

Introduction to CBD

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Cannabidiol, better known as CBD, is an extract from the *Cannabis sativa* plant, most commonly known as Cannabis. It is an agricultural hemp plant (Johnson, 2018). The sister compound THC is only present in the female cannabis plant, because it produces resinous flowers and causes the “high” that so many marijuana consumers want. On the other hand, the male cannabis plant, which is also known by some as hemp, might not have any THC, but contains some CBD. Unlike marijuana, hemp contains only trace levels of THC (tetrahydrocannabinol), which gives marijuana its euphoric qualities. Hemp is known for its fibers and has commonly been used to make ropes, auto parts, fabrics industrial materials and many other products. Hemp highly-nutritious seeds have been beneficial to cardiac and skin diseases (Rawls, 2019). Both the female and male cannabis plants have a source of CBD for cannabidiol oil extraction. Both Cannabidiol (CBD) and its sister Tetrahydrocannabinol (THC) interact with the cannabinoid receptors found in the human body and brain, but they differ dramatically in their effects. Phytocannabinoids are cannabinoids are derived from plants. Endocannabinoids are cannabinoids are produced naturally in the human body.

Hemp became legal in 2018 with the signing of the Hemp Farming Act of 2018, making the use and sale of products made from hemp legal across all 50 states. This does not apply to marijuana (Rawls, 2019).

How Does CBD work?

Medical experts suggest that the biological effects of cannabinoids, a major constituent of the *Cannabis Sativa* plant (marijuana) are

mediated by two members of the G-protein coupled receptor family: cannabinoid receptor type 1 (CB1) prominently found in the central nervous system and cannabinoid receptor type 2 (CB2) in the rest of the body. THC has strong bonding affinity to both CB1 and CB2, while CBD has minimal affinity for either receptor (Zou & Kumar, 2018).

CBD exhibits most of its therapeutic benefits through indirect actions, activating non-cannabinoid receptors/ion channels (Ibeah, 2015) like:

- **Adenosine receptors:** These have been implicated in regulating coronary blood flow and oxygen consumption by cardiac muscle and are also present in the brain, most notably in the forebrain. CBD (50 µg/kg) inhibits the subsequent ventricular tachycardia following coronary artery occlusion in rats—an effect abolished by 8-cyclopentyl-1, 3-dipropylxanthine, an adenosine A₁ receptor antagonist. These results demonstrate that CBD can exert an antiarrhythmic effect, possibly mediated by the adenosine A₁ receptor.
- **Fatty Acid Amide Hydrolase (FAAH) Inhibition:** This leads to higher levels of endocannabinoids such as anandamide. Endocannabinoids exhibit activity at CB1 and CB2 receptors, providing many health benefits.
- **Antagonizing GPR55 Receptors:** GPR55 receptors are widely distributed in the brain (especially the hippocampus). It has been demonstrated that GPR55 activation produces anxiolytic effects in rodent models. Additionally, GPR55

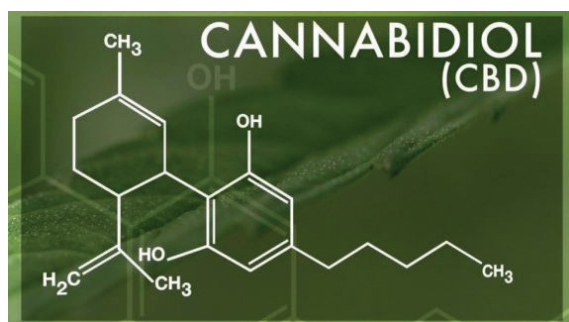
promotes cancer cell proliferation when activated. These facts may explain CBD's therapeutic role in controlling high blood pressure.

- **Activating TRPV1 Receptors:** Involved in regulating pain, body temperature, and inflammation. TRPV1 activation has been shown to cause anxiety-like behavior in rats.
- **Activating the 5-HT1A Receptor (at high doses):** The 5-HT1a receptor helps regulate anxiety, addiction, appetite, sleep, pain perception, nausea, and vomiting. CBD exhibits reasonable affinity at plausible concentration for 5-HT_{1A} and 5-HT_{2A} receptors, and 5-HT_{2A} receptors act as a target for fenfluramine. CBDA (the raw form of CBD) shows an even higher affinity for this receptor than CBD.
- **Activating PPAR-gamma Receptors:** PPAR-gamma receptors are located on a cell's nuclei and play a role in degrading beta-amyloid plaque (seen in Alzheimer's condition). It also plays a role in lipid uptake, insulin sensitivity, and dopamine release. This action explains why CBD may benefit diabetes, schizophrenia, and Alzheimer's. The peroxisome proliferator-activated receptor (PPAR) γ , otherwise known as the glitazone receptor, is thought to be responsible for lipid storage and glucose metabolism, and some anticancer effects of CBD are thought to be mediated through interaction with PPAR γ .

The Effects of CBD

CBD is non-psychoactive substance, which means that it will not cause the "high" effect in the user. Because of this, CBD appears more frequently than THC in dietary and natural supplements.

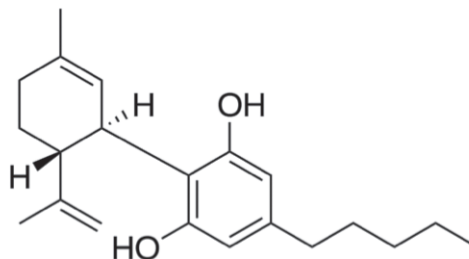
CBD is one of the most critical cannabinoids contained in the cannabis plant. It exists both in agricultural hemp, as well as medical cannabis.



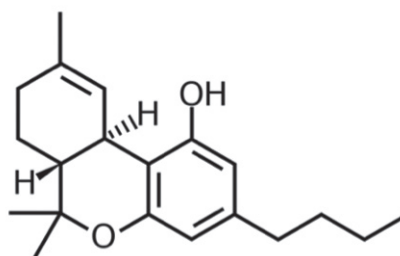
While cannabinoids are present within several plants in nature, cannabis is the only plant known to contain CBD.

CBD has the same chemical formula as THC, 21 carbon atoms, 30 hydrogen atoms, and 2 oxygen atoms. The difference is in the arrangement a single atom, which can be observed below (Cadena, 2018):

Differences Between THC and CBD



Cannabidiol



Tetrahydrocannabinol

Cadena (2018) explains three differences between THC and CBD:

1. THC creates a psychoactive effect, while CBD does not. When ingesting CBD for medical purposes, there is relief of unwanted discomfort, but with little or no noticeable effect on your cognitive abilities.
2. Research suggests CBD may be better for inflammation and neuropathic pain, while THC may excel with spasticity and cramp-related pain.
3. Sometimes high doses of THC can exacerbate pain symptoms, and hence THC consumed in this capacity should be done in small amounts.

Some experts suggest that a combination of THC and CBD is the ideal way to approach pain, giving validity to something known as the entourage effect.

What is the Entourage Effect?

The entourage effect describes the phenomenon where the 400 plus compounds in cannabis have a synergistic effect on the body (Novicki, 2019).

For example, 100mg of isolated CBD may be substantially less effective at alleviating symptoms than 100mgs of a whole-plant, CBD-containing cannabis extract. Many argue that consuming the plant in its whole form provides all the necessary cofactors to facilitate proper absorption.

CBD Oil from Hemp

- It is legal in all 50 states
- Plant grows tall (two to four meters) with minimal flowers
- It is usually grown outdoors
- Although it has a naturally higher CBD to THC ratio than cannabis, overall levels of cannabinoids and terpenes are much lower in hemp.
- Cannabinoid profile supports 'entourage effect' more than hemp CBD oil.

CBD Oil from Marijuana

- Higher risk of THC content
- More diversity in cannabinoid and terpene profiles
- Plants are small and bushy, with more flowers
- It is usually grown indoors
- It is not legal in all 50 states (may require a prescription)

Medicinal Uses of CBD

Many researchers claim beneficial effects of CBD in the following medical conditions (Freeman, 2019):

- Reduction of neuropathic pain by binding to CB1 receptors while reducing swelling
- Stopping seizures in epilepsy. It has been very beneficial in children with status epilepticus. In June 2018, the Food and Drug Administration approved Epidiolex, the first prescription drug containing CBD and was used to treat difficult-to-control seizures (Holland, 2019)
- Relief of discomfort in Attention Deficit Hyperactivity Disorder (ADHD) sufferers
- Reduction of social anxiety, cognitive impairment, and discomfort in patients diagnosed with Generalized Social Anxiety Disorder (SAD)

- Decrease of spread of cancer by "turning off" genes involved in tumor development
- Combats neurodegenerative disorders like Alzheimer's by removing plaque that block neuron-signaling
- Reduction of cigarette addiction by modulating the rewarding effects of nicotine
- Improvement of sleep quality and restoring respiratory stability to those experiencing sleep apnea
- Clearing acne by inhibiting lipid synthesis on the skin
- Regulating blood sugar and lowers insulin resistance
- Providing relief to those suffering from IBD (Crohn's or Colitis) through its anti-inflammatory effects
- Improving symptoms of Multiple Sclerosis (MS) and Amyotrophic Lateral Sclerosis by providing durable protection to neurons
- Preventing obesity. Several follow up studies have shown CBD usage is associated with smaller waist circumference

Why Is CBD Used More Often Than THC in Natural Supplements?

1. THC is an illegal drug with considerable immediate and long-term cognitive side effects. These include impaired thinking and reasoning, a reduced ability to plan and organize, altered decision-making, and reduced control over impulses.
2. Chronic use of THC correlates with significant abnormalities in the heart and brain.
3. CBD lacks the harmful cognitive effects of THC and can in fact counteract the psychoactive effects of THC.
4. Cannabis plants with small amounts of CBD and high levels of THC result in a stronger 'stoned' effect; while plants with larger amounts of CBD and less THC result in a weaker, more relaxed effect.
5. Manufacturers are currently creating strains with higher CBD to THC ratios to minimize the psychoactive side effects.

Overall, the lower health risks of CBD, combined with its efficacy, make it a better candidate for natural applications than THC.

Side Effects of Cannabinoids

CBD is well tolerated while THC manifests the following temporary side effects due to the psychoactive effects of the drug (Holland, 2019):

- Increased heart rate
- Coordination problems
- Dry mouth
- Red eyes
- Slower reaction times
- Memory loss

What is the Best CBD Dosage?

There is no official serving size (Cadena, 2018). “Take one dropper of CBD per day,” is one of the most common dosage recommendations. While this can definitely be a dosage, there’s no way to tell if it is the right dosage for the given individual as it doesn’t take into account important factors such as the:

- Concentration of CBD
- Weight of the individual
- Individual’s body chemistry
- Severity of the condition being treated

The usual dose is 1 to 6 mg for every 10 lbs. of weight taken orally. This dose should be started small and increased gradually as tolerated. One should always consult a physician when in doubt.

Is CBD Addictive?

CBD is not physically addictive and does not produce any physical withdrawal symptoms when it is stopped. Some people may metabolize CBD differently than others because of anomalies

within the cytochrome P-450 (CYP450) enzyme system. These differences could be due to liver problems, genetics, or an interaction with other drugs taken at the same time. Therefore, the physician should test cytochrome P-450 enzyme system before adjusting the dosage.

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- 1.** What is CBD?
 - A.** CBD is the main psychoactive component of the cannabis plant and is the primary agent responsible for creating the ‘high’ in recreational use.
 - B.** CBD is non-psychoactive substance, which means that it will not cause the “high” effect in the user.
 - C.** CBD is one of the first plants that spun into fiber and it is also one of the fastest growing plants in the world.
 - D.** CBD is the receptors distributed in the cerebellum that control bone density and blood pressure.

- 2.** What is the Entourage Effect?
 - A.** The phenomenon where 400 plus compounds in cannabis have a synergistic effect on the body
 - B.** The psychoactive phenomenon creating the ‘high’ in recreational cannabis use
 - C.** The addictive effect on human beings
 - D.** The anomalies within the cytochrome P-450 (CYP450) that is related to liver problems

- 3.** Cannabidiol is an extract from the:
 - A.** Calycanthus plant
 - B.** Fittonia albivenis plant
 - C.** Camellia sinensis plant
 - D.** Cannabis sativa plant

- 4.** True or False: CBD has the same chemical formula as THC but differs in the arrangement of a single atom.
 - A.** True
 - B.** False

- 5.** True or False: CBD is physically addictive.
 - A.** True
 - B.** False

- 6.** True or False: CBD exhibits most of its therapeutic benefits through indirect actions, activating non-cannabinoid receptors/ion channels.
 - A.** True
 - B.** False

- 7.** Which of the following is a reason why CBD oil from hemp differs from CBD oil from marijuana?
 - A.** It has higher risk of THC content.
 - B.** It is usually grown indoors.
 - C.** The overall levels of cannabinoids and terpenes are much lower.
 - D.** It is not legal in all 50 states.

- 8.** In June 2018, the Food and Drug Administration approved the first prescription drug containing CBD. Which of the following medical conditions was this drug approved to treat?
 - A.** Epilepsy
 - B.** Depression
 - C.** Anxiety
 - D.** Multiple sclerosis (MS)

- 9.** The clinical use of CBD:
 - A.** Increases cigarette addiction
 - B.** Promotes cancer by “turning on” genes in tumors
 - C.** Causes formation of amyloid plaques as in Alzheimer’s disease
 - D.** Regulates blood sugar and lower insulin resistance in diabetics

- 10.** Why is CBD used more often than THC in natural supplements?
 - A.** It lacks the harmful cognitive effects of THC.
 - B.** It is legal in everywhere in the United States.
 - C.** It prevents obesity with several studies showing CBD use is associated with smaller waist circumference.
 - D.** It has lower health risks.

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