

## Introduction

- Our research focuses on the hypothalamic-pituitary-adrenal (HPA) axis, regulating cortisol secretion in a 24-hour circadian rhythm.
- Cortisol plays vital roles in metabolic and behavioral processes, including the cortisol awakening response and modulation of anti-inflammatory pathways (Bremner et al., 2020; Cocchi et al., 1980; D Liakakos et al., 1975).
- Stress-induced cortisol elevation disrupts metabolism, immune function, and memory, impacting overall health (Gonzalez & Miranda-Massari, 2014; Khajehnasiri et al., 2015; McCann et al., 1990; Miller et al., 1998; Moritz et al., 2020).
- Disruptions in circadian rhythm are associated with metabolic dysfunction and impaired physical performance due to inadequate cortisol reduction before sleep onset (Schultchen et al., 2019; Zhang et al., 2011; Zulkapli & Abdullah, 2017, Nguyen et al., 2003; Padh, 1991).
- Sleep quality correlates closely with perceived stress and anxiety levels, with decreased sleep quality observed during stressful periods, such as the COVID-19 pandemic.
- Our study explores the complex relationships between stress levels, sleep quality, and cortisol dynamics in young adults using psychological assessments (e.g., PSS, STAI Y-1) and cortisol assays.
- By examining individual differences in cortisol levels influenced by stress and anxiety, we aim to understand their interplay with sleep quality and psychological well-being.
- Through longitudinal data collection over a week, we seek to detect changes in cortisol secretion and sleep patterns, employing statistical analyses to uncover these complex relationships.

## Methods

### Participants

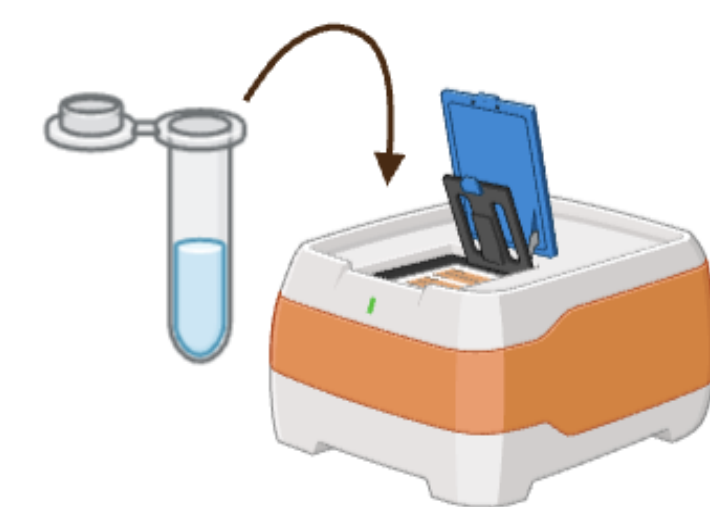
- Twenty-seven undergraduate students (12 male, 19 female, 1 nonbinary) aged 19 to 25 were recruited from a specific course section.

### Cortisol Measurement

- Salivary samples were collected before and a week after the experiment at 12:30 PM to measure cortisol levels.
- Competitive immunoassay was used for quantification.

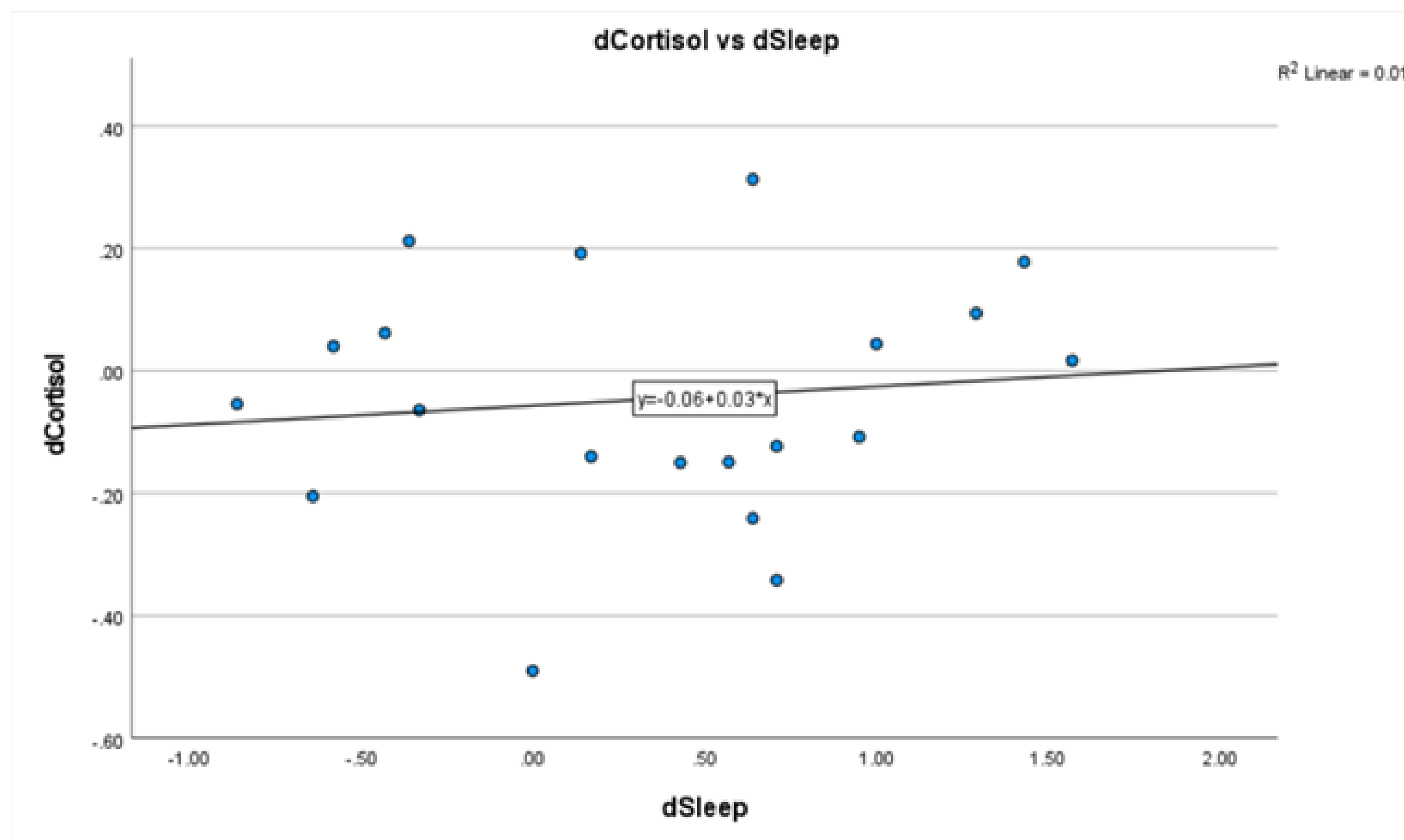
### Psychological and Wellbeing Assessment

- State-Trait Anxiety Inventory (STAI Y-1) and Perceived Stress Scale (PSS) surveys were administered with total sleep time being self-reported
- Statistical Analysis: Data from 20 participants were analyzed using descriptive statistics, Pearson correlation, linear regression, and t-tests (paired and independent) to assess relationships and differences between variables.



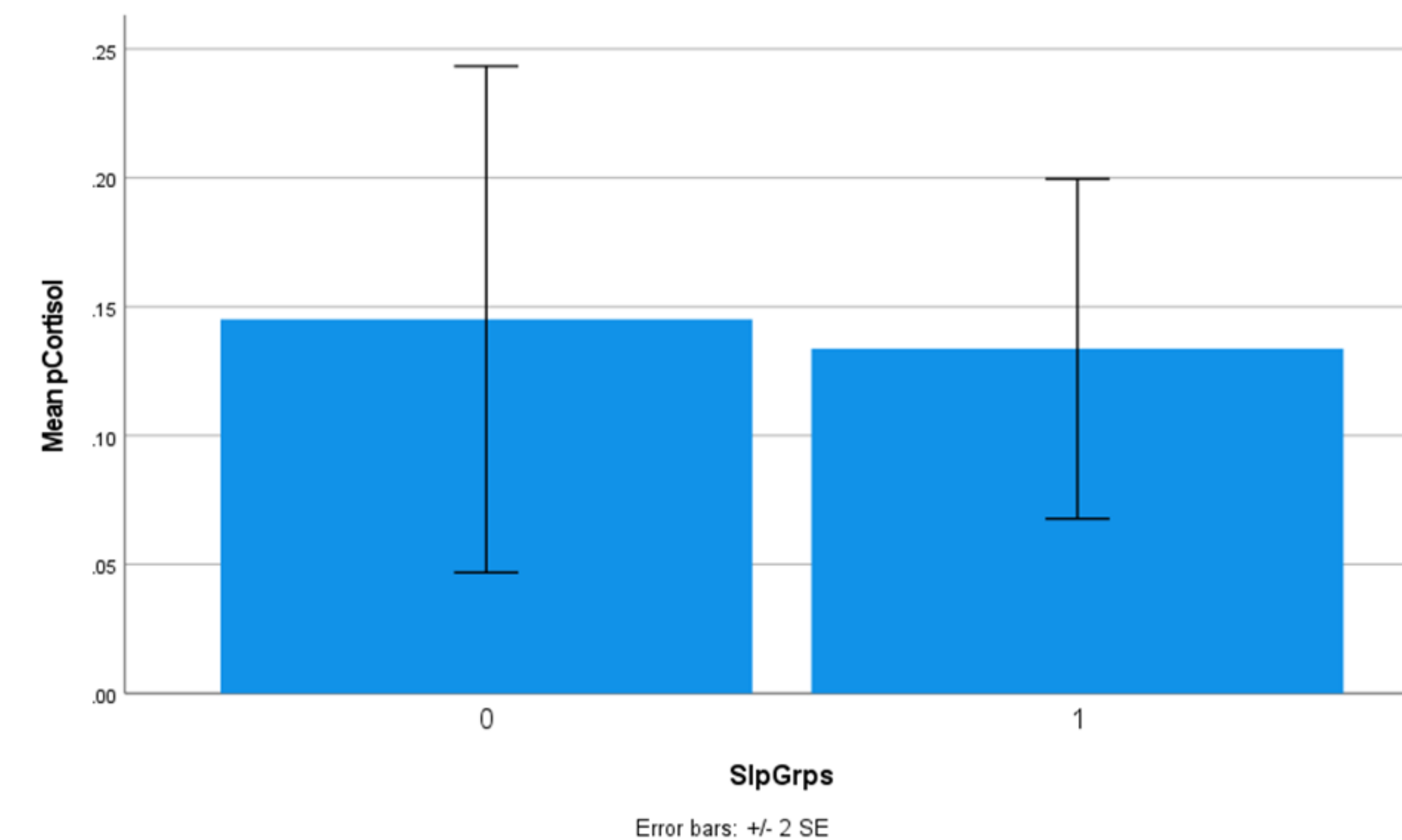
## Results

**Fig. 1**  $\Delta$ Cortisol vs  $\Delta$ Sleep



**Figure 1.** Linear regression analysis displaying correlation between change in cortisol after a week ( $\Delta$ Cortisol) and change in sleep after a week ( $\Delta$ Sleep). The equation was matched to the line of best fit, and an adjusted R is given to indicate  $\Delta$ Cortisol variance due to  $\Delta$ Sleep.

**Fig. 2** Post-intervention cortisol by Sleep Group



**Figure 2.** Mean post-intervention cortisol levels ( $\Delta$ Cortisol) in low sleep (<7 hrs.) and high sleep (>7 hrs.) groups (0, 1, respectively). Errors bars reflect a 95% confidence interval.

**Fig. 3** STAI and baseline Cortisol

		totSTAI	bCortisol
totSTAI	Pearson Correlation	1	<b>-.019</b>
	Sig. (1-tailed)		.467
	N	20	20
bCortisol	Pearson Correlation	<b>-.019</b>	1
	Sig. (1-tailed)	.467	
	N	20	20

**Fig. 3** Pearson correlation analysis for total STAI score (state trait anxiety inventory responses summed to a total) and pre-intervention cortisol levels (bCortisol). The correlation between the two variables is  $-0.019$ . One-tailed significance test yields  $p = 0.467$ .

## Discussion

- Our findings reveal an unexpected positive correlation between the change in cortisol levels and the change in sleep quantity, as illustrated in Figure 1.
- There were no significant associations found between sleep quantity and changes in cortisol levels.
- Figure 2 depicts no significant difference in cortisol levels between the low and high sleep groups.
- Neither Perceived Stress (PSS) nor Trait Anxiety (STAI) showed significant associations with changes in cortisol levels.
- This study sheds light on the intricate relationship among cortisol, sleep, and psychological factors in college students.
- The positive correlation observed between changes in cortisol levels and sleep quantity challenges previous research on the relationship between sleep duration and cortisol regulation.
- Individual differences in trait anxiety did not exhibit significant associations with variations in cortisol levels over the 1-week period, suggesting the need for further investigation.

### Future Considerations

- Explore longer-term trends in cortisol, sleep, and psychological factors for a more comprehensive understanding.
- Incorporate broader psychological assessments for deeper insights into their effects on cortisol and sleep.
- Include other biomarkers like heart rate variability or genetic markers to better understand underlying physiological mechanisms.
- Investigate lifestyle habits, social support, and coping strategies to understand how they influence cortisol, sleep, and psychological factors.
- Expand participant demographics to enhance generalizability and uncover potential moderating factors.
- Implement interventions like cognitive-behavioral therapy for insomnia to explore causal relationships and inform targeted interventions for better health outcomes.

## References & Acknowledgements

