



PROJECT RESULTS

Evaluating Interference of THC Levels in Hemp Food Products with Employee Drug Testing

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Background and Objective:

Since 1998, industrial hemp has been grown in Manitoba and other provinces as a niche crop for both grain and fibre. Particularly the seeds offer nutritionally valuable properties. 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 for cooking, dressings, and in capsules as supplements. The seeds are generally hulled prior to use in snack bars, nut butters, and other spreads, or sold in bulk for cooking and baking.

In recent years, the expansion of products from hemp seeds into its largest potential market, the "natural foods" sector in the U.S., has faced a significant obstacle. Flowers of industrial hemp plants contain small quantities of delta-9-tetrahydrocannabinol (THC), the main psychoactive ingredient in marijuana. Depending on hemp cultivar and degree of seed cleaning, traces of THC are also present on whole seeds and the products made from them. The presence of THC in hemp foods has raised concerns 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 commercial hemp seeds containing comparatively high THC levels. Thorough cleaning of hemp seeds typically keeps THC levels in oil and hulled seeds produced in Canada to less than 5 and 2 micrograms per gram ($\mu\text{g/g}$) - or parts per million (ppm) - respectively.

Workplace drug testing programs for marijuana in the U.S. generally observe the following procedures: a urine sample is collected – either announced or random – 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 screening test results indicate the presence of THCCOOH above a specified "cutoff" level (most commonly used is 50 nanograms/milliliter (ng/mL) or parts per billion (ppb), the sample is "confirmed" by the more specific GC/MS (gas chromatography/mass spectroscopy) method. If GC/MS detects THCCOOH at levels above the confirmation cutoff, usually 15 ppb, a urine sample is considered "confirmed positive". 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 only on the outcome of a screening test and do not demand confirmation testing by GC/MS.

The objective of this study was to establish a correlation between extended daily ingestion of THC via hemp food and the likelihood of failing screening and/or confirmation testing of urine for marijuana. This involved a statistically significant number of persons consuming quantities of hemp oil that provided daily THC doses representative of the quality of hemp seeds now available from Canada.

Procedure and Project Activities:

The study involved 15 adult volunteers (ages 29-84, 10 female, 5 male) none of which had, as confirmed by a baseline specimen, any recent exposure to THC in hemp foods or medicinal or recreational drugs. Each volunteer ingested, during four consecutive 10-day periods, daily THC doses ranging from 0.09-0.6 milligrams (mg). THC was administered in 15 milliliter (mL) doses - one tablespoon – (0.6 mg in 20 mL) of four different blends of hemp and canola oils. Table 1 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 – which would have to be eaten to ingest the same amount of THC.

Table 1. THC concentration in oil, daily doses, and corresponding oil and seed consumption

Study period (10 days each) #	Oil dose (mL/day)	THC dose (mg/day)	Corresponds to daily consumption of		
			Hulled hemp seeds (g/day) at 2 µg/g THC	Hemp seed oil	
				(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

Urine samples were collected prior to the first ingestion of oil, on days 9 and 10 of each study period, 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 specimens.

Results and Discussion:

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 screening positives at the 50 ppb cutoff or confirmed

positives at the 10 ppb cutoff. A daily dose of 0.6 mg/day may cause a screening positive at 50 ppb but not its confirmation by GC/MS at the 10 ppb level. The amount of hemp foods of commercially available quality, which is required to ingest 0.45 mg per day of THC is not impossible, yet also not likely to be ingested, even by avid consumers of hemp foods.

Conclusions:

The results of this study indicate that even extended ingestion of currently available hemp foods is not likely to produce urine samples which exceed the 50 ppb cutoff in the immunoassay screening test. The occurrence of screening positives at the 20 ppb cutoff is conceivable. However, their confirmation by GC/MS at the 10 or 15 ppb cutoff is highly unlikely. These findings and conclusions indicate that the following measures will be effective in virtually eliminating the potential interference between consumption of hemp food products and workplace drug testing:

- Implementation and enforcement of quality control measures aimed at limiting concentrations of total THC in hemp oil to 5 µg/g and in hulled seeds to 2 µg/g.
- Adherence of employers and administrators of drug testing programs to established U.S. federal guidelines for urine testing. Notably, these require that any urine samples, which fail the initial screening test by immunoassay, must be confirmed by the more specific GC/MS (gas-chromatography/mass spectrometry) method.

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