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The Smoking/Drinking Connection: Smoking Reduces the Effects of Alcohol on Postural Reflexes

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Introduction

- This project (one of MARC's three research components) brings into the laboratory a key theme of the center:
- ***Smoking and heavy alcohol consumption are closely related.***
 - Adolescent smoking is a strong risk factor for heavy drinking.
 - Adult smokers are four to five times more likely to be heavy drinkers.
 - The majority of alcoholics also smoke.
- Laboratory findings can be related to interview and questionnaire data.



Hypothesis: *Nicotine Reduces the Intoxicating Effects of Alcohol*

- The hypothesis agrees with evidence from animal models for cross tolerance between nicotine and alcohol, and some supporting evidence from human studies (e.g. Madden et al., 1996).
- Studies by Schuckit and others show that persons with **low levels of intoxication** after receiving a laboratory dose of alcohol are at **increased risk** for becoming alcoholic—presumably because they are more tolerant of heavy drinking.
- Smoking-related tolerance for alcohol may thus be one route to heavy drinking.



Study Design

Subjects are tested in a laboratory protocol in which they are challenged with acute alcohol drinking and cigarette smoking, individually and in combination.

- Male and female young adults (ages 21-30).
- Data presented here are based on 27 subjects.
- Regular smokers.
- Social drinkers.
- Subjects are given detailed psychiatric and medical interviews, to facilitate comparisons between interview and laboratory findings, and to provide continuity with other MARC projects.



Methods: Procedures

- Subjects participate in four laboratory sessions, each 6-7 hrs in length and given in balanced order.
- The sessions involve the four combinations of Alcohol (or Placebo Alcohol) and Smoking (or Non-Smoking).
 - Placebo alcohol (A-S-).
 - Alcohol alone (A+S-).
 - Placebo alcohol plus cigarette smoking (A-S+).
 - Alcohol plus cigarette smoking (A+S+).
- Subjects smoke individual cigarettes at the 3 times indicated in the next figure.
- Testing is preceded by 3 hrs smoking deprivation.



Methods: Alcohol Dosing

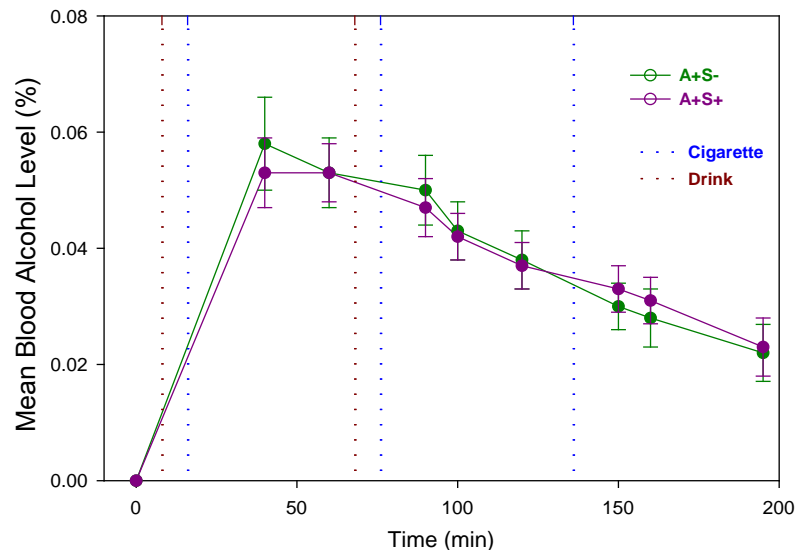
- Alcohol is given orally, in an initial loading dose of 0.80 mg/kg lean body weight (0.56 g/kg for females) followed after 60 min by a small maintenance dose (0.075 g/kg for males, 0.053 mg/kg for females).
- Alcohol is meted out in four small cups over a 8 min period.

• Shown at right are BAC levels in the two sessions in which alcohol was administered.

• BAC levels peak between 0.05 and 0.06%.

• ***Smoking does not affect BAC.***

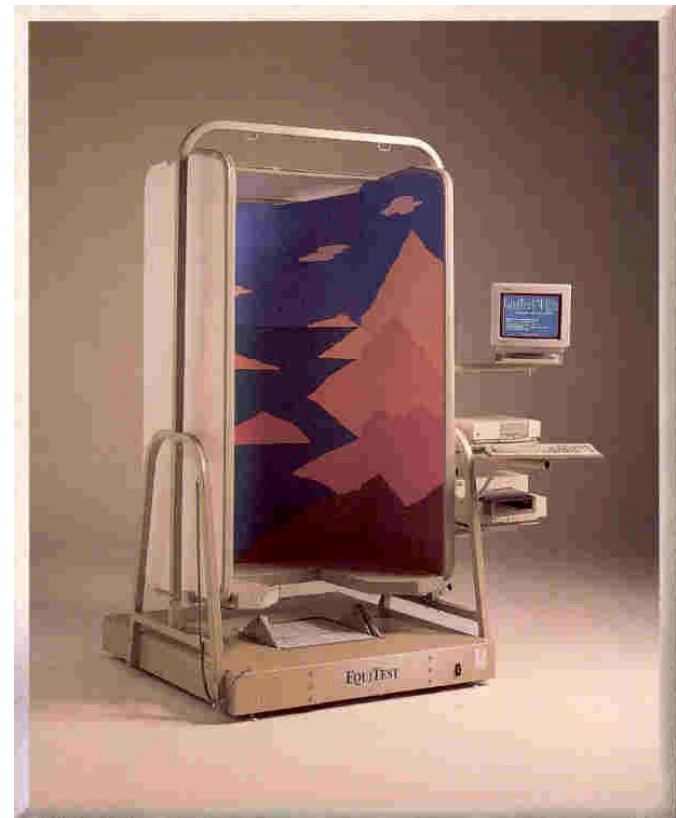
• Dosing times are shown by vertical dashed lines.





Methods: Computerized Dynamic Posturography (CDP)

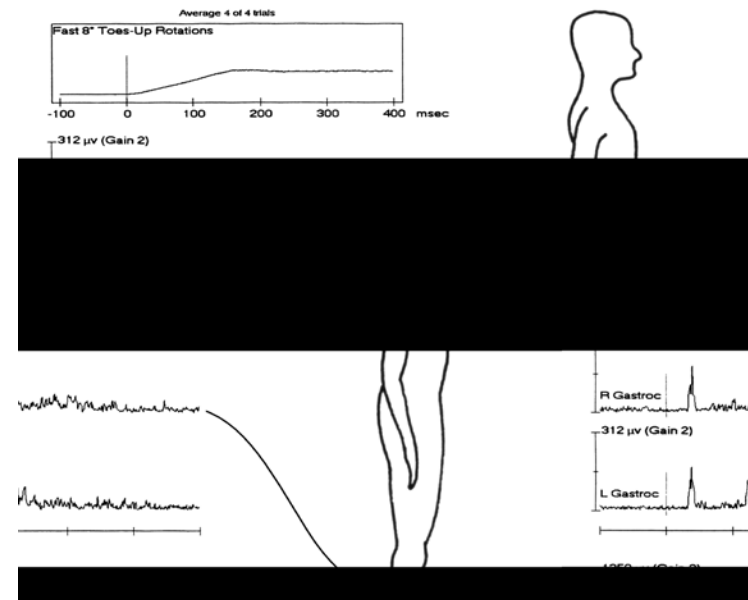
- CDP techniques yield separate tests of sensory and motor functions.
- Subjects stand on a moveable platform that can challenge balance by making abrupt movements, and also senses sway and shear forces kinematically.
- Visual surround can also be moved in phase with sway to distort normal cues to balance.





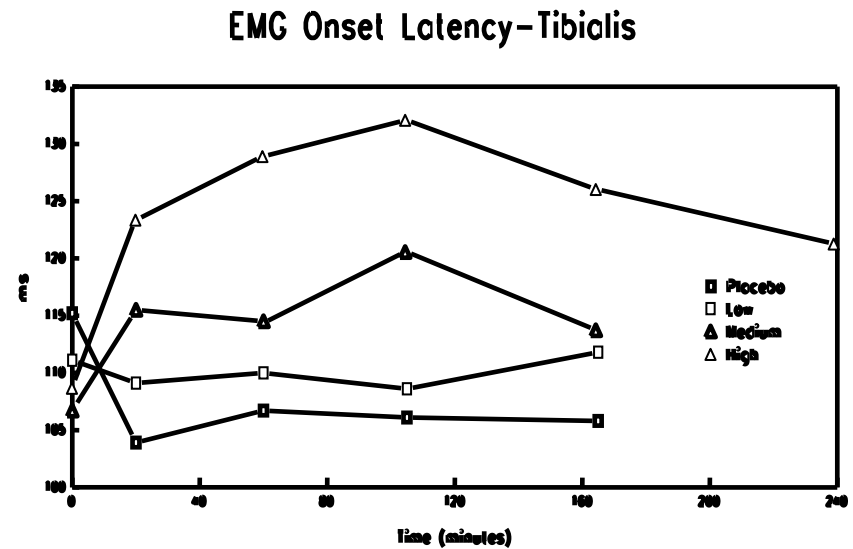
Methods: CDP Motor Control Tests

- Motor control tests involve sudden rotational or translational movements of the support surface.
- The corrective reflexes are studied using electromyographic (EMG) recordings from leg and trunk muscles.
- Data shown here are from toes-up rotation.
- The early, spinal stretch reflex in the gastrocnemius further destabilizes balance and must be corrected with a long-latency tibialis response involving long loops through the brain.
- As shown in the next panel, the onset latency of the corrective tibialis reflex is prolonged (slowed) by even modest doses of alcohol.



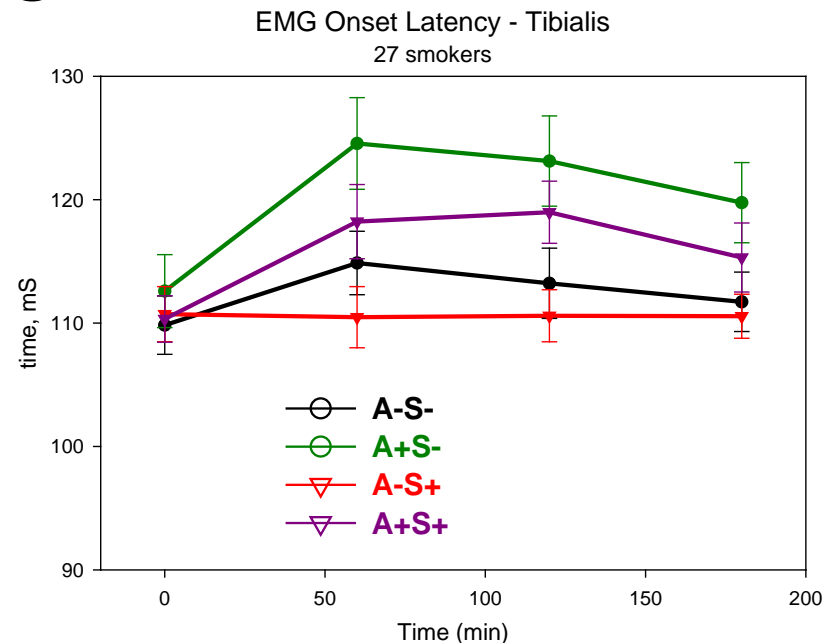
Results: Dose-Related Effects of Alcohol on Latency of Long Loop Postural Reflexes

- Shown here are tibialis reflex latencies (toes-up condition) from a preliminary study of 12 subjects, who received four alcohol doses (placebo, 0.4, 0.8, 1.2 g/kg lbw, in separate sessions).
- Long loop reflexes were slowed by all doses.
- Early short spinal stretch reflexes were unaffected (not shown)
- These data attest to the extreme sensitivity of the long loop reflex latency measure to modest doses of alcohol.



Results: Effects of Alcohol and Smoking on Latency of Long Loop Postural Reflexes

- The onset latency of the corrective tibialis reflex was significantly prolonged by Alcohol, at each of the measurement times following dosing.

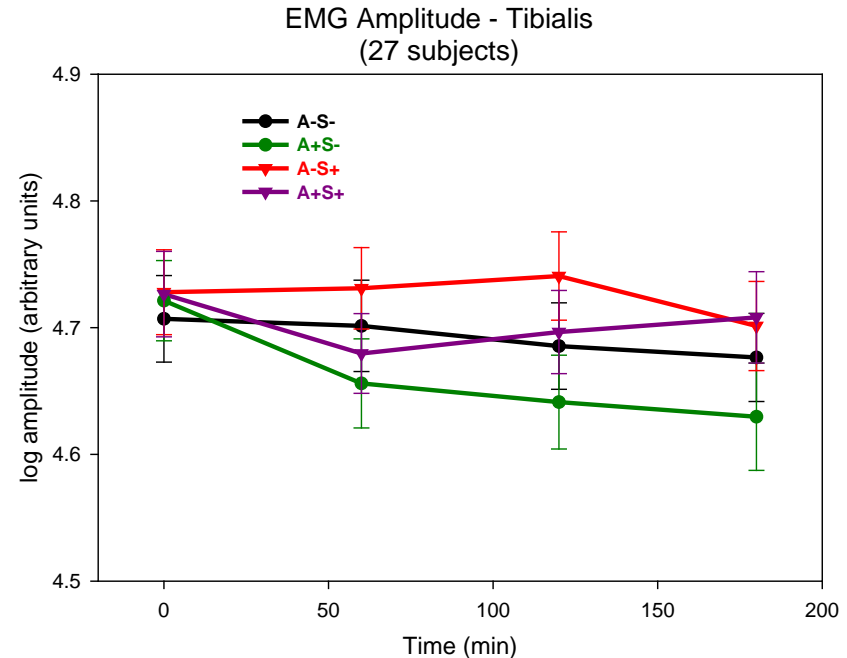


- Consistent with the overall hypothesis, the slowing of the long-loop tibialis reflex produced by Alcohol was significantly offset if subjects also Smoked.***



Results: Effects of Alcohol and Smoking on Amplitude of Long Loop Postural Reflexes

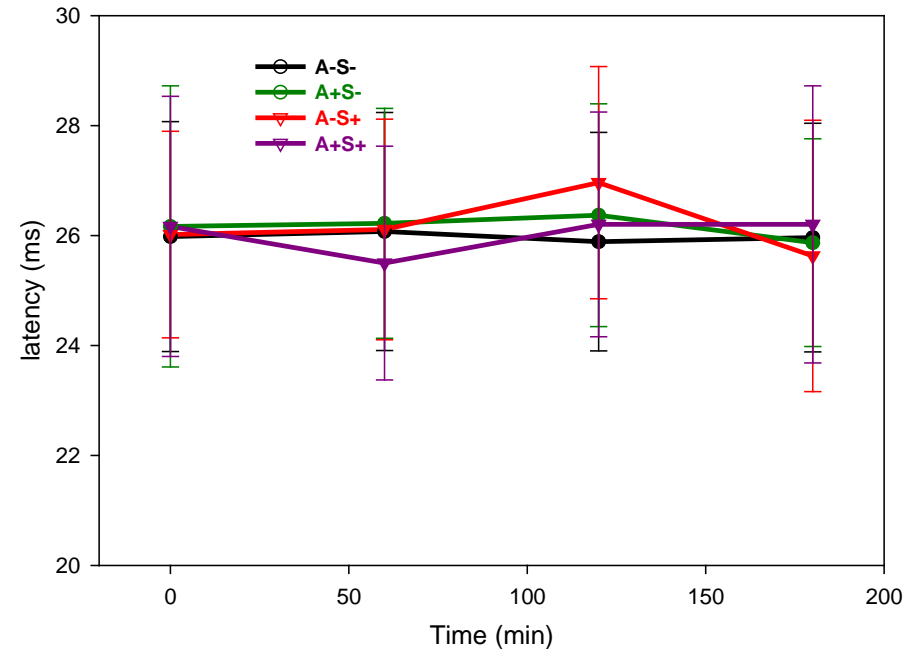
- The amplitude of the corrective tibialis reflex was also significantly affected by alcohol and smoking.
- The reflex amplitude was significantly reduced by alcohol, and increased by smoking.
- Consistent with the overall hypothesis, the effects of alcohol on reflex amplitude were offset if subjects also smoked.***



Results: Effects of Alcohol and Smoking on Latency of Early Spinal Stretch Reflexes

- In agreement with findings of other studies, the onset latency of the early gastrocnemius stretch reflex was not significantly affected by Alcohol or Smoking.
- These findings suggest that the effects on long loop reflexes (described above) are central in origin.

EMG Onset Latency - Early Tibialis
(27 smokers)





Conclusions

- Postural control was impaired by a modest dose of alcohol, as assessed using electromyographic (EMG) recordings of leg muscles following rapid toes-up perturbations of the support surface.
- Consistent with our overall hypothesis, ***the impairments were reduced when subjects also smoked.***
- In accord with previous evidence that low reactivity to alcohol is a risk factor for alcoholism, these findings suggest that smoking may be causally involved in the development of heavy drinking.
- Responses in other domains (cardiorespiratory, subjective report) showed a mixture of effects suggesting that a variety of cross-tolerance, antagonistic, additive and sensitization processes are also present.