

Episode 19: Poppy Seed Toxicity: The Truth Behind the Bagel

This transcript was created by AI from audio and lightly edited for readability. Treat it with caution, and assume occasional transcription errors may remain.

TRANSCRIPT

Welcome back to the Tox Lab. I'm Rebecca. I'm Rob. This week we're looking at poppy seeds.

This was an episode suggested to us by a listener, so thank you for that. Rebecca, poppy seed baked goods. Do you like poppy seed bagels? I have to say I just think bagels are disappointing donuts.

Fair enough. I quite like bagels, actually poppy seed ones in particular. But here's a question. Have you ever had a poppy seed bagel or a poppy seed muffin before having a drug test?

No, I haven't. We can chat a bit more about poppy seeds and drug tests a bit later on, but why don't we look a bit at what poppy seeds are, where they come from. We're all probably familiar with them, as I say, on our bagels or in our lemon and poppy seed muffins, maybe. But they've actually got a long history of poisoning people as well.

So poppy seeds come from the poppy plant, obviously, that often red, although it isn't always red, is it? There's lots of different varieties. A big flower with a huge seed pod that grows in the middle. And they're absolutely filled with poppy seeds.

I don't know if you've ever maybe grown one in the garden, but when they flower and the flower dies and you're left with that pod, they're absolutely filled to the brim with these little black poppy seeds. And the poppy plant is really, really interesting. It contains a whole host of different opioid compounds. Things you've likely heard of like morphine and codeine also contains sort of lesser known compounds like noscopine, piperine, and also a compound called thebane, which we'll chat about in a little bit.

And actually the seeds don't contain any of these opiates, do they? They're actually mostly found in the sap of the plant. So the poppy plant produces this opiate-rich latex. So these poppy plants, it's one particular species, isn't it?

Papaver somniferum. And this translates to sleep-bringing poppy. Okay. But yeah, they produce this latex and this latex is quite rich in opiate compounds, morphine, codeine, things like that.

And it's basically produced as a defense mechanism by the plant to stop herbivores from eating it. It tastes bitter, potentially it's toxic. And as we know, a lot of these compounds like morphine, codeine, they've got a lot of use in medicines. Poppies are often grown to harvest the opiate compounds for use in medicines.

But as we said earlier, also these poppies produce a seed which is used in culinary uses. So the seeds themselves don't actually contain any opiates, but they can be contaminated with the latex as part of the harvesting process. So people have been known to soak large amounts of poppy seeds to try and remove these opiate alkaloids found in the latex that they've contaminated the seeds in the form of a tea. And some regular users of poppy seed tea can consume approximately 280 milligrams of morphine.

That's a lot of morphine. So a typical dose for somebody who's completely opiate naive might be 15, 20, 30 milligrams of morphine for pain relief. So 200 or so milligrams in one setting is quite a lot. And as we've said earlier, the Papavir, Somniferum poppy is what produces traditional opioids like morphine, codeine.

You can get different variants. There's a variant known as top one which is cultivated exclusively by the pharmaceutical industry. So this variant accumulates the bane due to reduced conversion to codeine and morphine. And this is used to produce things like oxycodone, buprenorphine, naltrexone, naltrexone.

But because of this really high, the bane content, these poppy seeds aren't food grade, so shouldn't enter the food supply at all and therefore shouldn't be consumed by humans. So we've got different varieties of poppy, some of which produce morphine, codeine, some of which have been selectively bred to produce the bane, which as Rebecca says is used as a synthesis starting point to produce drugs that are what we call semi-synthetic opiate compounds. So things like oxycodone or naloxone.

So one of the reasons that the poppy seeds from that top one variant aren't food grade because of their high, the bane toxicity is the bane is known to be toxic. I'm not entirely sure how it works. It's thought it could inhibit glycine. So like strychnine.

Yeah. And that I assume sebane does the same. You can get kind of like neuromuscular excitability, sort of involuntary skeletal muscle contractions and seizures and things like that. Yeah.

And unlike sort of morphine and codeine, it doesn't act like a traditional opiate. It doesn't bind to the mu opioid receptor. It doesn't cause the sedation, the euphoria that we associate with use of more traditional opioids. In fact, if anything, it seems to sort of do the opposite.

So today we're going to be talking about an observational study from Australia where poppy seeds from the top one variant entered the food supply. So they looked at 23 analytically confirmed the bane poisonings that occur between the 1st November 2022 and the 8th of January 2023 that were identified by three prospective toxicovigilant systems. They used the Emerging Drug Network of Australia, an organisation known as PRIZE, and then the Emerging Drug Network of Australia, but the Victoria Division to identify these cases.

So all of these cases were males with a median age of 35 and poppy seed tea was regularly used in 18 of these cases where the information was provided and the median amount of poppy seeds used to make a tea was 340 grams. It seems like quite a decent amount of poppy seeds. It's quite a chunk, isn't it? Quite a half a, trying to imagine what I buy if I go to Tesco and buy poppy seeds.

Probably buy a 500 gram bag, so about half a bag. Some detail was given to how the tea was prepared. So this is seven of these cases. Acid had been added in the form of lemon juice and this was thought to be added to help extract the opioids present in the latex that have contaminated the poppy seeds.

Eight were extracted in cold water and six used warm or hot water. So in all of these cases clinical features occurred with about four hours of ingestion of the tea. Everyone presented with muscle spasms. Nine individuals suffered with rigidity.

Six suffered with convulsions and all treated with benzodiazepines. Five individuals suffered from a metabolic acidosis with a raised lactate and the median lactate concentration was 14.8. It's pretty high actually, isn't it? It's a really decent lactate and in two of these cases, interestingly, patients have muscle spasms but no convulsions are present.

Some also went on to develop rhabdomyolysis, so muscle breakdown and had significantly raised CKs or creatine kinase, which is a marker we look for to sort of diagnose rhabdo. And about five people also developed AKIs or acute kidney injuries. Two of these received continuous kidney replacement therapy, so probably dialysis. So quite unwell a lot of them, weren't they?

They were, in two of these cases, the individuals suffered from a cardiac arrest. So in one of these cases involved a 46 year old male who had ingested 1480 grams of poppy seeds extracted in cold water and lemon juice. He suffered from leg spasms one hour after drinking the tea, then developed generalized

tonic-clonic convulsions and went into cardiac arrest. He suffered from a profound metabolic acidosis, developed an AKI and rhabdo, but did recover and was discharged on day 19.

And the concentration of the vein on a vision was 2.4 milligrams a liter, codeine was present at 0.04 milligrams a liter, and morphine was present at 0.04 milligrams a liter. The other individuals that suffered from cardiac arrest wasn't so lucky. This involved a 60 year old male who developed a hypoxic brain injury and died on day 14. At presentation, his the vein concentration was 5.6 milligrams a liter, codeine was present at 0.3 milligrams a liter, and morphine present at 0.06 milligrams a liter.

So what happened in these cases? Why was the thebane content so high? Well they believed that the poppy seeds that they were using to make the tea were these high thebane variants that shouldn't have entered the food supply chain at all and had just somehow gotten into the supply chain. And these were sold in Coles, which I understand is quite like a big supermarket chain in Australia, so it would have been widely available to lots of people and therefore put lots of people at risk of the vein toxicity.

I don't think they're entirely sure how that happened, but there was definitely a cluster in Australia of people presenting with the vein toxicity after drinking poppy seed tea. I think Australia's quite a big producer actually of high thebane poppy, specifically for use as a precursor for pharmaceuticals. Yeah I think along with France and Spain, Australia is one of the highest producers of that top one poppy variety. So these were not only from high thebane content poppies, they must have been significantly contaminated with latex as well, so they must have been effectively unwashed poppy seeds.

And that kind of takes us on to the sort of point really about what counts as a food grade poppy seed and what doesn't. And as we said at the start, the seeds themselves don't actually produce the opiate compounds, it's if they're contaminated with the sap during the harvesting. So food grade poppy seeds are washed quite extensively and have got relatively low content of these opiates. So this cluster of outbreaks in Australia isn't the only cases are there.

We've also seen cases of overdose whereby people have brewed poppy seed tea and extracted out large amounts of the morphine and codeine. So from varieties of poppy that contain higher amounts of more traditional opiates. So the next paper we're going to talk about today involves poppy seed opioid exposures and the cases we're looking at in this paper were reported to the national poison data system between 2000 and 2018 and they found 591 exposures during this time period of people being exposed to poppy seeds and then reporting this.

So out of these 591 exposures that were reported, over two-thirds of these were in people over the age of 13 years and over half of these were intentional exposures. Those who were intentionally exposed were mostly male compared to females who were most likely to be unintentionally exposed and of these intentional exposures 74% of these were single product exposures. So situations where the only thing they were exposed to in that poisoning situation was the poppy seeds, is that right? Yeah so 290 people were only exposed to poppy seeds in single product exposures.

94% of these had ingested the product. Over 2000 had at least one symptom and common symptoms included drowsiness, vomiting, nausea, respiratory depression and pinpoint pupils. At least half of them were treated or referred to a healthcare facility and just under half had at least one therapy so whether this was being given fluids or naloxone or oxygen things like that. There were a handful of cases, 26 of which a major effect or death was the outcome and poppy seeds were likely to be attributed to this outcome.

So at 18 non-fatal overdoses and eight deaths, the median age of which was 24, 20 of these had ingested poppy seeds as a tea but all of these cases were considered like intentional exposures. Six had a history of depression anxiety and alcohol use disorder. So looking into the details of these cases, nine of them had lab tests which showed substances other than opiates present. Twelve cases had medical histories which showed that they were on other substances as I think in total about 14 cases multiple substances were involved.

Benzones and cannabis were being the most common. So non-food grade poppy seeds as we see here can be associated with poisoning. Both the Australian cases through sebum toxicity or the American cases which showed a lot of respiratory depression which is consistent with morphine exposure from the poppies.

So the brewing of poppy seed tea may be viewed by some as a cheaper quite and quite lower risk alternative to street opiates or an alternative to use when opioids are unavailable.

But I think the studies we've looked at have highlighted that there still is substantial risk associated there's going to be variations in opioid content or potentially compounds like the vein in poppy seeds that aren't necessarily food grade. Different extraction methods like the use of an acid like lemon juice or water temperature can affect the extraction and therefore how much you're being exposed to and that can all contribute to a risk of overdose. I think that's the biggest thing here isn't it?

It's that inconsistency batch to batch how much morphine, codeine or the vein is present in your seeds and I suspect that's hugely variable given that it's essentially how contaminated with the latex are the seeds. It's gonna be huge amounts of variation isn't there? Yeah. Plus different varieties of poppy producing different amounts and things like that.

So should unwashed poppy seeds be regulated? I mean potentially as we've talked about in this episode there are risks associated with unwashed poppy seeds and there is a potential for abuse if people get hold of them and know that they might contain latex which has the morphine, codeine and things like that in there. So let's look at food grade poppy seeds in particular then the kind of poppy seeds that you might put on your bagel. How much morphine, codeine and so on do they contain?

So I did some maths and what they call low alkaloid seeds or the food grade poppy seeds. They typically contain up to about four milligrams of morphine per kilo of seeds so in order to reach a sort of 10 milligram dose you're looking at kilograms worth of poppy seeds. That's a lot of poppy seed bait. Which would be a lot, yeah precisely which would be a lot of bagels.

They do contain low levels though. People who may be in their line of work like lorry drivers have to get a drug test and they test positive and it's because they've eaten a couple of bagels. I believe the US have now increased their cutoff to avoid potential false positives from bagel consumption. So in summary poppy seeds can be very high in traditional opiates or indeed some lesser known but still toxic opiates their vein but actually most of the time if you're just eating a poppy seed bagel or two you're really unlikely to come across any significant issues.

Obviously preparing poppy seed tea on the other hand can carry with it quite a few risks. Differences in sources of poppies, degrees of unwashedness and also different bring methods. So I think we're going to wrap it up there. I hope you've enjoyed listening this week.

Do give us a like and a follow on social media. You can find us on instagram at @the_tox_lab. Feel free to comment on any of our posts about any of our episodes. You can send us a direct message with suggestions for future episodes, only feedback you might have.

For those of you who don't use social media you can email us now. Our email address is the Tox Lab at gmail.com and that can also be found in the description below along with all the papers that we've talked about in this episode. Hope you all have a wonderful week and we'll see you next time. Bye!