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Introduction

- Previous studies in major depressive disorder (MDD) suggest that males show greater cortisol increases to acute stress compared to females, who tend to show a more blunted response.¹
- Somatic symptoms, such as headaches and muscle aches, often occur in those with MDD, as well as in response to stress.²
- Few studies have explored whether cortisol responses to stress and somatic symptoms are related.
- In the present exploratory analyses, we investigate the relation between cortisol response to acute stress and somatic symptoms in a group of young adults with current or remitted MDD, as well as healthy controls.

Methods

- Somatic symptoms were assessed using the Mood and Anxiety Symptoms Questionnaire (MASQ).³ We formed a new subscale consisting of 18 MASQ questions focused only on somatic symptoms (Cronbach's $\alpha = 0.92$; e.g., racing heartbeat, gastrointestinal upset).
- Serum cortisol levels were collected across six time-points before and after exposure to a stressor combining the Maastricht Acute Stress Test (MAST) and Montreal Imaging Stress Task (MIST).
- Area under the curve with respect to ground (AUC_g) and increase (AUC_i) were calculated for each participant's cortisol levels across the session. AUC_g represents the magnitude of the cortisol response, and AUC_i represents the change in cortisol from time-point 1.
- The MAST/MIST combined stressor requires the participant to do mental math under social evaluation while placing his/her hand in ice water.^{4,5}

Participant Demographics

Demographic	Male (N = 29)		Female (N = 38)	
	N	%	N	%
Clinical Group				
Healthy Controls	21	72.4	15	39.5
MDD	3	10.3	14	36.8
rMDD	5	17.2	9	23.7
Race				
White	18	62.1	21	55.3
Black or African American	2	6.9	3	7.9
Asian	6	20.7	6	15.8
Native American	0	0	1	2.6
More than one	2	6.9	4	10.5
Prefer not to answer	1	3.4	4	10.5
Ethnicity				
Hispanic/Latinx	4	13.8	6	15.8
Not Hispanic/Latinx	25	86.2	32	84.2
	M	SD	M	SD
Age in years	21.4	2.4	21.2	2.1

Psychosocial Stressor: MAST



Figure 1. Photo depicting MAST

To induce acute stress, the MAST involves submerging a hand in cold (2° C) water, a cognitive challenge of mental arithmetic, social evaluation from two evaluators, and uncontrollability of trial duration. The MAST is followed by multiple rounds of the MIST, a mental arithmetic task which grows increasingly difficult.

Linear Regression of Somatic Score versus AUC_g

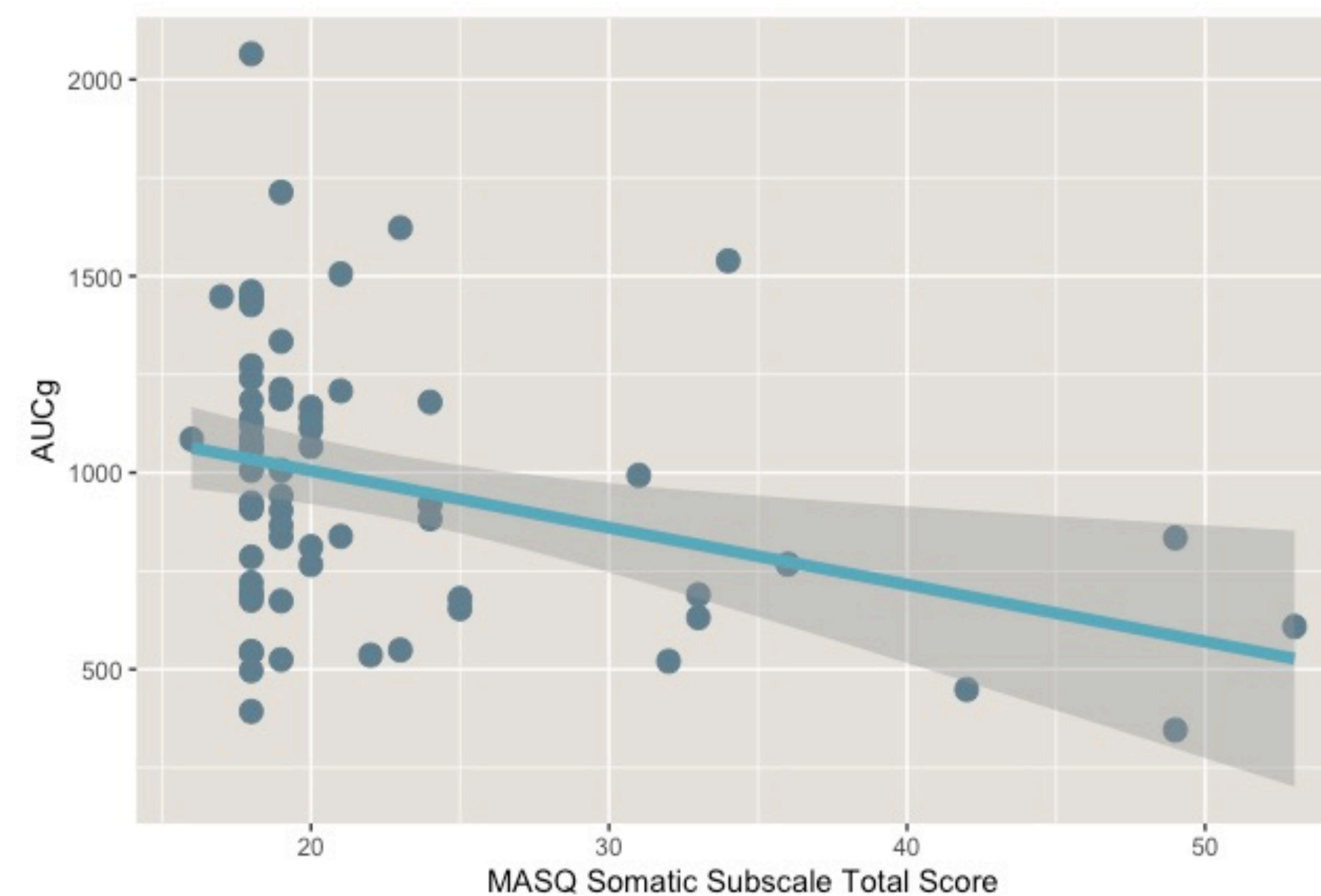


Figure 2. Somatic symptoms significantly predict AUC_g ($p = 0.006$).

AUC_i of Cortisol Change over Time

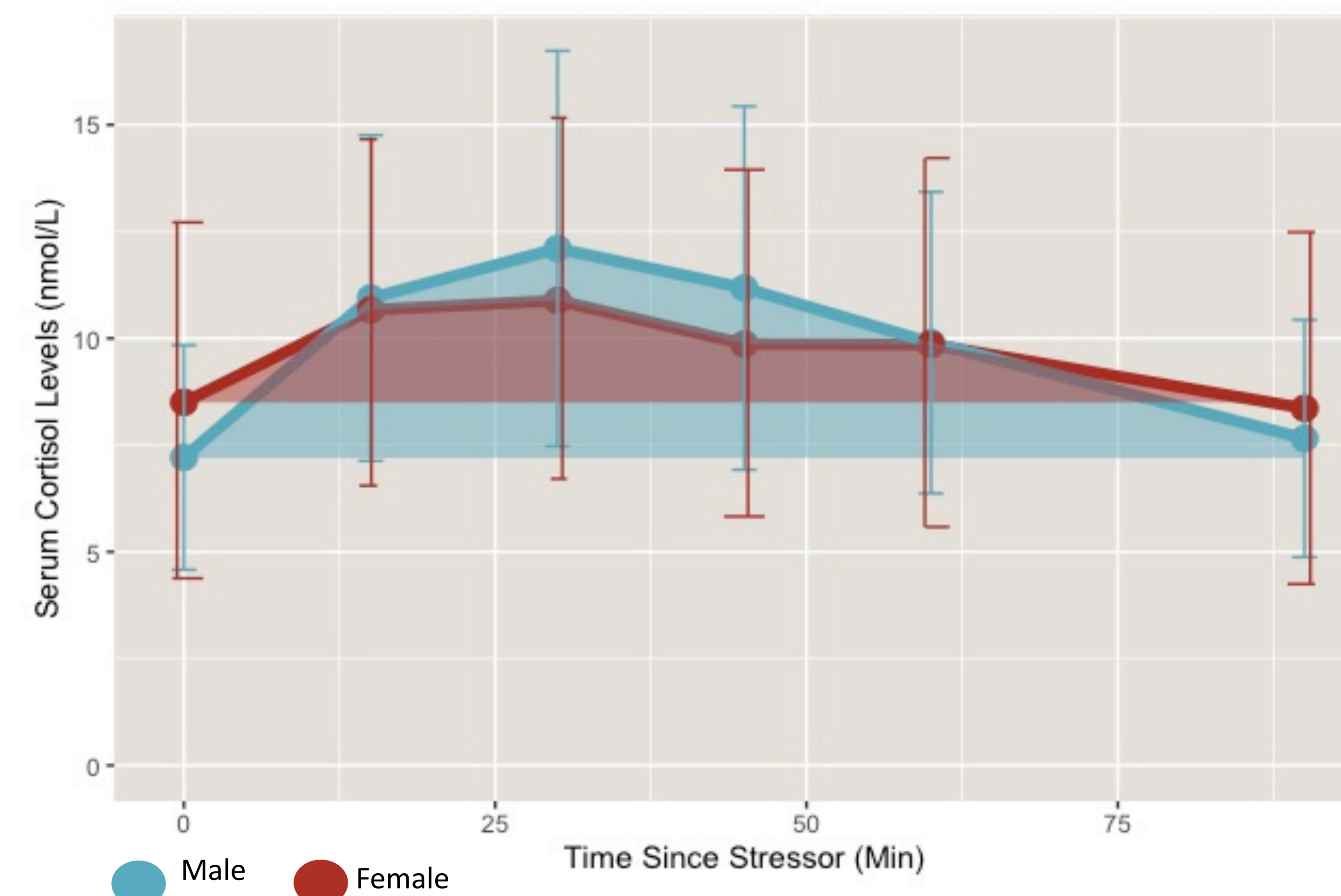


Figure 3. Changes in mean serum cortisol by sex over six time points. The AUC_i of females was significantly lower than the AUC_i of males ($p = 0.0497$).

Results

- The mean score on the Somatic Subscale across all participants was 22.28 (SD = 8.00). There were no significant differences in somatic subscale scores by gender or clinical group.
- Linear regression models of increasing complexity predicting AUC_g and AUC_i were compared to determine the model of best fit. The linear regression models that included somatic symptoms and group were not significantly better than the models that only included somatic symptoms ($ps > 0.13$).
- Somatic symptom scores significantly predicted AUC_g in a simple linear regression, $F(1, 65) = 7.95$, $p = 0.006$, adjusted $R^2 = 0.095$. Greater somatic symptoms predicted lower AUC_g values, $b = -14.49$, 95% CI [-24.76, -4.23], $p = 0.006$. Group, sex, and age were not significant predictors ($ps > 0.36$).
- For AUC_i , neither somatic symptoms, group, nor age were significant predictors ($ps > 0.225$). However, women showed a lower AUC_i than men, $t(65) = 2.02$, $p = 0.047$.

Discussion

- Higher somatic symptom scores predicted lower overall cortisol response to stress, independent of depression history, age, and sex. This suggests that the presence and/or severity of somatic symptoms may be related to hormonal stress response and dysregulation in the HPA axis.
- Since somatic symptoms significantly predicted AUC_g but not AUC_i , this suggests that there is a relationship between somatic symptoms and the total magnitude of cortisol produced in response to stress, but not the change in cortisol from baseline.
- Consistent with past research, women showed a blunted response to stress as compared to men, as reflected by a lower AUC_i . However, future studies should seek to replicate this finding.
- Limitations include the small number of males in the MDD and rMDD group, as well as reduced variability in somatic symptom endorsement.
- Future work should clarify the relationship between somatic symptoms, depression, and cortisol stress response by utilizing an explicit report of stress or a dimensional approach to depressive symptoms.

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