

# Identification of Substance Abuse among Children in Pediatric Emergency Department

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## ABSTRACT

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

**Materials and Methods:** The data of this cross-sectional study was gathered from the patients admitted to the pediatric emergency department with complaints of substance abuse and patients without an 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 order for confirmation.

**Results:** A total of 17 patients were presented in the emergency department. 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 is increased in teenagers. Emergency department doctors must be informed and trained regarding substance abuse since patients are frequently presented in 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 certainly 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 prevalence and severity of physical and psychoactive symptoms, and the potentially serious consequences related to the use of SCs (3).

There is an alarming increase in substance abuse and more importantly the age that people starting to abuse substance decreased in Turkey (4). Increased abuse of substance will lead to increase hospital admissions. Based

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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 pediatric emergency department (PED).

## Materials and Methods

The data gathered from the patients admitted with complaint of substance use and patients that substance detected in their urine using screening tests without any history of substance use in PED between April 2015 and August 2016 were analysed. In that time period, a total of 21062 patients admitted to the PED, 2432 (11.54%) of them were between 13 and 18 years of age.

Screening performed in patients with substance use, and in patients with complaints of unexplained unstable cognitive conditions, chest pain and palpitation. Fourty three patients underwent urine screening test. There were positive results in 24 patients. Within 24 patients, 5 were excluded from the study due to 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 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 urines of 24 patients in 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 Üniversitesi Teknoloji Araştırma, Geliştirme

Uygulama ve Araştırma Merkezi (TÜTAGEM) laboratory in the same day from fresh urine. The confirmation test results obtained within hours.

Cases were analyzed in terms of age, gender, admission time, primary complaints in admission, clinical findings, laboratory findings, method of substance 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 consents were obtained from the patients and/or their parents. Also the consequences were shared with the patients and their parents. The study was approved by the local research ethics committee Trakya University Faculty of Medicine (approval number: 17/21, date:15.10.2018).

## Results

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 synthetic cannabinoids in Turkey) abuse, one patient had a history of simultaneous Bonzai and cannabis abuse, one patient used simultaneous Bonzai, cannabis, ecstasy and an unknown substance, remaining patients had histories of cigarette use and alcohol consumption. One patient brought intubated to the PED. This patient also had a previous history of intubation after Bonzai use. Two patients without substance abuse history in admission

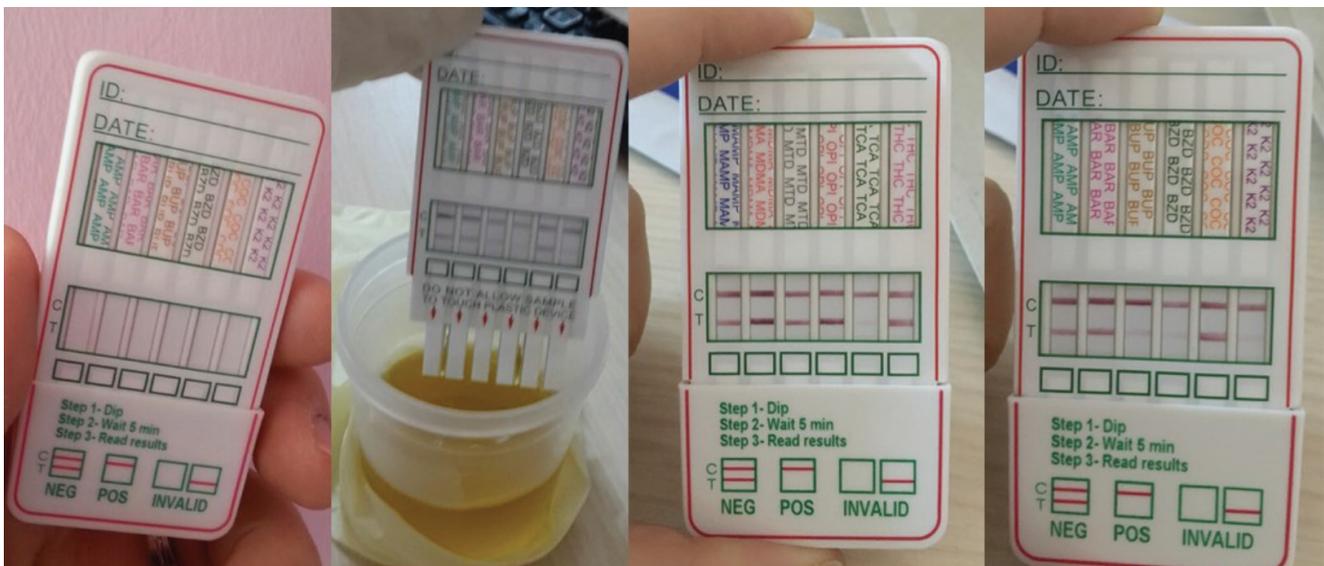
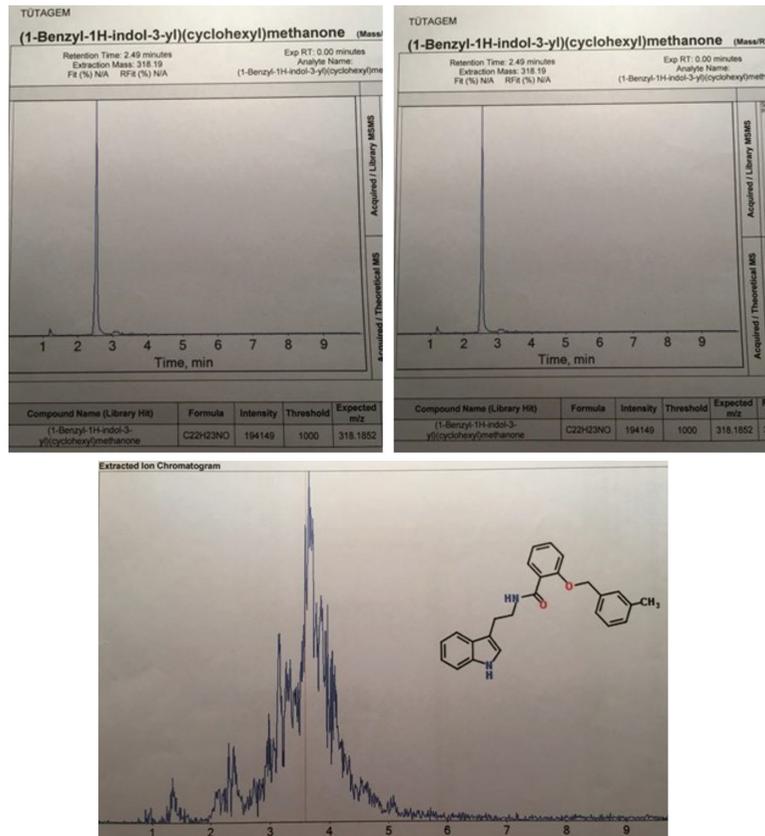


Figure 1. Rapid DOA (drugs of abuse) panel test



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

to the PED confessed that they have consumed Bonzai after a positive screening test. One patient with 3 years 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 followed: 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%) patients. Laboratory analyses showed that most of the patients had high levels of creatin 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 PT (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 AST (12%, n=2, mean 84 IU/L), high ALT (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 required in 5 patients (general pediatrics ward, n=2; pediatric intensive care unit, n=2 and pediatric surgery service, n=1). Remaining 12 patients discharged after observations at 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 use rate derived from the patient anamnesis. In our study, SCs was the most frequent used substance. In Turkey, SCs are called "Bonzai". SCs, most commonly known as "spice" or "K2", have become popular substances because of easy availability and their invisibility in routine drug tests (7). The most preferred way of SC use is by smoke inhalation which causes symptoms similar to cannabis (marihuana) (8). Herbal products usually contain more than one SCs compounds (9). SCs have also been detected in mixtures containing other psychoactive

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 use	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 CK: 489 U/L CK-MB: 45 U/L Troponin-I: 0.038 µg/L	Unknown	No/18 hours	SC
2	16/ Female	Unable to talk, Mumbo Jumbo	Confusion, drowsiness, tachycardia, Temporary agitation 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 K: 3.1 mmol/L	Inhalation	No/21 hours	SC
4	16/ Male	Syncope, seizure	Tendency to sleep Temporary agitation Miosis	80	110/70	14	BSL: 107 mg/dl PT: 16,9 sec.	Inhalation	No/12 hours	SC
5	13 Male /	Chest pain, palpitation	Tachycardia	115	110/60	15	CK: 242 U/L CK-MB: 44U/L 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 CK-MB: 41U/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 BSL: 153 mg/dl PT: 15,9 sec.	Inhalation	No/17 hours	SC
8	17/ Male	Fever Mental fog	Agitation Crying crisis Body temperature: 38,9	96	115/57	15	PT: 15,5 sec.	Inhalation	No/10 hours	SC
9	16/ Male	Chest pain	Uneasiness ECC: ST elevation	88	113/78	15	CK: 936 U/L CK-MB: 106 U/L Troponin I: 2,9 µg/L LDH: 394 U/L ALT: 61 U/L AST: 119 U/L	Inhalation	Yes	SC
10	17/ Male	Found unconscious by the policemen and transferred intubated	Unconsciousness Hypotension Tachycardia Conjunctival hyperemia	130	102/53	7	CK-MB: 153 U/L 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 PT: 15,9 sec.	Inhalation	No/6 hours	SC

Table I. Continued

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 use	Hospitalization/ observation duration (hours)	Substance
12	18/ Male	He was found fainted in his room	Tendency to sleep , Confusion, Hypotension ECG:ST elevation	80	80/50	13	BSL:119 mg/dl CK-MB: 33 U/L	Inhalation	No/8 hours	Marijuana+SC
13	17/ Male	Palpitation, Inappotent, Mouth dryness, Trembling hands	Agitation, Tremor, Thirst Tachycardia, Sweating	118	125/70	15	BSL: 109 mg/dl LDH:386 U/L AST:49 U/L 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 BSL:137 mg/dl	Inhalation	No/4 hours	SC
15	17	Vomiting, spasms, blank staring, unable to walk after getting 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	Distonia 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 CK-MB:30 U/L	Unknown	Yes	SC

ECG: electrocardiogram, LDH: lactat dehydrogenase, CK: creatin kinase, BSL: blood sugar level, PT: protrombin time, K: potassium, AST: aspartate aminotransferase, AL.T: alanine aminotransferase, SC: synthetic cannabinoid

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 showed that SCs addiction is linked to alcohol, cigarettes, hallucinogens, opiates, benzodiazepines, amphetamines and cocaine addiction (13,14,15). Studies have shown that most frequent adverse effects of these substances are tachycardia, agitation, irritability, anxiety, hallucination, nausea, vomiting, hypertension, confusion, conjunctival hyperemia as well as other affecting the entire organ systems (3,5,7). Forrester et al. 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%). Remaining symptoms were observed in less than 10% of the patients (16). Our study reports confusion and tachycardia as the most frequent symptoms. Several studies showed that SCs use leads to increase creatinine kinase, lactic dehydrogenase, hyperglycemia, hypokalemia and acidosis, (17, 18) which is similar in our study.

In our study, one patient has been using marijuana and has been complaining discontinuously ongoing 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 become 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 cause 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 speculated that more patients will be admitted to the ED in the future with withdrawal symptoms due to the increase 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 came clear that his symptoms were present for at least 3-5 days and became more severe each day. Cutaneous and subcutaneous emphysema at bilateral cervical and supraclavicular regions were found in physical examination and confirmed by radiology. Even though, the patient's laboratory tests were normal and no clinical history of substance use, morphine metabolites were found in his urine. In literature, pneumomediastinum and cervical emphysema related to cocaine inhalation, marijuana inhalation, ecstasy ingestion are indicators of withdrawal symptoms of illicit drug (22, 23, 24).

The diagnosis of substance abuse can be confirmed by clinical history, physical examination and toxicological test results (10). Urine is the most 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 negative (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 only be shared with the patient unless permission is given or a substance is found that cause an acute medical problem, and additional care and monitoring are required (26). After the ED staff was educated regarding the symptoms of substance abuse more specific SCs abuse, the number of patients diagnosed and treated in the ED for substance abuse doubled.

### **Study Limitations**

Heterogeneous distribution of both patient group and their symptoms, small number of patients and lack of a statistical analysis are the key limitations of our study. The study may have a more accurate significance when administered on a larger group of patients.

### **Conclusion**

In conclusion, substance abuse is very common among teenagers with SCs as the number one choice

of substance. Patients with substance abuse 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. And also, community education such as TV, radio advertisements and social awareness campaigns should be performed against the invasion of substance use among population.

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