

Nellia Bellaert^{1, 2}, Michael J Crowley¹, Hilary P Blumberg^{1, 3}, Mandy Rossignol², Christen Deveney⁴, Wan-Ling Tseng¹

¹Child Study Center, Yale School of Medicine, New Haven, CT, USA. ²Department of Cognitive Psychology and Neuropsychology, University of Mons, Belgium. ³Department of Psychiatry, Yale School of Medicine, New Haven, CT, USA. ⁴Department of Psychology, Wellesley College, MA, USA.

Background

- **Irritability** and **anhedonia** are prevalent symptoms of Major Depressive Disorder (MDD).
- Both have been proposed to result from **dysfunctional reward processing, but in opposite directions**.
 - Irritability: \nearrow reward responsivity in children.¹
 - Anhedonia: \searrow striatal reactivity to reward receipt.²
- No research to date has investigated how the presence/severity of both symptoms are linked to reward responsivity in the same sample.
- The Reward Positivity (**RewP**) is an ERP commonly used as a measure of reward responsivity.³
- We focused on young adulthood because it is a critical period for development of mood disorders.

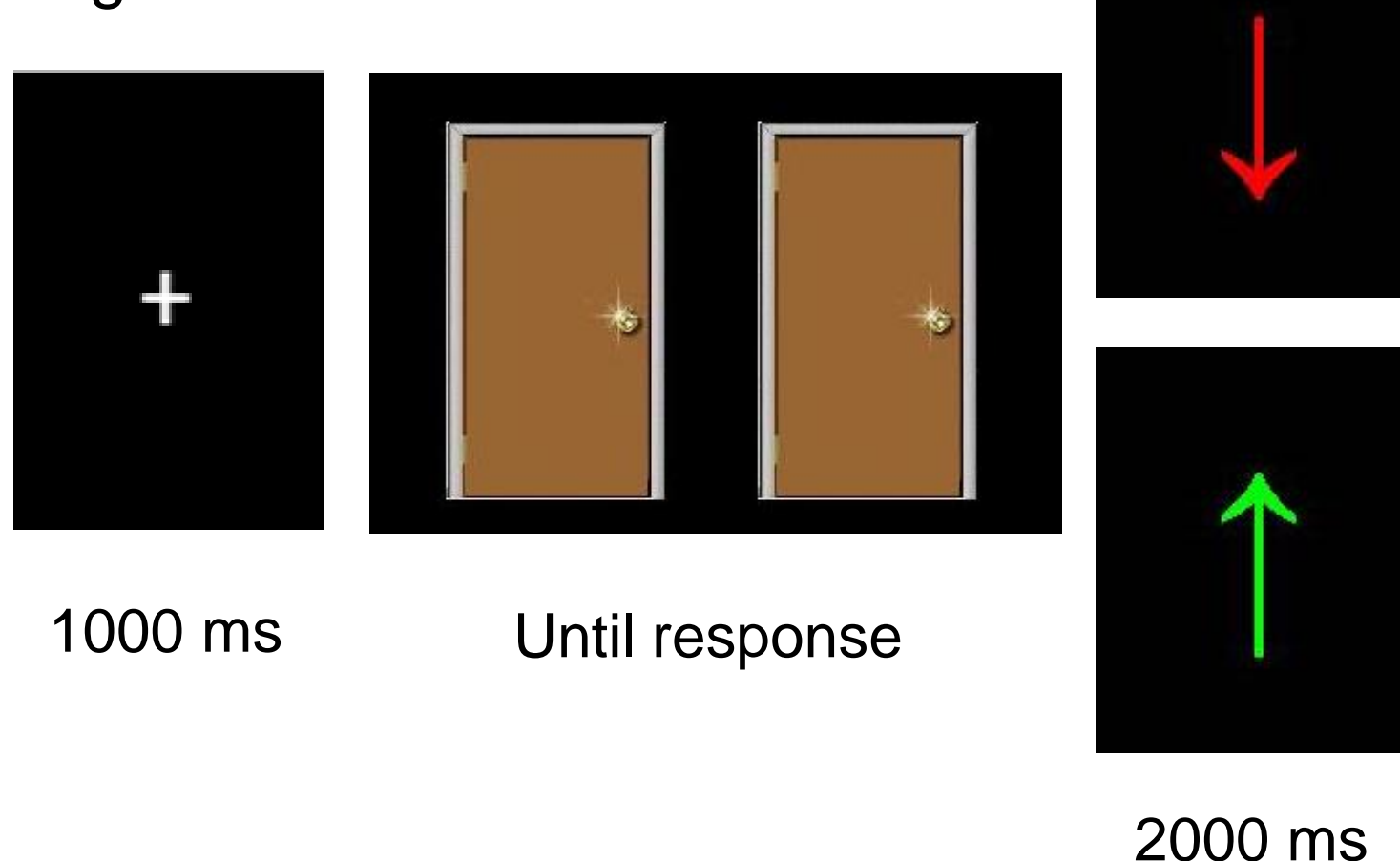
Aim

- Evaluate the main and interactional effects of irritability and anhedonia on RewP in young adults

Method

- 25 young adults (18 females)
- Age range 18-25 years
- Questionnaires:
 - Brief Irritability Test (BITe)
 - Dimensional Anhedonia Rating Scale (DARS)
 - Depression, Anxiety and Stress Scale (DASS-21)
- 128 GSN EGI
- Doors Task³ (Fig. 1)

Figure 1. Trial in the Doors Task



ERP preprocessing

- 0.3-30Hz bandpass filter.
- Re-referenced to average.
- Baseline correction -200ms.

ERP analyses

- FRN (Feedback Related Negativity) = mean amplitudes 250-350ms post-feedback from Cz.
- RewP = FRN to gain – FRN to loss.

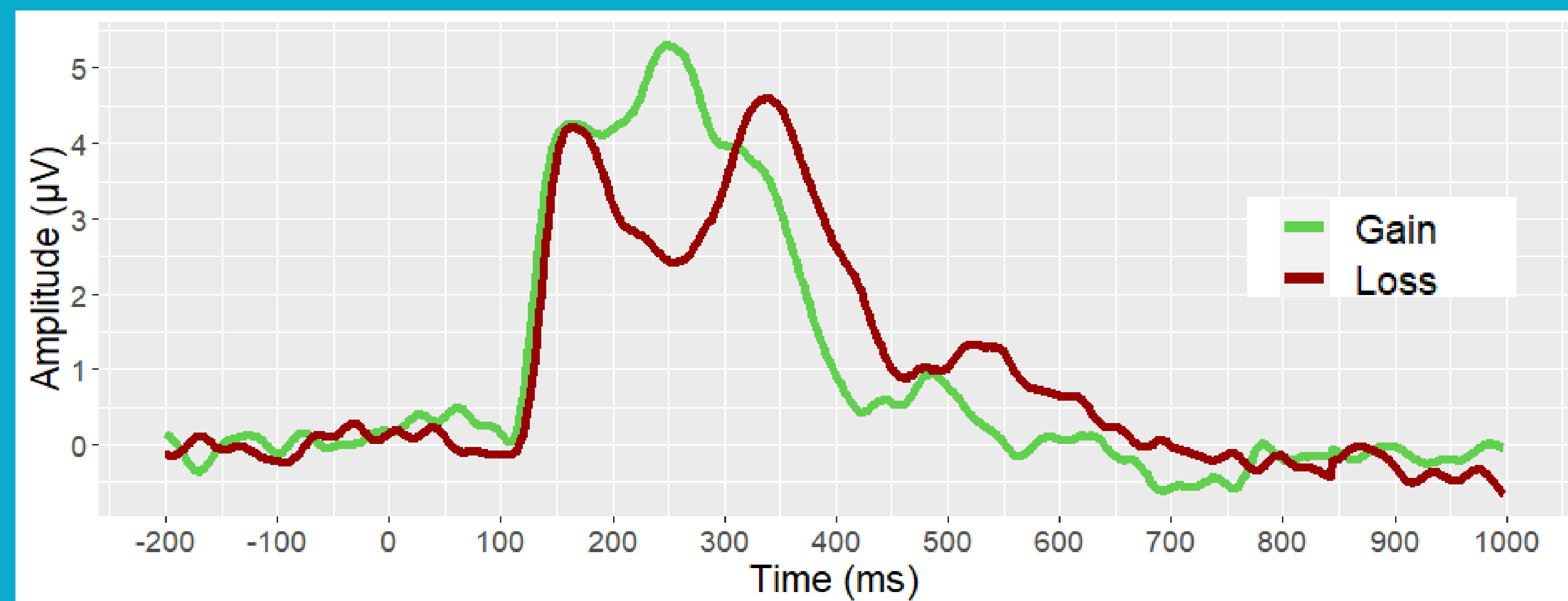


Figure 2. Grand average waveforms in response to gain and loss feedback at Cz.

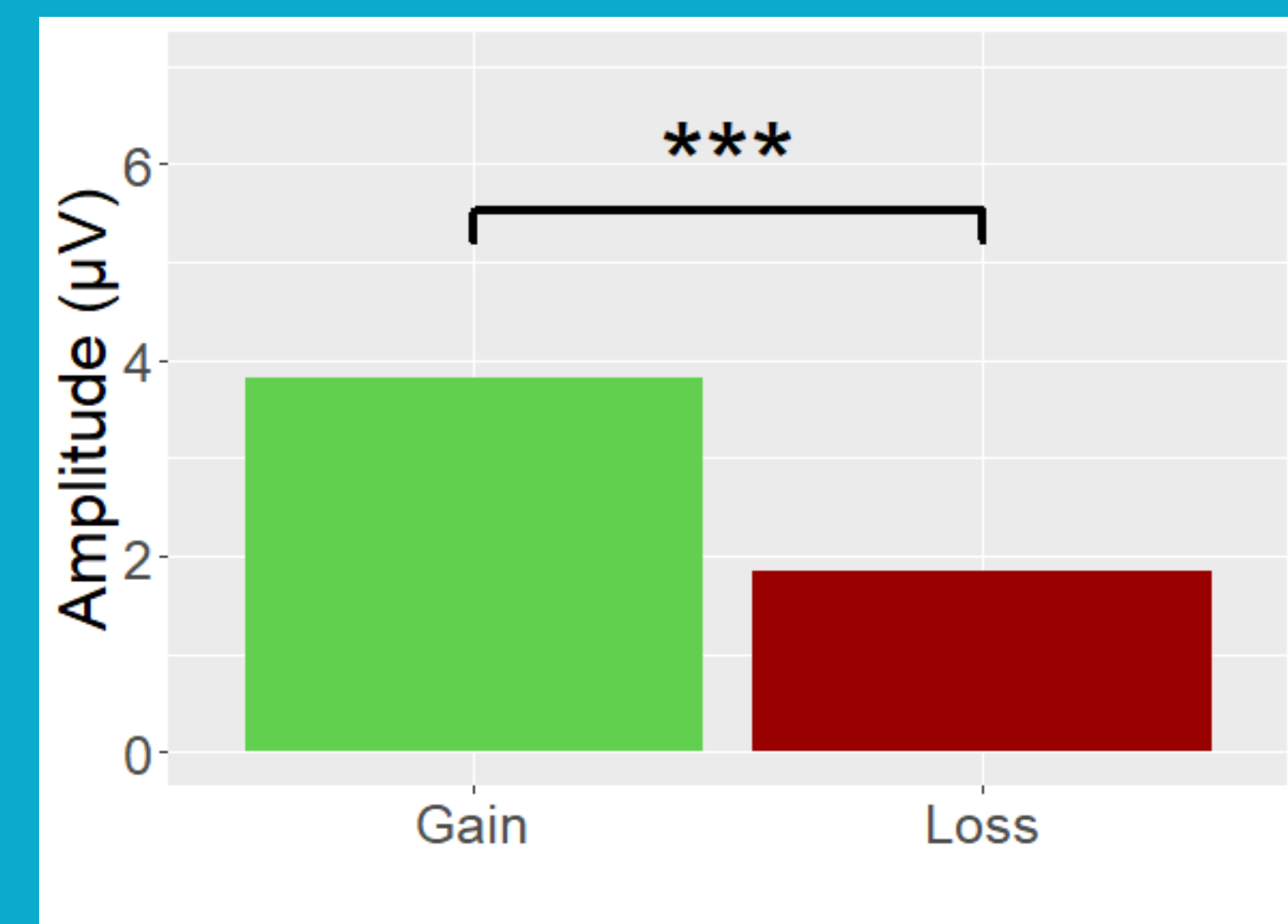


Figure 3. The FRN amplitude to gain feedback was more positive than to loss feedback

Reward responsivity was not associated with irritability or anhedonia individually, or the interaction between both symptoms

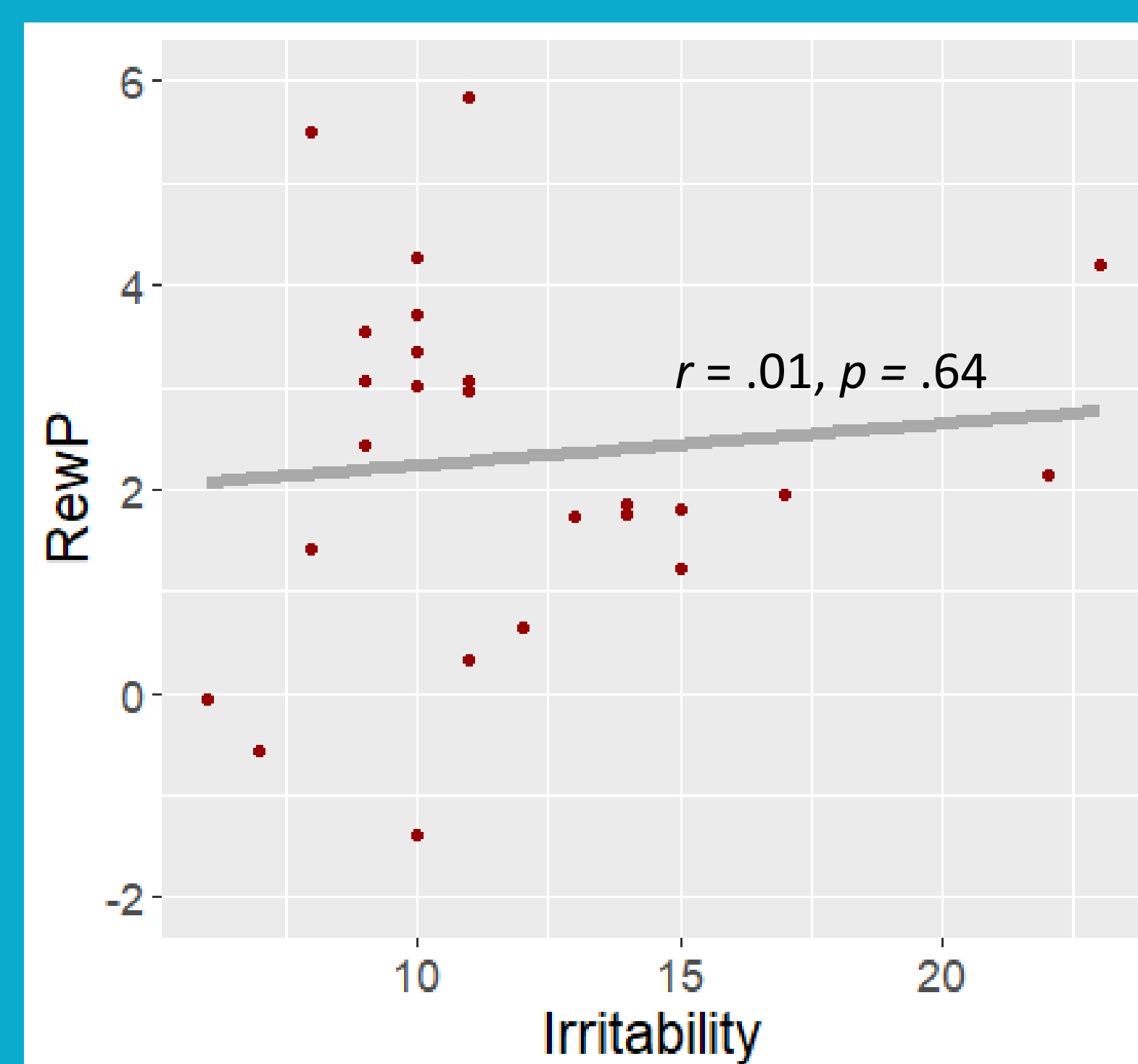


Figure 4. Relationship between RewP and Irritability

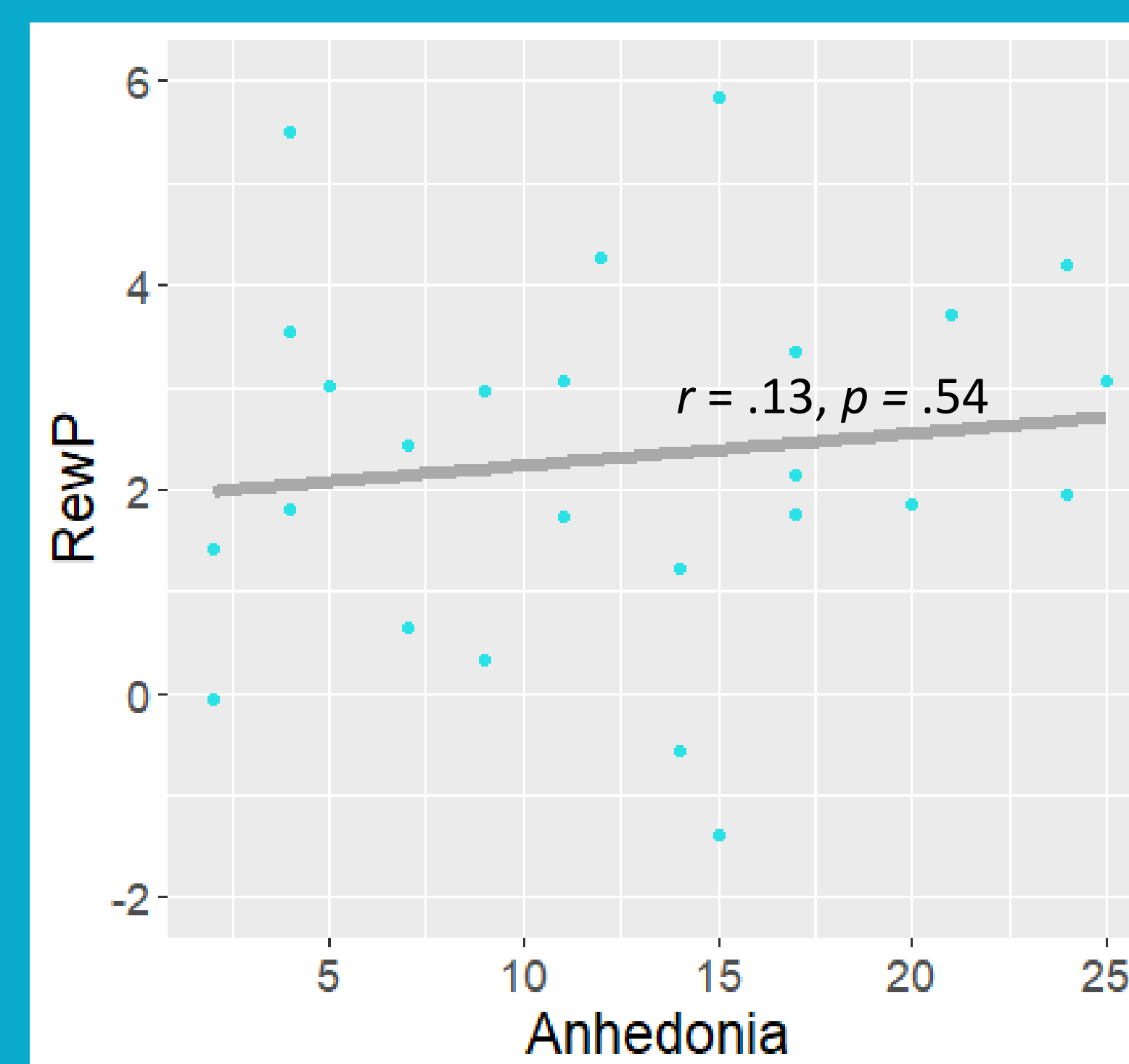


Figure 5. Relationship between RewP and Anhedonia

Predictor	b	95% CI [LL, UL]	SE	t	p
(Intercept)	2.21	1.33, 3.09	0.42	5.22	<.0001
Irritability	-0.01	-0.27, 0.25	0.12	-0.09	0.93
Anhedonia	0.03	-0.10, 0.16	0.06	0.48	0.63
Irritability * Anhedonia	0.06	-0.02, 0.03	0.01	0.47	0.63

Table 1. Results of the linear regression analysis using the centered means of irritability, anhedonia, and the interaction term irritability * anhedonia to predict RewP. B = estimate, SE = Standard Error, CI = confidence interval; LL = lower limit; UL = upper limit.

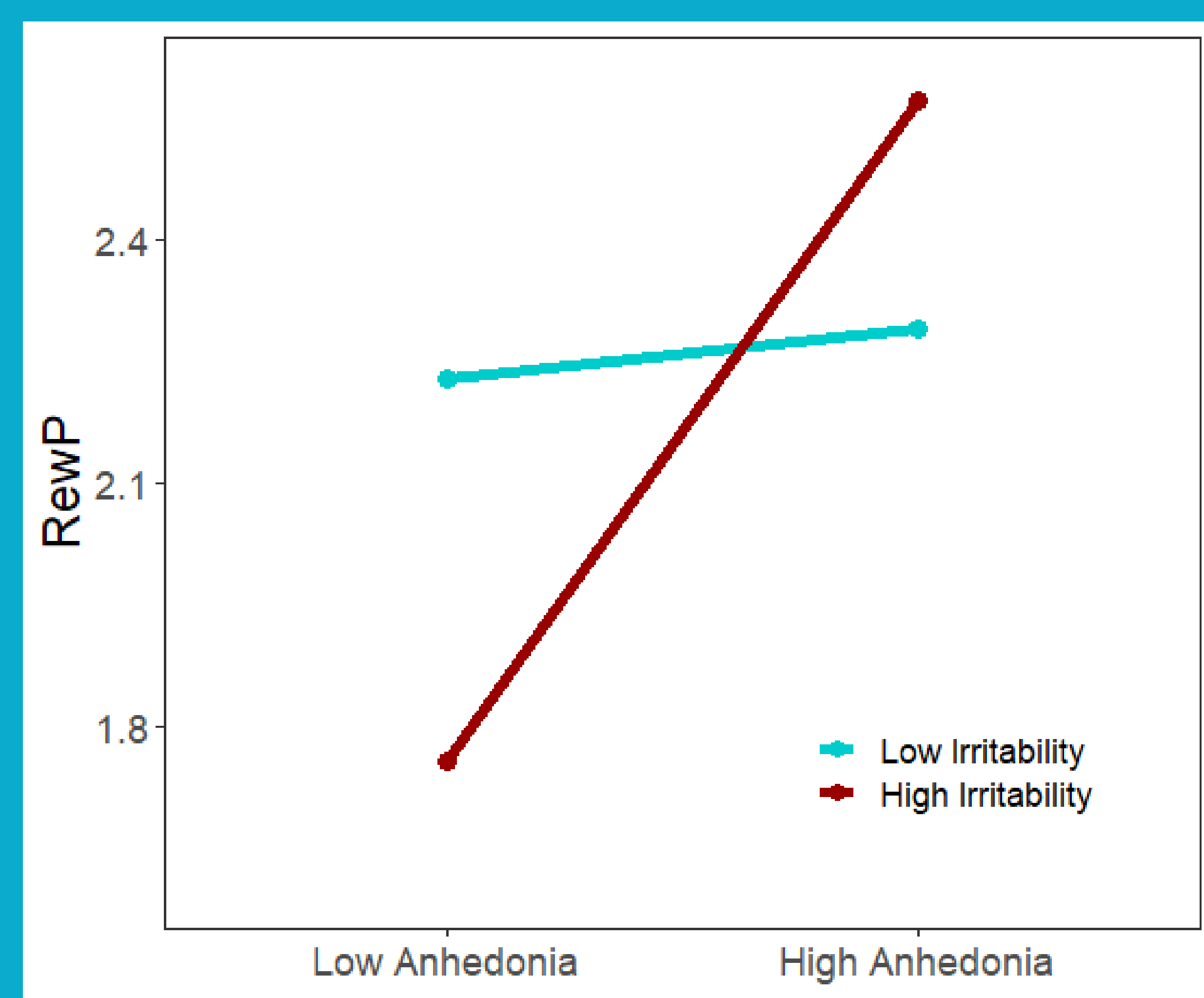


Figure 6. Interaction plot between irritability and anhedonia on the RewP. Low values are – 1 SD and high values are + 1 SD from the mean.

References

1. Brotman MA, Kircanski K, Stringaris A, Pine DS, Leibenluft E. Irritability in Youths: A translational model. *American Journal of Psychiatry*. 2017;174(6):520-532.
2. Borsini A, Wallis ASJ, Zunszain P, Pariante CM, Kempton MJ. Characterizing anhedonia: A systematic review of neuroimaging across the subtypes of reward processing deficits in depression. *Cognitive, Affective and Behavioral Neuroscience*. 2020;20(4):816-841.
3. Poudfit GH. The reward positivity: From basic research on reward to a biomarker for depression. *Psychophysiology*. 2015;52(4):449-459.

Results

- FRN to gain is higher than to loss, $t(40.61) = 4.23, p < .0001$ (Fig. 3).
- Irritability, anhedonia, and depression are positively correlated, $r = .54 - .63, p < .0001$.
- A linear model showed no effect of irritability, anhedonia, or the interaction between irritability and anhedonia on the RewP, $F = 0.20, p = .89$ (Table 1, Fig. 4 & 5).
- However, the interaction graphs showed a potential interacting effect of irritability and anhedonia (Fig. 6).

Discussion

- First study to simultaneously investigate irritability and anhedonia on RewP.
 - Interaction effect between irritability and anhedonia on RewP was NS, which may be due to small N. However, a potential interacting effect suggests:
 - In the high irritability group, greater anhedonia appears linked to higher RewP.
 - In the low irritability group, anhedonia and RewP appear unrelated.
 - The failure to consider anhedonia in past studies might explain the absence of findings between RewP and irritability in adulthood. Future studies should take this interaction into account.
 - If this pattern holds with an adequate N, it might suggest that irritability, when co-occurring with anhedonia, may have different neural mechanisms than irritability presenting alone.
 - Limitations:
 - Sample size is small. Power calculation revealed that $N \geq 65$ is required to detect a moderate effect size.
 - Need of clinical sample to fill the higher ends of the irritability and anhedonia spectrums
- Recruitment still ongoing