

I. INTRODUCTION

Increasing commercialization of the cannabis industry in California and nationally has led to uncontrolled product diversification, resulting in potent, highly intoxicating products that are more likely to cause addiction and other harms. While misleading marketing and contamination are common, even the most responsibly produced cannabis will negatively affect certain people. The younger the person, the higher the THC dose, and the more frequently cannabis is used, the more likely for it to cause harm. From inhalable to edible, these are the basics.

II. IMPORTANT TERMS

Cannabinoids

Cannabinoids are naturally occurring, biologically active chemicals produced by the *Cannabis sativa* L. plant.¹ Some possess psychoactive properties, and many bind to or interact with the Endogenous Cannabinoid System present in all people.² The most common cannabinoids include:

- **Tetrahydrocannabinol (THC)** is the main substance in cannabis that causes intoxication as well as other harmful effects. In the plant, it is present as non-intoxicating **tetrahydrocannabinolic acid (THCa)**. THCa converts to psychoactive **delta-9 tetrahydrocannabinol (D9THC)** when exposed to heat, such as when cannabis is smoked, vaped, or cooked.³
- **Cannabidiol (CBD)** is not intoxicating but has its own risks.^{3,4}
- **Cannabinol (CBN)** comes from THC breaking down over time. CBN can be intoxicating.³

Since the 1980s, growers have bred plants to increase the psychoactive effects of cannabis by increasing THC content.^{5,6} Cannabis went from being a plant with 3-5% THC to having as much as 35% THC. These dramatic changes in THC content have led to more intoxicating products that have an increased potential to cause anxiety, paranoia, psychosis, and other harms or lead to addiction.⁷⁻¹¹

Cannabinoids from Hemp

Cannabis and hemp both come from the same *Cannabis sativa* L. plants.¹² THC is the main cannabinoid in cannabis plants whereas CBD is the main cannabinoid in hemp. Hemp products were supposed to be non-intoxicating; hemp is often produced for its fibers and seeds. After hemp production was legalized in the United States in 2018, some hemp growers and product manufacturers found it was more profitable to produce hemp for its cannabinoids.¹³⁻¹⁶ Some manufacturers extracted CBD from hemp and chemically modified it into

a host of THC-like compounds that are intoxicating; these are called hemp-derived intoxicating cannabinoids, and while they cannot be legally sold in California, they are commonly found at smoke/vape shops, gas stations, convenience stores, online merchants, and other types of retailers.¹⁷ Examples of synthesized products include tetrahydrocannabiphorol (THC-P), hexahydrocannabinol (HHC), as well as delta-8 and delta-10 THC.

Although delta-8 and delta-10 THC may exist naturally in small amounts, they are usually synthesized in larger quantities for use in intoxicating hemp products. More research is needed to determine their short- and long-term effects in humans.¹³⁻¹⁶

Terpenes

Terpenes are chemicals that occur naturally in many different types of plants, including *Cannabis sativa* L., and are responsible for different aromas.^{3,18} Terpenes, either naturally derived or synthetically created, are often added to inhalable cannabis products to create flavors and aromas. Very little is known about the safety of inhaling terpenes, but some terpenes commonly found in cannabis, such as Pinene, are known to be harmful when inhaled at certain concentrations.¹⁹⁻²²

Varieties/Strains of Cannabis

Names are used to distinguish different types of cannabis, but they generally do not effectively guide consumers.²³ Strain names that identify characterizing flavors (e.g., “cherry pie” or “gelato”) are more for marketing purposes and often used even when the flavor is not present. Like with flavored tobacco products, these flavor-indicating names attract younger users.^{24,25} Claims about specific effects from certain strains are often made, however these claims tend to be inaccurate generalizations; cannabis typically impacts different people differently.²⁶ Effects may also vary because cannabinoid content can change due to growing conditions and processing.²⁷

III. INHALABLE PRODUCTS

Cannabis Flower

Often called “buds,” cannabis flowers (*Figure 1*) are the main part of the *Cannabis sativa* L. plant that is smoked after it has been harvested, dried, and trimmed. Historically, cannabis flowers had much lower THC content than what is seen in today’s market.^{5,6} While some countries that legalized cannabis, such as Uruguay,^{28,29} limit how much THC cannabis may contain, in California there is no THC limit on inhalable products; finding less intoxicating, lower potency cannabis flowers in the state’s legal market is difficult. As with tobacco or any other smoke, burning cannabis produces particulate matter and carcinogens that are harmful when inhaled.^{30,31}



Figure 1

Concentrates

Concentrates refer to any form of cannabis product that contains a higher concentration of the plant’s cannabinoids than the flower itself.³² Concentrates can range from 40% to as much as 99% THC. Due to the high THC content of concentrates, these products are more likely to cause addiction as well as other harmful effects.⁷⁻¹¹ Cannabis concentrates were traditionally produced mechanically; however, modern methods have been developed that pass solvents such as hydrocarbons (e.g., butane, propane) or CO₂ through dried cannabis plant material, dissolving the resin, which is the part of the cannabis plant containing cannabinoids and terpenes. The solvents and the dissolved resin are then separated from the plant matter, and the solvent is evaporated, leaving the extracted resin behind. “Live” resin is produced using the same process, but with flash-frozen, not dried, cannabis. The extracted resin can become a variety of other concentrates such as budder, crumble, shatter, distillates, and isolates:

Budder and Crumble

Budder, aka butter or batter (*Figure 2*) is whipped to incorporate air and achieve a light and creamy consistency; Crumble is also whipped, but slowly, making it crumbly; both can look dark brown to bright yellow or blonde in color.



Figure 2

Shatter

Shatter (*Figure 3*) is not whipped, and is brittle and glass-like in texture and appearance but becomes malleable in warmer temperatures. It typically has between 75% - 95% THC content.



Figure 3

Distillates/Isolates

Distillates and isolates are generally produced when the extracted resin goes through a further distillation process to isolate a single cannabinoid, like THC. They usually have a thick, oily consistency.

Concentrated Products Made Using Mechanical or Physical Methods of Separation

Mechanical or physical methods have long been used to make cannabis concentrates, typically containing 40%-60% THC, and do not involve the use of solvents. A traditional method is dry sifting, using screens that separate the cannabinoid-containing resin glands (trichomes) from cannabis plant material. The loose trichomes are called **kief** and can be pressed to make **hash** (*Figure 4*). There are wet sieving methods that use cold/ice water to produce **bubble hash** (*Figure 5*). **Rosin** (*Figure 6*) is made by pressing cannabis plant material between two heated plates and collecting the oil that is expelled from the cannabis. **Live rosin** is produced using the same process, but with flash-frozen, not dried, cannabis. Rosin can be extremely high in THC and is usually a viscous golden or amber honey-like substance.



Figure 4



Figure 5



Figure 6

Methods of Consumption and Effects

A variety of approaches or devices are employed for inhaling cannabis vapor or smoke, all of which come with risks. For example, smoking cannabis is associated with respiratory illness³³ and vaping has been associated with serious lung disease.^{34,35} When cannabis is inhaled the effects are quick, usually felt within 10 minutes, peak within 1-2 hours, and then gradually wear off.³⁶ Controlling the amount of THC inhaled can be difficult unless using a device that limits how much can be inhaled at once.

Cannabis flowers can be ground and rolled into a **joint** (Figure 7) using papers. When cannabis flowers are ground up and wrapped in a tobacco leaf or an emptied cigar, it is called a blunt; tobacco-free “blunt” wrappers are also sold. Joints and blunts are often sold pre-rolled and ready for use; they are more hazardous when they are infused with additional THC concentrates. Pre-rolls marketed with flavor-indicating names or those using flavored wrappers are especially concerning because they are more appealing to youth.^{24,25}

Pipes are used by putting cannabis flower and/or concentrates into a “bowl” to be ignited, then the smoke can be inhaled through a chamber. **Bongs and bubblers** are types of waterpipes, which have chambers that can be filled with liquid that cools and condenses the cannabis smoke as it passes through while the user inhales.



Figure 7



Figure 8

Vaporizers (Figure 8) heat cannabis oil or cannabis flower (“dry herb vaporizer”) to a temperature that turns the cannabis into a vapor that is inhaled. “Vapes” or “vape pens” are typically discrete and portable, made in shapes that can resemble anything from a USB drive to car keys to pens. There are also larger table-top vaporizers, such as the Storz and Bickel Volcano®. Vaping also produces harmful particulate matter.^{21,31}

Dabbing is a way to vaporize or combust cannabis concentrates. A “dab” of cannabis concentrate is heated on a glass, metal, or ceramic “nail” inside a “dab pen” or “dab rig” (Figure 9) and the user inhales the resulting smoke/vapor. Dabbing causes a rapid, intense high that can cause extreme intoxication and adverse effects.³⁷



Figure 9

IV. NON-INHALABLE PRODUCTS

Edible Cannabis Products

When conventional foods are infused with cannabinoids they are referred to as edible cannabis products or edibles. Gummies, candies, and baked goods are the most well-known types of edibles; however, cannabis can be infused into drinks, sauces, snacks, and many other foods. Cannabis-infused beverages can pose a significant risk to youth, as they may be packaged with 10 doses in a single container, sometimes resembling the size of a 2-ounce energy shot.

Orally consumed cannabis products act more slowly than inhaled products. They can be felt within 30 minutes but usually take 1-2 hours to impart their full effect and generally last longer than inhaled products.³⁸ This delayed onset of effects often results in adverse events when a user takes more doses of an edible before the full effects set in, causing over-intoxication and other harms.



Figure 10

Tinctures

Tinctures (Figure 10) are cannabis-infused solutions, made using either cannabis plant material or concentrates. They typically contain ethanol, glycerin, or vegetable oils. Tinctures are usually consumed by mouth but can also be applied to the skin.

Other Cannabis Products

Cannabis-infused skin products (Figure 11) can include creams, lotions, ointments, or balms. These are intended to affect a targeted area of the body. Patches and suppositories also exist.



Figure 11

V. YOUTH ACCESS

Intoxicating cannabis products are accessed by youth in a number of ways. Sometimes cannabis products are diverted from licensed, regulated businesses, but even in states where cannabis has been legalized there is still a significant illicit cannabis market, especially in California.³⁹ While intoxicating hemp products are currently illegal in California, they still are sold online by out-of-state businesses, often without age verification.

In a preliminary study conducted by researchers at the Public Health Institute, of adolescents who reported ever using cannabis, over half (54%) of those aged 16-17 and 64% of 18-20 year olds said they had gotten it from a legal source, either a store (with a fake ID, medical ID, or someone else bought it from a legal store) or a licensed delivery service. 60% of the 16-17-year-olds and 43% of the 18-20-year-olds said they purchased from a dealer.

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