

# Medical Implications of Marijuana and Cannabis-Derived Products

Arjavon Talebzadeh\*

California Northstate University School of Medicine, 246 F Street, Chula Vista, CA 91910, USA

\*Corresponding author: Arjavon Talebzadeh, California Northstate University School of Medicine, 246 F Street, Chula Vista, CA 91910, USA, Tel: (619) 420-3311

## ABSTRACT

This study was conducted to better understand the medical implications of marijuana and the biochemical basis of its effects on psychiatric health.  $\Delta$ 9-tetrahydrocannabinol (THC) is a cannabinoid in marijuana with structure similar to neurotransmitter anandamide, allowing THC to bind to cannabinoid receptors on regions of the nervous system associated with memory formation, coordination, and attention focus. THC and CBD in marijuana are observed to have implications for treatment in cancer patients for moderate pain relief, narcoleptic seizures, and possibly inhibition of cancer cell activity. Regulation of marijuana should be considered due to its great potential for misuse. This study will review will reflect upon the biochemical properties of marijuana and other products derived from Cannabis and methods of marijuana ingestion for both recreational and medical purposes. It will further elaborate upon the implications of Cannabis in medical use, side effects, social risks and the holistic overview of the basic properties of Cannabis and other implications.

## Keywords

Cannabis  
Marijuana  
Treatment  
THC  
CBD  
Receptors  
Pulmonary effects  
Cannabidiol

## INTRODUCTION

Cannabis is currently listed by the Drug Enforcement Administration (DEA) as a Schedule I drug, a label that is generally attributed to drugs with negative effects and no benefits [1]. Two of three known species in the genus Cannabis yield flowering plants with physical and chemical properties associated with marijuana [2]. Marijuana and other Cannabis-based products contain  $\Delta$ 9-tetrahydrocannabinol (THC), a cannabinoid associated with the psychoactive properties of marijuana, and cannabidiol (CBD), a potential agent to inhibit cancer growth. Controversy is drawn on the basis of two arguments about the value of marijuana and the rights of its users respectively. Under implementation of the Controlled Substances Act of 1970, the U.S. federal government has placed restrictions on the use of Cannabis for recreational and medical purposes while states have ratified laws to legalize marijuana use within their own jurisdiction [3]. Thirty-seven states and the District of Columbia have legalized marijuana for medical use and some also allow recreational use [4]. This study specifically seeks to weigh the benefits and risks of marijuana ingestion with respect to physical and mental health

and whether substances derived from the Cannabis plant have significant implications for medical treatment.

## LITERATURE REVIEW

Marijuana is a product derived from dried leaves, flowers, stems and seeds of the Cannabis sativa or Cannabis indica plant [5]. Marijuana and other Cannabis-derived products contain  $\Delta$ 9-tetrahydrocannabinol (THC), cannabidiol (CBD), and at least one hundred other cannabinoids that have been discovered in Cannabis [6]. THC is primarily responsible for the psychoactive effects, feelings of relaxation, and appetite stimulation associated with marijuana consumption [7]. CBD is reported to have anxiolytic, anti-depressant, and anti-convulsant effects and to counteract pro-psychoactive effects of THC.

The delta-9-tetrahydrocannabinol (THC) in marijuana has a chemical structure similar to the neurotransmitter anandamide, an endogenous cannabinoid. This quality of THC allows it to bind to cannabinoid receptor proteins like CB1, a G protein-coupled receptor responsible for initiating a signal transduction pathway for hyperpolarization of neurons. CB1 and other nerve

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receptors with affinities for cannabinoid ligands are present in all subsections of both the central nervous system (CNS) and peripheral nervous system (PNS). CB1 receptors are especially in high concentration on neurons of the hippocampus, a region of the brain associated with formation of new memories; the orbitofrontal cortex, a brain region attributed to the shifting of attention focus [8]. Binding of THC and other cannabinoids in marijuana to CB1 and other cannabinoid receptors at the hippocampus has thus been attributed to interruption of memory formation, learning, and the ability to perform complex tasks [9]. Other sections with significant CB1 density include the cerebellum and the basal ganglia, sections of the brain attributed to balance, coordination, and reaction time, so binding of THC to receptors on such sites can trigger initiate cell responses that prompt impairment of one's ability to drive safely, play sports, and other activities that require attention and motion.

Marijuana and other cannabinoid products can be ingested or absorbed into the body in many different forms. Marijuana can be smoked both recreationally and medically using cigarettes, pipes, or vaporizers [10]. Vaporizers are used to inhale extracted ingredients from marijuana without the negative effects associated with inhaling tar in marijuana smoke [11]. People may also recreationally consume marijuana mixed into foods, like brownies and other home-made or commercially available foods [12]. Bioavailability of chemicals in marijuana occurs more slowly when ingested by eating. After inhalation of marijuana smoke or vapor, maximum THC concentration in the brain is reached after about fifteen minutes [13]. By contrast, ingestion of marijuana requires about thirty minutes to two hours to reach maximum THC levels and generally absorbs a greater percentage of the original THC dose relative to inhalation methods. Because it takes longer to feel marijuana-associated sensations when ingested, there have been hospitalized cases of marijuana over consumption due to the slower, more efficient absorption into the bloodstream [14]. Some cannabinoid-based drugs available in the United States include Dronabinol, which is used to treat both AIDS-related anorexia and cancer chemotherapy-associated nausea and vomiting [15] and Nabilon, a synthesized cannabinoid similar to THC also used for treatment for chemotherapy-related nausea and vomiting [16].

## DISCUSSION

Application of marijuana for medical use requires an understanding of its effects on both physiological and mental health. Among healthcare practitioners, there has been interest in use of cannabinoid-based treatments for cancer nausea and vomiting associated with cancer chemotherapy, palliative care-

associated chronic pain relief, post-traumatic stress disorder, and AIDS-associated anorexia. Cannabis-based treatments can be tailored to contain different concentrations of delta-9-tetrahydrocannabinol (THC) and cannabidiol (CBD). Primary clinical effects of THC include euphoria, stimulation of appetite, and relaxation. Although the mechanism is not currently understood, CBD and THC have been observed to be an effective treatment for reducing seizures in epileptic patients. Both CBD and THC are also recognized for pain-relieving effects. THC and CBD may act as ligands to cannabinoid receptors on nociceptive (pain sensory) neurons that activate production of GABA [17], a neurotransmitter that can inhibit action potentials like those of sensory impulses. Such cannabinoids may thus be used as alternative treatment to weaker opioids used for moderate pain relief [18]. Coadministration of THC and CBD with radiation therapy has been observed to induce increased autophagy and apoptosis of cancer cells [19]. CBD by itself has also been observed to reduce proliferation and promote apoptosis in cancer models [20].

In addition to its applications for treatment, it is important to consider the side effects for the ingestion of any pharmaceutical agent, because such a chemical will be exposed to receptors of cells all across the body as it travels through the circulatory and lymphatic systems. Any significant affinity a pharmaceutical agent has for a surface protein (or an intracellular component if it is fat soluble) may induce significant effects in addition to any desired pharmaceutical effects. Primary regions of concern for medical and recreational use marijuana include its impacts on cognitive, psychiatric, cardiovascular, and respiratory health. Marijuana has been observed to have dose-dependent, short-term effects on such neuropsychological functions as attention, concentration, and associative learning [21]. Patients with history of mental illnesses are advised to avoid long-term use of marijuana, because the contents of Cannabis may exacerbate psychoactive symptoms of schizophrenia [22] and induce temporary hallucinations and paranoia [23]. Patients with cardiovascular issues and elders are also advised to abstain from marijuana intake due to its effects on heart rate. Marijuana ingestion has been observed to increase activity of the sympathetic nervous system and simultaneous lower parasympathetic nervous system, which induces tachycardia and vasodilation [24]. The effects of such greater heart activity includes an increased risk of a heart attack. Pulmonary effects of marijuana smoke inhalation are analogous to those of tobacco smoke [25]. Marijuana smoke induces loss of cilia on superficial bronchial epithelium and impaired function of alveolar macrophages. The loss of such cilia should lessen the function of the lower respiratory tract to remove substances,

which relies on the coordination of cilia to move mucus that traps substances out of trachea and hopefully into dorsal oral cavity. Impaired function of alveolar macrophages simply decreases resistance to pathogenic agents. It also should be noted that marijuana smoke has not been associated with an increased risk of cancer [26].

Regardless of the legal status of marijuana and other Cannabis-derived products within a jurisdiction, it is important to recognize that these substances can get into the hands of people they are not intended for. Hsiao, et al. [27] argues that “marijuana legalization is incompatible with individual liberty,” because marijuana is a substance that impairs cohesive thought and thus the appropriate conditions for preservation of liberty. A collection of 56 neuroimaging studies was observed to find consistent evidence of decreased volume of the hippocampus, the region of the brain responsible for brain development, and less hippocampal gray matter density among regular marijuana users relative to control groups. It is also reported that there has been a rise in emergency cases regarding use of marijuana edibles, because uninformed individuals--especially underage youth--are unaware of the greater efficiency and longer delay in effects associated with marijuana edibles when compared to marijuana smoke or vapor inhalation. Fortunately, there are currently no reports of teenagers and adults who have died solely from marijuana overconsumption, suggesting that marijuana does not contain significant concentrations of lethal toxins. There is concern that among recipients of medical marijuana who claim to need it for pain relief that there is faking or exaggeration of pain [28], because the majority of medical marijuana users are young males ages 18 to 25, the same demographic attributed to general use of marijuana, while the majority of those in chronic pain are elderly females. This suggests that medical prescription of marijuana should be carefully administered and that physicians should be weary of whether administration is an appropriate course of action.

## CONCLUSION

The benefits, the harmful effects, improper use, and the medical implications should each be considered when discussing the use of marijuana in medicine. THC is a substance that mimics a cannabinoid neurotransmitter to induce many symptoms characteristic of marijuana ingestion. For medical purposes, THC and CBD are chemical species that give marijuana candidacy for use in treatment of moderate pain relief and chemotherapy associated nausea and vomiting in cancer patients. Despite its potential benefits for cancer patients, there are significant side effects with implications for psychiatric, cardiovascular, and pulmonary health. After considering the

possibility of misuse, medical administration of marijuana should consider avoiding use of marijuana as a primary option for treatment. Despite the fear of such issues, further research into the effects of CBD on cancer cells and the mechanisms that allow marijuana to inhibit narcoleptic seizures would be insightful for potential use of marijuana in oncological treatment.

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