

## Detection of Morphine and Codeine Following Consumption of Poppy Seeds

### To the Editor:

The presence of opiates on the surface of inadequately washed poppy seeds used in baking has been reported to result in measurable urine concentrations of morphine and codeine (1,2). In order to confirm these findings and to assess the degree to which this represents a problem in light of the current environment of urine drug screening, we conducted the experiments described below.

A canned poppy-seed filling (Solo<sup>®</sup>, packed by Sokol & Company, Countryside, IL) was obtained from a local grocery store. According to the label, the mixture consisted of poppy seeds, cornstarch, water, and sugar. A cookie confection (hamantaschen) was prepared according to a recipe on the can's label. The cookies were made with a flour, water, and butter dough and topped with about 1 teaspoon of the poppy-seed filling. The cookies were baked at 350°F for 25 min.

Urine samples were obtained before and 2 h after the consumption of the poppy-seed cookies by 5 laboratory volunteers (4 males and 1 female). Each person ate 2 cookies, except for one individual (JB), who ate 3. The urine samples were analyzed with the EMIT<sup>®</sup> opiate assay (Syva Corp, Palo Alto, CA) and by GC/MS.

The GC/MS procedure involved extraction of the urine samples using a commercially available solvent-extraction method (Toxi-Lab<sup>®</sup>, Analytical Systems, Laguna Hills, CA) following the addition of nalorphene as an internal standard and derivatization with trifluoroacetic anhydride. Total morphine was measured using acid hydrolysis prior to the extraction and derivatization (3). Standards for the GC/MS assay were prepared from morphine and morphine glucuronide for the free and total morphine determinations, respectively. The GC/MS used consisted of a Hewlett-Packard 5710 gas chromatograph and an HP 5970 mass-selective detection using an HP 19091J-002 5% phenyl methyl silicon 25-m capillary column. The selective ion monitoring mode was used with acetylated morphine identified by masses of 364, 365, 477, and 478 amu and acetylated codeine by masses of 283, 338, 395, and 396 amu. The results of the EMIT and GC/MS analyses are given in Table I.

**Table I. Results of EMIT<sup>®</sup> and GC/MS Analysis for Opiates**

| Subject | Time Post-Consumption (H) | Ratio* of EMIT Rate to Cutoff | GC/MS Results Morphine (ng/mL) |       |
|---------|---------------------------|-------------------------------|--------------------------------|-------|
|         |                           |                               | Free                           | Total |
| DA      | 2                         | 1.16 (+)                      | 60**                           | 792   |
| JB      | 2                         | 1.33 (+)                      | 40**                           | 1481  |
|         | 24                        | 0.95 (-)                      | 25                             | 468   |
| DC      | 2                         | 1.17 (+)                      | 75                             | 931   |
| GR      | 2                         | 1.23 (+)                      | 40                             | 979   |
|         | 24                        | 0.99 (-)                      | 25                             | 491   |
| AZ      | 2                         | 1.15 (+)                      | 30                             | 722   |

\* Ratios greater than 1.00 are decreased positive.  
\*\* Codeine also identified.

All the samples collected prior to the consumption of the poppy-seed cookies were negative for opiates by the EMIT procedure. As shown in Table I, all of the 2-h post-prandial results were positive by EMIT (i.e. greater than the 300 ng/mL Syva calibrator) and positive for morphine with the total morphine greater than the free morphine by more than a factor of 10. Further, codeine was found in a concentration of approximately 20 ng/mL in two of the samples without hydrolysis. Urine samples from two of the subjects were tested 24 h after poppy-seed consumption and were found, as shown in Table I, to be just below the EMIT calibrator cutoff and to contain 25 ng/mL free morphine and about 500 ng/mL total morphine.

Clearly, the consumption of poppy-seed confections can result in positive screening tests for opiates which are confirmable by GC/MS, particularly if the samples are hydrolyzed, rendering the morphine glucuronide readily extractable. The ratio of total to free morphine is quite large, as might be expected due to the extensive first-pass metabolism that characterizes morphine absorbed into the portal circulation. However, this ratio would not distinguish recent poppy-seed consumption from heroin or morphine use (4).

We conclude that food containing poppy seeds should be avoided by those persons subject to drug testing. Even the very modest amount of poppy seed used in this study resulted in positive, GC/MS-confirmed tests for opiates. Questions concerning the consumption of such foods must be included in the history that should be a part of the pre-analytical phase of a drug-abuse testing program.

#### **Acknowledgment**

The authors wish to thank Ms. Edna S. Zebelman for baking the poppy-seed cookies.

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