

# Marijuana

## Marijuana Plants

Marijuana plants and the plant material that is smoked or ingested contain a variety of chemical substances. The known active ingredients are "cannabinoids," and each plant contains about 100 different cannabinoids. There are over 600 other substances in the plant. However, the effects of only 6-8 of the plants cannabinoids are known. These cannabinoids are: delta- 9 tetrahydrocannabinol (THC), its sister compound cannabitol (CBN), delta-9 tetrahydrocannabivarin (THCV), cannabigerol (CBG), cannabidiol (CBD), delta- 9 tetrahydrocannabinolic acid (THCA) and cannabadiolic acid (CBDA).

THC is the main psychoactive component. CBN also has psychoactive properties but is about 50X less potent than THC. CBD and THCV are much less psychoactive and cause more sedation. There are 2 species of marijuana plants: Cannabis sativa (high in THC) and Cannabis indica (more CBD, less THC).

## Addiction to marijuana

Nearly every addictive drug, including marijuana, targets the brain's reward system by flooding the circuit with the neurotransmitter, dopamine. Neurotransmitters are necessary to transfer impulses from one brain cell to another. The brain adapts to the overwhelming surges in dopamine by ultimately producing less dopamine and by reducing the number of dopamine receptors in the reward circuit. As a result, two important physiologic adaptations occur: (1) the addict's ability to enjoy the things that previously brought pleasure is impaired because of decreased dopamine, and (2) higher and higher doses of the abused drug are needed to achieve the same "high" that occurred when the drug was first used. This compels the addict to increase drug consumption in order to increase dopamine production leading to physiologic addiction and intense cravings for the drug.

## Marijuana and brain development

The human body produces trace amounts of cannabinoids that play an important part in the development and maturation of the brain. Human cannabinoids act at the cellular level by combining with receptors on the surface of the cell allowing the cell to communicate with other cells. This interaction between the cannabinoid, the receptor, and the cell is referred to as the human "endo-cannabinoid system." The trace amounts of human cannabinoids that are produced are immediately degraded and are only active for a very, very short time. The prolonged presence of cannabinoids in the blood, and therefore at the cellular level, resulting from exposure to marijuana, has deleterious effects on cell growth and communication between cells and may result in inflammation and delayed maturation, and injury or death of the cell. Cannabinoid-induced inflammation in the brain has been shown to cause brain-cell death. (Cutano et al. J Clin Invest. 2013;123(7):2816-2831). These effects occur and the in the fetus, infant, child and young adult and the resulting functional defects may persist for years or even a life time.

Exposure to cannabinoids present in marijuana affects nearly all other neurotransmitters through the action of prolonged activation of the cannabinoid receptors in brain cells. This results in delayed maturation and development of the immature brain (brain development continues to about age 25 years); cognitive impairment with learning problems and limited or decreasing IQ; and behavioral disorders, including aggression, impulsive behavior, and a variety of mental health problems



**Street Names / Slang terms Associated with Marijuana:**

MJ, Pot, Weed, Kush, Purps, Wacky Weed, Laughing Grass, Green Buds, Chronic, Wax, Hash, THC Oil, Dope, Ganja, Hashish, Mary Jane, Blunt, Cheeba, Jay, Doobie, Swag, Skunk, White Widow, Black Ice, Sherm, Wet Sticks, Joint, Giggle

Smoke, Joy Stick, Amp Joint, Dusting, Buda, Basuco, Coco Puff, Airhead, Burn One, Fly Mexican Airlines, Mow the Grass, Toke, A-Bomb, Baby Bhang, 420, BC Bud, Blast a Stick, Dinkie Dow, Flower Tops, Moota/Mutah, Crunked



### Recreational marijuana

Marijuana is used for its mildly tranquilizing, mood and perception altering effects. The psychoactive ingredient in marijuana is THC (delta-9-tetrahydrocannabinol). The marijuana on the streets today is unlike the marijuana in the 60's, 70's, 80's, 90's, or early 2000's - it is a potent addictive drug cultivated to maximize its psychoactive effect. The THC content of marijuana continues to increase. In the 60's - 80's the THC content ranged from 2-7%. Today it is around 23-28%. However, in some places the THC content may be of 50% or higher. Today's marijuana should not be looked at as "just marijuana."

Marijuana concentrate (hashish, THC oil, wax, shatter) has become very popular. THC is extracted from the plant buds by using butane or other chemicals. Oil can be mixed with butter, known as "buddah" on the street, and is used to make marijuana edibles: cookies, cakes, brownies, pies, yogurt, ice cream, chocolates, etc.

Hashish may be a greenish brown solid substance, or a brownish tan waxy substance known as "wax", "earwax" or "dabs" on the street. This wax is usually smoked in vaporizers, which may look like pens or inhalers. Vaporizers typically have a section that contains a liquid, sometimes flavored, that is used to reduce the odor or marijuana making smoking less detectable.

Marijuana joints can be laced with other drugs such as PCP, cocaine, ecstasy, methamphetamine, heroin, or embalming fluid. The street names of marijuana joints often describe what is laced in the joint, i.e.; "black ice" is marijuana laced with meth, "white rhino" is marijuana laced with cocaine, and wet sticks or "sherm" is marijuana laced with embalming fluid.

**Indicators of marijuana use:**

Relaxed inhibitions  
Errors in judgment  
Distinct odor of marijuana  
Lack of motor coordination  
Loss of eye convergence  
Irritated mucous membranes

Difficulty concentrating  
Distorted perception of time  
Impaired memory and attention  
Flattening of emotions  
Lack of motivation  
Dry mouth

### Effects of using marijuana

**Immediate effects:** The physical effects of using marijuana include euphoria, rapid heart rate, increased blood pressure, and rapid respirations. Other physical changes include red eyes, dry mouth and increased appetite or "the munchies." One of the main problems is slowed reaction. Because marijuana impairs judgment and motor coordination and slows reaction time, an intoxicated person has an increased chance of being involved in and being responsible for an accident.

The dangers of smoking marijuana are summarized as follows:

- Impaired perception
- Diminished short-term memory
- Loss of concentration and coordination
- Impaired judgment
- Increased risk of accidents
- Loss of motivation
- Diminished inhibitions
- Increased heart rate
- Anxiety, panic attacks, and paranoia
- Hallucinations
- Damage to the respiratory, reproductive, and immune systems
- Increased risk of cancer

**Secondhand smoke:** Exposure to marijuana, including exposure to second-hand marijuana smoke, during pregnancy has been shown to increase the risk of stillbirth (Varner M. *Ob Gyn* 2014;123(1);113-125). The study documented that blood THC levels even below the 3 ng/ml threshold of "intoxication" is detrimental to the unborn child. Blood levels of THC above 3.5ng/ml have been repeatedly documented in people exposed to second-hand marijuana smoke for at least 3 hours. (Rohrich J. *J Anal Toxicol* 2010;34(4):196-203)

**Emotional health:** According to the National Institute on Drug Abuse, the main effects of marijuana on mood include euphoria, calmness, anxiety, and/or paranoia. Other short-term psychological effects include a distorted sense of time, magical or "random" thinking, short-term memory loss, and depression. These psychological problems generally ease after a few hours but residual effects can last for days.

**Seizures:** In most users, THC is a pro-seizure drug inducing new onset of seizures. However, this is a very controversial issue and the results of scientific studies are mixed: some report that smoking marijuana may precipitate seizures while others report that marijuana suppresses seizures. There may not be a clear answer to this question because of the variability of the contents and concentration of psychoactive substances in marijuana and the psychological differences between people.

**Red-eye and vision problems:** The eye tissues contain cannabinoid receptors and exposure to cannabinoids induces corneal vasodilatation resulting in "red eye". Cannabinoid exposure also has short-term and long-term effects on visual acuity and causes alterations in color discrimination and an increase in sensitivity to light. (Kiplinger et al. *Clin Pharm & Therapeutics* 1971;12:650-657). Long term-marijuana users, even after abstaining for as long as 10 years, tend to have an increase in sensitivity to light and a decrease in dark adaptation, color matching and visual acuity. (Dawson et al. *Invest Ophthalmol Vis Sci* 1977;16:689-699)

**Stillbirths:** Exposure to marijuana, including exposure to second-hand marijuana smoke, during pregnancy has been shown to increase the risk of stillbirth (Varner M. *Ob Gyn* 2014;123(1);113-125). The study documented that blood THC levels even below the 3 ng/ml threshold of "intoxication" is detrimental to the unborn child. Blood levels of THC above 3.5ng/ml have been repeatedly documented in people exposed to second-hand marijuana smoke for at least 3 hours. (Rohrich J. *J Anal Toxicol* 2010;34(4):196-203)

### Long-term health consequences of using marijuana

**Dental health:** Using marijuana is associated with the development of periodontal dental disease. This effect occurs in people who smoke marijuana; ingest marijuana, and who only use the drug occasionally. The periodontal effects are related to the negative systemic effects of cannabis on the immune system. (Ashton CH. *Br J Psychiatry* 2001;178:101-106) High frequency users have more severe periodontal disease causing inflammation of the gums leading to loosening of

the teeth from the gums and underlying bone resulting in early loss of teeth. (Thompson et al. JAMA, 2008;299(5):525-531) Cannabis use has also been linked to several other oral and dental problems including fiery-red gingivitis, gingival overgrowth, inflammation of the uvula and benign and cancerous oral tumors.

**Cardiovascular events:** There have been an increased number of reports of cardiovascular complications in young people. There are multiple case reports of atrial fibrillation in children and adults following exposure to cannabis (Singh et al. Pediatrics 2014;133(2):e443-446, Korantzopoulos et al, Am J Card 2014;113(6):1085-1086). In addition, cannabis use is associated with cardiovascular complications. A recent report from France, where reactions to substance abuse must be reported, revealed that from 2006-2010 1.8% of all cannabis-related sequella were cardiovascular, including acute coronary syndromes, peripheral arteriopathies (Buerger-like diseases {thromboangiitis obliterans}) and cerebral complications (Jouanjus et al, J Am Heart Assoc. 2014;3:e000638).

**Emphysema and spontaneous pneumothorax:** The known consequences of chronic marijuana smoking include chronic cough, sputum production, wheezing and high frequency of acute bronchitis (Taylor et al, Addiction 2000;95:1669-1677). Spontaneous pneumothorax has also been reported to be the presenting symptom of bullous emphysema in otherwise healthy asymptomatic young adults who chronically smoke marijuana but not tobacco. The bullae appear at the apex of the lung with no signs of emphysema of the entire lung. Chronic marijuana use should now be included in the differential diagnosis of pneumothorax (Beshay M et al, European Journal of Cardio-Thoracic Surgery, 2007; 32:834-838).

**Hyperemesis syndrome:** The cannabinoid hyperemesis syndrome may occur following frequent use of marijuana for several months or years. Essential clinical criteria for the diagnosis include 1) history of regular cannabis use, 2) severe nausea, 3) vomiting that recurs in a cyclic pattern over months and 4) resolution of symptoms after stopping cannabis use. Supporting features for the diagnosis include (1) compulsive hot baths with symptom relief, (2) colicky abdominal pain, and (3) no evidence of gall bladder or pancreatic inflammation. (Simonetto, DA et al. Mayo Clinic Proceedings 2012;87(2):114-9).

**Risks to family, job, and safety as a result of using marijuana:**Inadvertent exposure to THC either through exposure to second hand smoke, accidental ingestion of marijuana-edibles or contact with marijuana buds during the drying process may pose a significant health threat to innocent by-standers. As noted, exposure to second hand smoke results in increased blood levels of THC with all the consequences of inhaling or ingesting marijuana. There are numerous reports in the medical literature about accidental childhood THC poisoning resulting in hospitalization, including the necessity of ICU care. (Wang, GS. JAMA Pediatr 2013; 167(7):630-633 and Molly C. Arch Pediatr. 2012; 19(7):729-732). Family members and friends, especially children, who have a history of asthma, are prone to severe asthma attacks following exposure to marijuana smoke by either inhalation or contact with contaminated clothing. THC in marijuana buds is volatile (forms a gas) and exposure to buds during the drying process can result in increased blood levels of marijuana. (Ross SA. J Nat Prod 1996; 59(1):49-51)

Marijuana may be detected in the urine for at least 30 days after using marijuana or after exposure to second-hand smoke. The more often someone smokes, the longer THC stays in one's system. The THC detected in urine for employment testing is for the metabolite of THC, known as THC-COOH and is non-active. There is an allowable amount of 50 nanograms of the THC metabolite before someone has failed the drug test. Employers have the right to perform random drug tests on employees. Positive tests may cause a person to be unemployable.

The National Highway Traffic Safety Administration ([www.NHTSA.gov](http://www.NHTSA.gov)) has extensively studied the effects of marijuana on driving. Marijuana impairs driving for up to 3 hours after use and results in:

- Decreased car handling performance
- Increased reaction times
- Impaired time and distance estimation
- Motor in-coordination
- Decrease vigilance

**Mental health disorders- chronic depression and schizophrenia:**Short-term psychological effects include a distorted sense of time, magical or "random" thinking, short-term memory loss, and depression. These psychological problems generally ease after a few hours but residual effects can last for days. There is a significant and consistent relationship between marijuana use and the development of schizophrenia and chronic depression. The results of scientific studies showing an association between marijuana use and these mental disorders are alarming. A prevalence rate of persistent depression as high as 40% in chronic marijuana smokers has been reported (Brook JS. Psychol Rep 2011; 108(2):339-357). A 2004 article in the British Journal of Psychiatry reviewed 4 large studies, all of which showed a significant and consistent association between consumption of marijuana, mostly during teenage years or early 20s, and the later development of schizophrenia. The review concluded that marijuana is a "causal component" in the development of schizophrenia and other psychotic disorders. (Caspri et al., Biol Psychiatry, May 2005.) The mechanism of action is not clear but some studies implicate sudden depletion of dopamine or alterations in the dopamine receptor. (Strejilevich SA et al. Med Hypotheses 2012;78(1):107-112) In addition, a number of well-designed scientific studies have shown an association between chronic marijuana use and increased rates of chronic depression and schizophrenia in people with abnormalities of the COMT gene. Variations in the COMT gene are present in 1:4000 live births (Zammit et al. Br J Psychiatry 2011; 199(5):380-385).

**Learning problems and school performance/job performance:** Early initiation and continued use of marijuana affects memory, attention and ability to think clearly, making it difficult to concentrate, learn new things, and make sound decisions (Dougherty DM et al, *Psychopharmacology* 2013;226(2):307-319). As a result, school performance is impaired, increasing number of absences and increasing the risk of dropping out of school. In Washington State, the Healthy Youth Survey results for 2012 found that high school students who used marijuana were more likely to get lower grades in school (Cs, Ds, or Fs) compared to those that do not use. While it is difficult to distinguish whether this is due to learning difficulties, lack of motivation, or because marijuana users mix with peers who may be involved in a range of risk taking behaviors, using marijuana at an early age is independently associated with learning problems. (Crean RD et al. *J Addict Med.* 2011;5(1):1-8).

**Loss of IQ:** Recent reports show that fewer teens and young adults believe that cannabis is harmful to health. Concomitantly they are beginning to use cannabis at a younger age and more frequently (daily cannabis). In view of this change in behavior a long-term epidemiological study was performed using data collected on over 1000 participants over a 38 year period. The results revealed that users had more cognitive problems and a decline in IQ over the study period (average 8 points). The problems were more severe in users who started marijuana during adolescence and in more persistent users. (Meier M. *Proc Natl Acad Sci USA* 2012;109(40):E2657-2664). Other studies have confirmed that teens who are chronic marijuana users have reduced problem solving skills and exhibit "cognitive inflexibility." (Egerton A et al. *Neuropsychopharmacology* 2005;30(10):1895-18905).

**Memory loss and changes in brain structure:** Persistence use of cannabis in adolescents is associated with defects in both acute and long term memory. Researchers have suggested that these defects are related to changes in synaptic function within the cortico-basalganglio-thalamic circuits that play an important role in memory. This circuitry includes the striatum, globus pallidus and thalamus (S-GP-T). These areas contain a dense population of CB1 receptors. A recent controlled study of patients with poor memory function, who were part of a larger cross-sectional neurobiological study of schizophrenia, and who persistently smoked marijuana underwent MRI brain surface mapping. This unique study compared findings in 4 groups of patients with poor memory function documented by neuropsychological testing: the groups included 2 populations, one with schizophrenia and one without schizophrenia. The groups were subsequently divided into 2 subsets, those who were addicted to smoking marijuana (but did not use marijuana for the preceding 6 months), and those who never used marijuana. It is known that patients with schizophrenia exhibit structural changes in the S-GP-T. These same changes were present in study patients who did not have schizophrenia but chronically smoked marijuana and were most severe in schizophrenic patients who smoked marijuana (Smith MJ et al., *Schizophrenia Bulletin* 2014;40:287-299).

**Withdrawal:** THC is a fat-soluble drug and therefore stays in the body fat much longer than other drugs. Withdrawal symptoms include anxiety, tremor, aches and pains, sleep problems and craving of the drug. Restlessness, irritability, and insomnia can occur in heavy users.

### Effects of prenatal exposure to marijuana on infants and children

**Acute effects:** Exposure to marijuana, including exposure to second-hand marijuana smoke, during pregnancy has been shown to increase the risk of stillbirth 2-fold. (Varner M. *Ob Gyn* 2014;123(1):113-125). The study documented that blood THC levels even below the 3 ng/ml threshold of "intoxication" are detrimental to the unborn child. Blood levels of THC above 3.5ng/ml have been repeatedly documented in people exposed to second-hand marijuana smoke for at least 3 hours. (Rohrich J. *J Anal Toxicol* 2010; 34(4):196-203).

**Long-term effects of prenatal exposure on infants and children:** Prenatal exposure to marijuana has been associated with numerous problems in the infant. Infants may have a "high pitched cry" of the type potentially associated with developmental delay. Some research suggests that infants may also have a T-cell immune defect. The developing fetal endocannabinoid system is vulnerable to maternal marijuana. A recent scientific study links fetal exposure to an increased risk for aggressive behavior and attention problems as early as 18 months of age. (Marroun EL. *Drug Alcohol Depend* 2011; 118(2-3):470-474). The relationship between prenatal marijuana exposure and long-term school achievement has also been examined. As a group prenatally exposed children performed below non-exposed peers on standard intelligence tests at age 6 years, showed attention problems and depression at age 10 years and performed poorly on standardized tests to measure reading, spelling, and mathematics reasoning at age 14 years. (Goldschmidt L. *Neurotoxicol Teratol* 2012; 34(1):161-167)

**Natal Exposure/Breast Feeding:** Current evidence indicates that cannabis use during breastfeeding adversely affects the infants' neurodevelopment and impacts neuropsychiatric, behavioral, and executive functioning. The effects on learning and behavior may influence future adult productivity and outcome. Women using cannabis during lactation should be advised about what is known and encouraged to stop using. (Jaques et al, *J. Perinatol* 2014, doi 10.1038/jp.2013.180)

**Accidental intoxication in infants and children:** Infants and children may be accidentally exposed to THC through exposure to second hand smoke, volatilization of THC during drying of the marijuana plant (buds) or ingestion of marijuana edibles. In February 2013, the National Institute on Drug Abuse published statistics confirming an increase in marijuana use among teens which is now at a 5 year high. More worrisome is the report by Wang and colleagues in July 2013. Medical toxicologist George Wang and his colleagues at the Rocky Mountain Poison and Drug Center in Denver published a study about pediatric marijuana poisonings. "We are seeing increases in exposure to marijuana in young pediatric patients, and they have more severe symptoms than we typically associate with marijuana," Wang said "We hadn't seen these exposures before the big boom of the medical marijuana industry." At children's hospital there were a total of 1378 patients younger than 12 years evaluated for unintentional ingestions during the retrospective study group

from January 2005 to the end of 2011. Of those cases, there were 0 of 790 cases due to ingestion of marijuana prior to the law's change and 14 of 588 cases after the law changed on Sept. 30, 2009. (Wang et al, JAMA Pediatrics. 2013;167(7):630-633).