The SFST and Driving Ability. Are they related?

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Abstract

The SFST includes the Horizontal Gaze Nystagmus test, the Walk and Turn test and the One Leg Stand test. Several studies report the reliability and validity of the SFST to detect alcohol intoxication as low as .08% BAC. Victoria Police, Australia, have recently included the SFST in law enforcement, not to test for alcohol intoxication, but to test for drug impairment. Victoria Police, by law, must establish that the driver being prosecuted was impaired to a degree equivalent to a BAC above .10%, irrespective of the level and class of drug found in the drivers specimen. Since no studies have clearly established the relationship between SFST performance and driving impairment this study examined the relationship between performance on the SFST and performance on a driving task. The aim of this study was to establish the accuracy of the SFST in detecting driving impairment after the administration of cannabis. Forty participants were administered the SFST and a driving task in placebo, 1.74% THC and 2.93% THC conditions. The administration of the SFST resulted in 73% correct classification of the sample as either impaired or not impaired on the driving task after the administration of cannabis. The results indicated that the OLS test was the best predictor of driving ability and the inclusion of a ‘new’ sign HMJ (head movements/jerks) scored in the HGN test, improved the accuracy in detecting impairment.

Introduction

Statistics

Road fatalities related to marijuana intoxication have steadily increased over the last 10 years and this has led to the introduction of sobriety testing in Victoria, Australia to test for driving impairment caused by marijuana intoxication. Surveys have reported an increase in community concern in Australia over the use of marijuana and an increase in the prevalence and use of marijuana (National Campaign Against Drug Abuse Survey; 1985, 1988, 1991, 1993; National Drug Household Survey; 1995, 1998). Commensurate with the increase in the use of marijuana in society, road statistics indicate that the number of road accidents and deaths involving the presence of THC (the active ingredient in marijuana) in driver specimens has also increased (Drummer & Gerostamoulos, 1999).
Cannabis impairs driving ability.
Past research examining the effects of THC on driving indicate that the consumption of THC results in the impairment of both car control (Moskowitz, 1985), and the maintenance of the lateral position of a vehicle (Ramaekers et al., 2000). In addition, intoxication by THC increases the likelihood of crashing into obstacles on a driving course (Hansteen et al., 1976).

Cannabis impairs SFST performance
The validity of sobriety tests have been previously examined by other researchers and their conclusions suggest that sobriety tests have a varied accuracy in detecting impairment caused by drugs, ranging from 44% (including predictions of specific drug class) to 94% (prediction of any drug other than alcohol) (Heishman et al., 1996; Compton, 1986).

Are the SFST and driving performance related?

Method
We tested 40 participants comprising 14 females and 26 males. All participants completed a medical examination questionnaire, demographics questionnaire, Frequency of Cannabis Use Questionnaire and Intoxication Rating Questionnaire. All participants completed 3 testing sessions involving the administration of a placebo cigarette (0% THC), the administration of a low THC cigarette (1.74% THC) and the administration of a high THC marijuana cigarette (2.93% THC). All sessions were randomised, counter-balanced and double-blind. In each session, participants completed 3 sobriety tests and 2 driving simulator tests. Sobriety tests were scored by allocating a score of 1 for each sign (error, e.g., hopping during test performance to maintain balance) observed by the administrator. Generally, a score of 2 or more constituted impairment to a degree equivalent to a blood alcohol concentration (BAC) above 0.10%. The driving simulator test comprised 36 variables. Each time the participant performed an error, a loading factor was added to the corresponding variable (e.g., collision (variable) loading factor is 10, if a collision occurred twice a score of 20 was allocated to this variable). The sum of all 36 variables constituted the level of overall driving impairment.

Results and Discussion

Driving
Results from the driving simulator task revealed that THC impaired the driving variables: ‘straddling the solid line’ and ‘straddling the barrier line’. Increasing levels of THC increasingly impaired the ability to maintain the steady position of a vehicle within the correct traffic lane. The consumption of low and high doses of THC resulted in two or more wheels of the vehicle moving over a solid line marked out for traffic moving in the opposite direction. Low and high doses of THC also resulted in two or more wheels of the vehicle moving over a broken/barrier line marked out for traffic moving in the same direction. Increasing levels of THC impaired both the balance and the attention required to control the position of a vehicle in traffic. These results are consistent with past research indicating that THC impairs car control (Moskowitz, 1985) and increases the standard deviation of the lateral position of a vehicle (Smiley et al., 1981; Ramaekers et al., 2000). Research into the effects of
THC on brain cannabinoid receptors indicate that THC interferes with normal functioning of the cerebellum, the brain region responsible for balance, posture, and the coordination of movement (Childers & Breivogel, 1998).

**SFST**

The results of the present study also indicate that THC impairs performance on sobriety tests with more individuals impaired with increasing levels of THC (e.g., at Time 1; placebo: 2.5%, low THC: 23.1%, and high THC: 46.2%). The test most related to the level of THC was the OLS, where almost all signs of this test were observed, after the consumption of both low and high THC cigarettes. The accuracy of a ‘new’ sign in the scoring procedure of the HGN test: head moves/jerks (HMJ) was also identified. Including HMJ increased the percentage of individuals scored as impaired after the consumption of low and high THC cigarettes (e.g., at Time 1; placebo: 2.5%, low THC: 38.5% and high THC: 56.4%). Including HMJ as a sign significantly improved the accuracy of the SFST to detect impairment associated with the level of THC.

The SFST and Driving Ability. Are they related?

When driving ability was impaired and significantly related to the level of THC, the SFST was also related to level of THC. Sobriety test performance was related to driving impairment, because, as driving impairment increased with the level of THC, so did the number of signs present during the performance of the sobriety tests.

Although there was a positive linear relationship between driving ability and performance on the sobriety tests, such as the relationship between straddling barrier lines and the OLS test, the validity of sobriety tests to predict driving impairment in part depends upon the size of this relationship. Using performance on the SFST to assess “impairment”, 46.7% of individuals in the high THC condition were impaired. A discriminant analysis was performed to determine whether the remaining 53.3% of participants were also impaired but not classified as impaired, or whether the SFST correctly classified them as not impaired. The results indicated that the sobriety tests (SFST, HGN, WAT and OLS) correctly assessed 76.3% of participants in the high THC condition as either impaired on driving or not impaired on driving. Specifically, this percentage included the correct identification of 84% of impaired drivers as impaired, but only 61.5% of unimpaired drivers as unimpaired. The best predictor of driving impairment was the OLS test. In the low THC condition the sobriety tests correctly classified 100% of impaired drivers as impaired, but this occurred at the expense of falsely classifying most unimpaired drivers as also impaired. This finding suggests that sobriety tests detect the presence of THC even when driving is not impaired.

Examining the utility of including the ‘new’ sign HMJ in the SFST indicated that when identifying impairment on the driving task performed at Time 2, in both the low and high THC condition, the SFST was a better predictor of driving impairment when HMJ was included than when the sign was not included. This finding suggests that the inclusion of HMJ in the SFST scoring procedure increases the likelihood of detecting drivers who are impaired by THC.
Conclusion

In conclusion, the results suggest that THC consumption impairs driving performance by reducing one’s ability to maintain a safe position in traffic. At this time THC plasma levels are between 3 and 5 ng/ml. Performance on the sobriety tests is also impaired by increasing levels of THC. The OLS test is the most sensitive test in detecting the presence of THC. The SFST and the tests that it comprises are relatively accurate predictors of driving impairment but do misclassify 16% of impaired individuals and 38.5% of not impaired individuals. In addition, the results suggest that sobriety tests are more sensitive to the presence of THC than actual driving impairment. This was revealed by the large number of individuals judged as impaired on driving in the low and high THC conditions even when driving was unaffected. It is important to note that when this occurred, the sobriety tests were accurate in detecting 100% of impaired individuals. Finally, the introduction of the ‘new’ sign HMJ is likely to increase the accuracy of the SFST to detect individuals impaired by THC and therefore this sign should be considered for inclusion in SFST administration by policing agencies.