Reward Processing in Social Competitive Task in Subjects with Familial History of Alcoholism

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Abstract:

BACKGROUND: Healthy subjects demonstrate activation in the "reward circuit", especially in the ventral striatum (nucleus accumbens, NAcc) during reward anticipation, during performance of the Monetary Incentive Delay Task (Hommer and collaborators). Alcoholic subjects, and those with a family history of alcoholism, fail to show this NAcc activation, However, the relationship of this finding to brain activation during reward processing of socially relevant, rather than monetary information is unclear. We investigated the brain circuits involved in processing of reward anticipation in healthy participants with and without a positive family history of alcoholism using a social, competitive decision-making task.

METHODS: Forty-five subjects, 26 with (affected father plus other relatives) and 19 age and sex matched subjects without family history of alcoholism, were tested using functional MRI while playing a goal-directed, competitive Domino game against what they believed was a human opponent. Winning involved having to bluff the opponent on occasion, risking being caught and punished. We analyzed a predefined interval during the game, the Anticipation to Outcome interval, during which participants had already chosen to bluff or play fairly, but were not yet aware of their opponent's response; thus they did not know if they were going to be punished or rewarded. fMRI data were realigned using INrealign, normalized, and smoothed at 9mm. Statistics were created using the general linear model (GLM), generating first level (subject) and second level (group comparison) statistics. The anticipation to outcome interval was compared between the two groups.

RESULTS: Compared to participants with no family history of alcoholism, participants with such a history showed abnormal brain activation in several brain regions while anticipating rewards, including the ventral striatum and ventromesial prefrontal cortex ($p<0.05$;uncorrected).

CONCLUSIONS: These results suggest that alcoholism family history positive individuals exhibit deficient BOLD activation during periods of socially driven reward anticipation compared to non family history positive individuals. Previous studies have delineated deficiencies in ventral striatum, but not ventromesial prefrontal cortex in association with alcoholism risk during reward anticipation, although this latter region processes reward outcomes. The deficiencies found in this study may suggest an inherited aspect of a generalized response to reward anticipation which may be one part of the genetic component that increases risk for alcohol misuse problems.

Sponsored by NIAAA 1 P50-AA12870-05, J Krystal (PI), Project 4 PI G Pearlson and RO1 AA015615 to GP.