



# Identification of Substance Abuse Among Children in a Pediatric Emergency Department

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## ABSTRACT

**Aim:** Illicit substance use is a worldwide important public health problem with increasing substance abuse rates and decreasing starting age. In this study, our aim was to determine the complaints of the patients in pediatric emergency department (PED) admission in order to increase awareness about substance abuse.

**Materials and Methods:** The data of this cross-sectional study was gathered from those patients admitted to a PED with complaints of substance abuse and patients without a history of substance abuse, but with a positive urine drug test. A screening urine test was used for the qualitative determination of drug substances. If positive, a quantitative liquid chromatography integrated mass/mass spectrometry test was ordered for confirmation.

**Results:** A total of 17 patients presented to the emergency department. The most frequent symptoms were unstable cognitive conditions and tachycardia. Laboratory analyses showed high creatine kinase-MB. Synthetic cannabinoids were the most frequently detected substance in urine screening and confirmation tests. Twenty-nine percent of patients were hospitalized and no mortality was observed.

**Conclusion:** The use of illegal substances has increased in teenagers. Emergency department doctors must be informed and trained regarding substance abuse since patients frequently presented to the emergency department with cognitive malfunctions. Also, it should be remembered that patients may present with symptoms concerning various organ systems.

**Keywords:** Pediatric emergency, substance use, synthetic cannabinoids

## Introduction

Illicit substance abuse is a major public health problem leading to biological, psychological and social disorders when addiction occurs over a longer period of time (1). The European Monitoring Centre for Drugs and Drug Addiction (EMCDDA) collects, analyzes and disseminates scientific information on drug-related issues and provides an evidence-based picture of the drug phenomenon. The use of illicit substances among the general population in Turkey appears to be rare according to the 2017 EMCDDA report. In 2011, cannabis was the most common illicit drug

used, followed by amphetamines and MDMA/ecstasy. The highest rate of illicit substance abuse was in young males (15-34 years old). Worldwide use of synthetic cannabinoids (SCs) have increased in recent years leading to an increase in unexpected complications and symptoms (2). Many clinicians are unaware of the prevalence and severity of physical and psychoactive symptoms, and the potentially serious consequences related to the use of SCs (3).

There has been an alarming increase in substance abuse and more importantly the age that people start to abuse substances has decreased in Turkey (4). Increased abuse of

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substances will lead to an increase in hospital admissions. Based on our recent publication (5), we suspect there are more undiagnosed cases of substance abuse. To address this concern, we performed a urine drug test on suspected patients at a pediatric emergency department (PED).

## Materials and Methods

The data gathered from the patients admitted with complaints of substance abuse and patients who had substances detected in their urine using screening tests despite having no history of substance use in PED between April 2015 and August 2016 were analyzed. In that time period, a total of 21,062 patients were admitted to the PED, 2,432 (11.54%) of them were between 13 and 18 years of age.

Screening were performed on patients with substance use, and on patients with complaints of unexplained unstable cognitive conditions, chest pain and palpitation. Forty three patients underwent a urine screening test. There were positive results in 24 patients. Within these 24 patients, 5 were excluded from the study due to a negative confirmation test after a positive urine screening and no history of substance use. Furthermore, 2 patients without confirmation tests were also excluded. This study contains the results of 16 patients with a positive confirmation test results and one patient with Withdrawal syndrome.

The Rapid DOA Panel test (Figure 1) is an immunochromatography based one step in vitro test. This test was used for substance screening in the urine samples of 24 patients in the PED. This test qualitatively determines the presence of drug substances in human urine. To confirm the findings of the screening test, a quantitative liquid chromatography integrated mass/mass spectrometry test was used (Figure 2). The confirmation test was performed in Trakya University Technology Research and Development Application and Research Center laboratory on the same day using fresh urine. The confirmation test results were obtained within hours. Cases were analyzed in terms of age, gender, admission time, primary complaints in admission, clinical findings, laboratory findings, method of substance

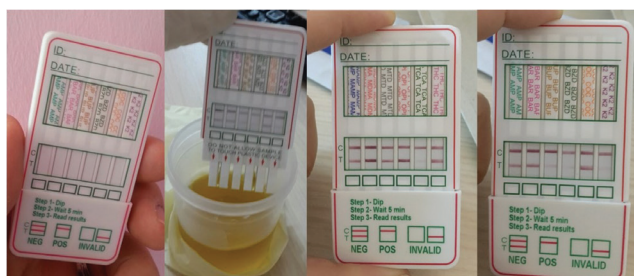


Figure 1. Rapid drugs of abuse panel test

use, additional substance use, length of hospital stay, period of monitorization and mortality rates. Intoxication severity was assessed using (1) the Poison Severity score (PSS) according to the following grades: none (grade 0), minor (grade 1), moderate (grade 2), severe (grade 3) and fatal (grade 4) and (2) the Glasgow Coma scales (GCS). Oral informed consent was obtained from the patients and/or their parents. Also, the results were shared with the patients and their parents. The study was approved by the Trakya University Faculty of Medicine, Scientific Research Ethics Committee (approval no: 2018/366, decision no: 17/21, date: 15.10.2018).

## Statistical Analysis

Research data were analyzed by SPSS 23.0 statistical package program. Descriptive statistics were presented as mean ( $\pm$  SD), median (minimum, maximum), frequency distribution and percentage.

## Results

The general aspects of the patients are listed in Table I. Only 2 patients in our study were female (female/male: 2/15). The age range was between 1 and 17 years. Most of the patients were adolescents who were between 13-17 years of age (n=14), one patient was 1-year-old and two patients were 9-years-old. Four patients had a history of Bonzai (common name for SCs in Turkey) abuse, one patient had a history of simultaneous Bonzai and cannabis abuse,

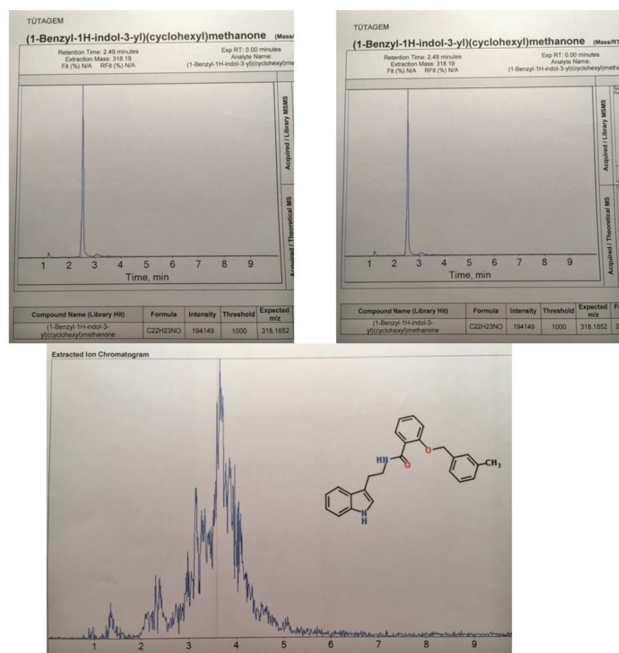


Figure 2. Quantitative liquid chromatography integrated mass/mass spectrometry test

**Table I.** General aspects of the patients

| Case no | Age/ Gender | Complaint on admission  | Accompanying findings   | Heart rate per minute | Blood pressure (mmHg) | Glasgow Coma scale | Abnormal laboratory findings  | Method of substance abuse | Hospitalization/ observation duration (hours) | Substance |
|---------|-------------|---|---|-----------------------|-----------------------|--------------------|---|---------------------------|---|-----------|
| 1       | 14/Male     | Headache, pins and needles sensation on left arm, change in consciousness | Mydriasis, confusion, headache, drowsiness                              | 98                    | 100/65                | 14                 | LDH: 325 U/L<br>CK: 489 U/L<br>CK-MB: 45 U/L<br>Troponin-I: 0.038 µg/L                              | Unknown                   | No/18 hours                                   | SC        |
| 2       | 16/ Female  | Unable to talk, gibberish   | Confusion, drowsiness, tachycardia, temporary agitation<br>Hypertension | 112                   | 130/80                | 13                 | PT: 16.5 sec.   | Oral                      | No/19 hours                                   | SC        |
| 3       | 15/Male     | Uneasiness, restlessness  | Anxiety   | 74                    | 120/76                | 15                 | CK-MB: 29 U/L<br>K: 3,1 mmol/L  | Inhalation                | No/21 hours                                   | SC        |
| 4       | 16/ Male    | Syncope, seizure  | Tendency to sleep<br>Temporary agitation<br>Miosis                      | 80                    | 110/70                | 14                 | BSL: 107 mg/dL<br>PT: 16,9 sec.   | Inhalation                | No/12 hours                                   | SC        |
| 5       | 13/Male     | Chest pain, palpitation   | Tachycardia   | 115                   | 110/60                | 15                 | CK: 242 U/L<br>CK-MB: 44U/L<br>Troponin I: 0,033 µg/L   | Oral                      | Yes   | Marijuana |
| 6       | 1/Male      | Tendency to sleep   | Tachycardia, Mydriasis  | 150                   | 90/50                 | 13                 | BSL: 124 mg/dL<br>CK-MB: 41 U/L   | Oral                      | No/12 hours                                   | SC        |
| 7       | 17/ Female  | Nausea, Fatigue   | Tendency to sleep, Hypotension, Tachycardia                             | 121                   | 90/60                 | 13                 | K: 3,3 mmol/L<br>BSL: 153 mg/dL<br>PT: 15,9 sec.  | Inhalation                | No/17 hours                                   | SC        |
| 8       | 17/Male     | Fever, Mental fog   | Agitation<br>Crying crisis<br>Body temperature: 38.9                    | 96                    | 115/57                | 15                 | PT: 15,5 sec.   | Inhalation                | No/10 hours                                   | SC        |
| 9       | 16/Male     | Chest pain  | Uneasiness<br>ECG: ST elevation   | 88                    | 113/78                | 15                 | CK: 936 U/L<br>CK-MB: 106 U/L<br>Troponin I: 2.9 µg/L<br>LDH:394 U/L<br>ALT: 61 U/L<br>AST: 119 U/L | Inhalation                | Yes   | SC        |
| 10      | 17 Male     | Found unconscious by police and transferred intubated                     | Unconsciousness<br>Hypotension<br>Tachycardia<br>Conjunctival hyperemia | 130                   | 102/53                | 7                  | CK-MB: 153 U/L<br>CK: 226 U/L   | Inhalation                | Yes   | SC        |
| 11      | 9/ Male     | Headache, Dizziness, Fatigue, Fever, Vomiting                             | Tendency to sleep, Tachycardia, Nausea Vomiting                         | 132                   | 110/80                | 15                 | BSL: 116 mg/dL<br>PT: 15,9 sec.   | Inhalation                | No/6 hours                                    | SC        |

|    |          |   |   |     |        |    |   |                     |             |              |
|----|----------|---|---|-----|--------|----|---|---------------------|-------------|--------------|
| 12 | 18/ Male | He was found unconscious in his room                                | Tendency to sleep, Confusion, Hypotension ECG:ST elevation                              | 80  | 80/50  | 13 | BSL:119 mg/dL<br>CK-MB: 33 U/L                              | Inhalation          | No/8 hours  | Marijuana+SC |
| 13 | 17/ Male | Palpitation, Inappetent, Mouth dryness, Trembling hands             | Agitation, Tremor, Thirst Tachycardia, Sweating   | 118 | 125/70 | 15 | BSL: 109 mg/dL<br>LDH:386 U/L<br>AST:49 U/L<br>CK-MB:68 U/L | Withdrawal syndrome | No/6 hours  | SC negative  |
| 14 | 17/ Male | Found unconscious   | Mydriasis, Confusion, Drowsiness  | 92  | 100/60 | 14 | LDH: 300 U/L<br>BSL:137 mg/dL                               | Inhalation          | No/4 hours  | SC           |
| 15 | 17       | Vomiting, spasms, blank staring, unable to walk after taking bonzai | Tendency to sleep, Blank staring Nausea   | 58  | 95/55  | 15 | CK-MB: 29 U/L   | Inhalation          | No/11 hours | SK+Ecstasy   |
| 16 | 16/Male  | Sore throat, cervical swelling                                      | Crepitation in palpation at cervical and supraclavicular region, subcutaneous emphysema | 86  | 110/70 | 15 | CK:470 U/L  | Unknown             | Yes         | Morphine     |
| 17 | 9/Male   | Dystonia on the neck, Deviation of the eyes                         | Torticollis Fixed glancing to external side Tachycardia Irritability Thirst Dizziness   | 138 | 100/80 | 15 | BSL:117 mg/dL<br>CK-MB:30 U/L                               | Unknown             | Yes         | SC           |

ECG: Electrocardiogram, LDH: Lactate dehydrogenase, CK: Creatine kinase, BSL: Blood sugar level, PT: Prothrombin time, K: Potassium, AST: Aspartate aminotransferase, ALT: Alanine aminotransferase, SC: Synthetic cannabinoid

one patient used simultaneously Bonzai, cannabis, ecstasy and an unknown substance, the remaining patients had histories of cigarette use and alcohol consumption. One patient was brought intubated to the PED. This patient also had a previous history of intubation after Bonzai use. Two patients with no substance abuse history in admission to the PED confessed that they had consumed Bonzai after a positive screening test. One patient with a 3-year history of Bonzai use voluntarily admitted with symptoms of substance withdrawal (Case 13). The most common presenting symptoms among patients on admission were unstable cognitive conditions (drowsiness, clouding of consciousness, confusion and secondary aggression, anxiety and restlessness) and tachycardia. Only one patient had a GCS result lower than 8. Seven patients had GCS scores between 12-14 and 9 patients had GCS scores of 15. PSS results were as follows: 1 subject had grade 3, 8 subjects had grade 2 and 8 subjects had grade 1 scores. The most common clinical findings were tachycardia in 8 (47%), hypotension in

3 (17.6%), mydriasis in 3 (17.6%), chest pain in 2 (11.7%), hypertension in 1 (5.8%) and myosis in 1 (5.8%) patient. Laboratory analyses showed that most of the patients had high levels of creatine kinase (CK)-MB (53%, n=9, mean 69.6 U/L), followed by hyperglycemia (47%, n=8, mean 122.75 mg/dL), high lactic dehydrogenase (LDH) levels (24%, n=4, mean 351.25 U/L), high CK levels (24%, n=4, mean 472.6 U/L), slightly longer prothrombin time (24%, n=4, mean 16.14 sec), high troponin-I (18%, n=3, mean 0.99 µg/L), hypokalemia (12%, n=2, mean 3.2 mmol/L), high aspartate aminotransferase (12%, n=2, mean 84 IU/L), high alanine aminotransferase (6%, n=1, mean 61 IU/L). Substance intake occurred mostly by inhalation. SCs were the most frequently detected substance in urine screening and confirmation tests. Other substances detected in the urine were ecstasy, cannabis and morphine. Hospitalization was required in 5 patients (general pediatrics ward, n=2; pediatric intensive care unit, n=2 and pediatric surgery service, n=1). The remaining 12 patients were discharged after observations at

| <b>Table II. Continued</b>  |
|---|
| <b>Possible findings on physical examination indicating substance abuse</b> |
| <b>General findings</b>   |
| - Altered mood  |
| - Poor dress/hygiene  |
| - Inappropriate or strange behavior   |
| <b>Chronic substance abusers</b>  |
| - Mood swings   |
| - Depression  |
| - Paranoia  |
| - Anxiety   |
| - Poor hygiene  |
| - Bizarre behavior  |
| <b>Vital signs</b>  |
| - Weight loss   |
| - Hypertension (cocaine, amphetamine)                                       |
| - Hypotension (heroin)  |
| - Hyperthermia (cocaine, amphetamine)                                       |
| - Hypothermia (heroin)  |
| - Tachycardia (marijuana, cocaine, amphetamine)                             |
| <b>Ear-nose-throat</b>  |
| - Red eyes (marijuana)  |
| - Dilated pupils (marijuana, cocaine, amphetamine)                          |
| - Constricted pupils (heroin)   |
| - Nasal irritation  |
| <b>Cardiac</b>  |
| - Arrhythmias (heroin, cocaine, amphetamine)                                |
| <b>Abdomen</b>  |
| - Hepatomegaly  |
| <b>Skin</b>   |
| - Abscesses   |
| - Tattoos   |
| - Needle track marks  |
| <b>Neurologic</b>   |
| - Altered sensorium   |
| - Poor coordination   |
| - Ataxia (amphetamine)  |
| - Nystagmus   |
| - Hyporeflexia or hyperreflexia (marijuana, cocaine, amphetamine)           |

PED. The mean duration of the observation was 11.5 (4-21) hours. No mortality was observed.

## Discussion

Illicit substance use is an important public health problem in Turkey (6). Based on our previous study and other published data, substance abuse among patients admitted to the PED is higher than the substance abuse rate derived from patient anamnesis. In our study, SCs was the most frequently abused substance. In Turkey, SCs are called "Bonzai". SCs, most commonly known as "spice" or "K2", have become popular substances because of their easy availability and their invisibility in routine drug tests (7). The most preferred method of SC use is by smoke inhalation which causes symptoms similar to cannabis (marijuana) (8). Herbal products usually contain more than one SCs compounds (9). SCs have also been detected in mixtures containing other psychoactive substances such as stimulants, hallucinogens and sedatives and can be sold as ecstasy tablets (3). SCs derivatives have a high affinity for cannabinoid receptors and are clinically 30-800 times more potent than cannabis (10). A survey assessing the knowledge of ED physicians on SCs clinical symptoms showed that 68% recognized the clinical profile variability, while 44% were unaware of the context (11). Other studies have also shown that the awareness of ED physicians regarding the symptoms of SCs use was low (12). Thus, awareness about SCs is needed, especially among ED physicians. Recent studies have shown that SCs addiction is linked to alcohol, cigarettes, hallucinogens, opiates, benzodiazepines, amphetamines and cocaine addiction (13,14,15). Studies have shown that the most frequent adverse effects of these substances are tachycardia, agitation, irritability, anxiety, hallucination, nausea, vomiting, hypertension, confusion, conjunctival hyperemia as well as others affecting the entire organ systems (3,5,7). Forrester et al. (16) evaluated 305 adolescents with SCs abuse and showed that the most frequent clinical symptoms were tachycardia (41.6%), drowsiness/lethargy (24.3%), agitation/irritability (16.4%), vomiting (13.1%), and hallucinations (10.8%). The remaining symptoms were observed in less than 10% of the patients. Our study reports confusion and tachycardia as the most frequent symptoms. Several studies showed that SCs use leads to increased creatinine kinase, lactic dehydrogenase, hyperglycemia, hypokalemia and acidosis, (17,18) which is similar to our study.

In our study, one patient had been using marijuana and had been complaining about intermittent chest pain and tachycardia for 1 year. Pediatric cardiology, gastroenterology

and neurology evaluations could not find any reason for the chest pain and tachycardia. After his urine was found positive for marijuana, further detailed past medical history revealed that (admitted the use of chickpea powder), it became clear that his symptoms were a side effect of cannabis/marijuana use. It is known that acute exposure to cannabis/marijuana increases heart rate, blood pressure and causes hypotension (19). The increasing availability of marijuana edibles, including hemp oil, candy, popcorn, and beverages has been associated with increased ED visits. Sometimes adults and children are not aware of the ingredients of the food they consume (20).

We speculate that more patients will be admitted to the ED in the future with withdrawal symptoms due to the increasing use of SCs. In our study, one adolescent patient with a 3-year use of SCs was admitted to the ED with complaints of agitation, lack of appetite, xerostomia and sweating. His symptoms were a result of deprivation of the substance for three days. The patient was prescribed benzodiazepine and discharged. Withdrawal symptoms are documented as agitation, anxiety, mood swings, tremor, palpitation, diaphoresis (sweating), hypertension, hyperventilation, headache, nausea and vomiting (20,21).

One adolescent male patient in our study was admitted to the ED with complaints of sore throat and swelling from his throat to his shoulders. After examination, it became clear that his symptoms had been present for at least 3-5 days and became more severe each day. Cutaneous and subcutaneous emphysema at the bilateral cervical and supraclavicular regions were found in physical examination and confirmed by radiology. Even though the patient's laboratory tests were normal and there was no clinical history of substance use, morphine metabolites were found in his urine. In the literature, pneumomediastinum and cervical emphysema are related to cocaine inhalation, marijuana inhalation, ecstasy ingestion and are indicators of withdrawal symptoms of illicit drug use (22,23,24).

The diagnosis of substance abuse can be confirmed by clinical history, physical examination and toxicological test results (10). Urine is the preferred sample type because it is non-invasive and easy to obtain in sufficient amount. Clinicians should be familiar with their specific laboratory limitations and common false negatives (e.g. when metabolites are at concentrations less than the established thresholds) and false positive results associated with substance abuse screening tests. A high index of suspicion for substance abuse is warranted in relevant clinical contexts for agents that are not present on routine

toxicology screening, such as SCs. Detection of SCs requires specialized mass spectrophotometry capabilities (25). The confirmation test in our study was a high-specific specialized mass spectrophotometric test.

Indications for drug screening include emergent presentations of altered mental status, acute injuries, life-threatening symptoms that require a correct diagnosis to provide appropriate treatment, monitoring for abstinence in drug rehabilitation centers, and court ordered drug testing. Results of drug testing can be shared only with the patient unless permission is given or a substance is found that causes an acute medical problem, and additional care and monitoring are required (26). After the ED staff were educated regarding the symptoms of substance abuse more specific to SCs abuse, the number of patients diagnosed and treated in the ED for substance abuse doubled.

### Study Limitations

The heterogeneous distribution of both patient group and their symptoms, the small number of patients and lack of a statistical analysis are the key limitations of our study. A similar study may provide a more accurate findings when administered on a larger group of patients.

### Conclusion

In conclusion, substance abuse is very common among teenagers with SCs being the number one choice of substance. Substance abuse patients can easily hide it from their doctors. Thus, ED physicians must be educated regarding the symptoms of substance abuse because patients may present with various symptoms and may be treated symptomatically or referred to incorrect clinics and encounter delayed diagnosis. Also, community education such as TV, radio advertisements and social awareness campaigns should be performed to target the rise of substance abuse among the population.

### Ethics

**Ethics Committee Approval:** The study was approved by the Trakya University Faculty of Medicine, Scientific Research Ethics Committee (approval no: 2018/366, decision no: 17/21, date: 15.10.2018).

**Informed Consent:** Oral informed consent was obtained from the patients and/or their parents.

**Peer-review:** Externally peer-reviewed.

### Authorship Contributions

Surgical and Medical Practices: N.A.Ç., Concept: N.A.Ç., T.E., Y.K., Design: N.A.Ç., Data Collection or Processing:

N.A.Ç., T.E., Y.K., Analysis or Interpretation: N.A.Ç., T.E., Y.K.,  
Literature Search: N.A.Ç., T.E., Y.K., Writing: N.A.Ç.

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