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CANNABIS SATIVA: THE DIFFERENCE BETWEEN Δ8-THC AND Δ9-TETRAHYDROCANNABINOL (THC)

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ABSTRACT

Cannabis (Cannabis sativa L.) is gaining popularity in the modern world through industrial, food, cosmetic, and medicinal uses. Although hemp can also be used for pharmaceutical purposes, it contains small amounts of Cannabinoids. Higher amounts of Cannabinoids can be produced in Cannabis varieties popularly known as "Medical Cannabis sativa (Marijuana or drug type). **Phytocannabinoids** are produced by the Cannabis sativa L. plant. They contain high levels of plant Cannabinoids, of which Cannabidiol (CBD) and Δ9-tetrahydrocannabinol are the most abundant and pharmaceutically most important. Δ8-tetrahydrocannabino (Δ8-THC) is an isomer or a chemical analog of Δ9-THC. Overall, the pharmacokinetics and pharmacodynamics of **Δ8-THC** and Δ9-THC are very similar. **Δ8-THC** is found naturally in Cannabis, though at substantially lower concentrations than Δ9-THC. Δ8-THC products may provide much of the experiential and therapeutic benefits of delta-9-THC with **lower risks** and **lesser adverse effects**. Further systematic research will be critical in verifying the favourable reports of Δ8-THC consumers.

Keywords: Ayuverda, Cannabis sativa, Desi Vijaya, Drug type, Himalayan hemp, India, Marijuana, Phytocannabinoids

INTRODUCTION

Cannabis belongs to the family Cannabaceae, and phytocannabinoids are produced by the Cannabis sativa L. plant (Figure-1) (1-25, 39). Cannabis sativa L. is a widespread species in nature (1-9). Cannabis sativa belongs to Cannabiaceae as a medicine was used before the Christian era in Asia**,** mainly in **India,** China, Bhutan, Nepal, Afghanistan, Pakistan and Persians (1-42). According to ***Ayuverda*** in India, the medicinal value of the Cannabis plants was well documented as **Vijaya** and often known as **Desi Vijaya** (1-20; 40-42). This was the first Indian written evidence to support the medicinal value of **Cannabis plants which was well documented in *Ayuverda*** in India (1-9; 40-42). The earliest written reference to Cannabis in India may occur in the ***Atharvaveda***, dating to about 2500 BCE (1-9). It is found in various habitats ranging from sea level to the temperate and alpine foothills of the **Indian Himalaya Region** from where it was probably spread over the last 10,000 years (1-10). Many of the historians believed that **Indian Himalayan Region** was the centre of origin of Cannabis sativa and Cannabis indica (6-9;40-42). Further Cannabis sativa L. is a wind-pollinated, dioecious herb (i.e., the male and female reproductive structures are on separate plants), although monoecious plants can occur in some populations (1-10). Additionally, the species C. sativa L. is a potential source of fiber, food, oil, and protein (1-10).

Cannabis is a genus of annual flowering plant and is often divided into 3 species—**Cannabis sativa, Cannabis indica,** and **Cannabis ruderalis**—but there is significant disagreement about this, and some consider them subspecies of the same parent species (1-30; 40-42).

The species C. sativa L. exhibits an astonishing diversity of morphological, physiological, and chemical characteristics, all of which could be attributed to the species great genetic diversity and adaptation to different growing conditions (39).

Cannabis sativa (**Figure-1**) is classified into two types one is called as Industrial Cannabis sativa (hemp or fiber type) refers to non- intoxicating, low Δ9-tetrahydrocannabinol (Δ9-THC) cultivars of Cannabis sativa (1-39). Industrial Cannabis sativa (hemp or fiber type) contains only 0.2 to 0.3% of THC (1-42). On other hand Medical Cannabis sativa (Marijuana or drug type) refers to cultivars with high levels (20-35%) of Δ9-THC, the primary psychoactive Cannabinoid found in the plant and a federally controlled substance used for both recreational and therapeutic purposes (1-25, 39). Although marijuana and hemp belong to the same genus and species, they differ in terms of chemical and genetic composition, production practices, product uses, and regulatory status (1-42).

Medical research on Cannabis has primarily focused on isolated Δ9-tetrahydrocannabinol (THC) and Cannabidiol (CBD). The chemical make up of each variant of Cannabis is influenced by environmental conditions (e.g., light, water, nutrients, soil, airflow, etc.) and the underlying genetic makeup. Since genotype does not change, genetic data is essential baseline information for understanding Cannabis diversity, consistency, and potential effects. The World Health Organization reports Cannabis as the most widely cultivated, trafficked and abused illicit drug, and it constitutes over half of worldwide drug seizures. Currently there are 700 Cannabis hybrids in the market known for high demand (1-35).

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Figure-1: The robust growth (10 to 15-feet height) of Industrial Cannabis sativa (Hemp)

Phytocannabinoids are bioactive natural products found in flowers, seeds, and fruits (1-38). However, Cannabis sativa plants are perceived as criminal and unacceptable to communities, as most consumers cannot differentiate between psychoactive and non-psychoactive cannabis plants (1-39). They can be beneficial for treating human diseases (such as **multiple sclerosis, neurodegenerative diseases, epilepsy,** and **pain**), the cellular metabolic process, and regulating biological function systems (1-30). In addition, several phytocannabinoids are used in various therapeutic and pharmaceutical applications. Cannabis has several varieties suitable for various purposes (1-39). Therefore, Cannabis sativa has been widely used in industrial, ornamental, nutritional, recreational, and pharmaceutical applications and herbal medicine (1-25, 39). Cannabinoids are predominantly insoluble in water but soluble in alcohol and other nonpolar solvents (1-25). According to the recent literature, over 200 phytocannabinoids have been identified in the cannabis plant (1-25, 39). Cannabis sativa L. subspecies are plants that contain a large variety of secondary metabolites, including phytocannabinoids, terpenoids, and flavonoids, which have profound anti-microbial activities, in addition to possessing anti-inflammatory, anti-oxidative, and neuromodulatory properties (1-39). They are classified into different subclasses according to their chemical structure. Cannabidiol (CBD), ∆9 -tetrahydrocannabinol (∆9-THC), Cannabigerol (CBG), ∆8-tetrahydrocannabinol (∆8 -THC), and Cannabinol (CBN) are the most studied (1-42).

The difference between Δ8-Tetrahydrocannabinol (THC) and Δ9-Tetrahydrocannabinol (THC)

The use of the intoxicating Cannabinoid, Δ8-tetrahydrocannabinol (Δ8-THC) has grown rapidly over the last several years (1-38). Overall, the pharmacokinetics and pharmacodynamics of **Δ8-THC** and **Δ9-THC** are very similar (1-20). Δ8-THC is a partial agonist of the cannabinoid CB1 receptor and has Cannabimimetic activity in both animals and humans (1-30). The reduced potency of Δ8-THC in clinical studies compared with Δ9-THC can be explained by weaker cannabinoid CB1 receptor affinity, although there are other plausible mechanisms that may contribute (1-39). Among hundreds of Cannabinoids, Δ8-tetrahydrocannabinol (Δ8-THC) has rapidly risen in popularity among consumers of cannabis products (1-35). **Δ8-THC** is an **isomer** or a **chemical analog of delta-9-THC**, the molecule that produces the experience of being high when ingesting cannabis. Δ8-THC differs in the molecular structure from Δ9-THC in the location of a double bond between carbon atoms 8 and 9 rather than carbon atoms 9 and 10 (1-30). Due to its altered structure, Δ8-THC has a lower affinity for the CB1 receptor and therefore, has a **lower psychotropic** potency than Δ9-THC (1-30).

Δ8-THC is found naturally in Cannabis, though at substantially lower concentrations than Δ9-THC (1-27). It can also be synthesized from other cannabinoids (1-25). Most of the Δ8-THC users experienced a lot or a great deal of relaxation (71%); euphoria (68%) and pain relief (55%); a moderate amount or a lot of cognitive distortions such as difficulty concentrating (81%), difficulties with short-term memory (80%), and alerted sense of time (74%); and did not experience anxiety (74%) or paranoia (83%) (1-35). Participants generally compared Δ8-THC favorably with both Δ9-THC and pharmaceutical drugs, with most participants reporting substitution for Δ9-THC (57%) and pharmaceutical drugs (59%) (1-30). Participant concerns regarding Δ8-THC were generally focused on continued legal access (1-30).

Δ8-THC (1-10) may provide much of the experiential benefits of Δ8-THC with **lesser adverse** effects (1-38). Future systematic research is needed to confirm participant reports, although these studies are hindered by the legal statuses of both Δ8-THC and Δ8-THC (1-35). Cross-sector collaborations among academics, government officials, and representatives from the Cannabis industry may accelerate the generation of knowledge regarding Δ8-THC and other Cannabinoids (1-35). A strength of this study is that it is the first large survey of Δ8-THC users, limitations include self-report data from a self-selected convenience sample (1-24).

In one of the study in 1973, Δ8-THC and Δ9-THC were administrated to six research participants (1-30). Despite the small sample size, researchers concluded that Δ8-THC was about two-thirds as potent as Δ9-THC and was qualitatively similar in experiential effects (1-20). In 1995, another researchers gave Δ8-THC to eight pediatric cancer patients two hours before each chemotherapy session (1-35). Over the course of 8 months, none of these patients vomited following their cancer treatment (1-35). The researchers concluded that Δ8-THC was a more stable compound than the more well studied Δ9-THC (1-25) consistent with other findings (1-38), and suggested that Δ8-THC could be a better candidate than Δ9-THC for new therapeutics (1-42).

Δ8-THC products may provide much of the experiential and therapeutic benefits of Δ9-THC with lower risks and lesser adverse effects (1-30). Substitution of Δ8-THC for Δ9-THC may be consistent with harm reduction, one of the core principles of Public Health (1-25). The current study provided a broad descriptive assessment of self-reported experiences with Δ8-THC (1-30). Further systematic research will be critical in verifying the favorable reports of Δ8-THC consumers (1-42).

CONCLUSION

The phytocannabinoid, Δ8-tetrahydrocannabinol (Δ8-THC) has rapidly risen in popularity among consumers of Cannabis products (1-35). **Δ8-THC** is an isomer or a chemical analog of Δ9-THC. Δ8-THC products may provide much of the experiential and therapeutic benefits of Δ9-THC with **lesser adverse effects**. Phytocannabinoids are bioactive natural products found in some flowering plants, Cannabis sativa, liverworts, and fungi that can be beneficial for the treatment of humans and animals and present

potent antibiotic effects. The most uses of phytocannabinoids are based on anti-inflammatory, neuroprotective, and anti-nociceptive activities. The most important phytocannabinoids possess therapeutic, antibacterial, and antimicrobial properties. Hence they are used in treating several human diseases, and these compounds can contribute to cold, heat, and UV radiation tolerance. The phytocannabinoids have versatile use and are beneficial for humans and plants if appropriately used. Hemp products, CBD, and THC, are the greatest wholesale potential markets and are highly attractive for their recreational and medicinal properties.

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