

A fatal case involving several synthetic cannabinoids

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Abstract

Aims: A 36-year-old man collapsed at home right after he had smoked an herbal blend named “Mary Joy Annihilation”. After arrival of the ambulance, the man already suffered seizures and died after admission to hospital despite continued attempts of resuscitation. In the decedent’s apartment, the police found the residual of a joint, which was seized for analysis. The aim was to determine whether a synthetic cannabinoid intoxication could be considered as a contributing factor to the cause of death.

Methods: Femoral blood, bile fluid, gastric content, hair, brain, lung, kidney, liver, and adipose tissue samples were obtained during autopsy. Blood, bile fluid and gastric content samples, homogenized tissues and pulverized hair were extracted liquid-liquidly and analyzed by LC-MS/MS (MRM/ESI⁺). The residual of the joint was macerated in ethanol and analyzed by GC-MS in scan mode. The femoral blood sample was also analyzed by GC-MS in scan and SIM mode.

Results: In femoral blood 0.1 ng/mL JWH-018, 0.3 ng/mL JWH-122, 1.4 ng/mL AM-2201, 1.5 ng/mL MAM-2201, approximately 6 ng/mL UR-144, and 250 ng/mL amphetamine could be detected. The synthetic cannabinoids were also found in other tissues. In addition, JWH-210 could be detected in hair and adipose tissue samples. The joint contained the same synthetic cannabinoids except for JWH-018 and JWH-210.

Conclusion: An acute influence of several synthetic cannabinoids and amphetamine can be assumed. Detection of JWH-210 in adipose tissue and hair and lack of it in blood and joint indicates that a previous consumption of other substances had occurred.

1. Introduction

Synthetic cannabinoids emerged on the drug market a few years ago and are still an issue in forensic toxicology. In the meantime different cases occurred where the consumption of herbal blends containing synthetic cannabinoids was correlated with life-threatening conditions and quite often resulted in admission to the hospital [1-5]. There were also some fatalities where the intake of synthetic cannabinoids was related to the cause of death [6, 7].

Case Report

A 36-year-old man smoked an herbal blend named “Mary Joy Annihilation” together with his girlfriend and some friends. Right after the consumption of the smoking mixture the man collapsed. The witnesses immediately called the ambulance. After arrival, the man already suffered seizures and finally died several hours later in the hospital despite continued attempts of resuscitation. In the decedent’s apartment, the police found the residual of a joint, which was seized for analysis (Fig.1).



Fig. 1. Seized Joint.

2. Material and Methods

Femoral blood, bile fluid, gastric content, hair, brain, lung, kidney, liver, and adipose tissue samples were obtained during autopsy. Adipose tissue was homogenized in and extracted by acetone. The other tissues were homogenized in water and isolated by liquid-liquid extraction according to Maurer et al. [8]. Blood, bile fluid and gastric content samples were also extracted liquid-liquidly according to the same procedure. The hair samples were first washed twice with water and once with acetone, pulverized, and extracted with ether/ethyl acetate after alkaline hydrolysis with aqueous sodium hydroxide. JWH-018-d₉ (10 ng/mL) was added before each extraction as internal standard. The samples were analyzed by LC-MS/MS, MRM/ESI⁺ (Thermo Fisher TSQ Quantum Ultra AM). Separation was achieved using a C18 column (150 x 2.1 mm, 3.5 μm) and gradient elution (0.1% aqueous formic acid and 0.1 % formic acid in acetonitrile). The residual of the joint was macerated in ethanol and analyzed by GC-MS in scan mode. The femoral blood sample was also analyzed by GC-MS in scan and SIM mode for common drugs of abuse, medical drugs and poisons. For quantification, the blood sample was sent to the institute of legal medicine in Freiburg and analyzed according to Kneisel et al. [9].

3. Results and Discussion

Autopsy Findings: Autopsy revealed a stenosing coronary sclerosis and unspecific findings such as pulmonary and cerebral edema and congestion of the inner organs with blood.

Toxicological Findings: The joint residual contained the synthetic cannabinoids JWH-122, MAM-2201, AM-2201, and UR-144 (Fig.2).

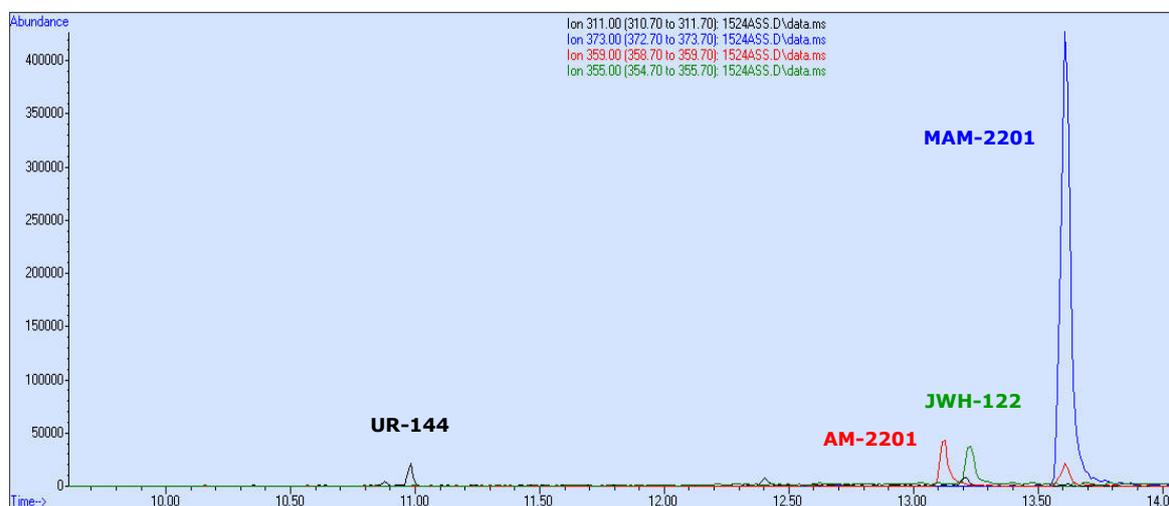


Fig.2. Results of the joint analysis.

The results of the femoral blood sample analysis can be seen in Tab.1. The synthetic cannabinoids detected in the joint residual were also found in the blood sample and additionally JWH-018. According to Hutter et al., JWH-018 can be artificially formed after burning a joint containing AM-2201 [10]. This could be one possible explanation for the detection of JWH-018 in the blood sample and the lack of it in the joint. Furthermore, 250 ng/mL amphetamine were found in femoral blood. The synthetic cannabinoids were also detected in other body samples. A summary of the results is listed in Tab.1.

Tab.1. Results of body sample analyses (* estimated concentration, --- not found).

Drug	Femor Blood [ng/mL]	Brain [ng/g]	Lung [ng/g]	Liver [ng/g]	Kidney [ng/g]	Bile Fluid [ng/mL]	Gastric Content [µg abs.]	Hair [ng/mg]	Adipose Tissue [ng/g]
JWH-122	0.39	Traces	1.3*	---	---	2.0*	8.5*	0.05*	200*
MAM-2201	1.5	0.7*	9.1*	---	1.3*	32*	780*	13*	1800*
AM-2201	1.4	0.1*	2.0*	---	---	5.9*	270*	3.0*	180*
UR-144	6.0*	---	---	---	---	11*	50*	0.7*	800*
JWH-018	0.1	---	---	---	---	---	9.0*	0.05*	30*
JWH-210	---	---	---	---	---	---	---	0.01*	53*

Besides the cannabinoids found in the blood sample, JWH-210 could be detected in hair and adipose tissue samples. Regarding the femoral blood concentrations, one would assess them as very low to low compared with those of Δ^9 -Tetrahydrocannabinol (Δ^9 -THC) expected after recent consumption. But taking their CB₁-receptor binding affinities into consideration (Tab.2), it becomes apparent that their affinities, except for UR-144, are sharply higher than the one of Δ^9 -THC. So a higher potency can be assumed. UR-144 has much higher affinity for the CB₂-receptor with a K_i of 1.8 nM [11].

Tab. 2. CB₁-receptor binding affinities of Δ^9 -THC, JWH-122, AM-2201, UR-144, JWH-018.

Substance	K _i [nM] [11-13]
Δ^9 -THC	41 ± 2
JWH-122	0.69 ± 0.05
AM-2201	1.0
UR-144	150
JWH-018	9 ± 5

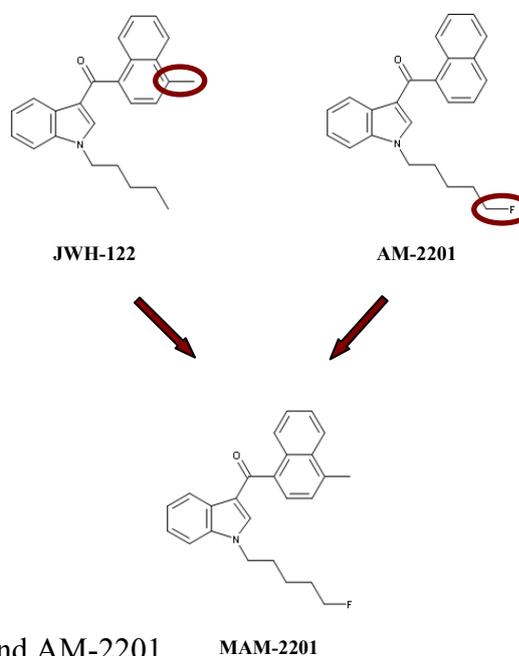


Fig.3. Structures of MAM-2201, JWH-122, and AM-2201.

It also has to be mentioned that the K_i value of MAM-2201 has not yet been determined. The synthetic cannabinoid was invented specifically for recreational use by hybridizing the two drugs JWH-122 and AM-2201 (Fig.3). Therefore, its binding affinity is likely to be as high as the ones of JWH-122 and AM-2201 or even much higher.

4. Conclusion

An acute influence of several synthetic cannabinoids and amphetamine can be assumed. Due to the fact that some of the synthetic cannabinoids show much higher potency and efficacy than THC and may produce life-threatening conditions, they can be considered at least as a contributing factor in the lethal outcome, particularly in combination with the relatively high amphetamine concentration. Nevertheless, the amphetamine concentration is significantly lower than levels found in previously reported fatalities [14, 15]. Detection of JWH-210 in adipose tissue and hair and lack of it in blood and joint indicates that a previous consumption of other substances had occurred.

5. References

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