

Poppy Seed and Prohibited Drug Testing

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Introduction

This paper presents three 2019 cases of Royal Australian Navy (RAN) personnel with positive tests for urinary morphine attributable to poppy seed (PS) ingestion. All three cases occurred during a period of particularly potent culinary PS in Australia. Australia produces PS with high morphine content for medicinal purposes. Most culinary PS consumed in Australia is imported from elsewhere.

Case one

A 49-year-old senior officer with 24 years RAN service tested positive for morphine (410 ug/L morphine and no codeine or thebaine). This member had volunteered (in advance) for prearranged Prohibited Substance Testing Program (PSTP). On the morning of their PSTP urine testing, this member had eaten two pieces of commercially available (toasted) bread. The member described this bread as being a white loaf with seeds on top. They subsequently determined that these seeds were PS. This member was on no other relevant medication at the time of their PSTP test.

Some months later, this member and their spouse purchased online urine drug test kits for self-testing. They were both negative at baseline and both positive for urinary morphine three hours later after eating two pieces of the same commercially available bread. This member had a negative urinary morphine result the following morning.

Case two

A 53-year-old senior officer volunteered to participate in PSTP urine testing, which they had pre-authorized. This member was not aware that they had ingested PS on the morning of their PSTP urine test. They returned a positive result for morphine (850 ug/L), negative for codeine and thebaine. The member subsequently determined that they had ingested PS by researching the contents of their commercially prepared packaged meals. They had eaten two slices of bread containing PS. This PS content had not been declared on the meal labels.

Case three

A 28-year-old high performing and health-conscious sailor returned a urine morphine result of 380 ug/L (negative for codeine and thebaine) on a random PSTP urine screen. This sailor had not declared PS ingestion at the time of their PSTP urine test. They subsequently determined that a commercially available 'wholemeal and seeds' loaf contained 4% PS. This sailor re-tested negative for urinary morphine after stopping eating the 'wholemeal and seeds' loaf.

It was not possible to independently corroborate the histories provided above. The three individuals' character, their positions within RAN and their laboratory results are all highly congruent with their provided histories.

Literature review

Papaver somniferum is the plant species from which opium and PS are derived. Opiates (which are sometimes referred to as opiate alkaloids) consist of drugs including opium and those derived from opium. The latter group includes morphine, thebaine (also called para-morphine) and codeine. Opium contains both morphine and codeine. Heroin is derived from morphine. Morphine is not metabolised to codeine, but both codeine and heroin (via 6-acetylmorphine [6-AM]) are metabolised to morphine. Codeine, however, is often included as an impurity in illicit sources of morphine. Thebaine is used as a marker of PS origin of opiates.¹⁻³

Opioids (including fentanyl, oxycodone and pholcodine) are a synthetic class of drug with the same effect as opiates. Opioids do not contain and are not metabolised to codeine, morphine or 6-AM.

The current RAN PSTP tests for amphetamines, opiates (morphine, codeine, 6-AM and pholcodine), benzodiazepines (multiple), cocaine and THC (marijuana).

PS contain small amounts of morphine and smaller amounts of codeine.⁴ Meadway² found Australian PS to contain 90ug/g of morphine and 6.5ug/g of codeine. This paper did not document the thebaine concentration.

Typically dietary sources of PS intake will only produce urine concentrations in the hundreds (of ng/mL), but can occasionally produce much higher results.⁵ The concentration of ingested PS-based opiates may be significantly higher in PS-based tea (particularly if homemade), than in solid foods. There is a wide range of urine concentrations (of morphine and codeine) from PS ingestion by country of PS origin, between individuals and the same individual at different times.⁶

The ingestion of PS has been reported to persist in urine for up to 48 hours² and cause morphine-positive oral fluid test results for up to an hour⁷. One researcher detected morphine in urine up to 1 hour after consuming 820mg PS in a bagel (130–315 mg PS/kg body weight).⁸ If the result is positive for morphine and/or codeine and negative for 6-AM, then PS ingestion may be an explanation.⁹ A differential diagnosis between heroin and PS consumption using the morphine/codeine ratio does not seem to be possible.¹⁰

Cassella (1997), found only one subject's urine to include thebaine (along with morphine and codeine).³ The respective post-mortem urine concentrations for this subject were 22, 122 and 47 ng/ml. Thebaine, however, has a shorter half-life than either morphine or codeine. Thus a positive post-PS ingestion urine drug test generally becomes negative progressively for thebaine, then codeine and finally morphine.

There are apocryphal accounts of a person dying after drinking a homemade PS-based opiate concoction in Tasmania¹¹ and in New York¹².

The Australian cuff-off for morphine is 300 ng/ml. USA has raised its federal drug testing threshold from 300 to 2000 ng/ml, partially in an attempt to reduce the false positive drug tests arising from PS ingestion.^{13,14}

References

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Summary

PS ingestion can cause a positive RAN PSTP urine result. Due to a wide variation in PS concentration within food and inter- and intra-individual metabolism, it is not possible to predict how much PS intake is required at a given time to trigger a positive RAN PSTP urine result. Homemade PS-based tea may produce higher results than commercially baked PS products.

Depending upon the amount of PS ingested, this may produce a positive oral morphine result for up to one hour, and a positive urine test for up to 48 hours.

PS can produce positive urine tests for morphine, a lesser concentration of codeine and lesser still concentration of thebaine. Thebaine is specific to PS only. Any other positive substance detected in the PSTP will be from a source other than PS. The laboratory that RAN currently uses for PSTP sample analysis will report a thebaine level greater than 10 ng/ml.

A low range urinary result for morphine can be caused by PS ingestion alone (as little as two pieces of PS containing bread). Coexisting with a lower level of codeine is suggestive of PS, and coexisting with thebaine is diagnostic of PS contribution. A low-level morphine result can also be caused by pure morphine ingestion, heroin ingestion or reflect the tail end of codeine ingestion and metabolism.

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