

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



and anhedonia

Kira St. Juste, Elizabeth Mulligan, C.J. Brush, & Greg Hajcak
Florida State University



INTRODUCTION

- Depression is a debilitating psychiatric disorder that substantially impacts both individuals and society.¹
- 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.²
- 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.³
- Next, each participant completed an EEG monetary gambling task (Doors Task)² 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.
- Δ RewP: scored as the residualized difference score following gain compared to loss feedback between 250-350 milliseconds post-feedback at the FCz electrode site.⁴
- 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

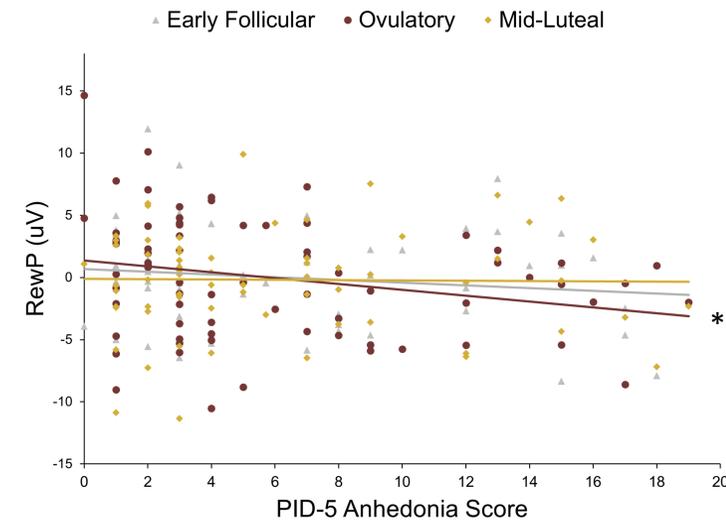
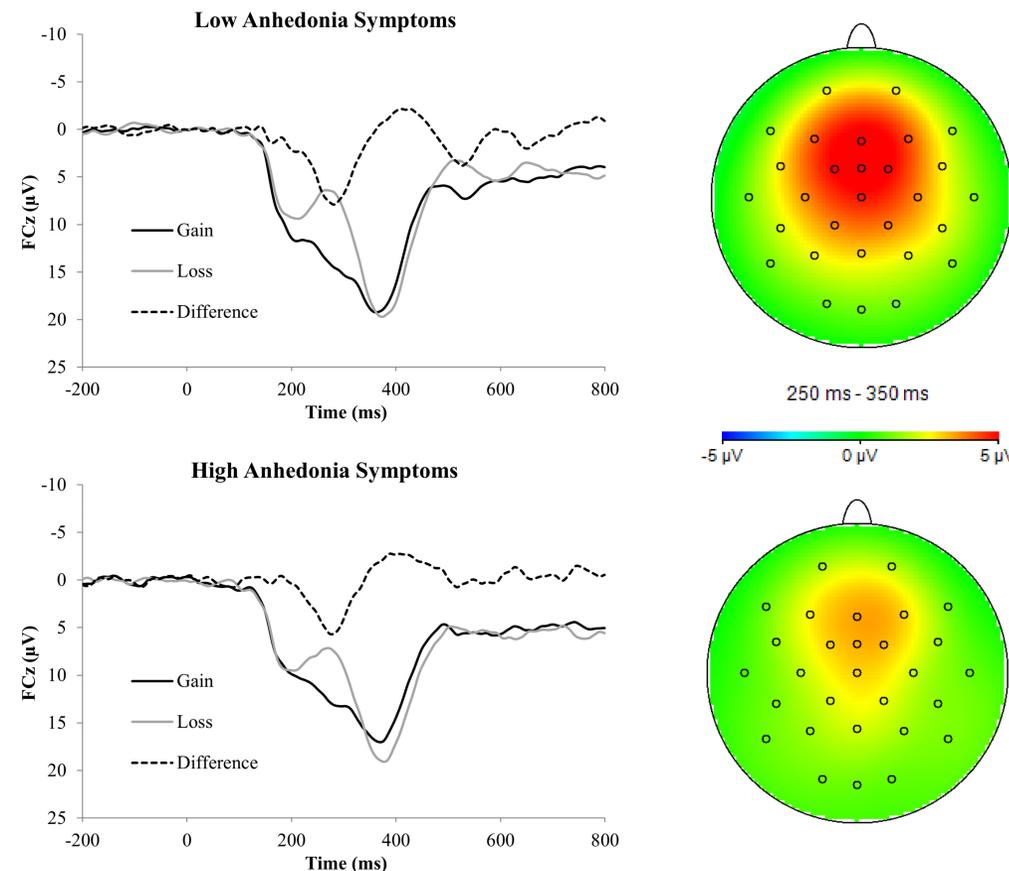


Figure 2: Ovulatory phase feedback-locked ERPs (left) for gains and losses, and topographic maps for the gain-loss difference (right) in individuals low (top) and high (bottom) in anhedonia symptoms



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.⁵
- 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

1. World Health Organization. (2019, November 29). Depression. *World Health Organization*. Retrieved February 24, 2022, from https://www.who.int/health-topics/depression#tab=tab_1
2. Proudfit G. H. (2015). The reward positivity: From basic research on reward to a biomarker for depression. *Society for Psychophysiology Research*, 52(4), 449–459. <https://doi.org/10.1111/psyp.12370>
3. Krueger, R., Derringer, J., Markon, K., Watson, D., & Skodol, A. (2012). Initial construction of a maladaptive personality trait model and inventory for DSM-5. *Psychological Medicine*, 42(9), 1879-1890. [doi:10.1017/S0033291711002674](https://doi.org/10.1017/S0033291711002674)
4. Klawohn, J., Burani, K., Bruchnak, A., Santopetro, N., & Hajcak, G. (2021). Reduced neural response to reward and pleasant pictures independently relate to depression. *Psychological Medicine*, 51(5), 741-749. [doi:10.1017/S0033291719003659](https://doi.org/10.1017/S0033291719003659)
5. Sakaki, M. and Mather, M. (2012). How Reward and Emotional Stimuli Induce Different Reactions Across the Menstrual Cycle. *Social and Personality Psychology Compass*, 6: 1-17. <https://doi-org.proxy.lib.fsu.edu/10.1111/j.1751-9004.2011.00415.x>

For questions regarding this poster, please contact Kira St. Juste at kjs21m@my.fsu.edu.