Case Studies of Driver Intoxication Attributed to use of Synthetic Cannabinoid Designer Drugs

Dr. Barry Logan
Ms. Jillian Yeakel

NMS Labs, 3701 Welsh Rd, Willow Grove, PA 19090
Center for Forensic Science Research and Education, Willow Grove, PA, 18901

Abstract

Background
Synthetic cannabinoid drugs with effects similar to marijuana have become popular since their appearance in Europe and the United States in 2009, and have been implicated in driver impairment.

Aims
The aim of the project was to identify characteristic behaviours, signs and symptoms in drivers subsequently confirmed as having ingested synthetic cannabinoid drugs as the sole apparent intoxicant consumed.

Methods
Blood samples from the individuals suspected of synthetic cannabinoid use were analysed for a relevant scope of synthetic cannabinoid drugs known to be prevalent on the street at that time. Arrest and laboratory reports from the subjects were reviewed and analyzed.

Results
Driving behaviours in these impaired drivers included poor vehicle control, collisions, and aggressive driving. Generally the constellation of effects was similar to those of marijuana, including watery bloodshot eyes, slightly dilated pupil size, lack of convergence of gaze, and increased pulse. There was no consistent evidence of horizontal or vertical nystagmus. Performance on field sobriety tests was poor, with problems with balance, coordination, fine motor control, attention, ability to follow instructions and presence of muscle tremors. The drugs detected in blood included JWH-018, JWH-250, AM-2201 and XLR-11. Concentrations of the drugs in whole blood were in the range 0.38 to 9.9ng/mL.

Discussion and Conclusions
The constellation of symptoms from synthetic cannabinoid use is very similar to that associated with marijuana use, with more frequent reports of anxiety. The clinical indicators were similar to those of the cannabis category in the Drug Recognition Expert (DRE) program. Synthetic cannabinoid testing should be performed in cases where the symptoms or history suggest cannabis use, but initial drug tests are negative. Future work will involve expansion of the scope of this testing and identifying additional cases with driving histories.

Introduction
Synthetic cannabinoid drugs have seen increasing popularity in the United States and worldwide since 2009 (Logan et al, 2011). These drugs which are prepared by spraying the psychoactive chemicals onto inert plant materials, and subsequently smoked in a joint or in a vaporizer, cause effects very similar to those experienced with marijuana.
toxicologists face the challenge of relating observed symptoms of impairment documented during a DUI arrest with the subsequent toxicology test results. To date no published reports have appeared of the specific signs and symptoms observed in these drivers, against which to evaluate future cases. Additionally since the drugs are novel, no controlled administration studies have been performed on which to base these opinions. Post hoc evaluation of known impaired drivers provides the best set of data for evaluating this novel and poorly understood new class of drugs.

**Methods**

A series of cases of suspected impaired driving were reviewed in which the driver underwent a psychophysical assessment and subsequently tested positive for synthetic cannabinoid drugs, but negative for other impairing drugs or alcohol. Subsequent to their arrest the drivers were evaluated through the standardized Drug Recognition Expert (DRE) protocol, which includes collection of cognitive and psychomotor (balance, tremor, divided attention, muscle tone) and physiological indicators (pulse, blood pressure, pupil diameter, lack of convergence, etc.) for evidence of common drug induced indicia.

Blood samples were subjected to routine testing by immunological and gas chromatographic procedures for the identification of drugs known to be common in the impaired driving population. In addition, based on the subjects’ statements, drug material or paraphernalia found in the vehicle, or impairment unexplained by the results of routine drug testing, blood samples from the subjects were also tested for synthetic cannabinoid drugs. Initially samples were either screened by ELISA for species cross-reacting to a JWH-018, and JWH-250 ELISA (Arntson et al, 2013), or by liquid chromatography- mass spectrometry (LC-MS/MS) (modified from Kacinko et al, 2010). The scope of testing included AM-2201, AM-694, JWH-018, JWH-019, JWH-073, JWH-081, JWH-122, JWH-175, JWH-200, JWH-210, JWH-250, RCS-4 and RCS-8.

**Results**

In total twelve cases were considered in which at least one synthetic cannabinoid drug was detected, but in which other drugs and alcohol were ruled out. Twelve subjects were positive for at least one synthetic cannabinoid, most were positive for more than one. Specific driving behaviours leading to the arrest were not available, although it was known that four of the cases resulted from motor vehicle accidents.

Review of the behaviour and appearance of the drivers indicated as follows. The attitude of the drivers was typically cooperative and relaxed, and coordination was noted to be generally poor. Speech was slow and slurred. Eye examinations indicated that eyelids were typically droopy, and their eyes were reddened. Subjects frequently had an inability cross their eyes (lack of convergence). Horizontal gaze nystagmus was typically absent in the subjects, while pupil sizes ranged from pinpoint to normal to dilated, with no apparent pattern.

Pulse rate was generally elevated, and systolic blood pressure was elevated in six of nine subjects in whom this was evaluated. In all cases, the DRE officer’s final opinion was that the subject was under the influence of cannabis. This was unsurprising, since the DRE program does not have a separate drug category for synthetic cannabinoids and the symptoms noted above are all consistent with the appearance of a subject under the influence of marijuana.
Performance in field sobriety tests was generally poor, with subjects displaying eyelid and leg tremors, and body sway during the Romberg balance, one-leg stand and walk-and-turn tests.

**Discussion**

While the cannabinoid CB1 and CB2 receptor binding of various synthetic cannabinoids have been documented either in the open literature or in patents, very little has been published regarding their functional activity. Drugs that bind to receptors can be either full or partial agonists, antagonists or inverse agonists depending on the signaling they generate and the secondary messengers they release. Circumventing the in vitro - animal study – clinical trial model and releasing these drugs straight to the street market, means that very little is known about their effects or potency. The adverse effect profile of the drugs has to date prevented any controlled human administration studies, relying instead on more anecdotal reports. Research teams have reported some self-experimentation, and anecdotal observation of individuals who have recently smoked the drug do support the effect profile as being similar to that of marijuana, with an important difference of increased incidence of reporting of anxiety and paranoia. Seizures have also been reported.

Hermans-Clausen et al (2012) reported adverse events data on 29 subjects reporting to an emergency room, who later were confirmed via toxicology testing to have ingested synthetic cannabinoids including CP47,497, JWH-018, JWH-019, JWH-081, JWH-122, and JWH-122. These subjects also displayed effects similar to those described in marijuana smokers. Additionally reports of emergency department visits and calls to poison control centers have identified marijuana-like symptoms in these subjects. This series of arrested drivers also show symptoms consistent with marijuana use, including notable, bloodshot eyes, lack of convergence, increased pulse and blood pressure, and psychomotor effects on balance. The subjects did however show highly variable effects with some subjects performing well in field sobriety tests in spite of having elevated blood concentrations of the synthetic cannabinoids. Certainly in these cases other drugs and alcohol were ruled out as the cause of the observed impairment, making it likely that the reason these individuals came to the attention of the police was due to their synthetic drug use.

In the absence of structured dosing studies, short case series of actual impaired driving subjects with comprehensive toxicology testing to rule out other drugs, and a relevant scope of testing for the most current synthetic cannabinoids is a useful source of information about potential spectrum of effects that may contribute to impairment.

**References**

