ANOVA Abstract Article

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Research hypothesis

A computerized task was used in two studies to examine the influence of stimulants, sedatives and fatigue on single-target and divided-attention responses in different parts of the visual field. The drug effects were evaluated over time against ascending and descending drug levels with repeated behavioral and subjective measures. An individual's ability to extract information from different parts of the visual field while taking a computerized test was measured under various conditions.

For the purposes of this abstract, Study Two, the interaction of stimulants and alcohol with fatigue, was examined. The hypothesis for this study was that impairment from alcohol and enhancement from stimulants on the Performance Online (POL) test would be greater after fatigue.

Null hypothesis

The null hypothesis for this study is that there is no significant difference in impairment from alcohol and stimulants on the POL test after fatigue.

Sample

Four independent groups of eight participants each received placebo, 10 mg. dextramphetamine, 250 mg. caffeine or alcohol. The first group of
participants received their treatment after 18 hours of induced fatigue, and the second group received their treatment after a night’s sleep in the clinic. Each main group had 16 participants. After six days, the same participants returned and received the same treatment along with the fatigue/sleep condition opposite to that from the first time. Each participant received the same drug treatment over the two periods.

The participants were volunteers who were recruited through newspaper advertisements and were paid $500 to participate. There were 19 women and 13 men ranging from 21 to 48 years.

**Level of significance**

A value of $p<.05$ determined statistical significance. The authors do not justify the use of this significance level.

**Summary statistics**

The independent variables and treatment groups are shown in Table 2 below.
The variances in this study are partitioned into sequence, participant within sequence, period, fatigue, treatment effect, and residual error. The mean age of the participants is 33.2 years.

**Evidence that assumptions were tested**

The authors do present evidence that they tested for the assumptions appropriate for the statistical procedure. The scores were analyzed by using an ANOVA for crossover designs with nested treatments. By using the crossover design, the authors maximized within-participant comparisons because each participant acted as his or her own control for fatigue effects.

The researchers also added testing time relative to dosing to characterize treatment effects over time and looked at the interaction between treatment and fatigue.

To minimize any learning effect on the Performance Online Test (POL), change from baseline scores were calculated by adjusting for baseline differences within each fatigue/no fatigue period.

This is an experimental study and a within-subjects/repeated measures design is often used with this type of research.

**ANOVA table**

The ANOVA table on the following page shows the results from the Repeated-Measures ANOVAs of the baseline-adjusted composite and divided attention scores from Study 2.
Use of the ANOVA table

Using the within-subjects repeated measures design was an advantage because fewer participants were needed for the study. It also reduced the variability among the participants thus reducing error variance. Since each participant underwent the same treatment with fatigue and no fatigue, it is expected that any changes would be due to the nature of the condition and not the variability among participants. This reduction in error variance results in a
greater probability of finding a statistically significant difference if there truly is one.

In situations where there might be a carry-over effect, repeated-measures design cannot be used. However, because the effects of specific dosages of stimulants were not long lasting in this study, the method used was appropriate.

There were no post hoc tests performed in this study. In order to determine where the differences took place, it seems a post hoc test would be necessary.

**Conclusions**

The ANOVA table shows that fatigue effects were statistically significant for the composite score $p = .0004$, so task performance was reduced during fatigue as compared with no fatigue. In the fatigue period, overall impairment worsened throughout the night, reflected by a decrease in the divided-attention scores.

The effect of time was not significant and did not interact with any other effects. The Composite score showed a significant Treatment x Fatigue interaction. Alcohol reduced scores after fatigue, whereas dextroamphetamine increased scores during the no fatigue period.

According to the authors, the findings confirmed their expectation that the interaction between a moderate amount of alcohol and sleep loss was devastating to visual and cognitive skills. Contrary to their prediction, the overall effects from the two stimulants on participants with fatigue were negligible.
When participants were fully rested, the dextroamphetamine produced significant enhancement in divided attention skills and the caffeine had no effect.

The authors report some statistics from the study that is not shown in any of the tables or graphs that are included in the article. For example, they state that the participants who received alcohol in the no fatigue period reported significantly greater impairment on the sedative scale than did comparable placebo participants, $p = .0382$. However, where that statistic came from is unclear. They also discuss the fact that participants reported significantly greater stimulant effects for caffeine $p = .0087$, dextroamphetamine $p = .0021$, and alcohol $p = .0001$ when they were fatigued compared with when they were not. Again, it is unclear where these statistics are from as there are no tables that show these.

The authors concluded that Study 2 shows that sleep loss further compromises skills similar to those essential for driving, such as scanning and decision-making, and those stimulants offer no significant help. The findings suggest strong relationships between the amount of sleep loss, the extent of impairment, and the loss of judgment. The loss of judgment brought on by fatigue could put drivers at a higher risk if they believe that taking anything might improve performance.

It seems like the authors draw some broad and general conclusions from this study. I am not convinced, based on the data provided, that their research supports all of their claims.
Quantitative research in area

The results of this study showed strong relationships between the amount of sleep loss, the extent of impairments, and the loss of judgment brought on by fatigue. When there is sleep loss, decision-making is affected and stimulants offer no significant help. While this study was looking at the risk factors that might increase accidents, these same factors might also have an effect on student learning in school. High school students in Fairfax County are currently catching the bus at 6:20 in the morning. Their first class starts at 7:10. My daughter runs out of the house with a cup of coffee to help her stay awake. How do all these factors affect her education? Research that looks at the effects of sleep loss and stimulants as it relates to education could certainly be an extension of this study.

On a lighter note, research that evaluates the effects of sleep loss for students in doctoral programs might also be appropriate. How many times after a late night of studying or writing papers, do I stop at Starbucks on my way to work and buy a latte with double espresso to get some caffeine in my system? According to this study, that high dose of caffeine does not significantly help combat fatigue. The only thing that really works is a good night’s sleep!

Pledge

I have received no aid on this assignment.