

POPPY SEEDS AND OPIATE TESTING

Q: Is it possible for patients to test positive for opiates following poppy seed consumption?

A: Yes. Small amounts of morphine and/or codeine may be present in oral fluid for two to four hours^{1,2} following ingestion of poppy seeds in foods or teas. These compounds may also be detected in urine for up to 48 hours³ after consumption. Amounts detected will vary based on the ingested amount, opiate content, harvesting methods, and food preparation techniques for ingested poppy seeds.

The opium poppy plant, *Papaver somniferum*, is a naturally-derived source of morphine and codeine as well as the related alkaloids thebaine, noscapine, and papaverine. Poppy seeds may be found in many food products such as breads, muffins, cakes, bagels, and salad dressings, as well as commercial or homemade teas. Typical baked products contain between 1 and 4 g of poppy seeds per serving, though the opiate content in foods can be highly variable depending on the preparation method.^{3,4} Poppy seeds are not the direct source of opiates found in poppy seed products; rather, contamination with other parts of the poppy plant during harvesting may contaminate the seed surface.³

Multiple studies have demonstrated that various processing methods such as washing, soaking, or grinding may reduce the opiate content on raw poppy seeds by 25% to 73%.⁴⁻⁷ Opiates present on poppy seeds are susceptible to further degradation by oxidation and heat during the baking process. Losses of up to 80-90% of the original opiate content have been reported as a result of baking.⁴

In the case of poppy-containing teas, parts of the poppy plant are brewed in warm water to produce an intensely bitter beverage. Teas made from poppy pods or poppy straw (a mixture of crushed seeds, pods, or stems) are more potent and carry the potential to cause an opiate overdose.⁸ Though poppy seeds are legal for sale and ingestion in the US, all other portions of the plant including pods and stems are schedule II controlled substances. Despite their controlled status, poppy pods and poppy straw are easily obtained through the Internet. According to a Drug Alert Watch released by the US Department of Justice, at least five men have died in the US following ingestion of poppy tea in the context of positive urine drug screens for other illicit drugs.⁸ Numerous overdoses and deaths have also been reported in the medical literature^{9,10} and in the news.^{11,12}

Historically, the “poppy seed defense” has been a commonly cited reason for patients to test positive for morphine on drug screens. Quantitation of morphine in urine following poppy seed ingestion has been the subject of numerous small studies. Codeine may also be detected, though it tends to appear at significantly lower levels and typically would not be present in the absence of morphine. One notable exception exists in the literature with the case of a subject who consumed bread containing an unusually high codeine-content variety of poppy seeds. The resultant urine specimens contained several times more codeine than morphine, suggesting ingestion of codeine alone.¹³

Many studies have found morphine present in urine at concentrations less than 2,000 ng/mL^{1,3,14}; however, a handful of studies have detected levels in the 10,000-18,000 ng/mL range.³ Drinking poppy seed tea may result in significantly higher concentrations of opiate in urine depending on the amount and source of seeds used as well as the amount of tea ingested. Patients may test positive for morphine and/or codeine in urine for up to 48 hours following poppy seed ingestion.³ Federal workplace drug testing currently uses a cutoff of 2,000 ng/mL morphine in accordance with

established recommendations from the Department of Health and Human Services' Substance Abuse and Mental Health Services Administration (SAMHSA).¹ If a patient's urine contains morphine at concentrations at or below 2,000 ng/ml, Aegis includes the following comment on the patient's report: "Test result may be due to the use of pharmaceutical morphine or codeine, or from eating poppy seed food products (bagels, muffins, salad dressing, etc.)."

Morphine and/or codeine concentrations measured in oral fluid are lower than in urine and produce a positive result for a shorter period of time following poppy seed ingestion. Oral fluid samples may contain small amounts of morphine and/or codeine (typically less than 300 ng/mL) for two to four hours after consumption of poppy seed-containing baked goods. Concentrations in oral fluid typically peak within one hour of ingestion.^{1,2}

The best advice for patients undergoing drug testing is to completely avoid poppy seed-containing products. It is important to note, however, that poppy seed ingestion may be unintentional, especially when hidden in restaurant dishes. For patients consuming poppy seed tea, physicians should evaluate patients' tea drinking habits and caution them against its use due to the risk for addiction and overdose.

NOTICE: The information above is intended as a resource for health care providers. Providers should use their independent medical judgment based on the clinical needs of the patient when making determinations of who to test, what medications to test, testing frequency, and the type of testing to conduct.

REFERENCES:

1. Samano KL, Clouette RE, Rowland BJ, Sample RH. Concentrations of morphine and codeine in paired oral fluid and urine specimens following ingestion of a poppy seed roll and raw poppy seeds. *J Anal Toxicol.* 2015;39(8):655-661.
2. Rohrig TP, Moore C. The determination of morphine in urine and oral fluid following ingestion of poppy seeds. *J Anal Toxicol.* 2003;27(7):449-452.
3. Lachenmeier DW, Sproll C, Musshoff F. Poppy seed foods and opiate drug testing- -where are we today? *Ther Drug Monit.* 2010;32(1):11-18.
4. Sproll C, Perz RC, Lachenmeier DW. Optimized LC/MS/MS analysis of morphine and codeine in poppy seed and evaluation of their fate during food processing as a basis for risk analysis. *J Agric Food Chem.* 2006;54(15):5292-5298.
5. Lo DS, Chua TH. Poppy seeds: implications of consumption. *Med Sci Law.* 1992;32(4):296-302.
6. Bjerver K, Jonsson J, Nilsson A, Schuberth J, Schuberth J. Morphine intake from poppy seed food. *J Pharm Pharmacol.* 1982;34(12):798-801.
7. Sproll C, Perz RC, Buschmann R, Lachenmeier DW. Guidelines for reduction of morphine in poppy seed intended for food purposes. *Eur Food Res Tech.* 2007;226(1):307-310.
8. US Department of Justice. SENTRY Watches: opium tea. Drug Alert Watch. March 2, 2010. https://www.justice.gov/archive/ndic/pubs40/40404/sw-Opium_Tea.pdf. Accessed April 13, 2017.
9. Bailey K, Richards-Waugh L, Clay D, Gebhardt M, Mahmoud H, Kraner JC. Fatality involving the ingestion of phenazepam and poppy seed tea. *J Anal Toxicol.* 2010;34(8):527-532.
10. King MA, McDonough MA, Drummer OH, Berkovic SF. Poppy tea and the baker's first seizure. *Lancet.* 1997;350(9079):716.
11. Harthorn J. Family, experts warn of poppy seed dangers after man's sudden death. West Michigan News Channel 3. May 27, 2016. <http://wwmt.com/news/local/family-experts-warn-of-poppy-seed-dangers-after-mans-sudden-death>. Accessed April 13, 2016.
12. Bult L. James Madison University college student died after consuming 'poppy seed tea' homemade concoction with 'lethal effects'. New York Daily News. February 25, 2016. <http://www.nydailynews.com/news/national/virg-college-student-dies-drinking-poppy-seed-tea-article-1.2543419>. Accessed April 13, 2018.
13. Chang J, Wang M, Appleton C. Headache bread- -a case of high codeine containing variety of poppy seed. *J Anal Toxicol.* 2012;36(4):288.
14. Maas A, Kramer M, Sydow K, et al. Urinary excretion study following consumption of various poppy seed products and investigation of the new potential street heroin marker ATM4G. *Drug Test Anal.* 2017;9(3):470-478.