

Evaluating Interference of THC in Hemp Food Products With Employee Drug Testing

Study Summary

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Executive Summary

A toxicological study was conducted to evaluate the potential conflict between extended consumption of hemp food products and workplace drug-testing programs in the United States. Fifteen volunteers ingested hemp/canola oil blends containing four different concentrations of delta-9-tetrahydrocannabinol (THC), each over a 10-day period. Corresponding THC doses ranged from 0.09 to 0.6 milligrams per day. Two urine samples were collected at the end of each period and analyzed for THC metabolites by immunoassay and GC/MS (gas chromatography/mass spectroscopy). Samples were also collected prior to the test and on days 1 and 3 after the last oil had been ingested.

The analyses showed that daily THC doses of 0.45 mg did not cause exceedance of the 50 parts per billion (ppb) cutoff used by federal programs to evaluate the outcome of immunoassay screening tests. Confirmation of these samples by GC/MS consistently found THCCOOH levels less than 5 ppb, with the exception of one sample confirmed at 5.2 ppb. This is significantly below the 15 ppb cutoff for confirmation under federal programs. THC doses as low as 0.2 mg/day caused several exceedances of the more stringent 20 ppb screening cutoff used by few employers and law enforcement agencies. Yet all of these samples were confirmed at less than 5 ppb. One of three volunteers consuming up to 0.6 mg/day of THC screened positive at the 50 ppb level but was confirmed at less than 5 ppb.

The findings suggest that a conflict between hemp food consumption and workplace drug testing is most unlikely if THC levels in hemp oil and hulled seeds are maintained below 5 and 2 parts per million (ppm) respectively, and if drug testing programs follow federal guidelines requiring that any urine sample screening positive be confirmed by GC/MS.

Background

In recent years, food products made from or containing seeds of the hemp plant (*Cannabis sativa*) have increasingly become available in natural food stores in North America. Hemp seeds offer several nutritional benefits. These include a balanced fatty acid composition of the oil (desirable omega-3/omega 6 ratio and presence of minor fatty acids such as gamma-linolenic acid (GLA)), a reasonably complete amino acid spectrum of the seed meat, and comparatively high concentrations of vitamin E. Food items from hemp seeds include cold-pressed oil used for cooking, in dressings, and in capsules as supplements. Hemp oil is also used in a range of bodycare products, such as creams, shampoos, soaps, and lip balms. The seeds are generally hulled prior to use in snack bars, nut butters, and other spreads, or sold in bulk for cooking and baking. A small amount of whole seeds continues to be used in snacks. Since commercial hemp farming was relegalized in Canada in 1998, the majority of hempseeds and oil in the U.S., previously made from imported Chinese birdseed, now originates in Canada and in the European Union (EU). Commercial farming of hemp in the U.S. remains prohibited under federal law.

The expansion of products from hemp seeds into their largest potential North American market, the “natural foods” sector in the U.S., now faces a significant obstacle. Flowers of industrial hemp plants contain minute quantities of delta-9-tetrahydrocannabinol (THC), the main psychoactive ingredient in marijuana. Industrial hemp varieties grown in Canada and the EU are bred to contain less than 0.3% THC in the upper portion of the flowering plant. In comparison, marijuana plants may contain 2-20% THC.

Depending on the hemp variety and the degree of seed cleaning, various amounts of THC residues can be found on the outer shells of whole seeds and in the products made from hemp seeds. The presence of THC in hemp foods has raised concern over their potential interference with employee drug-testing programs in the U.S. Studies conducted in 1995–1997 showed that eating hemp foods may in fact cause positive urine tests for marijuana. However, these studies involved the consumption of products from seeds with considerably higher THC levels—often more than 100 micrograms per gram ($\mu\text{g/g}$) or parts per million (ppm)—than are now commonly found in commercial hemp seeds in North America. Thus, these studies do not allow a realistic assessment of the potential impact of such foods on the outcome of employee drug tests. However, the federal Drug Enforcement Agency (DEA) and the Office of National Drug Control Policy cite the potential interference with drug-testing programs as one of their main objections to the importation and sale of hemp foods in the U.S.

Thorough cleaning of hemp seeds typically keeps THC levels in oil and hulled seeds produced in Canada to less than 5 and 2 ppm, respectively. Regulations in Canada, the main supplier of hemp seeds to the U.S., limit THC levels in hemp seed products to 10 parts per million (ppm). In the U.S., there is currently no such standard for the concentration of THC in food items.

Typical workplace drug testing procedures for marijuana in the U.S.

A urine sample—announced or random—is collected and screened for THC metabolites, using an immunoassay test. Such immunoassays can be performed rapidly and at low cost, yet they are not highly specific for THCCOOH, the main metabolite of THC. If a screening test detects THCCOOH above a specified “cutoff” concentration—federal workplace testing programs apply a 50 nanograms/milliliter (ng/mL) or parts per billion (ppb) cutoff—the sample is then “confirmed” by the more specific GC/MS (gas chromatography/mass spectroscopy) method. If GC/MS detects THCCOOH at levels above the confirmation cutoff of 15 ppb, a urine sample is considered “confirmed positive” for marijuana. Some employers and law enforcement agencies in the U.S. use a lower screening cutoff of 20 ppb and confirmation cutoff of 10 ppb. Very few drug-testing programs rely solely on the positive outcome of a screening test without automatic subsequent confirmation testing by GC/MS.

Study Objective and Design

The objective of the present study was to reevaluate the potential impact of hemp food consumption on the outcome of workplace drug tests for marijuana. Specifically, the study was designed to establish a correlation between extended daily ingestion of THC via hemp food and the likelihood of failing screening or confirmation tests of urine samples. The study involved 15 adult THC-naïve volunteers (ages 29–84, 10 female, 5 male). Each volunteer ingested, during four consecutive 10-day periods, daily THC doses ranging from 0.09 to 0.6 milligrams (mg), much below the typical 10 mg threshold for psychoactivity from THC ingestion.

THC was consumed in 15 milliliter (mL) doses—equivalent to one tablespoon (0.6 mg in 20 mL)—of four different blends of hemp and canola oils. The table shows the daily THC doses administered during the study and the corresponding amounts of hemp oil and hulled seeds—containing 5 and 2 ppm THC, respectively—that would have to be eaten to ingest the same amounts of THC.

Urine samples were collected prior to the first ingestion of oil (baseline sample), on days 9 and 10 of each of the four study periods, and 1 and 3 days after the last ingestion. All samples were analyzed for cannabinoids by radioimmunoassay (RIA), confirmed for THCCOOH by gas chromatography-mass spectrometry (GC/MS), and analyzed for creatinine to identify dilute samples.

THC concentration in oil, daily doses, and corresponding oil and seed consumption

Study period (10 days each)	Oil dose	THC dose	Corresponds to daily consumption of		
			Hulled hemp seeds	Hemp seed oil	
#	(mL/day)	(mg/day)	(g/day) at 2 µg/g THC	(mL/day) at 5 µg/g THC	(mL/day) at 20 µg/g THC
1	15	0.09	45	19	5
2	15	0.19	95	40	10
3	15	0.29	150	63	16
4	15	0.45	225	95	24
4	20	0.60	300	126	32

Findings and Conclusions

Analysis of the collected urine samples showed that even extended ingestion of up to 0.45 mg/day of THC is not likely to cause interference with federal drug-testing programs. The table shows that this daily dose of THC translates into the daily eating of 6 tablespoons of hemp oil or half a pound of hulled hemp seeds of commercial quality. Even hemp food connoisseurs rarely consume such quantities. At this dose, none of the volunteers exceeded the 50 parts per billion (ppb) cutoff for the immunoassay screening test, applied by federal workplace drug-testing programs. Confirmation by GC/MS consistently found THCCOOH levels of less than 5 ppb—i.e., considerably below the 15 ppb confirmation cutoff. The highest THCCOOH level measured in a single sample was 5.2 ppb.

THC doses as low as 0.2 mg/day caused several exceedances of the lower, more stringent, 20 ppb screening cutoff used by few employers and law enforcement agencies. Yet GC/MS confirmation found less than 5 ppb of THCCOOH in all of these samples. One of three volunteers consuming up to 0.6 mg/day of THC screened positive at the 50 ppb level, but was also confirmed at less than 5 ppb.

These findings suggest that even extended ingestion of considerable quantities of currently available hemp foods is not likely to produce urine samples that exceed the 50 ppb cutoff in the immunoassay screening test and a 10 or 15 ppb confirmation cutoff. The occurrence of screening positives at the 20 ppb cutoff is conceivable. However, their confirmation by GC/MS at the 10 or even 15 ppb cutoff is even less likely. Thus programs following the federal testing guidelines are unlikely to encounter confirmed positive samples for marijuana. On the other hand, programs that rely entirely on the use of screening tests with a low cutoff of 20 ppb and no automatic confirmation

of screening positives by GC/MS may occasionally encounter unconfirmed positive samples from consumers of hemp foods.

In summary, this study's findings indicate that the following measures will be effective in virtually eliminating interference between consumption of hemp food products and workplace drug testing:

- Adherence by hemp food processors to seed cleaning and quality control measures aimed at limiting concentrations of total THC in hemp oil to 5 µg/g—or ppm—and, in hulled seeds, to 2 µg/g.
- Adherence of U.S. employers and administrators of drug-testing programs to guidelines for federal programs, requiring that urine samples that fail a screening test be confirmed by GC/MS.

A detailed description of the study's design and results is being submitted for publication in a peer-reviewed journal. It will be posted at www.naihc.org following its publication.

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