

THE TOX LAB

Podcast Transcript

Episode 24: What is in that Vape?

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TRANSCRIPT

Hi everyone, welcome back to the Tox Lab. I'm Rebecca. I'm Rob. This week we're going to be looking at a couple of papers on vapes and, in particular, trying to answer the question: what is in that vape?

You ever been out on a night out and handed a vape and it's not what you thought it was? You thought it was going to be blueberry and it was pineapple? I mean, can't say I have because I don't vape. It's really weird that we live in a world where that's a thing that could happen, isn't it?

Yes, it is. Back in our day, if you smoked, it was smoking. There wasn't raspberry-flavored this or blueberry-flavored that. The papers we're going to look at this week are not nicotine vapes, but rather other things in vape devices.

So Rebecca, why don't you introduce us to our first paper? So the first paper we're going to discuss today covers synthetic cannabinoids in vapes. So an individual in the UK presented to a drug and alcohol service and voluntarily handed over seven sealed and unlabeled disposable vapes. This individual was a 45-year-old male who was in full-time employment and had been purchasing illicit vapes from a US supplier and these were thought to be THC-based products.

So even though he believed these were THC-based products, the certificate of analysis that came with the vapes suggested they were semi-synthetic cannabinoid products, and included HHC, HHC-P, THCP and THCO. We've talked a little bit about semi-synthetic cannabinoids before, haven't we? There's another episode we've done.

Yeah, back in episode two, who's been with us that long? We might have to do a bit of an update on that actually because there's been some changes in international law recently looking at those. So maybe we'll cover that again in the future. But basically, semi-synthetic cannabinoids are compounds that are chemically altered versions of cannabinoids found in cannabis plants, usually CBD, and they have varying degrees of psychoactivity.

This vaping liquid was believed to be a cannabis product, so a delta-9-THC-containing vape, yet was supplied with a certificate that said otherwise. So he started to use these in small quantities and found them strong, but enjoyable. He was a known cannabis smoker and it was more discreet than smoking traditional herbal material. His usage began to escalate and he was smoking one vape to completion every day for about a month.

And he was experiencing quite a lot of side effects including stomach cramps, loose bowels, memory loss, trouble focusing, and feeling dissociated from reality. When he stopped vaping, he experienced extreme anxiety, panic attacks, low and angry moods, became irritable, and also experienced some chest pain. So he presented to drug and alcohol services with these symptoms. And these symptoms were maybe not characteristic of what he was expecting from a cannabis-based product?

I'm assuming so. So the seven sealed and unlabelled disposable vapes that he presented to this drug and alcohol service were analysed using NMR. And they didn't detect any THC, but they did detect 5F-MDMB-PICA, which is a synthetic cannabinoid. And NMR is nuclear magnetic resonance, a technique

used to identify compounds.

We don't tend to use it a lot in analytical toxicology labs, but it's a great tool for research labs that have got it, and they're huge machines. And 5F-MDMB-PICA was found at a median concentration of 0.85 milligrams per millilitre. Across all seven vapes it varied between 0.59 and 1.63 milligrams per millilitre. And smoking a single vape to completion, which is what he was doing at the height of his usage, would expose him to about two milligrams of the synthetic cannabinoid.

So let's just backtrack slightly. 5F-MDMB-PICA. Yeah. So 5F-MDMB-PICA, that's a synthetic cannabinoid receptor agonist.

So it's not a compound found in cannabis. It's not a compound that was once found in cannabis and subsequently chemically altered. This is completely synthetic, made from the ground up. And it acts in a similar way to cannabinoids found in cannabis: it works on the same receptors.

But unlike THC, they're what we call full agonists as opposed to partial agonists. So they activate the receptor quite a bit stronger than cannabis, gram for gram. Synthetic cannabinoids have all got really, really hard to remember names. And it's to do with different chemical forms of the compound in question.

They've got a few different chemical regions. They have a head, a core, a tail, and they've all got different names. So you get different combinations of those, and that leads to the very hard-to-remember naming convention.

And then you were talking about the concentrations found in these vapes, weren't you? 5F-MDMB-PICA was found at a median concentration of 0.85 milligrams per millilitre. And it varied across the seven vapes from 0.59 to 1.63 milligrams per millilitre. And so synthetic cannabinoids like this, the effects tend to be a lot more intense than cannabis.

And the risks do seem to be higher. There have been a number of case reports of sudden death following synthetic cannabinoid use, even amongst individuals with a long history of using synthetic cannabinoids. Yeah, there's quite a few adverse effects associated with them, including AKI, cardiotoxicity, seizures, stroke, tremors, palpitations, and even central nervous system depression. I think what's quite shocking here is that they were sold as THC vapes.

And THC vapes are a thing. Obviously in this country, they're not legal, but in the States there's a huge market for what are now legal or decriminalised cannabis products, including vape devices. It contained a certificate of analysis, although clearly that certificate of analysis was fake. And actually what was in there was neither a cannabis product nor a semi-synthetic cannabinoid as described by the COA, but a synthetic cannabinoid, which is completely different.

So in 2018, 5F-MDMB-PICA was the fifth most common synthetic cannabinoid identified in drug seizures by the Drug Enforcement Administration. And in the US, it was made a permanent Schedule I controlled substance in April 2022. The other thing with this case is just how variable the concentrations of this synthetic cannabinoid were. There's clearly not very good quality control in the manufacture of these.

Yeah, that does contribute to added risk because if you smoked one to completion and felt okay, and then got another one from what you thought was the same batch and did the same, because of that variable concentration you could end up experiencing more severe side effects. Potentially double the dose, looking at some of these numbers. So why don't we look at the next paper, Rebecca?

This is shifting gears a little bit, isn't it? Yep, so this paper looks at e-cigarettes in prisons. So vaping devices found in prisons. So this paper is looking at e-cigarettes in Scottish prisons.

So back in November 2018, there was a smoking ban in Scottish prisons and all prisoners were transferred over to e-cigarettes. So they were given vape devices when they banned smoking in prisons. Yep, so it has been seen in prisons that people are tampering with their e-cigarette devices and adding drugs into them. So people are taking synthetic cannabinoid receptor agonists on paper, tearing this up, and then putting it into the cartridge and vaping it.

And this has been going on for quite a few years. I'm aware of synthetic cannabinoids being snuck into prisons going back six, seven, eight years, from when I first encountered cases like that. This particular paper focuses on five e-cigarette cartridges that were seized between 13 May 2022 and 1 July 2023. So they analysed the contents of the e-cigarette cartridges by dripping methanol through the mouthpiece, collecting it, sonicating it, and then analysing it using GC-MS. And in these samples, they detected anabolic androgenic steroids.

Four were positive for mestanolone and one was positive for oxandrolone. So anabolic steroids are steroid compounds that mimic the effects of testosterone and can lead to increases in muscle gain, aggression, things like that. Normally these compounds are taken orally or injected, but in this case they were detected in vaping devices, which seems quite unusual.

So a survey by the Scottish Prison Service between 2011 and 2017 looked at prisoners who inject drugs and found that between 22 and 36% of prisoners who admitted to having injected drugs in prison in the last month had injected anabolic androgenic steroids. So it seems to be a fairly common thing, but vaping them isn't. This was new. And all of these e-cigarette cartridges were positive for nicotine and four were positive for other substances, including a couple of different SCRA's, so ADB-BUTINACA and MDMB-4en-PINACA, delta-9-THC, and cocaine.

So it looks like these devices were being used to vape a few different compounds. And unfortunately in this study, they weren't able to quantitate the levels. They can't really tell whether the steroids were there as a major or minor component. So it could be that the intention was to vape the other drugs that were found and the steroids were a contaminant, or they could have been put in there with that intention.

And also, unlike the first paper, these were refillable vape devices. Yeah. So it's possible that the way these devices work, you've got a tank that you fill with liquid. So it's possible a liquid had been put in that tank containing a substance that was then subsequently topped up with a different liquid containing a different substance.

Yeah. And we could be detecting drugs from different times. So February 2022 was their first detection of illicit drugs in e-cigarette samples, and 6% of all samples seized in 2022 were vapes.

But that seems to have increased. So between January and August 2023, 16.8% of samples seized were vapes. And all of these were collected from a load of different prisons in Scotland. So it seems to be quite a widespread thing, this adulteration of vapes.

And these are prison seizures that are not evidential, correct? Yeah. I'm just thinking it could be that actually the prevalence hasn't increased, the rate of seizing vapes, suspecting them to have contained substances may have gone up as stuff at the prisons have cottoned on to what could be happening. Yeah, that is very true.

And looking at the images in this paper, the vapes do quite clearly look like they've been adulterated. There's like bits of pills or powders and things floating in the cartridge that obviously shouldn't be there. So you might be right in that sense that they're a bit easier to spot and they're being looked for. And a possible reason for us seeing an increase in adulterated vapes is that back in December of 2021, Scottish prisons started photocopying letters because a lot of these letters were being infused with drugs.

The paper was being soaked in different substances. The letters were being sent into prisons and then people were tearing them up and smoking them or vaping them and things like that. But since prisons have cottoned on to that fact and letters have started being photocopied, more traditional forms of drugs have started entering prisons again, like powders and pills and things, which are probably making their way into these e-cigarette cartridges as well. Yeah, so I recall seeing quite a few different questionable letters being sent into prisons: children's drawings, letters from loved ones.

Sometimes it's disguised as legal mail from false solicitors. And I think that probably still gets through because I think they're actually exempt from the photocopying laws. So going back to the steroids in this case, important question. I'm not sure we know the answer but I'm gonna ask you anyway.

Can you vape steroids? I think that's still up for debate. Interestingly in this paper, they did put a couple of feelers out on Reddit to see whether steroid users were vaping their steroids. And I think they got laughed out of a lot of Reddit groups for that comment.

And we don't really know what happens when you vape a steroid, what breakdown products you get from the heating, and whether they are active and give you any desired effect from taking a steroid, essentially. The heating coils in vapes are quite hot, aren't they? So it's entirely possible that the high temperature is causing chemical changes. What was interesting in this paper is that the authors do acknowledge that a particular steroid that was detected, mestanolone, could actually, if you're doing GC-MS analysis, be a breakdown product of a different steroid caused by the analysis itself.

And very, very briefly, GC-MS analysis essentially means you take a liquid sample, you inject it into what we call the inlet, and it is basically a very hot tube that turns your liquid into a gas. And so for some chemicals, they actually get altered by the inlet. GC-MS inlets are probably not as hot as vape coils. So actually it's entirely plausible that breakdown products, pyrolysis products, are being created when vaping these compounds.

So thinking more generally in terms of looking at both of these papers, they both show that vapes are possibly a new sort of frontier of drug delivery. I guess what's concerning, particularly about the first one, is just how mis-sold the products were. We could also be seeing another shift in the vape market. So disposable vapes were due to be banned in the UK from 1 June 2025.

And therefore people are going to be buying refillable vapes, and therefore refillable cartridges and liquids. And so that kind of opens up a whole new market of people potentially buying counterfeit vape cartridges that may or may not have things other than what they're intending to vape, like THC, semi-synthetics, synthetic cannabinoids, and potentially a whole host of other drugs that have made their way into these sorts of cartridges. I think the whole vaping phenomenon is quite interesting, isn't it?

As an ex-smoker, I can kind of get behind the idea of an alternative smoking product that is probably less harmful than traditional tobacco products. On the other hand, we've seen this huge marketing shift. You know, as we said at the start, the ridiculousness of blueberry flavor and pineapple flavor and potentially how that has brought a younger generation of people on board vaping. And that's potentially gonna be exacerbated again in the UK.

Those born after 1 January 2009 aren't able to buy tobacco-based products, so there'll be a move, I guess, that as people grow up and want to start smoking, they'll have to vape. I think the other thing that these cases highlight is that it isn't just nicotine that's being vaped, is it? That's, I think, the risk here: that actually these devices can be used to vape other substances as well. And I guess the question is, are we going to see more trends towards that?

Yeah, it'd be interesting to see in a year, six months down the line, how that sort of changes and whether we are seeing more alternative drugs in vapes that we wouldn't have seen previously. I certainly think if I'd have guessed, anabolic steroids wouldn't have been on my list. No, definitely not. So it does show how you can sometimes be surprised in what drug trends occur.

And then with any shift in this, we've got pyrolysis products, as we've said, and there is this sort of increased risk from novel drug delivery systems. Where does this leave us as toxicologists? Certainly, I had a question come my way recently about nitazene pyrolysis products, of which, of course, we don't know what they are. But that was a thought on my mind.

Actually, if there are new substances being vaped that were not vaped before, are we potentially missing things by not looking for the right compound because they're being chemically altered in the consumption and things like that? That is true, although these pyrolysis products might not be active compounds that have any effect as well. We just don't know. Or they might be.

It's very true. So I think really in summary, vapes don't just contain nicotine and that in itself could carry with it risks. And also that the future really of this novel drug market is continuing to evolve. And I guess all we

can do at the moment is really watch this space.

So I think we're going to wrap it up there. I hope you've enjoyed listening this week. Do give us a like, give us a follow, tell your friends, spread the word. We'd really appreciate that.

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