

δ9 THC content in illicit cannabis products over the period 1997-2004 (first four months)

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Summary. - The aim of this study is to determine delta 9 tetrahydrocannabinol (δ9 THC) content in 5227 seizures of cannabis products over the period 1997-2004 (first four months). The products were seized in Modena country (Italy). The samples were classified as marijuana and hashish and divided into subgroups. The following results show an increase in the potency (concentration of δ9 THC) of these products.

Key words: forensic science, cannabis, analysis, δ9 THC potency.

Riassunto (*Variazioni della percentuale di δ9 THC nelle preparazioni clandestine di Cannabis - periodo 1997-2004 - primo quadrimestre*). - Sono riferiti i risultati delle determinazioni di delta 9 tetraidrocannabinolo (δ9 THC) in 5227 reperti di derivati della cannabis sequestrati nel periodo 1997-2004 (primo quadrimestre) nel territorio modenese. I campioni sono stati classificati come marijuana e hashish e suddivisi in sottogruppi. Si presentano i risultati che documentano l'incremento della potenza (concentrazione di δ9 THC) delle preparazioni clandestine.

Parole chiave: scienze forensi, cannabis, analisi, potenza δ9 THC.

Introduction

Spreading of cannabis products (marijuana and hashish), in particular among the young generations, is increasingly being studied in epidemiological surveys [1, 2].

According to recent studies the demand for treatment of cannabis related disorders (tendency to suicide, depression and deviations) [3-6] has risen. Other epidemiological data, and in particular those of increased THC contents in illicit cannabis products, explain the "cannabis alarm" [7].

The marijuana sample's potency (δ9 THC concentration) [7] has increased from 1.5% (1980) to 4.2% (1997). Furthermore, the DEA (Drug Enforcement Administration) warns of a 1% increase over the 1970-1980 decade, a 6% increase in 2002 and a 13% increase in the sinsemilla variety (with some samples showing a 33% increase) [2].

The aim of this study is to determine delta 9 tetrahydrocannabinol (δ9 THC) content in 5227 seizures of cannabis products detained in Modena country (Italy) over the period 1997-2004 (first four months). This report shows the potency trends of δ9 THC.

Materials and Methods

Samples

Marijuana and hashish samples were seized by the police in Modena country over the period 1997-2004 (from January to April). On the Court's demand, they were analysed by the Institute of Forensic Medicine University of Modena and Reggio Emilia.

Firstly, the samples were classified according to their morphologic characteristics, following in part the Mahmoud A classification system [7].

Due to the characteristics of our samples, we decided to change something in that method: thus the samples were classified as follows:

1. marijuana: general definition regarding four products:
 - "loose marijuana": samples which are not compressed, nor chopped, with no definite form;
 - "kilobricks": samples of pressed cannabis made of leaves, heads, stems, seeds;
 - "buds": samples made of flowering heads;
 - "domestic marijuana" locally prepared cannabis products.

2. hashish: resin of cannabis plant, colour from light to dark brown, two types:

- samples of hashish cut into sticks;
- samples of hashish cut into bars (from 0.8 to 2.5 cm thick).

Sample analysis

Marijuana: after removing both the stems and seeds, 0.1g sample was extracted, at room temperature for one hour, with 10 ml of petroleum ether (C. Erba® Italy) containing docosane (SI) (1mg/ml) (Sigma Aldrich®). One microlitre of the filtered solution was injected by gas chromatography and gas chromatography mass spectrometry.

Hashish: samples, finely hashed, were analysed with the same method as the marijuana samples. One microlitre was injected in gas chromatography and in gas chromatography mass spectrometry.

Analysis by gas chromatography

Varian® gas chromatograph CP3880 with FID detector, DB5 column, J&W Scientific, Inc. (30 m x 0.25 mm i.d 0.25 µm film thickness) under the following conditions:

- initial temperature 150°C (1 min), programmed temperature 10°C/min, final temperature 290°C (2 min).
- temperature of the injector: 200°C in split mode (50 ml/min; split ratio 30:1).
- temperature of detector 300 °C.

Quantitative examination has been done with calibration curve made by certificated standard (delta 9 THC SALARS® Como Italy) to the concentrations: of 0.1; 0.5;1; 2; 3 mg/ml.

Analysis by gas chromatography mass spectrometry

Varian® 3400 gas chromatograph with Saturn 2000 mass detector equipped with DB5MS J & W (30 m x 0.25 mm i.d 0.25 µm film thickness) column under the following conditions:

- programmed temperature 120°C/1 min; rate 10°/min to 290°C/10 min;
- injector temperature: 250°C splitless;
- transfer line 280°C;
- layout in full scan range m/z 43-500.

Results

Over the period 1997-2004 (first four months), we analysed 4280 samples of hashish and 947 samples of marijuana.

Excepted from some rare cases the seizures were modest or small in quantity (from 20 to 5 g); Table1 shows the number of seizures for each subgroup of products and for each year.

Delta 9 THC content of marijuana samples goes from an average of 2.5% in 1997 to 15% in 2004.

About prevalence of some subgroup of products during years we detect: in 2002, we can find a prevalence of flowering heads with a high THC content and the appearance onto the market of selected home-produced marijuana strains while the kilobricks - pressed marijuana - which were significantly present on the illicit market, disappear in that year.

The following diagram shows the different THC content of the several product of marijuana: in 1997, 55% of the samples had a $\delta 9$ THC content of 0.5-3% and these percentages were the highest until 2001 excepted for the year 2000 in which 61% of the samples showed a percentage of 3-8%. Over the period 2002-2003, 53-58% of the samples were characterized by a 8-13% THC content, with some samples showing a potency higher than 20%.

In first four months of 2004, 57% of the sample had a $\delta 9$ THC content of 13-20% (Fig. 1).

The same evaluation was carried out with hashish seizures: the variation of THC content in hashish samples as well has its rising trend over the period considered; yet, if in 1997 the average content was of 4.5%, in 2004 it rose to 15.3%. The variation between two types (sticks or bars) in which hashish is sold on the illicit market, is narrow and probably caused by the deterioration of active ingredient. As to samples' distribution, Fig. 2 shows that until 2002 half samples

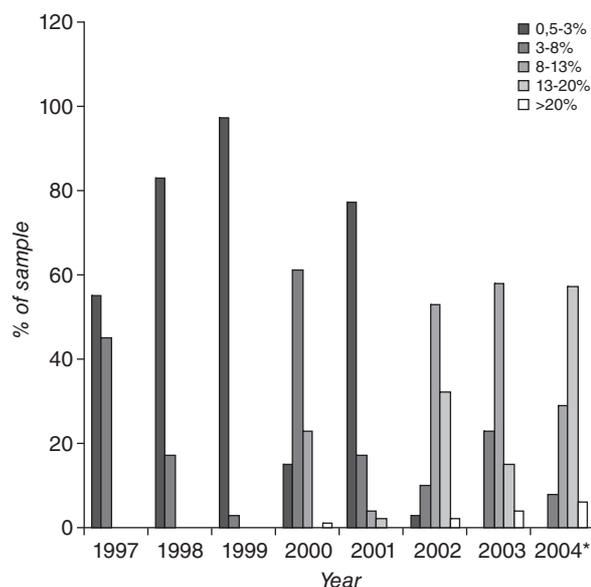


Fig. 1. - Distribution of marijuana samples on the basis of their $\delta 9$ THC content.

Table 1. - Number of seizures for each subgroup of products and for each year

Year	Marijuana				Hashish	
	Loose	Kilobrick	Buds	Home produced	Sticks	Bars
1997	5	11	17	8	120	7
1998	3	119	7	0	113	35
1999	3	257	7	1	276	8
2000	20	28	89	24	165	220
2001	2	46	22	2	338	170
2002	3	55	57	16	473	69
2003	6	0	20	21	260	1858
2004*	2	0	26	70	120	48

* first four months.

had a Δ9 THC content of 4-8%. From that point onwards, we can see samples of higher potency (13-20% of Δ9 THC) and in particular, in 2004 (from January to April), we find percentages of 13-20% in 44% of samples and a Δ9 THC content over 20% in 20% of samples.

Conclusion

Evaluation of cannabis samples show, over the period 1997-2000, a moderate fluctuation in the potency of hashish (from 4.5% of Δ9 THC to 6%) and a rise in that of marijuana (from 2.5% of Δ9 THC to 7%). The trend over the period 2002-2004 shows a remarkable increase of the potency with mean Δ9 THC values from 10.7% to 15% in marijuana and a range from 9.8% to 15.3% in hashish.

Our study shows that until 2002 medium Δ9 THC potency of marijuana is like to Δ9 THC potency of hashish.

As we show after 2002, most of seizures has a mean active ingredient content higher than 8%, that the trend is climbing to 13% and in some cases touches 20%.

Chemical analysis of confiscated material becomes important to understanding health problems associated with drug abuse.

Increase of Δ9 THC potency in all cannabis products will be an important element to understand adverse affects of drug use and abuse and value treatment possibility.

About marijuana, our study show percentages of Δ9 THC potency higher than in the past. These results improve increasing preoccupations about psychophysical effects of drug use and abuse.

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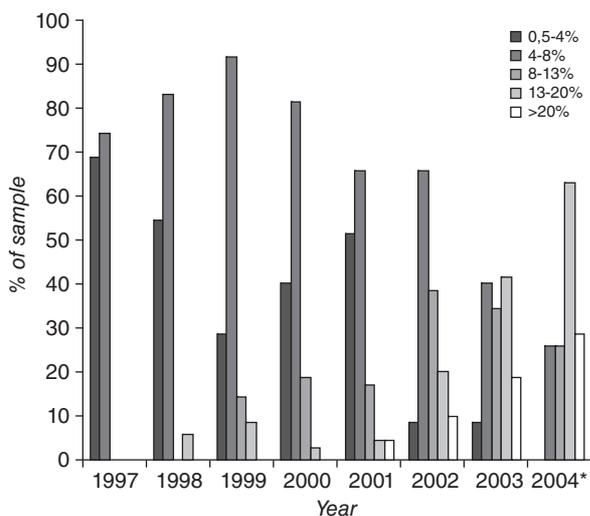


Fig. 2. - Distribution of hashish samples as to their Δ9 THC content. * First four months.

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