

# Effects of menstrual cycle phase on the association between the neural response to rewards and anhedonia



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## INTRODUCTION

- Depression is a debilitating psychiatric disorder that substantially impacts both individuals and society.<sup>1</sup>
- Anhedonia, or a loss of pleasure, is a core symptom of depression.
- A blunted neural response to reward (the Reward Positivity, or RewP) has been associated with depression and anhedonia in previous studies of adult men and women.<sup>2</sup>
- There is a lack of research examining the effects of the human menstrual cycle on the association between the RewP and anhedonia.
- The present study examined the association between anhedonia and the RewP collected in three different menstrual cycle phases: early follicular, ovulatory, and mid-luteal.

### Objective:

Examine whether the RewP-anhedonia association differs as a function of which cycle phase the RewP was collected in.

## METHOD

- 73 undergraduate women (mean age = 19.48, SD = 1.87) participated in a baseline session wherein self-reported anhedonia was measured with the Personality Inventory for DSM-5 (PID-5) Anhedonia Subscale.<sup>3</sup>
- Next, each participant completed an EEG monetary gambling task (Doors Task)<sup>2</sup> to elicit the RewP in three cycle phases:
  - Early follicular: Low estradiol (E2) and progesterone (P4)
  - Ovulatory: High E2 & low P4
  - Mid-luteal: High P4 & Moderate E2
- Cycle phases were confirmed via ovulation testing, menstruation tracking, and cycle day count. Order of cycle phase was counterbalanced.
- $\Delta$ RewP: scored as the residualized difference score following gain compared to loss feedback between 250-350 milliseconds post-feedback at the FCz electrode site.<sup>4</sup>
- Correlations were used to examine associations among anhedonia and the RewP collected in each phase.

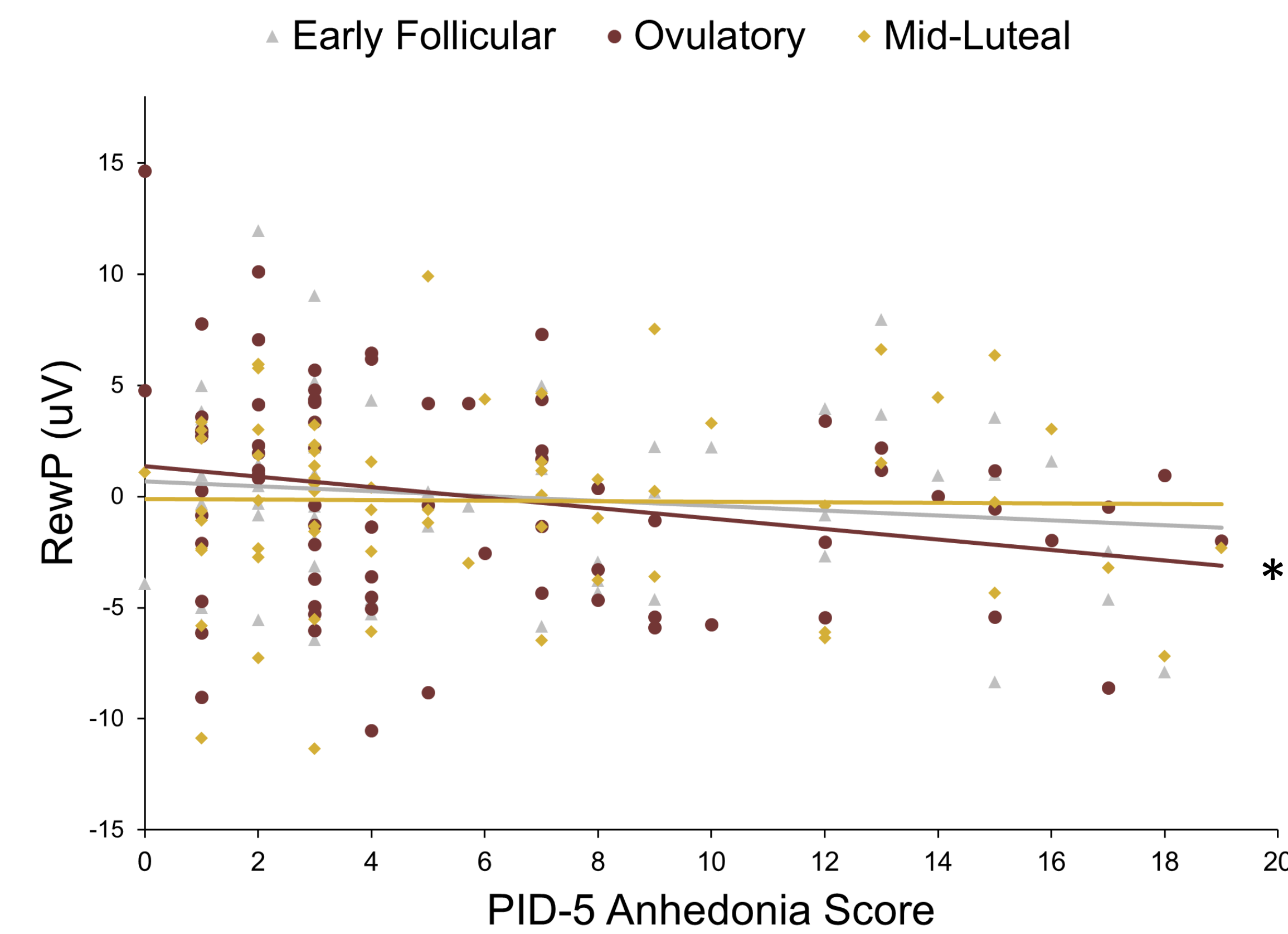
## RESULTS

**Table 1 :** Correlations between baseline anhedonia and the RewP collected in each cycle phase

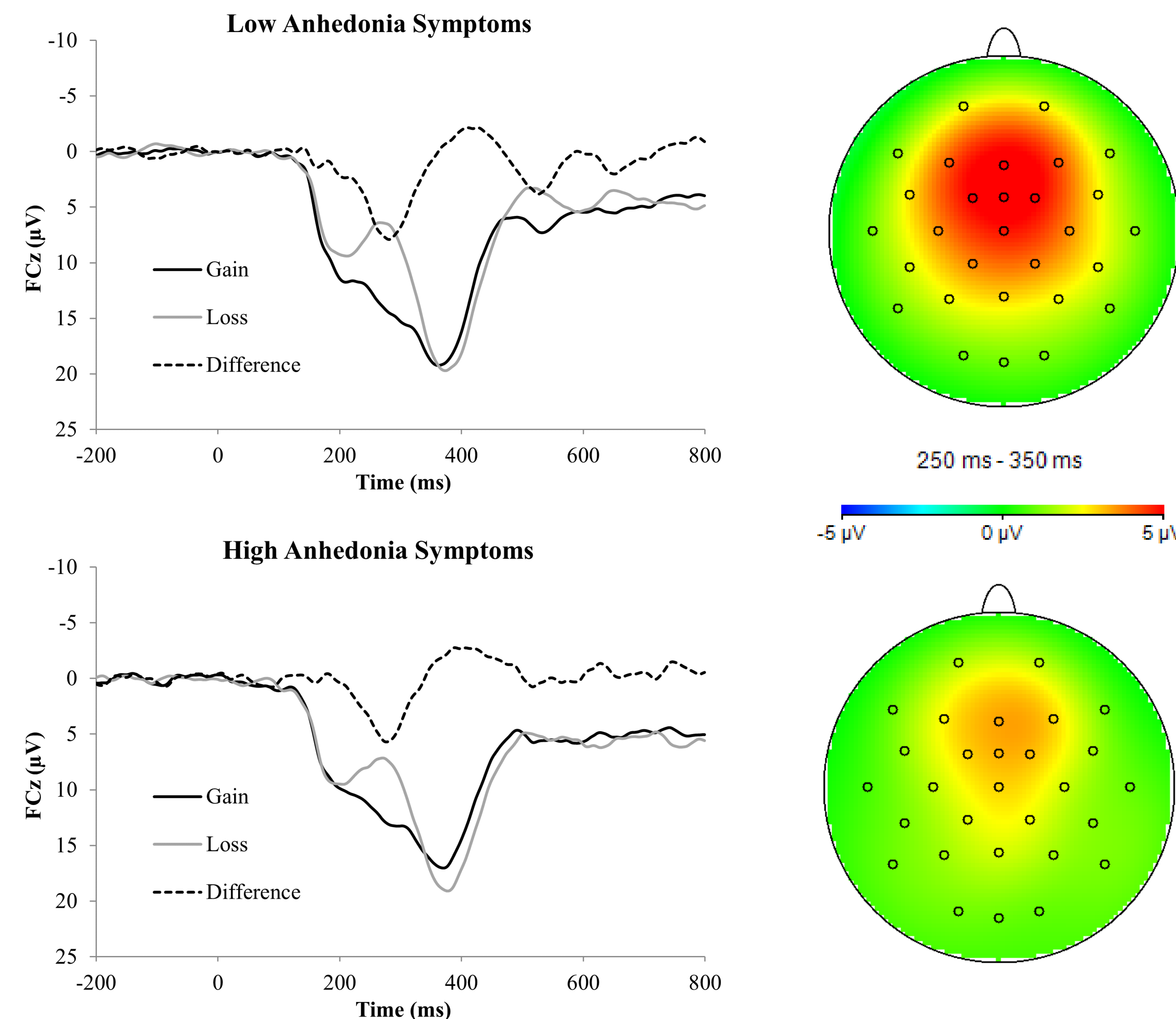
Variables	1	2	3	4
1. PID-5 Anhedonia	-			
2. Early Follicular RewP	-.13	-		
3. Ovulatory RewP	-.25*	.44**	-	
4. Mid-Luteal RewP	-.02	.38**	.35**	-

Note. \* $p < .05$ , \*\* $p < .01$

**Figure 1:** Scatter plot depicting the association between anhedonia symptoms and the RewP collected in each cycle phase



**Figure 2:** Ovulatory phase feedback-locked ERPs (left) for gains and losses, and topographic maps for the gain-loss difference (right) in individuals low (top) and high (bottom) in anhedonia symptoms



## DISCUSSION

- A blunted RewP was associated with increased anhedonia only when the RewP was collected in the ovulatory phase.
- The RewP was not associated with anhedonia when collected in the early follicular or mid-luteal phases of the menstrual cycle.
- The ovulatory phase is characterized by high estradiol, and estradiol is suggested to enhance reward sensitivity.<sup>5</sup>
- Thus, a lack of sensitivity to the reward-bolstering effects of estradiol may be associated with increased anhedonia.

**Our study provides novel evidence that: 1) the RewP-anhedonia association in women may be specific to when the RewP is measured in the ovulatory phase, and 2) it is important to account for menstrual cycle phases in event-related potential studies.**

## REFERENCES

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