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Female students' personality and stress response to an academic examination

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Female students' personality and stress response to an academic examination

Background: Women are vulnerable to stress-related disorders. Examinations are a source of stress, triggering emotional, cognitive, and hormonal responses. We examined women's psychological and hormonal stress responses and academic performance according to personality during a real-life examination.

Methods: Female students (*N* = 66) were divided into two groups based on hierarchical cluster analysis: one cluster characterized by high neuroticism and moderate extraversion (HN-ME; n=42) and the other by low neuroticism and high extraversion (LN-HE; n=24). Academic performance, perceived stress, and emotional dysregulation were analyzed. State anxiety, affect, and cortisol release were measured before and on the examination day.

Results: The HN-ME cluster was high in perceived stress, emotional dysregulation, and negative affect. This cluster also had higher state anxiety levels two days before and shortly after the examination compared to the LN-HE cluster. Students' cortisol levels were higher on the examination day, and there was a marginal significance of the Cluster factor in the cortisol release regardless of the day of measurement.

Conclusions: Women with high neuroticism and moderate extraversion may be more vulnerable to psychological stress in academic settings but similar to other women in their cortisol response.

Keywords: women; academic performance; neuroticism; psychological response; cortisol

Introduction

The personality traits neuroticism and extraversion may have an impact on stress-induced psychobiological reactions (e.g., Evans et al., 2016). Researchers have found that the association between neuroticism and vulnerability to mental health problems occurs more specifically in women (Goodwin & Gotlib, 2004). Studying the personality factors that influence women's psychobiological response to stress is relevant as they are associated with the manifestation of various mental disorders.

Psychological distress, academic performance, and scores on neuroticism and extraversion

Neuroticism is related to the tendency to experience negative emotions and respond to them adversely (Barlow et al., 2013). Individuals high in extraversion feel more positive emotions, need more activity and stimulation, and are more likely to seek social activities (Costa & McCrae, 1992). High neuroticism and low extraversion have been proposed as biological vulnerability factors for the etiology and maintenance of anxiety and depressive disorders (Barlow et al., 2013). This association seems to be stronger in clinical samples and women (Ripper et al., 2018). Research has also shown a relationship between neuroticism and vulnerability to stress and mental health disorders in non-clinical samples of women. For example, among Spanish female students, those with high levels of neuroticism tend to exhibit a higher prevalence of depression (Blanco et al., 2021).

The relationship of neuroticism and extraversion with academic achievement has been examined, considering each trait separately. The research findings show correlations with small effect sizes or even null relationships, especially for neuroticism (Trapmann et al., 2007; Zell & Lesick, 2022). Extraversion might facilitate academic success, particularly when social skills contribute more than intellectual skills (Wilmot et al., 2019).

Academic examination stress, cortisol response, and their relationships with neuroticism and extraversion

An academic examination is one of the most investigated natural stressors (González-Cabrera et al., 2014; Minkley et al., 2014; Ringeisen et al., 2019), with varying effects on salivary cortisol release. Although some studies reported an increase in salivary cortisol levels shortly before an examination (González-Cabrera et al., 2014; Ringeisen et al., 2019), others showed either no change or even a decreased cortisol release (Glaser et al., 1994; Takatsuji et al., 2008; Vedhara et al., 2000). These discrepancies may be due to individual differences in personality traits (Martinek et al., 2003) or sex (Spangler, 1997; Weekes et al., 2006), among other factors.

Research on the relationship between cortisol response to stressful events and the personality traits neuroticism and extraversion in non-clinical samples has reported inconsistent results. The lack of consistent evidence of an association between neuroticism and cortisol release (for a review, see Ormel et al., 2013) has been attributed to various factors, including the nature of the stressful event (i.e., laboratory or naturalistic stressor) or the participants' sex (Bibbey et al., 2013; Oswald et al., 2006; Weekes et al., 2006; Wirtz et al., 2007). Concerning the associations between extraversion and cortisol response to stress, most studies have shown no significant findings in middle-aged (Bibbey et al., 2013; Wirtz et al., 2007) and young adults (Poppelaars et al., 2019) or a negative correlation in young adults (Evans et al., 2016). Additionally, gender-specific effects were observed, with the association being non-significant in women but positive in men (Oswald et al., 2006). The disparate results in the literature might be attributed to individual differences in coping with interpersonal threats (Luo et al., 2023).

The importance of studying academic examination stress in women

Men and women experience and respond to academic stress in parallel but also divergent ways. Some studies have reported that women secrete less cortisol than men in academic examinations (Spangler, 1997; Weekes et al., 2006), whereas another study found no differences (Schoofs et al., 2008).

Although there is still important work pending on men's response to a real-life academic stressor, in this first study, we focused on women for the following reasons: (i) women are more vulnerable to stress-related disorders than men (Nolen-Hoeksema, 2012); (ii) in Spain, a substantial proportion of women are enrolled in universities, especially in disciplines like health and social sciences (Gómez Marcos et al., 2019; Varela-Mato et al., 2012); and (iii) little is known about the role of personality in women's psychobiological response to non-oral examination stress. Most of the literature analyzed these aspects separately and or did not disaggregate by sex (Paulus et al., 2016; Ringeisen et al., 2019). To our knowledge, no study has analyzed women's perceived stress, emotion regulation, affect, anxiety, cortisol release, and academic performance during a real-life examination as a function of their personality traits. This information is crucial for designing interventions to mitigate stress-related effects on examination performance, enhance women's psychological well-being, and improve academic results.

Research aims and hypotheses

This study investigated women's psychological and hormonal stress responses and academic performance as a function of their personality during a real examination at a university. To this end, a post-hoc exploratory analysis was conducted, and the sample was divided into two groups based on a hierarchical cluster analysis: one cluster characterized by high neuroticism and moderate extraversion (cluster HN-ME) and the other cluster characterized by low neuroticism and high extraversion (cluster LN-HE). To assess the psychobiological response to examination stress, state anxiety, affect, and salivary cortisol were measured in a session with no stressor and during a final university examination. Perceived stress and difficulties in emotion regulation were also assessed. Academic performance was calculated as the participant's success in the stressful task (i.e., examination grade) and the academic year (i.e., credits acquired).

Firstly, both groups' dependent variables were compared. We hypothesized that the women of cluster HN-ME would report higher anxiety levels, more negative affect, perceived stress, and emotional dysregulation than those of cluster LN-HE. However, we hypothesized that the academic performance would be similar in both women's clusters. We could not formulate any hypothesis concerning the comparison of the cortisol levels due to the inconclusive results in this regard.

Secondly, the effect of the cluster (HN-ME vs. LN-HE) on the anxiety, affect, and cortisol response to the stressor was studied separately at different time points. We hypothesized that negative emotions would be elevated on the examination day among women with higher neuroticism scores (Barlow et al., 2013). Due to the heterogeneity of previous findings, we abstained from formulating clear hypotheses regarding the conjoint effect of both traits on hormonal stress responses.

Method

Participants

A convenience sample of 108 women were invited to participate in the study. All were students from the first year of the Psychology Degree at the University of

Zaragoza who were taking the subject Basic Biology I. Sixty-nine of them agreed to participate. Three women were excluded from the final sample because they did not meet the eligibility criteria. Hence, the final sample comprised 66 women aged 18 to 25 (M = 18.64, SD = 1.19). They had not been diagnosed with any endocrine, neurological, or psychiatric disorder, nor had they been treated with any medication related to these disorders. They were instructed not to consume alcohol or engage in intense physical activity the day before each of the two study sessions. The characteristics of the sample are described in S1.1 of the Supplemental File.

After recruitment and on Day 1 (see Figure 1), participants completed several questionnaires, including the NEO-FFI, which assesses personality factors and is described in the Questionnaires section. A hierarchical cluster analysis was performed to detect and classify patterns of participants' personality traits. The cluster analysis yielded two cluster solutions: one cluster characterized by high neuroticism and moderate extraversion (cluster HN-ME), comprising 42 (63.6%) participants, and one cluster characterized by low neuroticism and high extraversion (cluster LN-HE), comprising 24 (36.4%) participants. S1.2 of the supplemental file shows the cluster analysis results as a dendrogram, and S1.3 shows the scree plot of coefficients by stage for the clusters.

The proportion of women in each phase of the menstrual cycle was equally distributed in the entire sample and each cluster. The menstrual cycle phases did not affect cortisol levels (see S1.4 of the Supplemental File). The menstrual cycle phase was not included as a variable in the main analyses for this reason.

Procedure

Following Hidalgo et al. (2015), participants were instructed a few days in advance about their habits the day before and in the hours before each session.

Specifically, the instructions were not to take any stimulating substances, to drink only water two hours before each session, and not to brush their teeth at least one hour before the beginning of each session.

Participants attended two joint sessions, with two days between them, on the university campus: one without a stressor (Day 1) and one with a stressor (Day 2). Both sessions were held between 11:00 and 12:15 and lasted no more than 100 minutes. Before taking part, participants received individual information about the aim of the study and signed an informed consent form. This study was conducted following the Declaration of Helsinki and was approved by the Ethics Committee of Aragon (CEICA, PI20/074).

Session without stressor

The session without a stressor took place on the first day of the study (see Figure 1, Day 1). In this session, participants completed a general questionnaire, which included sociodemographic, psychological, and daily habits measurements, among others. Participants also completed several self-assessment questionnaires (STAI-S, PANAS, PSS-14, NEO-FFI, and DERS), which are described in the Questionnaires section. Figure 1 shows the order of administration of the questionnaires. While participants were completing the State Anxiety Scale of the State-Trait Anxiety Inventory (STAI-S Pre-, S1) and the Positive and Negative Affect Schedule (PANAS), we collected a saliva sample to measure cortisol (C1). Seventy-five minutes later, we collected a second saliva sample (C2).

Session with stressor

The session with a stressor, the examination, took place on the second day of the study (see Figure 1, Day 2). Firstly, participants completed pre-task STAI-S (S2) and PANAS. The final examination of the subject of Basic Biology I was used as an ecological stressor. It was the first final university examination for 95.45% of the participants. After the examination, they completed the post-task STAI-S (S3). We collected two saliva samples to measure cortisol: before (C3) and immediately after the examination (C4). The timing of the saliva samples and the phase duration were the same in both sessions.

Insert Figure 1 near here

Questionnaires

Psychological response

Anxiety. Participants completed the Spanish version (Guillén-Riquelme & Buela-Casal, 2011) of the State Anxiety Scale of the State-Trait Anxiety Inventory (STAI-S; Spielberger et al., 1970). This 20-item questionnaire assesses anxiety as an emotional state. Items were rated on a 3-point Likert scale ranging from 0 (*not at all*) to 3 (*extremely*) to determine how participants felt at that moment. Cronbach's alpha values ranged from .87 to .89 in this study.

Affect. Participants' affect was evaluated by the Spanish version (Sandín et al., 1999) of the Positive and Negative Affect Schedule (PANAS; Watson et al., 1988). This questionnaire comprises 20 items based on two dimensions: positive affect and negative affect with 10 items per dimension. Subjects responded on a 5-point Likert scale ranging from 1 (*not at all*) to 5 (*extremely*), considering their mood at that moment. In this study, Cronbach's alpha values ranged from .77 to .84 for Positive Affect, and from .84 to .87 for Negative Affect.

Perceived stress. Participants completed the Spanish version (Remor, 2006) of the Perceived Stress Scale (PSS-14; Cohen et al., 1983). This 14-item scale evaluates the degree of perceived stress during the last month. Participants responded using a 4-point Likert scale ranging from 0 (*never*) to 4 (*very often*). This study obtained a Cronbach's alpha of .78.

Personality. Participants were assessed on five personality dimensions using the Spanish version (Manga et al., 2004) of the NEO Five-Factor Inventory (NEO-FFI; Costa & McCrae, 1992). This instrument comprises 60 items rating the "big five" personality factors, but only the 24 items related to the Neuroticism and Extraversion subscales (12 items for each scale) were administered in this study. Participants rated self-report questions on a 5-point Likert scale ranging from 0 (*strongly disagree*) to 4 (*strongly agree*). Both subscales had good internal consistency in this study, with a Cronbach's alpha of .80 and .81, respectively.

Emotion regulation. Participants' emotion-regulation troubles were assessed using the Spanish version (Hervás & Jódar, 2008) of the Difficulties in Emotion Regulation Scale (DERS; Gratz & Roemer, 2004). The measure includes a list of 28 items presenting five dimensions of emotion regulation. Participants responded on a 5-point Likert scale ranging from 1 (*almost never*) to 5 (*almost always*) to reflect the frequency of the behavior described in each item. This scale obtained a Cronbach's alpha of .93.

Academic performance

Examination. The examination comprised 50 multiple-choice questions and had a time limit of 75 minutes for completion. This examination was used as an ecological stressor. The final score in the examination, from 0 (*worst performance*) to 10 (*best performance*), was considered a measure of success in the stressful academic task.

European Credit Transfer and Accumulation System (ECTS) credits obtained. We considered the number of ECTS achieved at the end of the academic year as a long-term measure of the participants' academic success (Jiménez García et al., 2021; Năstasă et al., 2022). The value was obtained nine months after performing the examination session.

Biochemical analyses

Participants provided four saliva samples to assess cortisol concentrations (see Figure 1). Each participant deposited 5 ml of saliva in a plastic vial through passive drooling. The samples were frozen at -20°C, and the biochemical analyses were then performed in the Laboratory of Social Cognitive Neuroscience (University of Valencia) using Salimetrics Cortisol Enzyme Immunoassay kits (Salimetrics, State College, PA, USA). Assay sensitivity was 0.007 µg /dl. All four samples from each participant were analyzed using the same kit and in duplicate. Intra- and inter-assay coefficients of variations were all below 10%.

Statistical analyses

To determine possible subgroups according to the Neuroticism and Extraversion scores, a hierarchical cluster analysis was performed using Ward's linkage method with squared Euclidean distances. Also, a solution was selected based on the dendogram (see S1.2 of the Supplemental File) and the scree plot of coefficients by stage for clusters (see S1.3 of the Supplemental File) and agglomeration schedule.

Student's *t*-test for independent samples was used to analyze the differences between the clusters on perceived stress, difficulties in emotion regulation, and academic performance (i.e., examination grade and ECTS credits achieved).

The psychobiological response was studied, analyzing anxiety, affect, and cortisol responses separately with mixed-design ANOVAs. Cluster (HN-ME vs. LN-HE) was included as a between-subject factor, and Time (for Anxiety: Day 1, pre- and post-examination on Day 2; for Affect: Day 1 and Day 2) was included as a within-subject factor. Cluster as a between-subject factor, and Session (Day 1 and Day 2) and Time (pre- and post-examination) were included as within-subject factors in the ANOVA performed on cortisol levels. Cortisol values were logarithmically transformed, as they did not have a normal distribution according to the Kolmogorov-Smirnov and Levene tests.

The level of significance was < .05. There was one missing value (1.5 %) in the C1 variable because its concentrations were not detected by the assay kit. There were four missing values (6.0 %) in the ECTS achieved variable because 4 students did not provide this datum. These missing values were coded as empty cells in the database. Statistical analyses were performed with SPSS 25.0 for Mac (SPSS Inc., Chicago, IL, USA).

A priori power analyses with GPower 3.1.9.7 (Faul et al., 2007) were calculated to detect medium effects (d = .6) with a power of .95. The choice of the effect size for these calculations was based on the study of Weekes et al. (2006) and was established according to the main statistical hypothesis of the study: the cortisol response to the stressor. A sample size of 36 would be needed to detect medium effects in repeated-measures ANOVA and within-between interactions (two within-subject factors with two levels each: Session and Time; and one between-subject factor: cluster HN-ME vs. LN-HE). A priori power analysis also showed that a sample size of 138 would be needed to detect medium effects with *t*-tests for independent samples and an unbalanced sample ratio of 2:1 and a one-tailed test. That is, 92 participants would be required in cluster HN-ME, and 46 participants would be needed in cluster LN-HE.

Results

Differences between clusters in perceived stress, emotion regulation, and academic performance

Table 1 shows the mean and standard deviation of the scores for the variables perceived stress, emotion regulation, and academic performance. The participants in Cluster HN-ME showed higher perceived stress, $t(64) = 5.081$, $p < .001$, and more difficulties in emotion regulation, $t(64) = 3.752$, $p < .001$, than their counterparts in Cluster LN-HE, but the participants in both clusters exhibited a similar academic performance (i.e., examination grades, $t[64] = .580$, $p = .564$, and number of *ECTS* credits achieved, $t[60] = -.064$, $p = .949$).

Insert Table 1 near here

Psychobiological response

Table 2 shows the mean and standard deviation of the study variables at different time points.

Insert Table 2 near here

State anxiety

Results showed a main effect of time, $F(2, 64) = 70.682$, $p < .001$, $\eta^2 = .525$, and cluster, $F(1, 64) = 12.389$, $p = .001$, $\eta^2 = .162$, and a Time × Cluster interaction, $F(2, 64) = 3.638$, $p = .029$, $\eta^2 = .054$. Participants reported higher anxiety levels in S2 ($p < .001$) and S3 ($p = .042$) than in S1. Participants in cluster HN-ME had higher anxiety levels than those in cluster LN-HE, both in S1 ($p < .001$) and S3 ($p = .044$). In addition, higher pre-examination levels of state anxiety (S2) in comparison with the remaining measures (S1 and S3, both *p*s $< .001$) were found in the participants of both clusters. Finally, participants in Cluster HN-ME showed similar levels in S1 and S3 ($p > 0.99$), but this comparison was significant in Cluster LN-HE, with higher levels in S3 than in S1 ($p = .025$) (Figure 2A).

Positive affect

Results showed a main effect of time, $F(1, 64) = 20.413$, $p < .001$, $\eta^2 = .242$. The levels of positive affect were higher on the first day than on the second day ($p < .001$). However, cluster, $F(1, 64) = 2.918$, $p = .092$, and the Time × Cluster interaction, $F(1, 64) = 3.346$, $p = .072$, were not significant.

Negative affect

Results showed a main effect of time, $F(1, 64) = 79.458$, $p < .001$, $\eta^2 = .554$, and cluster, $F(1, 64) = 11.422$, $p = .001$, $\eta^2 = .151$. Thus, levels of negative affect were higher before the examination (pre-examination on Day 2) than on Day 1 ($p < .001$). Cluster HN-ME showed higher levels of negative affect than Cluster LN-HE ($p = .001$). Nevertheless, the Time × Cluster interaction was not significant, $F(1, 64) = 10.394$, $p = .569$.

Cortisol response

The repeated-measures ANOVA showed a main effect of session, $F(1, 63) = 10.825$, $p < .002$, $\eta^2 = .15$, and time, $F(1, 63) = 137.495$, $p < .001$, $\eta^2 = .69$. However, the factor cluster was marginally significant, $F(1, 63) = 3.896$, $p = .053$. Consequently, participants showed higher cortisol levels on the day of the examination (Day 2) than on Day 1 ($p = .002$). Also, participants showed higher cortisol levels in the pre-examination time (C1 and C3) than in the post-examination time (C2 and C4, both $p <$

.001), but there was no Session × Time interaction, $F(1, 63) = 1.127$, $p = .723$ (Figure 2B).

Insert Figure 2 near here

Discussion

We investigated women's psychobiological response to an academic stressor and performance as a function of their scores on neuroticism and extraversion. Feelings of state anxiety and negative affect, and levels of cortisol were higher on the examination day compared with two days before. These results confirmed that the academic examination was an effective stressor (Ringeisen et al., 2019; Verschoor & Markus, 2011).

The two clusters differed in their psychological scores, with higher scores in the Cluster HN-ME except for positive affect, in which scores were lower. The women in Cluster HN-ME showed slightly higher mean values, but within the range of variability, than the mean values found in other studies using non-clinical samples of women and measuring negative affect (Sandín et al., 1999), state anxiety (Guillén-Riquelme & Buela-Casal, 2011), perceived stress (Andreou et al., 2011), and emotional dysregulation (Hervás & Jódar, 2008). The means of positive and negative affect were closer to those obtained in clinical samples (Osma et al., 2021). In fact, women in this cluster reported higher levels of perceived stress during the last month, an expected result in participants with high scores in neuroticism (Gunthert et al., 1999). Therefore, Cluster HN-ME could be considered a vulnerable group, and Cluster LN-HE a non-vulnerable group.

Personality and psychological response

The scores in positive affect decreased on the examination day, and the scores in negative affect increased after the examination. These findings support previous research showing participants' lower self-reported positive and higher self-reported negative affect in stressful situations (Schneider, 2004).

Regarding state anxiety, both groups showed a similar pattern: the students had lower levels on the first day, reaching the highest level immediately before the examination, and showing a subsequent decrease in anxiety after the examination (see Figure 2A). Similar results were shown in another study using a female sample (Soric, 1999).

The results reveal differential responses to the stressor based on personality traits. The state-anxiety response was significantly higher in the vulnerable group than in the non-vulnerable group on both days. This could be attributed to a relation between neuroticism and increased levels of state anxiety, even when no stressing event is present, as previously reported in a sample of men (Borella et al., 1999). However, the baseline levels of state anxiety were measured two days before the examination, so an anticipated response to the stressful situation cannot be ruled out. As previously described by Muris et al. (2005), participants with high neuroticism may have ruminative thoughts about their academic performance. After the examination, the vulnerable group maintained high anxiety levels, which could be related to their emotion dysregulation (Paulus et al., 2016). Interestingly, both the vulnerable and the non-vulnerable groups reached similar anxiety levels shortly before the beginning of the examination. State anxiety interferes with academic examinations by consuming part of the processing capacity (Eysenck et al., 2007). Therefore, similar state anxiety levels in both groups shortly before the examination may explain their similar grades.

Personality and hormonal response

Regarding the physiological response, our results align with previous research finding higher cortisol levels on the examination day compared with two days before the examination (Ringeisen et al., 2019; Spangler et al., 2002). The fluctuation of cortisol levels on the examination day revealed low levels after the examination, but there was a similar fluctuation of these levels on the day without the stressor. This result precludes attributing the fluctuation of cortisol levels to an anticipatory response associated with the stressor, but rather to a global effect of the stressor on cortisol levels (Helbig & Backhaus, 2017; Ringeisen et al., 2019). No difference was found concerning temporal cortisol changes at different time points when the vulnerable and non-vulnerable groups were compared. The cortisol levels were generally higher in the vulnerable group than in the non-vulnerable group, but the difference between the levels of the two groups was only marginally significant. We cannot disregard the possibility that this difference would reach significance with a larger sample of participants, given that the number of participants was insufficient according to the a priori power analyses. Most research has not reported an impact of extraversion on cortisol release after acute laboratory stressors (Bibbey et al., 2013; Poppelaars et al., 2019). In addition, the extraversion scores in the two groups of our study varied to a lesser extent than the neuroticism scores. Therefore, a plausible hypothesis is that these results might be due to the high levels of neuroticism in the vulnerable group. To our knowledge, only one study has analyzed the impact of neuroticism on cortisol release during an academic examination (Verschoor & Markus, 2011). In concordance with our results, the authors found higher salivary cortisol on examination day compared to the control day and no significant effect of neuroticism on cortisol concentrations, but the specific p-value of the test was not provided (Verschoor & Markus, 2011). The groups of this study consisted of participants of both sexes and included a larger sample of individuals with low scores in neuroticism.

Personality and changes in anxiety and cortisol in an examination context

Our data reveal a consistent pattern of anxiety and cortisol responses, replicating prior research with pre-examination increases and post-examination decreases (Ringeisen et al., 2019) (see Figure 2). Differences between the clusters in state anxiety occurred on the first day and after the examination, but there were no group differences in the cortisol response at these time points. The vulnerable group exhibited an exacerbated anticipatory psychological response two days before the examination. Psychological and physiological reactions are only related in a quarter of the studies (Campbell & Ehlert, 2012), as these responses are mediated by different cognitive processes (Ringeisen et al., 2019). Research suggests that state anxiety is related to anticipatory processes of future events, appraising their consequences and how to respond to them (Duan et al., 2015; Wynn et al., 2010). In both groups, anticipatory cortisol release peaked shortly before the examination (Helbig & Backhaus, 2017; Merz et al., 2019; Ringeisen et al., 2019) and was associated with the reactive cortisol response (see S1.5 of the Supplemental File).

Strengths and limitations

This is the first study investigating women's academic performance, perceived stress, emotion regulation, and psychological and hormonal response during real examinations without a social-evaluative component, considering their neuroticism and extraversion traits. We used a female sample, primarily because women are more vulnerable to stress-related disorders. We used a naturalistic stressor—the first examination in a degree course—powerful and capable of triggering psychological and physiological changes.

Despite its strengths, the study also has some limitations. First, the composition and representativeness of our sample limit the generalizability of the results, excluding extrapolation to both male and female students from diverse university backgrounds. An increase in sample size is recommended for direct comparisons between the clusters (see the final paragraph of the Statistical analyses section, which states 92 women in Cluster HN-ME and 46 women in Cluster LN-HN), but this was a post-hoc exploratory study with no prespecified subgroups in terms of neuroticism and extraversion scores. Also, it was conducted in a real-life setting, so the potential number of volunteers and their personality traits were limited to those of the students enrolled in the same course. Second, although the phase of the menstrual cycle did not affect the cortisol levels of the participants, our study did not specifically include the menstrual cycle phase as an independent variable, and participant recruitment did not ensure sufficient representation of each phase to assess its impact on cortisol levels. Third, it would have been desirable to include an additional measure of long-term academic success based on the grades obtained by the students and not only on their number of ECTS achieved. Finally, future studies should measure all the Big Five personality traits, offering a richer understanding of their relationship with academic performance and other relevant variables.

Conclusion

Our results reveal higher stress vulnerability, at a psychological level, in women with high levels of neuroticism and moderate extroversion, even when their psychological response to stress does not interfere with academic performance. This is important from a preventive perspective because we can implement low-intensity psychological preventative interventions based on emotion-regulation training before women start experiencing emotional symptoms or disorders, difficulties in emotion regulation, and low academic achievement.

Disclosure statement

The authors report no conflicts of interest

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Table 1

Mean (M) and Standard Deviation (SD) of the Scores for the Variables: Perceived Stress, Emotion Regulation, and Academic Performance

	Entire sample (N = 66)	Cluster HN-ME (n = 42)	Cluster LN-HE (n = 24)
	M (SD)	*M (SD)*	*M (SD)*
Perceived stress	28.39 (6.42)	30.98 (5.91)	23.88 (4.55)
D. Emotion Reg.	62.41 (17.78)	68.07 (17.66)	52.50 (13.25)
Examination	5.36 (1.72)	5.44 (2.02)	5.21 (1.90)
ECTS	62.39 (12.68)	62.31 (11.48)	62.52 (14.77)

Note. D. Emotion Reg. = Difficulties in Emotion Regulation; Examination = Examination grade; ECTS = number of European Credit Transfer and Accumulation System credits achieved at the end of the academic year; HN-ME = high neuroticism and moderate extraversion; LN-HE = low neuroticism and high extraversion.

Table 2

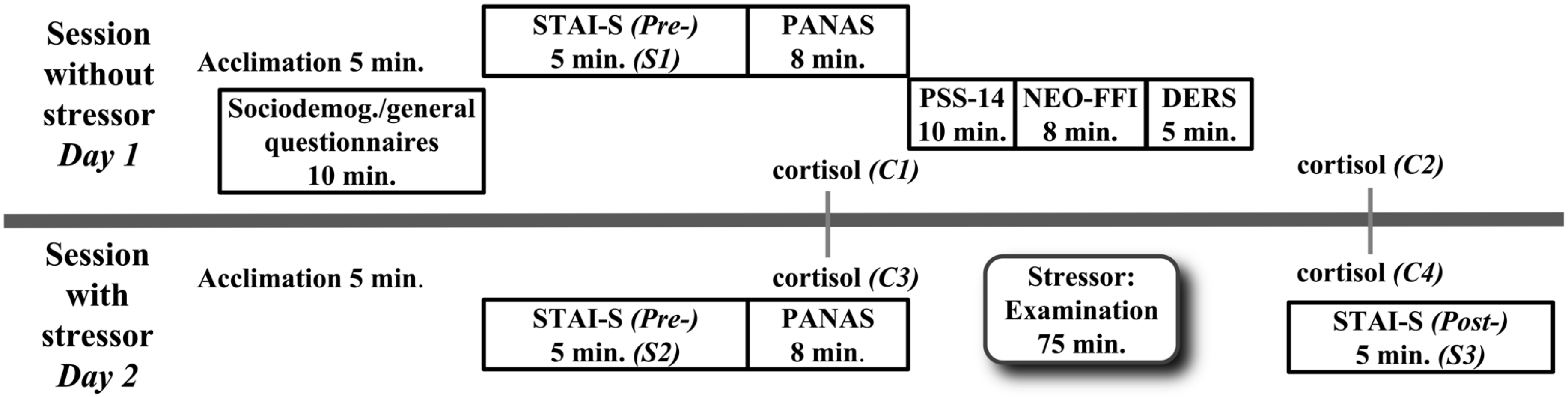
*Mean (*M*) and Standard Deviation (*SD*) of the Psychobiological Variables on Days 1 and 2*

			Entire sample (*N* = 66)	Cluster HN-ME (*n* = 42)	Cluster LN-HE (*n* = 24)
			M (SD)	*M (SD)*	*M (SD)*
Cortisol					
	D1	Pre (C1)	0.67 (0.31)	0.73 (0.30)	0.58 (0.31)
		Post (C2)	0.43 (0.27)	0.47 (0.26)	0.38 (0.29)
	D2	Pre (C3)	0.78 (0.30)	0.83 (0.26)	0.68 (0.34)
		Post (C4)	0.49 (0.24)	0.53 (0.22)	0.42 (0.27)
State-Anxiety					
	D1	Pre (S1)	24.20 (10.28)	27.86 (8.81)	17.79 (9.65)
	D2	Pre (S2)	38.33 (8.42)	39.48 (8.63)	36.33 (7.81)
		Post (S3)	27.03 (9.80)	28.86 (9.75)	23.83 (9.22)
Positive Affect					
	D1	Pre	29.59 (5.61)	28.26 (5.67)	31.92 (4.75)
	D2	Pre	26.53 (6.49)	26.21 (6.66)	27.08 (6.27)
Negative Affect					
	D1	Pre	22.38 (7.47)	24.31 (7.57)	19.00 (6.07)
	D2	Pre	31.30 (6.70)	32.81 (6.75)	28.67 (5.86)

Note. D1 = Day without stressor; D2 = Day with stressor; C1 = First sample of cortisol in session without stressor; C2 = Second sample of cortisol in session without stressor; C3 = Sample of cortisol before the examination; C4 = Sample of cortisol after the examination; S1= State-Anxiety levels in session without stressor; S2: State anxiety levels before the examination; S3 = State anxiety levels after the examination.

Figure 1

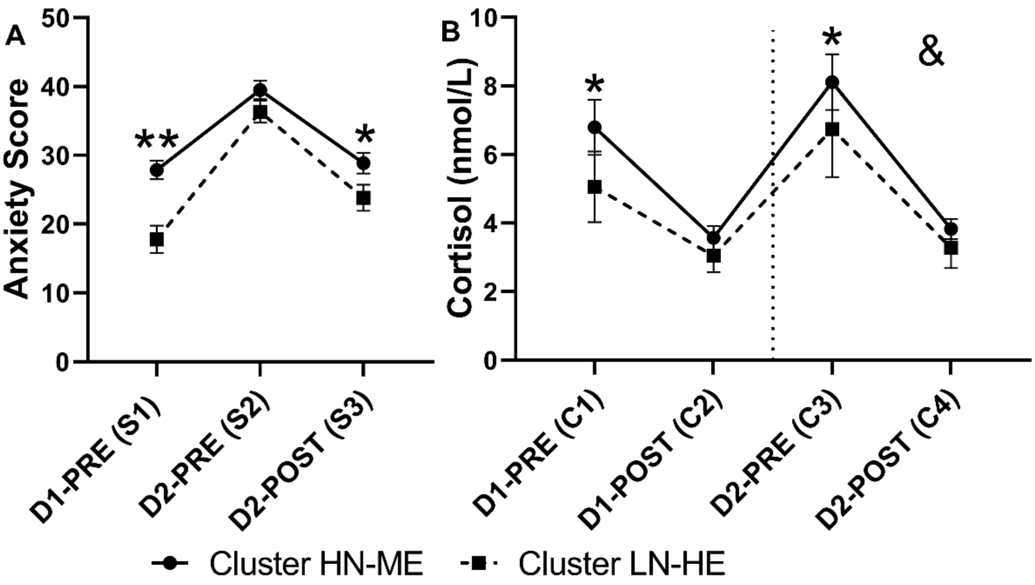
Timeline of the Sessions



Note. This figure visually represents the collection of salivary cortisol samples (C1, C2, C3, and C4), the stressor, and the administration of questionnaires. Abbreviations: sociodemog. = sociodemographic; STAI-S = State-Anxiety Inventory (S1, S2, and S3); PANAS = Positive and Negative Affect Schedule; PSS-14 = Perceived Stress Scale; NEO- FFI = NEO Five-Factor Inventory; and DERS = Difficulties in Emotion Regulation Scale.

Figure 2

Anxiety (A) and Cortisol (B) Patterns across Sessions



Note. Samples in the session without a stressor D1 (anxiety: S1; cortisol: C1 and C2), and samples in the session with a stressor D2 (anxiety: S2 and S3; cortisol: C3 and C4). Pre and Post indicate the timing (pre- and post-examination, respectively).
Depicted values are means, and error bars represent the SEM. The HN-ME group showed higher anxiety levels in the session without a stressor (D1 [S1], $^{**}p < .001$) and after the examination (D2 post [S3], $^{*}p = .044$) compared to the LN-HE group. Cortisol levels did not differ between participants of Cluster HN-ME and those of Cluster LN-HE. Participants showed higher levels on D2 than on D1 ($^{\&}p = .002$) and in the pre-examination time (C1 and C3) than in the post-examination time (C2 and C4, $^{*}p < .001$).