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Street Drugs in Denmark

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ABSTRACT: Street samples of heroin (n = 102) and amphetamine (n = 120) seized in different areas of Denmark during a one-year period were analyzed for purity and additive content.

The mean concentrations of the heroin and the amphetamine samples were 34 and 35%, respectively, but the purity of both drugs varied greatly.

Sugars and caffeine were the most frequently encountered cutting agents in both drugs. The additives phenobarbital, methaqualone, and procaine were seen only in heroin, especially in heroin base.

Half of the heroin samples were heroin base, the other half heroin chloride. Brownish samples of heroin base containing large amounts of opium alkaloids dominated in the seizures in the provincial towns, whereas white/beige samples containing heroin chloride with little or no papaverine or noscapine were frequently seen among the seizures in the capital. The result may indicate different import routes for heroin to the eastern and western parts of Denmark.

KEYWORDS: criminalistics, abuse drugs, heroin, amphetamine, purity, additives, cutting agents, Denmark

In Denmark, heroin (diacetylmorphine) and amphetamine are the most frequently abused "hard" drugs. Heroin has been a drug of abuse for many years, while the misuse of illicit amphetamine was not seen until 1985 [*1,2*]. Therefore, heroin has been the object of most previous studies on illicit drugs [*3–5*].

In 1987 the total quantities of heroin and amphetamine seized in Denmark were 13 and 56 kg, respectively, in comparison with 29 and 30 kg in 1988 [*2*]. The total amount seized is often used to indicate the existence and sometimes the size of an illicit drug market. This, in turn, is taken to reflect the level of use [*6*]. The disadvantage of this method of measuring drug abuse is that a few large seizures will dominate and distort the figures. Thus, heroin abuse has not doubled, and amphetamine misuse has not decreased by half in 1988 in comparison with 1987. Registration of changes in the incidence and quality of street drugs might therefore be a better indicator of changes in the pattern of drug abuse. In addition, knowledge of impurities, adulterants, and diluents in illicit drugs might also be a useful tool in police investigations.

In Denmark, seizures of street drugs are not always submitted to analysis. Moreover, the impurity pattern of the drugs received is not always determined. Therefore, in order to determine the quality of illicit street drugs in Denmark, the Department of Forensic Chemistry, University of Aarhus, decided to carry out a prospective study of street drugs in selected areas in cooperation with the police. The purpose of the project was to

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determine the quality (purity and additives) of street drugs (heroin and amphetamine) available on the black market in 1987 through 1989. An additional aim of the project was the registration of possible differences between street drugs seized in different areas of the country.

Materials

Seized samples of heroin or amphetamine weighing less than 0.6 and 1.0 g, respectively, were included whenever the wrapping was a needle sheath or metal foil/paper sachet ("users" packages). Samples in other wrappings were not included. The maximum weights selected were equivalent to the maximum quantity of heroin or amphetamine in a needle sheath.

The heroin material consisted of one sample a week from seizures in each of the four largest towns in Denmark (Copenhagen, Aarhus, Odense, and Esbjerg), while the amphetamine project also included samples from the provincial towns of Aalborg, Randers, Horsens, and Silkeborg.[2] In order to avoid a biased selection procedure, the first seizure which fulfilled the given requirements each week was submitted to the laboratory, together with a completed questionnaire.

Both projects ran for one year, the heroin project starting in September 1987 and the amphetamine project in February 1988.

Methods

All samples were subjected to both gas chromatography (GC) and high-performance liquid chromatography (HPLC) analysis. In addition, thin-layer chromatography (TLC) screening procedures were performed for barbiturates, paracetamol, strychnine, quinine, and sugars according to the routine methods of the laboratory. Qualitative tests for solubility, pH, ions, starch, and phenolphthalein were performed on all samles.

The gas chromatograph used was a Hewlett-Packard (HP) Model 5890A equipped with a flame ionization detector, splitless injection mode, and automatic injection. The gas chromatograph was connected to a HP Model 3396A integrator. The column was a HP-5 25 m by 0.2 mm (inside diameter) capillary column. The film thickness was 0.33 μm. The following temperature program was used: 60°C (for 1.5 min), 30°C/min to 200°C (for 0 min), 10°C/min to 300°C (for 0 min), 2°C/min to 310°C (for 5 min). The temperature of the injection port and detector were 225 and 350°C, respectively.

The equipment used for the HPLC analysis was a Hitachi Model 655A-12 pump connected to a Hitachi Model 655A variable ultraviolet (UV) photometer and an automatic injection system (Model 655A-40). A wavelength of 280 nm was used for analysis of heroin and heroin additives, while a wavelength of 220 nm was used for the amphetamine samples. The column was a 30 cm μ-Bondepack C-18 column equipped with a guard column. The mobile phase consisted of acetonitrile and an aqueous solution containing 0.75% ammonium acetate. The mixture ratio was 50:50 for the amphetamine analysis, but for separation of the opium alkaloids, the ratio varied from approximately 60:40 to 50:50 according to the age of the column [*3*]. Table 1 shows retention data on compounds detected in illicit heroin and amphetamine.

All samples were screened by GC while the quantitative determination of heroin, amphetamine, and most additives was performed by HPLC. However, when methaqualone was present, together with papaverine, these drugs were quantified by GC because of coelution by the HPLC method. In order to separate mixtures of caffeine and paracetamol, these two drugs, when both present, were quantified by HPLC at 240 nm using

[2]All the provincial towns mentioned in this article are situated in the western part of Denmark, Copenhagen, the capital, is situated in the eastern part of the country.

TABLE 1—*Retention times relative to caffeine of compounds detected in street samples of heroin and amphetamine.*

Compound	GC	HPLC
Amphetamine	0.53	1.42
Nicotinamide	0.68	0.91
Paracetamol	0.87	0.97
Noscapine[a]	0.92 + 0.97 + 2.30	3.72
Caffeine	1.00 (9.8 min)	1.00 (3.3 min)
Phenazone	1.05	1.19
Phenobarbital	1.10	1.25
Procaine	1.16	1.59
Methaqualone	1.29	1.99
Codeine	1.50	1.97
Morphine	1.54	1.40
Acetylcodeine	1.59	3.12
Monoacetylmorphine	1.61	1.81
Heroin	1.71	2.71
Papaverine	1.88	2.05
Ascorbic acid	ND[b]	0.74

[a]Decomposed.
[b]ND = not detected.

methanol/water, 65:35 as the eluent. Phenobarbital was quantified by HPLC at 195 nm using an eluent consisting of acetonitrile/phosphate buffer (215:785) at pH 4.4.

The color of the samples was described at the same time by one person. Only a description of the strength of the brown color (light, medium, or dark), and not the shades of red, yellow, or grey, has been attempted.

Results

Heroin

One hundred and two heroin samples consisted of sufficient material (>0.015 g) for quantitative and qualitative analyses. Four samples did not contain heroin, as was assumed upon seizure, but propoxyphene napsylate (36%), morphine chloride (95%), amphetamine sulfate (24%), and cinnarizin (18%). Fifty of the heroin samples were seized in Copenhagen and 52 outside the capital.

Fifty of the heroin samples were in the base form (Table 2), while 52 were chloride in form (Table 3). Approximately two thirds (69%) of the chloride samples were seized in Copenhagen.

Seventeen of the samples were white and 12 beige, while 73 samples were of various brownish colors (15 light brown, 30 medium brown, and 28 dark brown). All the white samples and all but one of the beige samples were chloride in form, whereas brownish colors dominated among the heroin base samples. The majority (83%) of the white/beige samples were seized in Copenhagen.

All samples contained monoacetylmorphine and all but one (Table 2, No. 30) contained acetylcodeine. In one sample (Table 2, No. 22) of a very low purity, the monoacetylmorphine content exceeded the heroin content. The alkaloids papaverine and noscapine were present in all but two of the heroin-base samples. In contrast, the alkaloids were detected in only half of the heroin chloride samples. Many samples contained very high concentrations of noscapine, and in a few samples, the noscapine content exceeded the heroin content. White samples never and beige samples seldom contained the opium

alkaloids papaverine and noscapine, whereas the noscapine content, in particular, was very high in the brownish samples.

Purity

The mean concentration of all 102 samples, calculated as heroin base, was 34%. Yet a significant difference was noticed according to the base/salt character of the sample. The mean concentration of the heroin base samples was 29%, and of the heroin chloride samples 45% (corresponding to 39% calculated as heroin base). The median values were 29 and 43%, respectively. None of the base samples had a concentration higher than 52%, while approximately one fifth of the chloride samples (calculated as base) were of a purity above this value (Fig. 1).

The mean concentration (calculated as heroin base) of heroin from Copenhagen was higher (40%) than that from the provincial towns (28%). Both heroin base and heroin chloride samples from Copenhagen had a greater purity.

Additives

All heroin base samples and all except four samples with very high concentrations of heroin chloride were adulterated, diluted, or both.

Seventy-five (74%) of the samples were diluted with sugars. In 41 samples, only one sugar was detected while two and three different sugars were found in 25 and 9 samples, respectively. Lactose was the most common sugar, but glucose and mannitol were also frequently encountered (Table 4).

Caffeine and phenobarbital were frequent additives, especially in heroin base samples (Tables 2–4). Concentrations of up to 32% caffeine and 25% phenobarbital were seen. No other barbiturates were detected. Methaqualone was encountered in a third of the heroin base samples, always in very low concentrations (a maximum of 3% of the sample weight) and most often in combination with phenobarbital. In addition, these samples often contained low concentrations of nicotinamide (maximum, 5%). Other cutting agents were paracetamol, phenazone, procaine, and ascorbic acid (Table 4). Phenolphthalein and starch were detected in a few samples, whereas quinine and strychnine were not detected.

All additives except the sugars were detected more frequently in the samples from the provincial towns than in the samples from Copenhagen.

Amphetamine

The amphetamine material consisted of 120 street samples containing sufficient material of amphetamine sulphate (>0.015 g) for quantitative and qualitative analyses. Eight samples seized as amphetamine were found not to contain the drug. Four of these consisted of the controlled drugs heroin chloride (87%), cocaine chloride (21%), propoxyphene napsylate (40%), and amfepramone chloride (70%). Of the other four samples, two were ascorbic acid, one contained a mixture of caffeine and phenazone, and one consisted of a mixture of caffeine, phenazone, acetanilide, and phenacetin. Forty-two of the amphetamine samples were seized in Copenhagen and 78 outside the capital.

Most of the samples (n = 76) were white, 24 were beige, 14 were of different shades of yellow, 5 were light brown, and 1 was dark brown.

Purity

The mean and the median concentrations of the 120 street samples were both 35%. The purity of the samples varied greatly, the lowest concentration found being 3% and

TABLE 2—*Composition of 50 street samples of heroin base: the content of opium alkaloids and cutting agents is given as a percentage of the sample weight.*[a]

Sample No.	Color	Place of Seizure	Heroin	Morphine	Monoacetyl-morphine	Acetylcodeine	Papaverine	Noscapine	Caffeine
30	beige	P	19.4	–	2.7	–	–	–	–
42	lbrown	P	4.8	–	1.6	0.4	–	–	26
50	lbrown	P	13.6	–	1.3	1.3	1.4	5.3	7
28	lbrown	P	15.3	–	0.7	2.9	1.3	10.0	17
4	lbrown	C	32.1	–	0.5	4.7	2.4	14.9	21
69	lbrown	P	34.2	–	2.0	2.9	1.3	7.8	17
37	lbrown	C	34.8	–	2.7	3.1	1.6	8.1	–
56	lbrown	C	38.0	–	2.3	4.1	1.7	11.3	19
101	lbrown	C	44.5	–	2.1	3.4	1.8	24.4	6
102	lbrown	P	49.5	–	3.2	5.0	1.7	14.1	–
1	mbrown	P	9.3	2.9	2.8	0.4	1.5	13.1	6
96	mbrown	P	11.5	–	0.7	1.1	1.1	7.2	7
16	mbrown	C	14.8	–	2.3	1.9	1.3	7.1	2
47	mbrown	P	15.2	–	0.5	0.9	1.3	5.1	1
57	mbrown	P	22.3	–	2.9	3.5	2.2	13.1	13
95	mbrown	P	26.0	–	0.3	1.8	0.9	7.1	–
80	mbrown	P	26.5	–	3.5	3.5	2.0	9.3	–
12	mbrown	C	29.7	–	2.1	4.6	1.5	13.1	20
85	mbrown	P	30.8	–	1.9	2.4	2.8	23.8	24
94	mbrown	C	38.7	–	1.1	2.7	1.5	12.8	4
39	mbrown	C	39.6	–	1.6	3.1	1.7	11.6	7
105	mbrown	P	42.0	–	2.0	3.0	2.9	22.9	8
79	mbrown	C	43.1	–	3.2	5.7	2.4	18.6	2
76	mbrown	P	44.9	–	2.3	5.7	2.1	18.7	15

77	mbrown	P	45.6	–	2.2	5.6	2.4	19.4	15
43	mbrown	C	46.4	–	2.0	2.8	1.7	21.2	9
11	mbrown	P	51.0	–	4.4	5.7	3.0	26.6	7
73	mbrown	P	51.0	–	3.3	6.6	2.4	18.2	16
22	dbrown	P	5.2	–	9.2	1.0	0.8	11.9	21
20	dbrown	P	10.7	–	1.6	0.6	1.0	10.4	6
9	dbrown	P	14.1	–	7.4	3.1	2.4	13.0	19
8	dbrown	P	14.3	–	0.7	1.9	1.7	8.8	11
49	dbrown	P	14.4	–	1.1	1.3	0.9	6.0	32
17	dbrown	P	15.9	–	2.7	0.8	1.3	14.1	6
15	dbrown	P	17.8	–	2.8	1.3	1.4	15.7	6
5	dbrown	P	18.8	–	3.4	2.5	1.6	12.6	4
24	dbrown	P	20.1	–	2.1	0.7	1.4	10.2	10
98	dbrown	P	22.4	0.9	1.6	3.2	1.8	10.2	31
89	dbrown	P	23.8	3.3	2.9	3.0	2.1	10.4	22
14	dbrown	P	26.1	–	3.1	4.1	2.6	19.6	23
61	dbrown	P	27.1	–	1.7	2.2	1.5	17.2	1
23	dbrown	C	27.6	–	4.6	2.9	1.4	9.4	11
44	dbrown	P	31.1	–	2.5	3.9	2.8	9.6	–
72	dbrown	P	31.1	1.0	2.3	4.3	1.9	11.4	–
100	dbrown	P	32.8	–	2.7	2.5	1.4	28.1	12
82	dbrown	P	35.6	3.2	2.8	5.5	2.2	12.9	–
54	dbrown	C	36.0	–	1.1	2.0	1.3	17.5	10
67	dbrown	P	38.8	–	3.4	4.1	1.8	13.5	12
48	dbrown	C	45.0	3.1	1.1	1.4	1.1	8.7	6
19	dbrown	C	52.0	1.4	2.7	6.0	4.1	15.4	–
% positive:			100	14	100	98	96	96	82

[a]Key to abbreviations: – = not detected; + = detected (>0.5%); lbrown = light brown; mbrown = medium brown; dbrown = dark brown; C = Copenhagen (eastern Denmark); P = provincial towns (western Denmark).

TABLE 2—*Continued.*

Sample No.	Phenobarbital	Methaqualone	Procaine	Paracetamol	Nicotinamide	Phenazone	Lactose	Glucose	Mannitol	Sucrose
30	–	–	–	–	–	–	–	+	–	–
42	–	–	–	–	–	–	–	–	–	–
50	1	–	–	–	–	–	+	+	+	–
28	–	–	–	–	–	–	+	–	–	+
4	1	–	–	–	–	–	–	–	–	–
69	1	1	–	1	–	–	+	–	+	–
37	–	–	–	–	–	–	+	–	–	–
56	3	1	–	–	–	–	–	–	–	–
101	13	–	–	–	–	–	–	–	–	–
102	–	–	–	–	–	–	+	+	+	–
1	25	1	–	–	1	–	–	–	–	–
96	8	–	–	8	–	–	–	+	–	–
16	1	2	–	–	–	–	+	+	+	–
47	19	–	–	–	–	–	–	+	+	–
57	–	–	2	3	–	–	+	–	–	–
95	–	–	–	–	–	56	–	–	–	–
80	1	1	–	–	–	–	+	–	–	–
12	21	–	–	–	–	–	–	–	–	–
85	3	–	1	–	–	–	–	+	–	
94	7	1	–	–	–	–	+	–	–	–
39	8	1	–	–	1	–	+	+	–	–
105	1	–	–	13	–	–	–	–	+	–
79	4	–	–	–	–	–	+	–	–	–

76	3	–	2	–	–	–	–	–	–	
77	2	–	2	–	–	–	–	–	–	
43	9	–	–	–	–	–	–	–	–	–
11	1	–	–	–	–	–	–	–	–	–
73	2	–	3	–	–	–	–	+	–	–
22	5	–	–	1	–	–	+	+	+	–
20	20	2	–	–	5	–	+	+	–	–
9	–	–	–	–	–	–	–	+	–	–
8	1	–	–	–	–	1	–	+	–	–
49	–	–	–	20	–	–	+	+	+	–
17	24	2	–	–	1	–	+	–	–	–
15	23	2	–	–	1	–	+	–	–	–
5	7	1	1	–	3	–	+	–	+	–
24	1	3	–	–	1	–	+	+	–	–
98	–	–	–	4	–	–	–	+	–	–
89	1	–	–	19	–	–	–	–	–	–
14	2	–	1	–	–	–	–	+	–	–
61	19	–	–	–	–	–	–	–	–	–
23	1	–	–	–	–	–	–	+	–	–
44	–	–	2	–	–	25	–	–	–	–
72	1	1	–	–	–	–	+	–	–	–
100	1	1	–	13	–	–	–	–	–	–
82	1	1	–	–	–	–	–	–	–	
54	22	–	–	–	–	–	–	–	–	–
67	2	3	–	–	–	–	–	–	–	–
48	13	1	–	13	–	–	–	–	–	+
19	–	–	3	–	–	–	–	–	–	–
% positive:	76	34	18	20	14	6	38	34	20	4

TABLE 3—*Composition of 52 street samples of heroin chloride: the content of opium alkaloids and cutting agents is given as a percentage of the sample weight.*[a]

Sample No.	Color	Place of Seizure	Heroin	Morphine	Monoacetyl-1 morphine	Acetylcodeine	Papaverine	Noscapine	Caffeine	Phenobarbital	Methaqualone	Procaine	Paracetamol	Nicotinamide	Phenazone	Lactose	Glucose	Mannitol	Sucrose
52	white	C	16.1	–	0.2	3.0	–	–	–	–	–	–	–	–	–	+	–	+	–
81	white	C	38.1	–	1.3	1.1	–	–	–	–	–	–	–	–	–	–	–	+	–
74	white	C	39.1	–	2.0	4.7	–	–	–	–	–	–	–	–	–	+	–	+	–
84	white	C	39.6	–	0.9	4.8	–	–	17	–	–	–	–	–	–	–	–	+	–
104	white	C	41.5	–	3.1	1.3	–	–	–	–	–	–	–	–	–	+	–	–	–
92	white	C	43.1	–	3.0	1.1	–	–	–	–	–	–	–	–	–	+	–	–	–
108	white	C	43.5	–	1.0	5.2	–	–	–	–	–	–	–	–	–	+	–	+	–
41	white	C	43.6	–	1.0	3.2	–	–	–	–	–	–	–	–	–	+	+	–	–
75	white	C	46.8	–	1.0	6.1	–	–	–	–	–	–	–	–	–	+	+	–	–
59	white	C	48.3	–	1.0	4.2	–	–	–	–	–	–	–	–	–	+	–	–	–
6	white	C	50.0	–	0.6	5.2	–	–	–	–	–	–	–	–	–	–	–	+	–
33	white	C	56.9	–	1.1	6.6	–	–	–	–	–	–	–	–	–	+	–	–	–
86	white	C	56.9	–	1.7	6.7	–	–	20	–	–	–	–	–	–	–	–	+	–
18	white	C	60.5	–	0.9	5.7	–	–	–	–	–	–	–	–	–	+	–	+	+
90	white	P	61.0	–	0.6	7.8	–	–	–	–	–	–	–	–	–	+	+	–	+
51	white	C	83.7	–	1.3	6.4	–	–	–	–	–	–	–	–	–	–	–	–	–
103	white	C	86.4	1.6	5.8	10.3	–	–	–	–	–	–	–	–	–	–	–	–	–
29	beige	C	16.8	–	1.0	2.7	–	–	–	–	–	–	–	–	–	+	–	–	–
68	beige	C	18.2	–	1.4	1.0	0.2	3.6	–	–	–	–	–	–	–	–	+	–	–
38	beige	P	30.8	0.1	2.9	0.7	–	–	6	–	–	–	–	–	15	+	–	–	–
91	beige	C	36.2	–	2.9	0.6	–	–	–	–	–	–	–	–	–	+	–	–	+
46	beige	C	46.7	–	2.5	8.1	–	–	–	–	–	–	–	–	–	–	–	+	–
63	beige	P	50.8	1.7	4.4	1.7	–	–	4	–	–	–	–	–	6	+	+	–	–

65	beige	P	53.4	–	0.4	2.7	–	–	–	–	–	–	–	–	–	+	–	–	–
71	beige	C	71.5	–	3.2	2.3	–	0.9	–	–	–	–	–	–	–	–	+	–	–
64	beige	C	79.4	–	3.3	2.5	–	1.6	–	–	–	–	–	–	–	–	+	–	–
62	beige	C	82.7	–	2.3	9.1	–	–	–	–	–	–	–	–	–	+	+	–	–
27	beige	C	92.3	–	3.9	8.7	–	–	–	–	–	–	–	–	–	–	–	–	–
31	lbrown	P	22.2	–	0.9	1.6	0.7	4.4	9	–	–	–	–	–	–	+	+	–	–
55	lbrown	P	22.8	–	2.1	2.9	1.5	5.9	–	–	–	8	–	–	–	+	–	–	–
78	lbrown	C	27.1	–	0.9	2.9	0.5	2.9	1	16	–	–	–	–	–	+	+	+	–
70	lbrown	P	33.5	–	0.7	3.7	1.2	4.6	–	1	–	–	–	–	–	+	+	–	–
36	lbrown	C	53.8	–	3.1	4.7	2.3	8.2	–	1	–	–	–	–	–	–	–	–	–
60	lbrown	C	61.6	–	0.8	7.6	3.2	16.4	–	–	–	–	–	–	–	–	–	–	–
97	mbrown	C	24.3	–	0.6	1.8	1.4	9.1	1	2	–	–	–	–	–	+	–	+	–
7	mbrown	P	27.0	–	5.1	3.3	1.8	8.3	–	–	2	5	–	–	–	+	–	+	–
13	mbrown	C	28.8	–	0.6	2.6	1.8	6.8	–	1	–	–	–	–	–	–	–	+	+
99	mbrown	P	29.4	–	2.9	3.4	1.8	8.8	–	1	1	–	–	–	–	+	–	–	–
87	mbrown	P	30.7	2.2	2.0	3.0	1.7	9.5	–	1	1	–	–	–	–	+	–	–	–
3	mbrown	C	35.2	–	3.7	3.6	2.4	9.4	–	–	–	7	–	1	–	+	+	+	–
25	mbrown	C	35.4	–	2.1	4.8	1.8	8.6	–	1	–	–	–	–	–	+	+	–	–
32	mbrown	C	35.4	–	3.5	4.4	2.1	14.1	–	–	–	15	–	–	–	–	–	–	+
53	mbrown	C	38.0	–	2.7	4.5	2.0	18.7	5	5	–	–	–	–	–	+	–	+	–
88	mbrown	P	48.9	–	3.8	3.8	0.7	4.2	–	–	–	10	–	–	–	+	+	–	–
107	mbrown	P	53.8	–	3.0	5.4	2.9	20.2	9	–	–	–	13	–	–	–	–	–	–
10	mbrown	C	55.4	–	1.8	6.1	1.8	5.6	–	–	–	–	–	–	–	–	+	–	–
58	dbrown	P	36.2	–	5.0	5.0	2.8	10.3	–	–	–	–	–	–	–	–	+	–	–
45	dbrown	P	39.3	–	0.8	3.8	2.1	9.5	–	–	–	–	–	–	–	–	+	–	+
66	dbrown	C	41.4	0.9	2.7	4.5	2.1	11.5	–	1	1	–	–	–	–	+	–	–	–
40	dbrown	C	44.3	–	0.8	4.8	2.2	11.7	–	–	–	–	–	–	–	+	–	–	+
34	dbrown	P	44.9	–	1.2	5.3	2.3	13.9	1	2	–	–	–	–	–	–	–	–	–
83	dbrown	P	54.2	4.2	4.2	7.0	2.5	16.3	–	1	1	–	–	–	–	–	–	–	–
% positive:			100	12	100	100	48	56	19	23	10	10	2	2	4	60	33	29	13

[a]Key to abbreviations: – = not detected; + = detected (>0.5%); lbrown = light brown; mbrown = medium brown; dbrown = dark brown; C = Copenhagen (eastern Denmark); P = provincial towns (western Denmark).

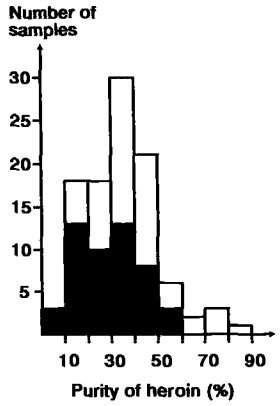

FIG. 1—*Purity of 102 street samples of heroin seized in 1987 through 1988:* ■ = *heroin base* (n = *50);* □ = *heroin chloride, calculated as heroin base* (n = *52).*

TABLE 4—*The frequency of detection of cutting agents in Danish street samples of heroin and amphetamine: results are given as a percentage of the total number of samples in each column.*

	Heroin			Amphetamine
	Base, % (n = 50)	Chloride, % (n = 52)	Total, % (n = 102)	Total, % (n = 120)
Caffeine	82	19	50	64
Phenobarbital	76	23	49	ND[a]
Methaqualone	34	10	22	ND
Procaine	18	10	14	ND
Paracetamol	20	2	11	2
Nicotinamide	14	2	8	ND
Phenazone	6	4	5	5
Ascorbic acid	8	2	5	3
Lactose	38	60	49	65
Glucose	34	33	33	73
Mannitol	20	29	25	10
Sucrose	4	13	9	11

[a]ND = not detected.

the highest 89% (Fig. 2). The mean concentration of the Copenhagen amphetamine samples was lower (31%) than that of those from outside the capital (38%).

Additives

All the samples, except three of very high purity, were adulterated, diluted, or both. Sugars and caffeine were the most common additives (Table 4). One or more sugars were detected in 114 samples (94%). Fifty-one samples were diluted with only one sugar, while two or three sugars were used in 46 and 16 cases, respectively. Glucose and lactose were the sugars most frequently encountered. Caffeine was used as a cutting agent in two thirds of the samples, more often in samples from the provincial towns than in samples from the capital. The average concentration of caffeine was 15%, but concentrations of up to 44% were found.

The pattern of the various additives detected in illicit amphetamine was less varied than that of the additives seen in heroin (Table 4). Phenazone, paracetamol, and ascorbic

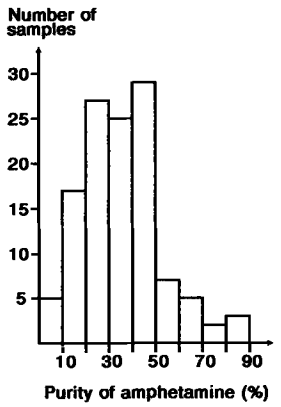

FIG. 2—*Purity of 120 street samples of amphetamine seized in 1988 through 1989.*

acid were detected in a few samples. Phenobarbital, methaqualone, procaine, and nicotinamide were not found.

Discussion

The street level purity of heroin in Denmark is high compared with that in the United States, where the retail purity has been approximately 5% for many years [*7*]. In Europe, a street level purity of approximately 20% has been reported in heroin seized in Hamburg, Germany, and Dublin, Ireland in the mid-1980s [*6*]. The same study showed purities of street heroin of approximately 50% in London and approximately 5% in Rome. In Amsterdam, the street level purity was found to be 37% in 1985, whereas a Spanish investigation of street drugs seized in 1985 through 1987 showed a purity range of 21 to 60% for the heroin samples [*8,9*]. However, comparison of street drugs seized in different countries is difficult, as different definition terms and methods of registration may have been used.

In a study on 156 street samples of heroin seized in the western region of Denmark in 1980 through 1985, a mean concentration of 29% was found [*5*]. The average concentration of street heroin in western Denmark has therefore not changed during the 1980s. The higher purity of heroin seized in Copenhagen may reflect a greater supply and availability of the drug in the capital than in the provincial towns.

It is only in recent years that major quantities of illicitly produced amphetamine have been available on the black market in Denmark. Knowledge of the street level purity of the drug in previous years is therefore limited. Analyses of 67 retail samples seized during the period 1982 through 1987 have shown a mean purity of 44%, which did not differ from the mean concentration of the total analyzed material (n = 144) [*1*].

The purity range of both heroin and amphetamine was wide. A relatively large number of samples of both street drugs were of purities above 50%, which in the heroin cases could have resulted in fatal intoxication. Moreover, some samples sold as heroin or amphetamine did not contain the drug they were said to be. Injecting heroin of a purity of 87% instead of, as intended, taking amphetamine is highly dangerous and may easily cause death. In this study, none of the samples consisted of mixtures of heroin and amphetamine, although both drugs are commonly used separately by drug addicts.

The pattern of cutting agents detected in the heroin samples was more varied than that in the amphetamine samples. Sugars and caffeine were, however, very frequently seen as cutting agents in both illicit drugs. The sugars lactose and sucrose were still used

just as often as heroin diluents as in the early eighties [*3*]. In contrast, the percentage of samples containing glucose was reduced by half, while the percentage of samples containing mannitol had increased from 3 to 25%. In comparison with heroin seized from 1981 through 1983, the percentage of samples containing caffeine had doubled, whereas the occurrence of procaine had not changed. The additives phenobarbital, methaqualone, and paracetamol had not been seen in samples seized in the early 1980s.

Many of the cutting agents influence the effect of smoking heroin. Caffeine and phenobarbital have been found to increase volatilization and thereby the effect of heroin, whereas ascorbic acid and sugars have the opposite effect [*8*]. In Denmark, injection is the most common method of administering heroin, whereas amphetamine is injected, sniffed, or taken orally. In order to dissolve heroin base, users add weak acids—often ascorbic acid. Mixing usually takes place immediately before injection, but sometimes ascorbic acid is used as a cutting agent (Table 4).

In this study, the heroin samples were divided according to the base/salt character of each sample. Yet, it is worth bearing in mind that the chloride samples might be a mixture of heroin chloride and heroin base [*10*]. Moreover, the chloride reaction may have been caused by an additive, for example, procaine hydrochloride, present in a sufficient quantity.

The percentage of samples containing the alkaloids papaverine and noscapine has doubled in comparison with heroin seized from 1981 through 1983 [*3*]. Moreover, the ratio of noscapine to heroin in each sample has increased significantly, and in more than half of the samples in this study the ratio exceeded the maximum seen in the 1981–1983 study.

The more varied impurity pattern (alkaloids and additives) of heroin seized nowadays, in comparison with that of heroin seized in the early 1980s, makes profiling more reliable than previously. The content of alkaloids in proportion to the heroin content of each sample gives information on the origin of the heroin [*4,10–12*]. These proportions remain constant despite possible subsequent dilution of the sample and may therefore be used when comparing samples [*3,13–16*]. Due to a large variation range, the ratio of noscapine to heroin is an especially useful indicator. In addition, detection of many pharmacologically active substances may be used for comparative purposes, since their presence may indicate the route of distribution. The cutting procedure most probably takes place in the country of origin, since many of these additives have also been detected in heroin seized abroad [*8,9,16,17*]. For example, procaine has been found to be a very common additive in heroin from Turkey, whereas investigations have revealed that phenobarbital is being used as an adulterant in heroin from Afghanistan and Pakistan [*10,17,18*].

In the early 1980s, heroin seized in western Denmark was similar to the Copenhagen material in this study; that is, it mainly consisted of white/beige samples of heroin chloride with little or no noscapine (Southeast Asian type) [*3,4,10,11*]. In the middle of the 1980s, a change took place, and since then, brownish heroin base samples containing high concentrations of noscapine (Southwest Asian type) have played a dominating role in the illegal market in western Denmark. The difference in the quality of heroin seized in Copenhagen in comparison with that of heroin seized in the provincial towns may indicate different import routes for the eastern and western parts of Denmark.

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