PROBLEM GAMBLING AND THE FRN
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BACKGROUND

The feedback-related negativity (FRN) is a negative deflection in the scalp waveform observed 200–350ms following the presentation of the outcome on that trial.1 Previous research identified the anterior cingulate cortex (ACC) to be the generator of the FRN,2 which has been hypothesized to represent the dopaminergic prediction error signal originating in the basal ganglia.2 The FRN has been shown to be larger following negative events (e.g., losses)2,4 and unexpected events2 as well as being sensitive to participant’s engagement in the task,3 sensitivity of responsibility over the outcome,4 and personality characteristics.8 Maladaptive gambling behavior has been associated with altered reactivity of the reward network.5,9 These changes are reflected in the FRN amplitude, which was shown to be attenuated10 and to occur earlier12 in pathological gamblers compared to healthy controls. Our study was conducted to examine how the sensitivity of the FRN to expectation about winning and perceived sense of control over the outcome relates to problem gambling (PG) behavior.

METHODS

Participants (grouped using CPGI13):
- Not at risk for PG (nPG): n = 22, 13 males (59%)
- 31.1 years (range 19 to 59)
- At risk for PG (PG): n = 19, 15 males (79%)
- 5 low-risk, 6 moderate-risk, 8 high-risk
- 30.1 years (range 19 to 44)

Procedure:
- Tasks were counterbalanced
- 128 channel Biosemi sensor net
- Processed using EEGLab (ICA to remove eye and muscle artifact)
- Segmented around feedback (-200ms to +1000ms)

Statistical Analysis:
- 2 (Gambling group) x 2 (Task) x 2 (Expectations) x 2 (Valence) x 8 (Channel) ANOVA was conducted on the peak FRN amplitude.
  - group by task by expectation (F (1,39) = 4.56, p = .039, ηp2 = .105)
  - group by valence by channel (F (2,78) = 3.43, p = .057, ηp2 = .081)

Follow-up analysis showed that individuals at-risk for PG were more sensitive to the valence of the outcomes in the gambling task compared to nPG group.

RESULTS

Gambling (Doors) Task
- Low perceived sense of control (self-report)
- Probability based expectations (consistent with behavioral predictions)
- Outcomes were divided based on prediction (e.g., unpredicted win = unexpected win)
- Higher perceived sense of control (self-report)
- Instructions based expectations (consistent with self-report)
- Outcomes divided by expectation based on cues (e.g., win on an easy cue = expected win)

Time Estimation Task

nPG
- Expectation effects: F (1,21) = 6.56, p = .018, ηp2 = .238.
- No Valence effects: F (1,21) = 0.94, p = .762, ηp2 = .040.

PG
- Expectation effects: F (1,18) = 14.76, p = .001, ηp2 = .413.
- No Expectation effects: F (1,21) = 2.31, p = .144, ηp2 = .099.

Valence effects
- Win: F (1,21) = 14.91, p = .001, ηp2 = .427.
- Loss: F (1,21) = 4.90, p = .037, ηp2 = .192.

CONCLUSIONS

- Individuals at risk for PG showed an increased sensitivity to reward characteristics and a decreased response to loss outcomes.
- Failure to replicate previous research examining severe pathological gamblers reporting a general attenuation of the FRN, suggesting that a general reduction in the FRN can be observed only after behaviour becomes clinically maladaptive.

REFERENCES


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