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# Synthetic Cannabinoid Use: A Case Series of Adolescents

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A B S T R A C T

**Purpose:** Synthetic cannabinoid products have been increasingly used by adolescents for the past few years, but little literature exists describing their psychoactive and physical effects. This study describes the psychoactive and physical effects of synthetic cannabinoids as reported by adolescent users.
**Methods:** This study reviewed the records of 11 individuals aged 15–19 years who were evaluated at the South Miami Hospital Addiction Treatment Center in Miami–Dade County, Florida.

The average age of the subjects was 17.3 years (standard deviation = 1.35; range (R) = 15, 19); 10 of 11 (91%) were male and 10 of 11 were Hispanic. The charts of youth who admitted use of synthetic cannabinoids were reviewed. Demographic information, characteristics of the substance, and descriptions of the psychoactive and physical effects were abstracted from the standardized, semi-structured clinician interviews.
**Results:** All the subjects reported a feeling of euphoria and memory changes. Nine (82%) reported negative mood changes. Marijuana and alcohol use was also reported by 10 (91%) subjects. The number of other drugs used was significantly correlated with the frequency of synthetic cannabinoid use ($r = .896$, $p < .05$).
**Conclusions:** Adolescent synthetic cannabinoid product users report significant psychoactive effects.


Synthetic cannabinoid products (SCPs), marketed as "Spice," "K2," and others, have been sold in retail outlets and via the Internet as early as 2004. These products are marketed as herbal incense; however, when smoked, they produce psychoactive effects similar to cannabis. Biochemical analyses have revealed that these psychoactive properties are not because of the herbal ingredients listed on product labels, but rather the addition of synthetic cannabinoids. These are groups of structurally diverse molecules with functional similarity to tetrahydrocannabinol (THC), the psychoactive compound in cannabis [1]. These products have become popular among adolescent users because of their cannabis-like effects, easy accessibility via Internet sites or head shops (specialty shops that sell drug paraphernalia), and the lack of reliable toxicological methods of detection [2].

There is a paucity of literature describing the psychoactive and physical effects of synthetic cannabinoid use. Single case reports in adults have described a variety of psychoactive effects. Positive mood changes (euphoria), negative mood changes (anxiety, depression), cognitive impairment, loss of consciousness, excitability and agitation, sedation, nightmares, and psychosis (hallucinations, paranoia) have been reported [2–7]. Physical effects reported include nausea, vomiting, diarrhea, tremors, xerostomia, sweating, hypertension, tachycardia, listlessness, and symptoms of dependency [3,6,7].

Beginning in 2008, European nations began recognizing the dangers of synthetic cannabinoid use and have since placed regulatory bans on the sale of their components. The U.S. military has now banned these products [8]. Increasing emergency room visits and poison control center calls has led the U.S. Drug Enforcement Agency to exercise emergency scheduling authority

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to designate five of the most common chemicals found in synthetic cannabinoids as Schedule I drugs for the next year to "avoid an imminent threat to public safety" [7,9,10].

Our study, the only case series in adolescents, provides useful descriptive information regarding the psychoactive and physical properties of synthetic cannabinoids. It is also the first study to describe these properties in Hispanic users. A greater understanding of these effects is important for the development of public policy and the identification and treatment of adolescents who use synthetic cannabinoids.

## Methods

The charts of all persons who were evaluated at the South Miami Hospital Addiction Treatment Center in Miami-Dade County, Florida, between February 1, 2010 and April 12, 2011, and who endorsed using SCPs were analyzed in this study. The average age of the subjects was 17.3 years (standard deviation = 1.35; $R$ = 15, 19). Of 11 subjects, 10 (91%) were male, 10 (91%) were Hispanic, and 7 (64%) were attending high school (Table 1).

Authorization was obtained from the respective institutional review boards. Information regarding the acute intoxication effects of SCP use was retrospectively extracted from patient records. Each adolescent underwent a clinical assessment that is a standardized, semistructured interview by licensed clinicians that inquire about the substance used, amount, frequency and dates of use, physical and psychoactive effects, and psychiatric and psychosocial history. Clinicians had the opportunity to expand on any answers given by the participants.

Statistical analysis was carried out using SPSS 17.0 software (SPSS, Inc., 2008, Chicago, IL). Frequency and descriptive statistics were calculated and correlated using Pearson product moment correlation coefficient. We used the $\alpha = .05$ level of significance in this study.

## Results

All the subjects reported that the route of use was smoking. Seventy-three percent (8/11) admitted to using these products more than three times lifetime, and 4 of 11 (36%) admitted to smoking SCPs multiple times per day. The frequency of SCP use was significantly correlated with the educational level of the subjects ($r = .945$, $p < .01$). Eight of 11 (73%) subjects admitted to first smoking SCPs 1–12 months before their evaluation. The great majority (9/11; 82%) of users admitted to purchasing SCPs in a retail shop. None reported purchasing SCPs through the Internet (Table 2).

The psychoactive effects of smoking SCPs clustered around changes in mood, cognition, and perception. All the subjects noted feeling euphoric. Nine of 11 (82%) subjects noted negative mood changes (such as, 4 of 11 (36%) reported irritability, and 3 of 11 (27%) anxiety). All 11 reported difficulties with memory. Only one person described auditory perceptual distortions, 5 (45%) described visual perceptual distortions, and 2 (18%) described paranoid thoughts.

Regarding physical effects, 3 of 11 (27%) reported palpitations, 1 of 11 (9%) restlessness, and 1 of 11 (9%) stimulation. Two of 11 (18%) subjects reported appetite changes: one experienced decreased appetite, and the other had increased appetite. One individual described feeling that he had blacked out while intoxicated. Two (18%) described muscular changes; one experienced tremors, and the other felt weakness (Table 2).

**Table 1**
Demographic characteristics

| Variable | Category | Total sample (n = 11) |
|---|---|---|
| Age | — | M = 17.2, SD = 1.35, $R$ = 15, 19 |
| Gender | Male | 10 (91%) |
| | Female | 1 (9%) |
| Ethnicity | White | 1 (9%) |
| | Hispanic | 10 (91%) |
| Highest level of education | 9th | 1 (9%) |
| | 10th | 1 (9%) |
| | 11th | 1 (9%) |
| | 12th | 4 (36%) |
| | College | 3 (27%) |
| | HS dropout (grade unknown) | 1 (9%) |
| Funding | Insurance | 8 (73%) |
| | Self-pay | 3 (27%) |
| Psychiatric Diagnosis | Attention-Deficit/Hyperactivity Disorder (ADHD) | 3 (27%) |
| | ADHD + learning disorder + depression | 1 (9%) |
| | None | 7 (64%) |

**Table 2**
Synthetic cannabinoid product characteristics and psychoactive and physical effects

| Variable | Category | Total sample (n = 11) |
|---|---|---|
| Product characteristics | | |
| Route of use | Smoking | 11 (100%) |
| | Drinking | 0 |
| Frequency of use | Once | 1 (9%) |
| | Twice | 2 (35%) |
| | >3/several times | 8 (73%) |
| | Multiple times/day | 4 (36%) |
| Duration of use | <1 month | 2 (18%) |
| | 1–6 months | 5 (45%) |
| | 7–12 months | 3 (27%) |
| | >12 months | 1 (9%) |
| Site of purchase | Retail/head shop | 9 (82%) |
| | Internet | 0 |
| | Friend/dealer | 3 (27%)[a] |
| Psychoactive and physical effects | | |
| Psychoactive effects | Euphoria | 11 (100%) |
| | Irritability | 4 (36%) |
| | Anxiety | 3 (27%) |
| | Numbness | 2 (18%) |
| | Anger | 1 (9%) |
| | Sadness | 1 (9%) |
| | Memory changes | 11 (100%) |
| | Auditory perceptual changes | 1 (9%) |
| | Visual perceptual changes | 5 (45.4%) |
| | Paranoid thoughts | 2 (35%) |
| Physical effects | Palpitations | 3 (27%) |
| | Appetite changes | 2 (18%) 1 increased; 1 decreased |
| | Muscular | 2 (18%) 1 trembling; 1 weakness |
| | Blackouts | 1 (9%) |
| | Restlessness | 1 (9%) |
| | Stimulation ("amphetamine–like") | 1 (9%) |

[a]One subject reported obtaining the product from both a retail shop and a friend/dealer.

All the adolescents in this treatment program admitted to using substances in addition to SCPs. Ten of 11 (91%) subjects reported abusing marijuana and alcohol. The number of other drugs used was significantly correlated with the frequency of SCP use ($r = .896$, $p < .05$). No other significant correlations were found.

All the subjects explained the reasons for using SCPs were to get "high" and avoid detection.

## Discussion

To our knowledge, this is the first case series to date reporting the psychoactive and physical properties of synthetic cannabinoid use in adolescents. Although positive mood changes were noted, adolescents experienced many of the same negative emotional effects from synthetic cannabinoid use as adults. Perceptual changes in our subjects were reported less frequently than changes in mood or emotions. The types of perceptual changes noted by these adolescents are similar to those experienced by adults [2,6,7]. This chart review was not able to distinguish whether these auditory and visual perceptual changes were true hallucinations.

The physical effects, including stimulatory effects, such as palpitations, restlessness, and "trembling," are also qualitatively similar to those reported by adults [2,7].

None of our subjects admitted to purchasing these products through the Internet. We speculate that this is because of the ease of retail purchase and the reduced access to credit cards required for online purchase among adolescents.

Although we are able to report the presence of psychoactive and physical symptoms, our chart review is limited in the ability to elucidate specific factors that may have contributed to each subject using these products. Prospective, structured interviews and controlled exposure studies could provide more comprehensive information (such as, specific types of memory problems) and limit bias. Also, our study was not able to define the types of SCPs used. The amount of product smoked and the relationship with other substances also being used is not known.

Our study group consisted of teenagers who were referred to a substance abuse treatment program and reported using other substances, principally marijuana and alcohol. Getting "high" and avoiding detection were reasons given by the individuals for using SCPs. The speed and sophistication of innovation in this area are remarkable. SCP use challenges existing models of drug control. Our study suggests to policy makers that SCP use should be addressed as a consumer protection and a drug control issue. Future research can help inform prevention, treatment, and policy approaches.

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