A Positive Cannabinoids Workplace Drug Test Following the Ingestion of Commercially Available Hemp Seed Oil

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Abstract

A commercially available health food product of cold-pressed hemp seed oil was ingested by one volunteer twice a day for 4 1/2 days (135 mL total). Urine specimens collected from the volunteer were subjected to standard workplace urine drug testing procedures, and the following concentrations of 11-nor-Δ^9-tetrahydrocannabinol carboxylic acid (9-THCA) were detected: 41 ng/mL 9-THCA at 45 h, 49 ng/mL at 69 h, and 55 ng/mL at 93 h. Ingestion was discontinued after 93 h, and the following concentrations were detected: 68 ng/mL at 108 h, 57 ng/mL at 117 h, 31 ng/mL at 126 h, and 20 ng/mL at 142 h. The first specimen that tested negative (50 ng/mL initial immunoassay test, 15 ng/mL confirmatory gas chromatographic–mass spectrometric test) was at 146 h, which was 53 h after the last hemp seed oil ingestion. Four subsequent specimens taken to 177 h were also negative. This study indicates that a workplace urine drug test positive for cannabinoids may arise from the consumption of commercially available cold-pressed hemp seed oil.

Introduction

Δ^9-Tetrahydrocannabinol (THC) is the major pharmacologically active component of the marijuana plant (*Cannabis sativa*). A major metabolite of THC is 11-nor-Δ^9-tetrahydrocannabinol carboxylic acid (9-THCA) (1). This pharmacologically inactive metabolite is excreted in the feces and in the urine. Studies conducted in the 1980s by Dubowski (2) and Ellis et al. (3) indicated that 9-THCA can be detected in urine for approximately 1–5 days in occasional, recreational smokers, and for 3–4 weeks in chronic, heavy smokers. A more recent study by Huestis et al. (4) indicated that detection times of marijuana metabolites in urine by immunoassay and gas chromatography–mass spectrometry (GC–MS) may be shorter than previously assumed.

The identification and confirmation of 9-THCA in urine is widely used in employment urine drug testing as an indication of the use of marijuana or the use of the antiemetic/appetite stimulant drug Marinol™ by the person from whom the specimen came. In the absence of any reasonable medical explanation, the confirmed presence of 9-THCA in the urine is considered definitive evidence of the illegal use of marijuana. Based on this evidence, actions may be taken against the donor, including denial of employment, termination of employment, or referral to a drug rehabilitation program.

Recently, a number of products advertised as "Hemp" products have appeared on the market. The hemp contained in these products is from the same plant species, *Cannabis sativa*, but the distributor claims that it contains only minute amounts of THC (5). The number of outlets selling hemp products has grown in recent years with a wide variety of hemp-based products ranging from socks to skin care products. In addition, some nutritionists and health food stores are now marketing hemp products as a source of high concentrations of essential amino acids and fatty acids (6). A hemp seed-containing snack bar was recently reported to have caused urine to test positive for the presence of cannabinoids (7).

The objective of this study was to determine if a person could test positive for metabolites of cannabinoids in a standard workplace drug-testing program as a result of consuming a health food product, cold-pressed hemp seed oil.

Experimental

A normal, healthy, adult male volunteer with no history of drug abuse or medical record of Marinol participated in this study. The subject was 49 years of age and weighed approximately 103 kg. A baseline drug test for cannabinoid metabolites was performed before beginning the study, and negative results were obtained.

The subject ingested 15-mL doses of cold-pressed hemp seed oil twice a day, in the morning and in the evening, for 4 days. The last dose was at 93 h. The recommended daily dose by the distributor was 15–60 mL per day. The total amount consumed over 93 h was 135 mL.

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Two to four urine specimens were collected each day, starting at the beginning of the third day after ingesting the hemp seed oil and lasting through the seventh day. The first morning-voided specimen was collected each day, with one to three additional specimens collected each day at the convenience of the volunteer.

Apparatus

Initial testing of specimens in this study was conducted by the homogeneous enzyme immunoassay Emit® II Cannabinoid 50 ng Assay (Behring Diagnostics, Cupertino, CA) using the Technicon Chem 1+™ chemistry analyzer system (Bayer Diagnostics, Tarrytown, NY) (8). The Technicon Chem 1+ was adapted for use with Emit II reagents for employment and clinical drug testing services. These modifications were approved by the National Laboratory Certification Program for the use in federally regulated employment drug testing.

For confirmation testing, a Hewlett-Packard (Palo Alto, CA) model 5890/5970A GC–MS with a DB-5 MS bonded-phase capillary column (12.5 m, 0.25-mm i.d., J&W Scientific, Folsom, CA) in a splitless mode with helium as the carrier gas and temperature programming was employed.

All solvents and reagents were of analytical grade. 9-THCA reference material was obtained from the Research Triangle Institute (Research Triangle Park, NC) and other reliable sources. 9-THCA-d_3 was obtained from Radian (Austin, TX). Derivatizing reagent *N,O*-bis(trimethylsilyl)trifluoroacetamide with 1% trimethylchlorosilane (BSTFA) was obtained from Alltech Associates (Deerfield, IL). Cold-pressed hemp seed oil, Hemp Liquid Gold™, distributed by Health From the Sun™ (Sunapee, NH), was used in this study.

Methods

All urine specimens were stored under refrigeration until analysis. All specimens were subjected to initial testing by homogeneous enzyme immunoassay and confirmation testing by GC–MS. The purpose of the initial test was to separate those specimens that had total cannabinoid metabolites of less than 50 ng/mL from those that were presumed positive. The Technicon Chem 1+ chemistry system used three calibrator solutions, a negative or drug-free calibrator, a cutoff calibrator at 50 ng/mL of 9-THCA, and a high calibrator at 100 ng/mL. The 50-ng/mL calibrator was used to establish a relative absorbance standard at 100. Specimens that produced an absorbance change greater than or equal to the 50-ng/mL cutoff calibrator were considered presumptively positive for the cannabinoid metabolites. In accordance with standard employment urine drug testing procedures, these specimens were then subjected to confirmation testing by GC–MS. For thoroughness, all specimens in the study were subjected to GC–MS confirmation testing regardless of the initial test results.

GC–MS confirmation testing was by liquid–liquid extraction of 9-THCA with 9-THCA-d_3 as the internal standard. The extract was derivatized with BSTFA. One microliter of the BSTFA solution was injected onto the GC–MS system.

Table I. Hemp Seed Oil Data

Time (h)	EMIT II*	9-THCA ng/mL†	Result‡
00§	86.4	0	negative
45	112.6	41	positive
48	108.6	20	positive
50	96.2	12	negative
69	112.4	49	positive
72	113.0	26	positive
93‖	111.9	55	positive
96	113.2	39	positive
99	113.2	31	positive
108	112.7	68	positive
117	112.7	57	positive
122	112.1	27	positive
126	111.9	31	positive
142	102.6	20	positive
146	92.6	12	negative
149	92.8	10	negative
169	91.6	9	negative
172	92.8	5	negative
177	87.9	6	negative

* Emit® II data expressed as relative absorbance. 50 ng/mL calibrator = 100.0.
† 9-THCA in ng/mL by GC–MS.
‡ Results in a standard workplace drug testing program, cutoff concentrations 50 ng/mL initial test, 15 ng/mL GC–MS confirmation.
§ First dose 15 mL of hemp seed oil.
‖ Last dose 15 mL of hemp seed oil.

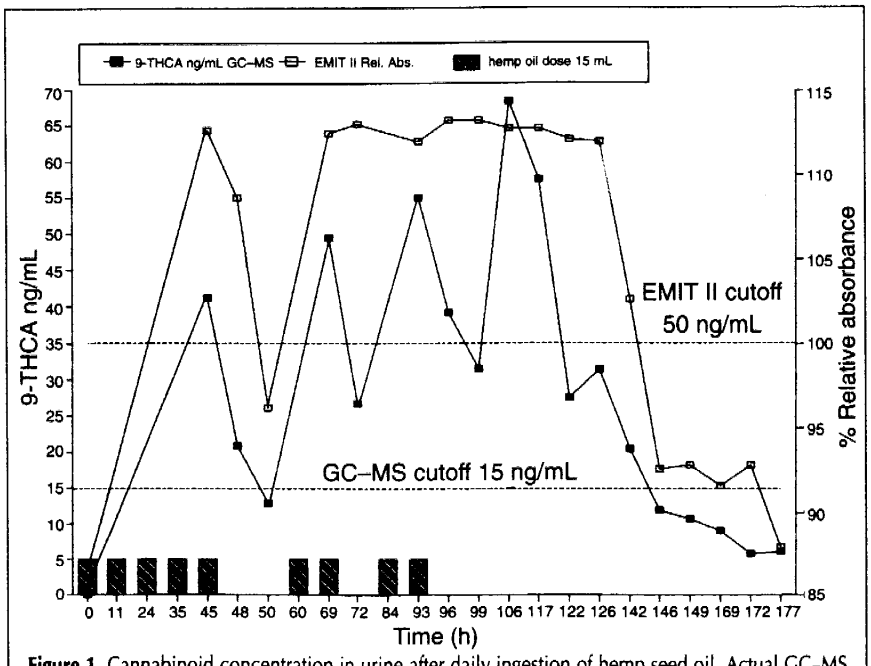

Figure 1. Cannabinoid concentration in urine after daily ingestion of hemp seed oil. Actual GC–MS 9-THCA concentrations are shown in nanograms per milliliter. Emit II data are shown expressed as relative absorbance to a 50-ng/mL cutoff calibrator; 50 ng/mL calibrator = 100% absorbance.

Quantitation of 9-THCA, was done through selective ion monitoring of the derivatized product. For 9-THCA the following ions were monitored: 371, 473, and 488. The ions 374 and 476 were monitored for the deuterated internal standard 9-THCA-d_3. A standard curve was established by analyzing three calibrators extracted with each batch of specimen aliquots. Peak-area ratios for 9-THC and the internal standard were determined for each calibration point, and a linear regression equation was established. Quantitative calculations were automatically performed by the software, which used the coefficients from the regression line. Consistent with standard workplace drug testing procedures, a positive cutoff concentration of 15 ng/mL of 9-THCA was used.

Results and Discussion

The results from testing of all specimens in this study are presented in Table I. The results show measurable amounts of 9-THCA in all specimens tested, with the exception of the baseline specimen collected before the ingestion of the hemp seed oil. One specimen collected at 50 h tested below the 50-ng/mL cutoff concentration for the initial test and below the 15-ng/mL cutoff concentration for confirmation and would have been considered negative by standard employment drug testing criteria. This negative result was attributable to a more dilute specimen, as indicated by a creatinine level of 0.674 g/L and a specific gravity of 1.011. These levels, though within normal limits, were lower than those in specimens submitted around it. During the period of twice-daily ingestion of the hemp seed oil, 9-THCA concentrations ranged from 12.9 to 68.4 ng/mL. Following cessation of ingestion of the hemp seed oil on day four of the study (93 h), specimens continued to exceed both the 50-ng/mL initial test cutoff concentration and the 15-ng/mL confirmation cutoff concentration for an additional 48 h with measurable amounts of 9-THCA being detected after 83 h (Figure 1). At no time during the study did the subject report any pharmacological effects that could be attributed to the ingestion of THC.

Conclusion

The results of this study indicate that at least one brand of commercially available cold-pressed hemp seed oil contains cannabinoids at levels capable of producing a positive standard workplace drug test. It was also noted that no pharmacological effects would be observed with the consumption of the hemp seed oil. A dose consistent with the manufacturer's recommendation of 1 to 4 tablespoons per day (15–60 mL) would be sufficient to cause a positive finding for cannabinoid metabolites in a workplace urine drug testing procedure designed to detect marijuana use.

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