 2 participants, as a result of missed samples.

Data were subsequently analyzed using multiple regression analyses. Specifically, we estimated two models predicting variability in cortisol and alpha-amylase output from narcissism

and negative affect and their interaction term, controlling for potential confounders (i.e., age, smoking status [dummy coded], oral contraceptive use status [dummy coded], and BMI). All continuous variables (i.e., narcissism, negative affect, age, BMI) were centered prior to analyses.

Notably, we adopted an aggregation approach and tested our hypothesis at the between-person level, focusing on daily AUC aggregate levels, for several reasons. First, prior research indicates that stable and aggregated patterns of cortisol activity, as captured by the AUC, are most relevant for predicting long-term mental and physical health outcomes (e.g., Björntorp & Rosmond, 2006; Epel et al., 2000; Parker, Schatzberg, & Lyons, 2003; Yehuda, 2002). In contrast, short-term, acute fluctuations of hormones—as captured by intraindividual variation within a day—are less relevant to most diseases of public health concern (e.g., coronary heart disease, diabetes, cancer), which tend to develop over very lengthy periods (Kuh & Ben-Shlomo, 2004). Second, the aggregation approach allows for the most reliable and precise assessment of cortisol and alpha-amylase output, and is therefore recommended for studies examining the effects of personality traits on physiological stress responses (see Gunnar, 2001; Hellhammer, Fries, Schweisthal, Schlotz, Stone, & Hagemann, 2007; Pruessner, Gaab, Hellhammer, Lintz, Schommer, and Kirschbaum, 1997).

Results

Preliminary analyses showed that cortisol and alpha-amylase output were statistically independent ($r = .07$, $p = .53$). This finding is consistent with theoretical conceptions and prior research indicating that under quiescent (non-stress) conditions, levels of these two biomarkers tend to be uncorrelated (e.g., Nater & Rohleder, 2009; van Stegeren et al., 2008).

We next tested our main hypothesis by examining whether the association between negative affect and each of these two biomarkers differed for individuals high and low in

narcissism. Table 2 presents results from the two regression models. The predicted interaction emerged between narcissism and negative affect predicting cortisol output, $t(54) = 2.07$, $p = .04$; there were no overall main effects of narcissism, negative affect, or any of the control variables (though negative affect was marginally associated with increased cortisol output, $p = .06$). We next examined simple slopes to determine the nature of this interaction. As is shown in Figure 1a, among individuals low in narcissism (-1 *SD*), negative affect was unrelated to cortisol output, $b = -.56$, $\beta = -.14$, $t(54) = -.77$, $p = .45$. However, among those high in narcissism (+1 *SD*), negative affect was associated with greater cortisol output, $b = 2.58$, $\beta = .63$, $t(54) = 2.38$, $p = .02$, suggesting that narcissistic individuals showed greater cortisol output to the extent that they experienced negative emotions across the three days.

Turning to our other neuroendocrine marker of stress, alpha-amylase, we again found the predicted interaction between narcissism and negative affect, $t(57) = 2.98$, $p = .004$; again no main effects emerged, though there was a marginal relation between negative affect and greater amylase output, $p = .07$. Replicating the pattern found for cortisol output, among individuals low in narcissism (-1 *SD*) negative affect was not significantly related to amylase output, $b = -3.73$, $\beta = -.29$, $t(57) = -1.70$, $p = .09$ (though there was a negative trend), but among individuals high in narcissism (+1 *SD*), negative affect was associated with increased alpha-amylase, $b = 9.13$, $\beta = .72$, $t(57) = 3.07$, $p = .003$ (see Figure 1b).[2] Together, these results suggest that narcissistic individuals show a stronger neuroendocrine stress response to everyday experiences of negative affect. Importantly, this finding cannot be attributed to narcissists experiencing greater or more frequent distress, as there was no zero-order relation between narcissism and aggregated negative affect ($r = -.03$, $p = .74$).[3]

Discussion

The present research demonstrates that narcissists exhibit greater neuroendocrine reactivity when faced with everyday negative emotions. These individuals showed a significant increase in cortisol and alpha-amylase output to the extent that they reported experiencing negative emotions on the days these biomarkers were assessed. In contrast, we found no evidence of an association between these biomarkers and negative emotional experiences among individuals low in narcissism. The convergence of these results across cortisol and alpha-amylase—two conceptually and empirically independent biomarkers of stress (Nater & Rohleder, 2009; van Stegeren et al., 2006; van Stegeren et al., 2008)—provides an internal conceptual replication, allowing for greater confidence in the robustness of the findings. Given the presumed negative impact of long-term increases in HPA and SNS activity on psychiatric and physical illnesses (e.g., McEwen, 2007; Parker et al., 2003), the present findings are suggestive of a relation between narcissism and negative downstream health consequences; narcissists who frequently encounter psychological hardship may experience chronically exaggerated stress reactivity, which in turn could increase their vulnerability to certain mental and physical health problems.

The present findings also inform current debates about whether narcissism is, in general, an adaptive or maladaptive personality profile. As several authors have argued, narcissism may best be conceived of as a "mixed blessing" (Paulhus, 1998; Robins & Beer, 2001). On one hand, studies have shown that narcissism can provide a number of benefits, particularly in the short-term, such as leadership attainment, social popularity, mating success, and psychological well-being (Back, Schmukle, & Egloff, 2010; Brunell et al., 2008; Holtzman & Strube, 2010; Sedikides et al., 2004). On the other hand, narcissism has also been shown to have a range of

negative consequences, such as reduced happiness and success in both the long- and short-term (Paulhus, 1998; Robins & Beer, 2001). In line with prior studies demonstrating that narcissism is associated with increased affective, cardiovascular, and HPA reactivity to aversive stimuli in a controlled laboratory setting (Bushman & Baumeister, 1998; Edelstein et al., 2010; Kelsey et al., 2001; Konrath et al., 2006; Rhodewalt & Morf, 1998; Sommer et al., 2009; Twenge & Campbell, 2003), the current findings indicate that this pattern also occurs in response to naturalistic aversive circumstances. Together, these findings delineate one pathway through which narcissistic traits might influence long-term health outcomes; specifically, narcissism may be most problematic when individuals face events that evoke negative emotions.

Several subsidiary results emerging from the present research also warrant discussion. First, narcissism was not significantly associated with self-reports of daily negative affect. Although this result may appear to differ from Sedikides and colleagues' (2004) finding that narcissists tend to report lower daily sadness, it is consistent with results from Bogart, Benotsch, and Pavlovic (2004), and Robins and Beer (2001), both of whom did not observe any significant relation between narcissism and dispositional negative affect, as measured by the PANAS (the measure used in the present research). The divergence between these findings (and our own) and that of Sedikides and colleagues' (2004) may be due to the assessment of different constructs. Whereas the former set of studies assessed generalized negative affect—with items such as "afraid", "ashamed", "scared", "distressed", and "upset"—Sedikides and colleagues (2004) focused more specifically on sadness (measured with the items "sad", "gloomy", "depressed", "blue"). Together, these results may indicate that narcissists experience less everyday sadness, but not necessarily less generalized negative affect. Future studies should probe this issue by more directly examining links between narcissism and specific negative emotions.

Second, although the zero-order association between daily experiences of subjective negative affect and salivary cortisol or alpha-amylase did not reach conventional levels of statistical significance (but instead were both marginally significant), this pattern is consistent with prior work. Despite the assumption that these biomarkers track distress, studies have generally found mixed results regarding these associations. Specifically, null relations have been documented in prior studies investigating the link between self-reported negative emotions and biological markers of stress in naturalistic, non-laboratory-based settings (e.g., Kurina, Schneider, & Waite, 2004; Polk, Cohen, Doyle, Skoner, and Kirschbaum, 2005; Sherman et al., 2012), though several other studies have found a positive association between negative affect and cortisol concentrations (Buchanan, al'Absi, & Lovallo, 1999; Smyth, Ockenfels, Porter, Kirschbaum, Hellhammer, & Stone, 1998). Paralleling these mixed results, studies assessing the link between perceived stress and salivary cortisol have produced inconsistent patterns, including numerous null correlations (e.g., al'Absi et al., 1997; Cohen et al., 2000; Kurina et al., 2004; Oswald, Mathena, & Wand, 2004; Reinhard et al., 2012). These mixed findings are thought to result from the complex interplay of neurobiological events that link subjective experiences to HPA axis activation, the moderating influences of genetics and lifestyle, other metabolic drivers of these systems' activity, and methodological issues related to their measurement (see Hellhammer et al., 2009 for a discussion); these issues likely account for the marginal relations observed in the present research.

There are several limitations of the present research, which should be addressed in future work. First, future studies are needed to test whether the current results extend to men. This issue is particularly important given the limited, and mixed, prior research concerning the effects of narcissism on physiology. While two studies reported greater stress-related physiology in both

narcissistic men *and* women (Reinhard et al., 2012; Sommer et al., 2009), Edelstein and colleagues (2010) found that narcissistic men, but not women, exhibited greater cortisol reactivity following a laboratory stressor. Given likely gender differences in cortisol responsivity, future work should directly examine the long-term physical health implications of narcissism on both men and women.

Second, future research should test whether the between-person effects found here also characterize intraindividual variation in emotions and biomarkers. The present research was not designed to test the hypothesis at a within-person level (i.e., whether the relation between emotional distress and cortisol or alpha-amylase production at the *intraindividual* level is moderated by narcissism). Although we assessed emotions and biomarkers repeatedly over a period of three days, only two lagged cortisol and alpha-amylase AUC values were available for each participant (i.e., Day 1 emotions predicting Day 2 biomarker output, and Day 2 emotions predicting Day 3 biomarker output). This resulted in a substantial reduction of statistical power, potentially leading to biased parameter estimates. Future research is thus needed to examine whether the effects found here at the between-person level also occur at a within-person level, using the necessary large-scale designs (e.g., by measuring biomarkers over multiple days in a sample sufficiently large to obtain satisfactory statistical power).

In sum, the present research suggests that narcissism may have a negative impact on hardiness and health, by virtue of promoting an exaggerated neuroendocrine stress response during times of emotional hardship. More broadly, these findings underscore the utility of assessing biological indicators of stress reactivity in naturalistic settings as a way of investigating the health implications of narcissistic personality traits.

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513 *Table 1*. Descriptive Information.

	%	*M*	*SD*
Age		20.60	3.53
Ethnicity			
Asian	58		
Caucasian	28		
Other	14		
Smoking status	7		
Oral contraceptive use	19		
Body mass index (BMI)		21.18	3.06
Narcissism (mean NPI score)		14.30	7.29
Mean daily negative emotions (PANAS negative affect across 3 days)		1.72	.65
Cortisol[a]		9.60 nmol/L	2.57
Alpha-amylase[a]		19.27 U/mL	7.57

514 [a] Mean cortisol and alpha-amylase values refer to the log-transformed daily average area under
515 the curve (AUC) averaged across three days of the study.

516 *Table 2.* Multiple Regression Models Predicting Cortisol and Alpha-Amylase Output

	Cortisol			Alpha-Amylase		
Predictor	*b* (*SE*)	β (*SE*)	*t*	*b* (*SE*)	β (*SE*)	*t*
Narcissism	.05 (.05)	.14 (.16)	.92	.10 (.14)	.10 (.14)	.74
Negative affect	1.01 (.53)	.25 (.13)	1.89†	2.70 (1.48)	.21 (.12)	1.83†
Age	.05 (.09)	.06 (.12)	.52	-.34 (.26)	-.14 (.11)	-1.31
Smoking status	1.87 (1.53)	.74 (.60)	1.22	7.24 (4.39)	.92 (.56)	1.65
Oral contraceptive use status	1.04 (.83)	.41 (.33)	1.25	-2.07 (2.31)	-.26 (.29)	-.89
Body mass index (BMI)	.02 (.11)	.02 (.13)	.15	.20 (.29)	.08 (.12)	.67
Narcissism × negative affect	.20 (.09)	.38 (.18)	2.07*	.81 (.27)	.51 (.17)	2.98**

517 † $p < .10$ * $p < .05$ ** $p < .01$

518 *Note.* Smoking status and oral contraceptive use status are each dummy variables coded "0" for

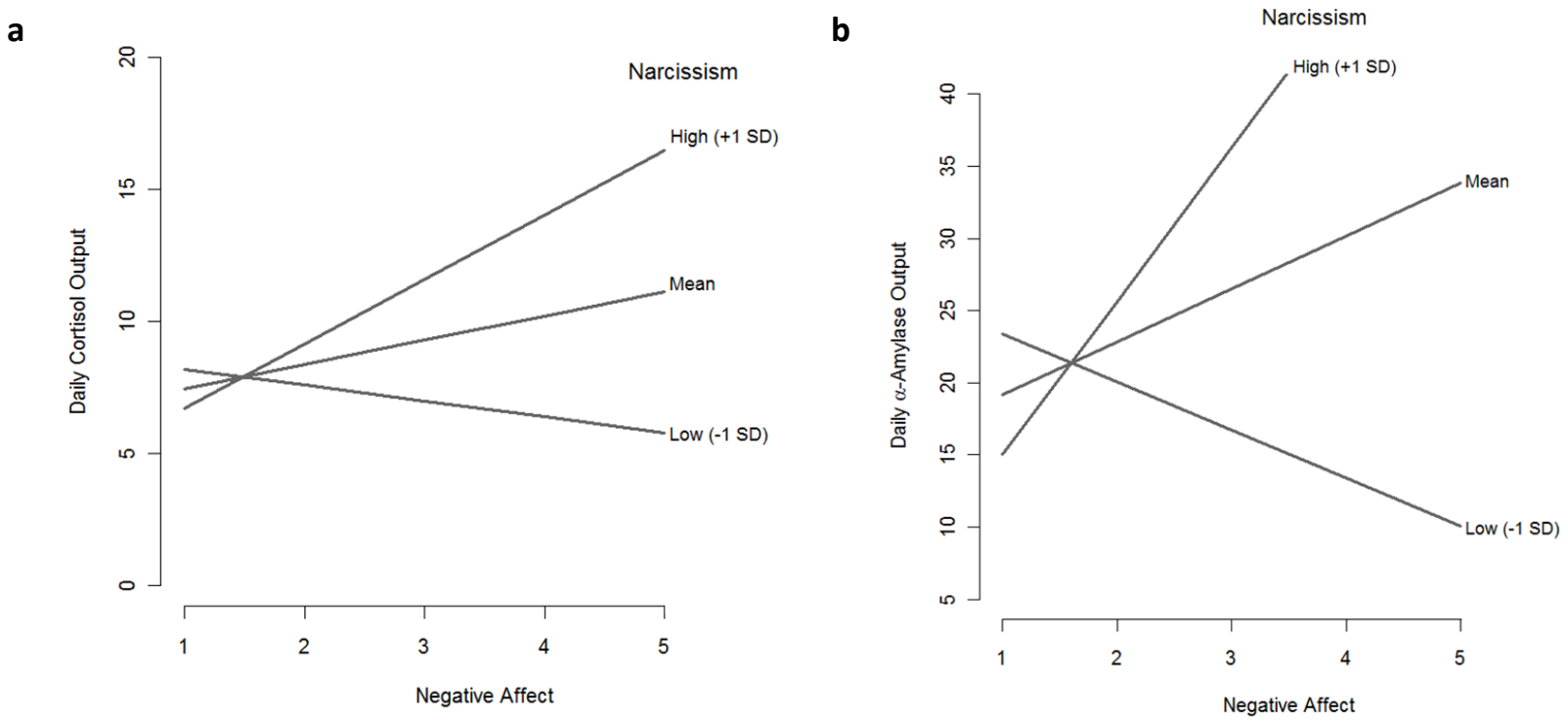
519 "no" and "1" for "yes".

520

Figure Captions

Figure 1. Simple slopes depicting the relation between negative affect and diurnal output of each biomarker of stress at different levels of narcissism, displayed separately for (a) cortisol, and (b) alpha-amylase. Combined, the significant interactive effects of negative affect and narcissism in predicting cortisol secretion ($p = .04$) and alpha-amylase secretion ($p = .004$) reveal that narcissistic individuals show increased cortisol and alpha-amylase output when they experience higher levels of negative affect; in contrast, levels on both biomarkers remain stable across different levels of negative affect among individuals who score lower on narcissism.

Figure 1.


a
Narcissism
High (+1 SD)
Mean
Low (-1 SD)
Daily Cortisol Output
0
5
10
15
20
1
2
3
4
5
Negative Affect
b
Narcissism
High (+1 SD)
Mean
Low (-1 SD)
Daily α-Amylase Output
5
10
15
20
25
30
35
40
1
2
3
4
5
Negative Affect

[1] These data were collected as part of a larger project examining associations between personality traits, daily emotions, and cortisol and alpha-amylase profiles. Other variables measured as part of this larger effort include the Big Five personality traits, social status, depression, and daily experiences of positive affect and pride.

[2] Subsidiary analyses were conducted to examine whether the effects found here might be attributable to specific NPI subscales—Leadership/Authority, Self-Absorption/Self-Admiration, Superiority/Arrogance, and Exploitativeness/Entitlement (Emmons, 1984). Results indicated that no single subscale consistently moderated the relation between negative emotions and both biomarkers, suggesting that the interactive effects found between narcissism and negative affect in predicting each biomarker are not driven by any one subscale alone, but rather by the emergent composite of all narcissism facets.

[3] Prior research has shown that the effect of narcissism on psychological well-being is largely a function of higher levels of self-esteem among narcissistic individuals (Sedikides et al., 2004), raising the possibility that the present findings are driven by self-esteem. To address this possibility, we conducted follow-up analyses in which we included self-esteem as a covariate in both regression models. Results indicated that the interactive effects between narcissism and negative emotions predicting both cortisol and alpha-amylase output remained significant and qualitatively identical to that reported in the main text even after controlling for self-esteem [cortisol output: $b = .19$, $\beta = .38$, $t(53) = 2.03$, $p < .05$; alpha-amylase output: $b = .86$, $\beta = .54$, $t(56) = 3.36$, $p < .01$]. More importantly, as was found in the models reported in the main text, among individuals low in narcissism (-1 *SD*), negative affect was related to neither cortisol [$b = -.64$, $\beta = -.16$, $t(53) = -.85$, $p = .40$] nor alpha-amylase output [$b = -2.98$, $\beta = -.23$, $t(56) = -1.43$, $p = .16$], when self-esteem was controlled for; whereas for those high in narcissism (+1 *SD*), negative affect was significantly associated with increased cortisol [$b = 2.45$, $\beta = .60$, $t(53) = 2.20$, $p = .03$] and alpha-amylase output [$b = 10.75$, $\beta = .85$, $t(56) = 3.75$, $p < .001$], when self-esteem was controlled for. Additional analyses testing whether the same interactive effects would emerge if self-esteem was substituted for narcissism (and narcissism removed entirely from the models) showed no significant interaction between self-esteem and negative emotions predicting either biomarker, ps > .15. Together, these follow-up analyses indicate that the present results are likely unique to narcissism, and do not reflect conceptual overlap with self-esteem.