Alcohol Effects on ERP Correlates of Cognitive Control

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Alcohol & Cognitive Control

Alcohol is associated with a number of behaviors and patterns of inattentiveness including aggression, role taking, and "loss of control" behavior. These behaviors are characterized by inappropriate modulation of conflict-monitoring tendencies, suggesting alcohol may impair cognitive control processes necessary for appropriate modulation of response tendencies. Cognitive control is an emerging construct in the field of cognitive neuroscience that refers to the ability to activate and maintain a goal-directed response in the face of conflict or distraction. It is a key property of performance on tasks that are complex, difficult, or novel, as well as that involve an external demand during task performance and suggests alcohol may interfere with control over control processes. Recent research on cognitive control has identified distributed components, effects of alcohol may be mediated by alcohol's impact on both evaluation and regulation of cognitive control. This research is of particular interest to studies of alcohol addiction, because the evaluation and regulation of cognitive control are essential for the successful control of behavior.

Methods

To test the effects of alcohol on cognitive control, participants were randomized to one of two groups: an alcohol group and a control group. The alcohol group was further divided into two subgroups: the placebo group and the alcohol group (target blood alcohol level = 0.08%). They performed a modified Stroop color-naming task in which the frequency of congruent, neutral, and incongruent conditions was manipulated. Participants were assigned to a no-alcohol control group, a placebo group, or an alcohol group (target blood alcohol level = 0.08%). Error rates were calculated for all dependent measures to link alcohol effects on each component with associated behavioral consequences.

Behavior Results

Average ERP Waveforms by Site and Beverage Group

Error Rate

Control Placebo Alcohol

Response Time

Control Placebo Alcohol

Summary

Research in this vein may be helpful for understanding the developmental trajectory of alcohol use disorders, which are often characterized by conflicting urges to use and to abstain from use. An inherited or acquired deficit in cognitive control function experienced in the mostly congruent context to the expected effects of alcohol and attempted to compensate by enhancing their evaluative control system.

Response Time:

A significant main effect of context was observed (p<.001) indicating more N2 interference in the mostly congruent context than in the MI context, suggesting that the group that controls alcohol effects on each component with associated behavioral consequences.

Error Rate:

In the alcohol group than the placebo group (p=.001) indicating that beverage only had an effect in the mostly congruent context (p<.001). The alcohol group thus exhibited a larger NSW in the incongruent condition, indicating more regulative activity. This was not observed in the control group, suggesting that alcohol may interfere with normal cognitive control function.

Error Rate:

This is a negative frontal slow wave suggested by previous research to index regulative control. Its topography, suggested source (PFC), latency, and sensitivity to condition effects support this assertion. NSW was calculated as negative slow wave (NSW) 375-475ms post-stimulus onset at the Cz scalp site.

Response Time:

A significant main effect of context was observed (p<.001) indicating more N2 interference in the mostly congruent context. This suggests that alcohol may interfere with normal cognitive control function, which is consistent with previous research. The alcohol group thus exhibited a larger NSW in the incongruent condition, indicating more regulative activity. This was not observed in the control group, suggesting that alcohol may interfere with normal cognitive control function.

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