Vaping Marijuana

This fact sheet describes the devices and products currently available in Washington State for vaping cannabis and — from a science-informed perspective — what is currently known and what more we need to know about vaping marijuana.

Not long ago, marijuana was mostly available in two forms: joints or baked into brownies. Not anymore. Marijuana legalization has brought many new commercial products to the market, with promises of delivering the safest, the most discrete, the most pleasurable or the purest cannabis use experience to consumers. There's no indication that the stream of new products is drying up; in a consumer-oriented environment the next perfect device is just around the corner. Among all the new products, those designed to vaporize cannabis getting a lot of attention from the industry.

Meanwhile, parents, public health officials, clinicians and cannabis consumers are seeking more information, beyond the marijuana industry's marketing sound bites.

Research suggests that – among marijuana users – vaporization is perceived as a safer alternative to smoking (Lee et al, 2016). It is widely known that smoking (any product) is bad for our health: when marijuana is smoked, its combustion releases carbon-monoxide and other by-products that when inhaled, harm your lungs, throat, and overall respiratory system.

Vaporization releases the main components of the marijuana plant before combustion occurs and at lower temperatures, thus avoiding the release of toxic by-products associated with combustion.

Does this mean that vaporizing cannabis is the safe way to go and there is nothing more to talk about? It's not that simple. While vaporization methods may spare the respiratory system (Tashkin, 2015), other risks involved in using marijuana are still the same. Many facets to this complex topic are not well researched or understood.

> The risks associated to marijuana use are not only or mostly related to the respiratory system. Impact on function, memory, coordination and risk of developing cannabis use disorder are related to how often, how much and in which circumstances a person consumes cannabis.

From a science-informed perspective, the jury is still out and it will take years to develop and conduct large and robust studies that can offer a better picture of the benefits and risks associated with this relatively new phenomenon. Even more importantly, the number and diversity of vaporization devices, products and vaping practices make it impossible to generalize findings without careful analysis.

What Cannabis Products Can Be Vaporized?

There are two types of products that can be vaporized: marijuana oils (also called extracts or concentrates) and the marijuana plant (usually flowers/buds).

Cannabis oils

There is a wide diversity of names and products under this broad category. Raber et al (2015) classified them by their production methods (Figure 1). In Washington State, these different extracts are available in retail stores, typically with THC content much higher than in the plant (typically 50-80% THC). It is also possible to find oils with very little THC and mostly CBD (non-intoxicating, medicinal cannabinoid), but this is less common.

The relative safety of these products is not well known and research on this topic is an urgent public health matter. For now, it has been suggested that the health risks associated with these products vary by methods of extraction (for example, water-based vs. butane extraction) and substances added afterwards (e.g. glycerol, added after CO2 extraction).

One of the concerning and not well-researched aspect of concentrates relates to contaminants and residues. In Washington State where marijuana is tested for pesticides and contaminants before going to retail, the testing is always performed on the raw materials (cannabis flowers). The concentrates are produced afterwards and not retested. At this point in time, it is not known:

- How much of the solvents remain in the cannabis extract and whether or not this poses a risk for the consumer.
- Whether cannabis extracts carry dangerous amounts of pesticides and other contaminants, given that possible safe levels detected in the plant exponentially increase with product concentration.

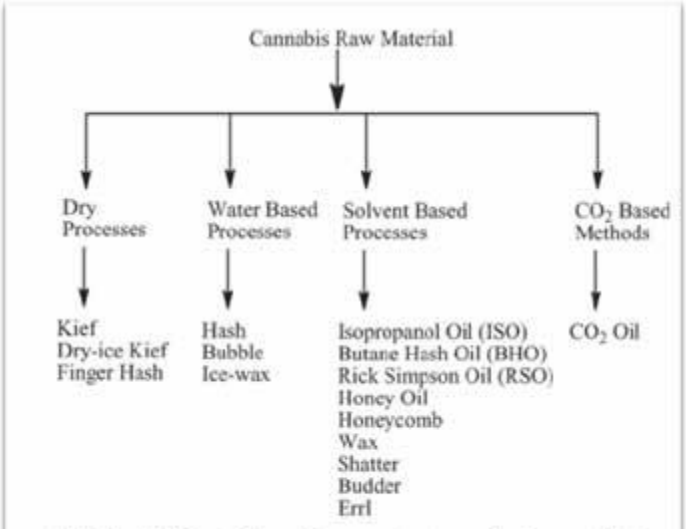

Fig. 1. Different Cannabis concentrate production methods.

In California (Raber et al, 2015), where testing is not mandated, 57 samples of cannabis concentrates were brought to a laboratory by medicinal patients. Laboratory analysis found that 72% of the samples presented solvent residuals (mostly isopentane, but also butane, hexane and propane, among others). A third (33.3%) of the concentrates were contaminated with pesticides, mostly paclobutrazol (Raber et al, 2015). The study does not report whether the levels of contaminants detected entail health risks; the safety threshold is not known at this point in time.

Another unanswered question is whether or not vaping high THC extracts translates into higher doses of THC per day, given the high potency of these extracts. It is possible that some consumers may see the very high concentration of THC or CBD as an opportunity to consume less and achieve the desired effect. It is also possible that some consumers will use concentrates as often as other forms of marijuana, which would dramatically increase their exposure to THC, thereby increasing the chances of developing cannabis use disorders. While there is some indication that this may be the case for "dabbing" (see Dab Rigs section), there are no current data for other vaping methods.

Plant

Flower buds from the cannabis plant can be vaporized; this practice is considered safer than smoking. Vaporizing the plant material is the most recommended method of cannabis administration for medicinal users. There is a chance, however, that those seeking to vape are in fact still inhaling marijuana smoke. In an unregulated market, many vape pens have poor temperature control and can heat cannabis to the point of combustion (see vaping devices, below); the use of high quality vaporizers are as important as the product being inhaled.

Vaping Devices

There are currently three main types of devices for vaping marijuana products: table top vaporizers, vape pens and dab rigs. There have been also some reports of utilization of e-cigarettes for hash oil vaporization (Morean et al, 2015)

Traditional desk top vaporizers

Vaporization of the cannabis plant through a desktop vaporizer is the safest method of inhaling cannabis and the recommended method for medicinal cannabis patients. This device is neither portable, nor discrete; in Washington State the cost of a desktop vaporizer varies between $500 to $600. Desktops vaporizers have precise temperature control and heat the cannabis to just below the point of combustion, near 338° F, causing the active compounds to evaporate into a vapor, thereby reducing the harmful by-products of combustion (Abrams et al, 2007). Because less of the THC is burned off than when smoked, vaporization may have a stronger psychoactive effect, but offers rapid onset of effects allowing the consumer to easily titrate dose to the desired effect.

Vape pen

Vape pens are a newer method for vaporizing marijuana and are not well-studied. The first generation of vape pens are similar to e-cigarettes, designed to slowly heat oil cartridge contents to the point of vaporization. While they are marketed as convenient, safe and affordable, they are unregulated and not very reliable (Giroud et al, 2015).

Some of these vape pens come with a cannabis oil cartridge attached to it – once the oil is used up, the whole device is discarded. These vape pens are also called "e-joints" and have the appeal of being small, convenient to carry, and release almost no cannabis smell when used. Other types of these first-generation devices have replaceable "e-juice" with variable THC/CBD content. First generation vape pens do not come with temperature control: they may heat cannabis to the point of combustion, making it equivalent to smoking. Many use piezo-electric elements that are red-hot within a second which can be hard on the lungs.

The second and third generation of vape pens use more sophisticated technology, with heating coils made of different materials (cotton, synthetic fillers, ceramic). These vape pens come with temperature control and a small compartment (called a tank) that can accommodate marijuana flowers, oil cartridges, and marijuana oils in the form of wax or shatter. They are bulkier and more expensive than first generation vape pens (up to $120), but can be used many times. (Giroud et al, 2015)

Between the simplest, first generation vape pens and the latest and more expensive models, there is an enormous variety of other products, varying in size, price, temperature control, heating technology, looks and portability. Some are rechargeable using blue-tooth technology, USB ports, or cell phones, while others still depend on electric power; and some are not rechargeable at all.

Dab rigs

Dabbing is a method to inhale cannabis vapor from concentrates, oils or extracts through a dab rig. The typical "dab" set-up involves a handheld torch and a type of bong or water pipe with a heating element that allows fast vaporization of cannabis concentrates. The most common type of heating elements are a skillet and nails, usually made from titanium or quartz or sometimes glass. "Dabbing" is inhaling cannabis extract vapors created by heating the skillet or nail with the torch and saving the vapor in a "dome" that attaches to the modified pipe. A quick search online suggests more than 200 different styles of dab rigs are available, with prices varying from $25.00 to more than $400 dollars.

Vaporization through dabbing delivers a very high dose of THC in a short period of time. To date there are almost no studies on this emerging practice in terms of prevalence, trends, and short/long term effects. Medicinal users may also dab, although seem to prefer traditional vaporizers (Loflin & Earleywine, 2014). Some studies suggest that dabbing is becoming popular among non-medical users, as documented by the number of tweets (Daniulaityte et al, 2015) and You Tube videos (Kraus et al, 2015) on the topic.

Some of the questions surrounding this emergent practice include:

- Is dabbing more likely to trigger psychotic episodes in cannabis users than other forms of cannabis use? A couple of case studies suggest this could be the case (Keller et al, 2016; Pierre et al, 2016).
- Is dabbing associated with a higher risk of cannabis use disorders? In an online national study, 357 cannabis users who reported dabbing rated this practice as "more dangerous" than using flowers and reported higher rates of withdraw symptoms and tolerance with dabs, compared to other methods of use (Loflin M & Earleywine, 2014).

Final Considerations in This Emerging Area of Study

Recently, the prestigious journal *Addiction* published an article (Budney et al, 2015) and a series of commentaries (Cox, 2015; Fisher et al, 2015; Gartner, 2015; Tashkin, 2015) about vaping marijuana in its "For Debate" section. It should be noted that "dabbing" was not part of this debate – while technically dabbing is a form of consumption of cannabis vapor, it has been treated as a separate phenomenon altogether by researchers, the marijuana industry, and consumers. The main points of this Debate are summarized below.

Possible benefits:

- Vaping may reduce negative health effects associated with inhalation of cannabis smoke. This is particularly important for medicinal users, whose health may be compromised and who may use cannabis daily.
- Theoretically, vaping limits second-hand exposure to cannabis smoke.
- Marijuana users report vaping tastes better than smoking, has no smell, and provides more desired benefits from a smaller quantity of cannabis.
- In countries where tobacco and marijuana are used together, the advent of portable vape pens may disentangle tobacco use from marijuana use, since they are mixed together to increase the burning properties of the most commonly available form of marijuana in these countries (hash oil). This possibility would mean many lives saved, since tobacco-associated mortality is very high. In the US, using marijuana with tobacco has been reported by 20% of recent users (Schauer et al, 2016).

Possible downside:

- The inhalation of residual solvents and carriers (such as glycerol) as well as concentration of pesticides may have deleterious health consequences.
- Increase in cannabis use frequency and/or quantity among consumers, due to convenience (higher portability and ability to disguise use in the absence of smell), better taste, and lower perception of risk.
- Increase in the incidence of new consumers who would not consider smoking marijuana but maybe interested in trying a method perceived as lower risk and less harsh for the lungs.
- Increase in marijuana addiction (or cannabis use disorders). Studies focused in other substances suggest that increases in potency (as is the case with extracts) and delivery efficiency (as is the case of vaporization) increases the probability of misuse and addiction.

In conclusion, marijuana consumers and the marijuana industry are embracing cannabis vaporization while outpacing our capacity as a society to produce science-based knowledge, inform the public, and promote health-oriented policy. It is hoped that research will discover answers to many of the existing questions to guide the decisions of individuals, professionals, and policy-makers alike.

Related Resources:

- Public Health - Seattle & King County: Tobacco, vapor, and marijuana. http://www.kingcounty.gov/depts/health/smoking.aspx
- ScienceNews for Students: https://www.sciencenewsforstudents.org/article/concerns-explode-over-new-health-risks-vaping

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