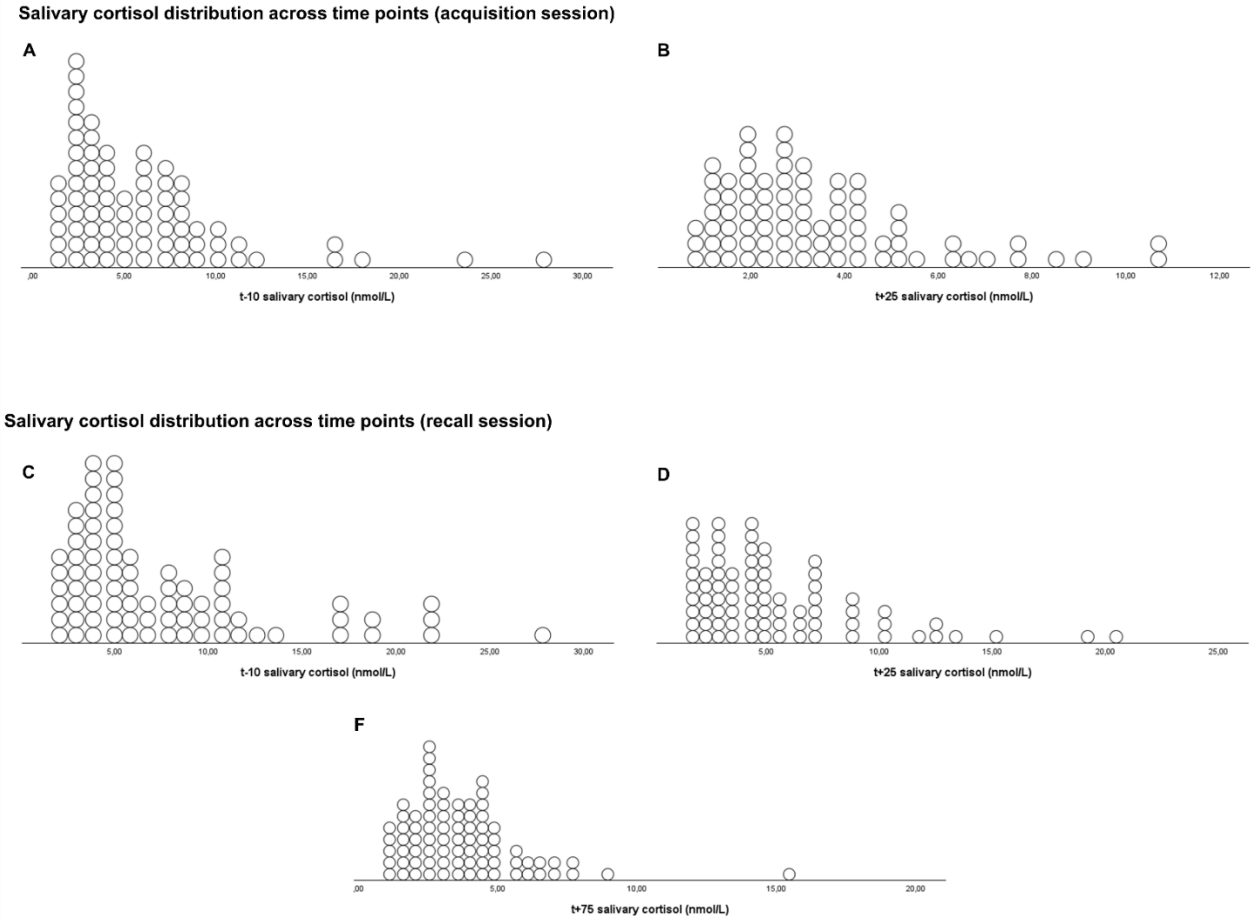
Memory retrieval after an acute academic stressor: an exploratory analysis of anticipatory cortisol and DHEA responses

SUPPLEMENTARY MATERIALS

S1.

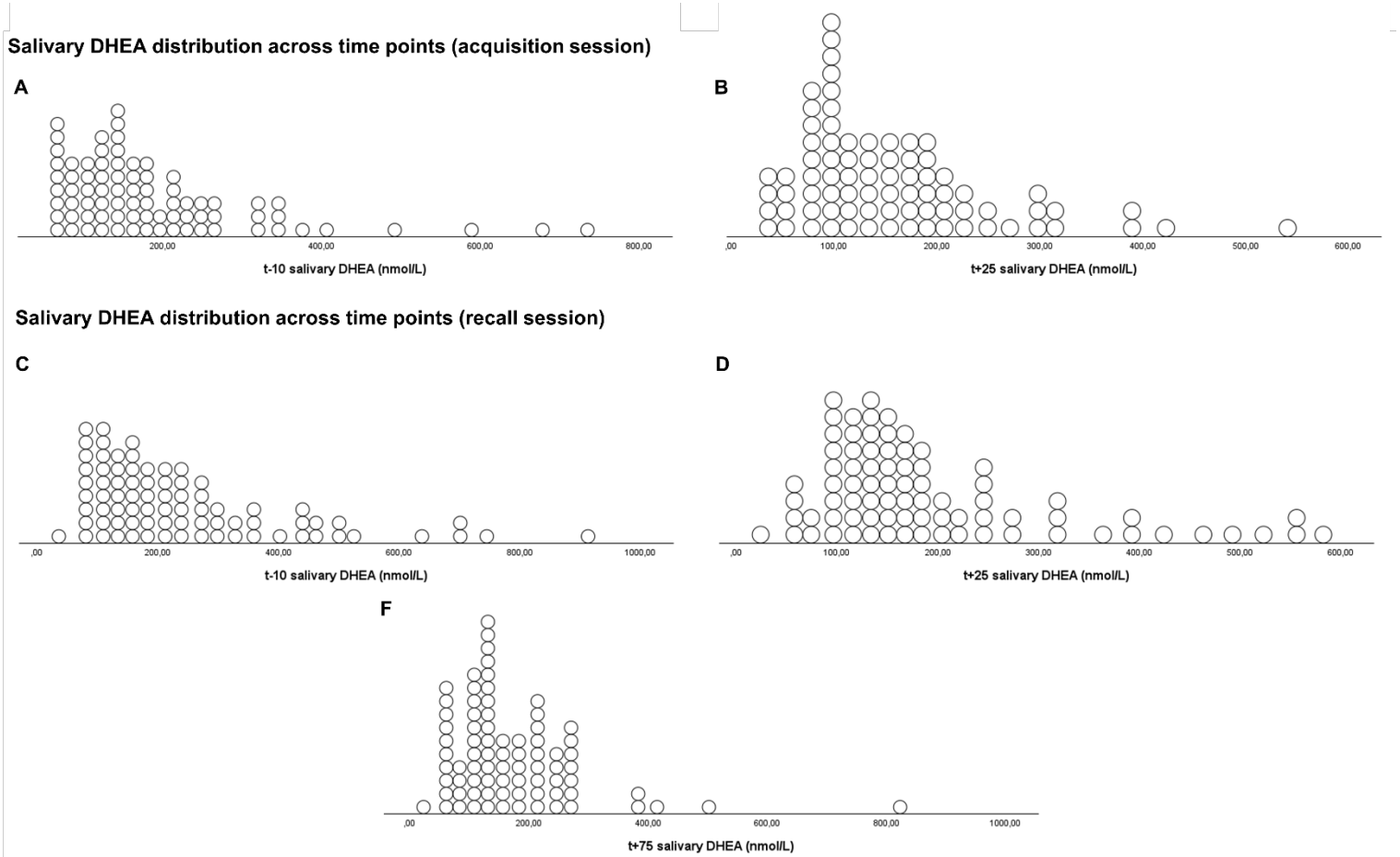
Figure S1. Salivary cortisol distribution across sessions and time points.



Note. Distribution of individual salivary cortisol concentrations (nmol/L) across time points in the acquisition session (t-10 and t+25) and the recall session (t-10, t+25, and t+75). Raw cortisol values are displayed to illustrate interindividual variability, data dispersion, and skewness. Each dot represents one participant.

S2.

Figure S2. Salivary DHEA distribution across sessions and time points.



Note. Distribution of individual salivary dehydroepiandrosterone (DHEA) concentrations (nmol/L) across time points in the acquisition session (t-10 and t+25) and the recall session (t-10, t+25, and t+75). Raw DHEA values are presented to visualize variability and distributional characteristics, including skewness and potential outliers. Each dot represents one participant.

S3.

Table S1. Mean and standard deviation for raw salivary cortisol and DHEA concentrations across sessions and time points.

Variables	*n*	*M* (*SD*)
Acquisition session		
Cortisol t-10 (nmol/L)	78	6.08 (4.80)
Cortisol t+25 (nmol/L)	79	3.46 (2.19)
DHEA t-10 (nmol/L)	79	192.38 (130.50)
DHEA t+25 (nmol/L)	79	157.51 (95.77)
Recall session		
Cortisol t-10 (nmol/L)	79	7.62 (5.48)
Cortisol t+25 (nmol/L)	78	5.48 (3.86)
Cortisol t+75 (nmol/L)	79	3.74 (2.18)
DHEA t-10 (nmol/L)	79	248.37 (175.10)
DHEA t+25 (nmol/L)	79	194.61 (126.18)
DHEA t+75 (nmol/L)	79	173.16 (115.14)

S4.

Text S1. Hierarchical regression analyses were used to examine associations between endocrine measures and memory outcomes while accounting for baseline hormonal variability. Given the absence of a control group, pre-stressor hormone levels from the previous day were entered in the first step of the models as control variables, allowing adjustment for individual baseline differences in hormone concentrations. Pre-stressor hormone levels obtained during the recall session (i.e., examination day) were entered in subsequent steps to assess their incremental contribution beyond baseline levels. This hierarchical structure was chosen to isolate variance specifically associated with the acute stress context while minimising confounding due to inter-individual endocrine variability.

S5.

Table S2. Exploratory regression analyses examining the relationship between pre-examination hormone levels and delayed free recall performance.

% Total delayed free recall performance		
	Step 1	R^2 = 0.006, Adj R^2 = -0.007, p = 0.500
		β (95% *CI*) p
	DHEA (AS_t-10)	-0.077 (-11.459, 5.643) 0.500
	Step 2	R^2 = 0.017, Adj. R^2 = -0.009, Δ R^2 = 0.011, p = 0.368
		β (95% CI) p
	DHEA (AS_t-10)	0.036 (-11.333, 14.018) 0.834
	DHEA (RS_t-10)	-0.153 (-16.254, 6.092) 0.368
% Negative pictures remembered in delayed free recall		
	Step 1	R^2 = 0.003; Adj. R^2 = -0.010; p = 0.629
		β (95% CI) p
	DHEA (AS_t-10)	0.055 (-10.061, 16.539) 0.629
	Step 2	R^2 = 0.005; Adj. R^2 = -0.021; Δ R^2 = 0.002; p = 0.672
		β (95% CI) p

			DHEA (AS_t-10)	0.108 (-13.440, 26.158)	0.524			
			DHEA (RS_t-10)	-0.072 (-21.182, 13.722)	0.672			
% Positive pictures remembered in delayed free recall								
Step 1	R^2 = 0.002, Adj R^2 = -0.011, p = 0.721		Step 1	R^2 = 0.001; Adj. R^2 = -0.012; p = 0.822		Step 1	R^2 < 0.001; Adj. R^2 = -0.013; p = 0.929	
	β (95% CI)	*p*		β (95% CI)	*p*		β (95% CI)	*p*
Cortisol (AS_t-10)	-0.041 (-10.904,7.574)	0.721	DHEA (AS_t-10)	-0.026 (-12.198, 9.712)	0.822	C/D ratio (AS_t-10)	0.254 (-5.393, 55.583)	0.105
Step 2	R^2 = 0.070, Adj R^2 = 0.046, ΔR^2 = 0.069, p = 0.021		Step 2	R^2 = 0.015; Adj. R^2 = -0.011; ΔR^2= 0.014; p = 0.300		Step 2	R^2 = 0.074; Adj. R^2 = 0.049; ΔR^2 = 0.074; p = 0.017	
	β (95% CI)	*p*		β (95% CI)	*p*		β (95% CI)	*p*
Cortisol (AS_t-10)	-0.227 (-3.653, 22.054)	0.158	DHEA (AS_t-10)	0.104 (-11.185, 21.238)	0.539	C/D ratio (AS_t-10)	0.254 (-5.393, 55.583)	0.105
Cortisol (RS_t-10)	-0.375 (-29.874, -2.480)	0.021	DHEA (RS_t-10)	-0.176 (-21.785, 6.795)	0.300	C/D ratio (RS_t-10)	-0.379 (-77.242, -7.906)	0.017
% Neutral pictures remembered in delayed free recall								
Step 1	R^2 = 0.021, Adj R^2 = -0.008, p = 0.207		Step 1	R^2 = 0.057; Adj. R^2 = 0.044; p = 0.035		Step 1	R^2 = 0.007; Adj. R^2 = -0.006; p = 0.455	
	β (95% CI)	*p*		β (95% CI)	*p*		β (95% CI)	*p*
Cortisol (AS_t-10)	-0.144 (-13.943, 3.073)	0.207	DHEA (AS_t-10)	-0.238 (-20.661, -0.781)	0.035	C/D ratio (AS_t-10)	-0.086 (-28.781, 13.017)	0.455
Step 2	R^2 = 0.040, Adj R^2 = 0.015, ΔR^2 = 0.019, p = 0.222		Step 2	R^2 = 0.061; Adj. R^2 = 0.036; ΔR^2 = 0.005; p = 0.541		Step 2	R^2 = 0.028; Adj. R^2 = 0.002; ΔR^2 = 0.021; p = 0.209	
	β (95% CI)	*p*		β (95% CI)	*p*		β (95% CI)	*p*

Cortisol (AS_t-10)	-0.002 (-12.208, 12.078)	0.992	DHEA (AS_t-10)	-0.163 (-22.137, 7.419)	0.324	C/D ratio (AS_t-10)	0.054 (-24.055, 34.030)	0.733
Cortisol (RS_t-10)	-0.199 (-20.936, 4.945)	0.222	DHEA (RS_t-10)	-0.101 (-17.045, 9.008)	0.541	C/D ratio (RS_t-10)	-0.201 (-54.013, 12.034)	0.209

Note. β shows standardized values. Adj R^2 = Adjusted *R*-squared; ΔR^2 = *R*-squared change; 95% CI = confidence interval; AS_t-10 = pre-session hormone levels in the acquisition session; RS_t-10 = pre-examination hormone levels in the recall session; C/D ratio = cortisol/DHEA ratio.

S6.

Table S3. Exploratory regression analyses examining the relationship between pre-examination hormone levels and recognition performance.

Discrimination ability (d′) in total recognition performance								
Step 1	R^2 = 0.042, Adj R^2 = 0.030, p = 0.071		Step 1	R^2 = 0.012, Adj R^2 = -0.001, p = 0.338		Step 1	R^2 = 0.028; Adj. R^2 = 0.015; p = 0.143	
	β (95% CI)	*p*		β (95% CI)	*p*		β (95% CI)	*p*
Cortisol (AS_t-10)	-0.205 (-0.663, 0.028)	0.071	DHEA (AS_t-10)	-0.109 (-0.615, 0.214)	0.338	C/D ratio (AS_t-10)	-0.167 (-1.481, 0.218)	0.143
Step 2	R^2 = 0.110, Adj R^2 = 0.087, ΔR^2 = 0.068, p = 0.019		Step 2	R^2 = 0.052, Adj R^2 = 0.027, ΔR^2 = 0.040, p = 0.076		Step 2	R^2 = 0.077; Adj. R^2 = 0.053; ΔR^2 = 0.049; p = 0.049	
	β (95% CI)	*p*		β (95% CI)	*p*		β (95% CI)	*p*
Cortisol (AS_t-10)	0.063 (-0.383, 0.577)	0.686	DHEA (AS_t-10)	0.110 (-0.403, 0.807)	0.507	C/D ratio (AS_t-10)	0.049 (-0.978, 1.346)	0.753
Cortisol (RS_t-10)	-0.374 (-1.128, -0.105)	0.019	DHEA (RS_t-10)	-0.297 (-1.015, 0.052)	0.076	C/D ratio (RS_t-10)	-0.310 (-2.651, -0.008)	0.049
Discrimination ability (d′) for negative pictures								
Step 1	R^2 < 0.001, Adj R^2 = -0.013, p = 0.873		Step 1	R^2 = 0.006, Adj R^2 = -0.007, p = 0.483		Step 1	R^2 = 0.001; Adj. R^2 = −0.012; p = 0.789	

	β (95% CI)	*p*		β (95% CI)	*p*		β (95% CI)	*p*
Cortisol (AS_t-10)	0.18 (-0.439, 0.516)	0.873	DHEA (AS_t-10)	-0.080 (-0.365, 0.763)	0.483	C/D ratio (AS_t-10)	0.031 (-1.008, 1.322)	0.789
Step 2	R^2 = 0.051, Adj R^2 = 0.025, ΔR^2 = 0.050, p = 0.050		Step 2	R^2 = 0.008, Adj R^2 R^2 = -0.018, ΔR^2 = 0.002, p = 0.691		Step 2	R^2 = 0.061; Adj. R^2 = 0.036; ΔR^2 = 0.060; p = 0.031	
	β (95% CI)	*p*		β (95% CI)	*p*		β (95% CI)	*p*
Cortisol (AS_t-10)	0.248 (-0.152, 1.190)	0.127	DHEA (AS_t-10)	0.130 (-0.516, 1.163)	0.445	C/D ratio (AS_t-10)	0.269 (-0.213, 2.960)	0.089
Cortisol (RS_t-10)	-0.321 (-1.431, -0.001)	0.050	DHEA (RS_t-10)	-0.067 (-0.888, 0.592)	0.691	C/D ratio (RS_t-10)	-0.342 (-3.788, -0.181)	0.031
Discrimination ability (d′) for positive pictures								
Step 1	R^2 = 0.055, Adj R^2 = 0.042, p = 0.039		Step 1	R^2 = 0.035, Adj R^2 = 0.022, p = 0.099		Step 1	R^2 = 0.033; Adj. R^2 = 0.020; p = 0.110	
	β (95% CI)	*p*		β (95% CI)	*p*		β (95% CI)	*p*
Cortisol (AS_t-10)	-0. 234 (-0.922, -0.025)	0.039	DHEA (AS_t-10)	-0.187 (-0.990, 0.087)	0.099	C/D ratio (AS_t-10)	-0.182 (-2.004, 0.209)	0.110
Step 2	R^2 = 0.105, Adj R^2 = 0.081, ΔR^2= 0.050, p = 0.044		Step 2	R^2 = 0.057, Adj R^2 = 0.032, ΔR^2 = 0.022, p = 0.184		Step 2	R^2 = 0.063; Adj. R^2 = 0.038; ΔR^2 = 0.030; p = 0.125	
	β (95% CI)	*p*		β (95% CI)	*p*		β (95% CI)	*p*
Cortisol (AS_t-10)	-0.005 (-0.640, -0.619)	0.974	DHEA (AS_t-10)	-0.024 (-0.851, 0.736)	0.886	C/D ratio (AS_t-10)	-0.013 (-1.595, 1.464)	0.932
Cortisol (RS_t-10)	-0.320 (-1.359, -0.018)	0.044	DHEA (RS_t-10)	-0.221 (-1.17, 0.23)	0.184	C/D ratio (RS_t-10)	-0.242 (-3.095, 0.383)	0.125
Discrimination ability (d′) for neutral pictures								
Step 1	R^2 = 0.073, Adj R^2 = 0.061, p = 0.017		Step 1	R^2 = 0.024, Adj R^2 = -0.012, p = 0.169		Step 1	R^2 = 0.059; Adj. R^2 = 0.047; p = 0.032	

	β (95% CI)	*p*
Cortisol (AS_t-10)	-0.270 (-1.005, -0.102)	0.017
Step 2	R^2 = 0.091, Adj R^2 = 0.067, ΔR^2 = 0.018, p = 0.221	
	β (95% CI)	*p*
Cortisol (AS_t-10)	-0.130 (-0.912, 0.377)	0.410
Cortisol (RS_t-10)	-0.195 (-1.113, 0.261)	0.221

	β (95% CI)	*p*
DHEA (AS_t-10)	-0.156 (-0.928, 0.166)	0.169
Step 2	R^2 = 0.084, Adj R^2 = 0.060, ΔR^2 = 0.059, p = 0.030	
	β (95% CI)	*p*
DHEA (AS_t-10)	0.109 (-0.523, 1.057)	0.503
DHEA (RS_t-10)	-0.360 (-1.471, -0.079)	0.030

	β (95% CI)	*p*
C/D ratio (AS_t-10)	-0.243 (-2.329, -0.109)	0.032
Step 2	R^2 = 0.066; Adj. R^2 = 0.041; ΔR^2 = 0.007; p = 0.461	
	β (95% CI)	*p*
C/D ratio (AS_t-10)	-0.163 (-2.370, 0.736)	0.298
C/D ratio (RS_t-10)	-0.115 (-2.423, 1.109)	0.461

Note. β shows standardized values. Adj R^2 = Adjusted R-squared; ΔR^2 = R-squared change; 95% CI = confidence interval; AS_t-10 = pre-session hormone levels in the acquisition session; RS_t-10 = pre-examination hormone levels in the recall session; C/D ratio = cortisol/DHEA ratio.