(REVIEW ARTICLE)

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Cannabis sativa: Difference between Medical Cannabis (Marijuana or drug type) and Industrial hemp

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Abstract

This paper reviewed the importance of *Cannabis sativa* and highlights difference between Medical Cannabis (Marijuana or drug type) and Industrial hemp. Cannabis has been used for thousands of years for recreational, medicinal, or religious purposes. Industrial hemp and marijuana share the same species, *Cannabis sativa* L, but represent different varieties. As such, there are genetic differences that lead to different chemical characteristics, which, in turn, lead to different uses. *Cannabis sativa* L., is classified into two types as Industrial *Cannabis sativa*, hemp or Medical *Cannabis sativa* L.(drug or marijuana) based on its Λ9-tetrahydrocannabinol (THC), content. Medical *Cannabis sativa* (drug or marijuana) contains very high levels of Λ9-tetrahydrocannabinol (THC) (above 0.3 to 38% of dry weight) and grown inside the greenhouse controlled conditions for the production of unfertilized female flowers. These female flowers accumulates the psychoactive molecule THC and used for health disorders. On the other hand Industrial *Cannabis sativa* L. (Hemp) contains very low levels of THC (0 to 0.3% of dry weight) grown outside in a large agriculture farms for the production of fibre, seeds and oil. Hemp is used as a functional food and medicine since it contains Cannabidol (CBD), and very low levels of THC.

Keywords: *Cannabis sativa*; Hemp; Λ9-tetrahydrocannabinol (THC); Marijuana or drug type

1. Introduction

Cannabis sativa L. belongs to the family *Cannabiaceae* was used as a medicine before the Christian era in Asia**,** mainly in India**,** China, Bhutan, Nepal, Afghanistan, Pakistan and Iran, and Persians [1-20]. Cannabis has been used for thousands of years for recreational, medicinal, or religious purposes [1-23]. Cannabis is also a wild noxious weed with notorious psychoactive principle (THC) found growing in all the parts of India. Cannabis has a long history in India, recorded in legends and religion [1-20]. It was 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 [1-20]. Many historians believed that Indian Himalayan Region was the centre of origin of *Cannabis sativa* L. and *Cannabis indica* L. [1-23].

The *Cannabis sativa* plant contains 560 chemicals, of which 204 are known as cannabinoids [1-21]. The most studied Cannabinoids are Λ9-tetrahydrocannabinol (THC), which produces the majority of its psychopharmacological and other effects through two Cannabinoid receptors, CB1 (localized mainly in the brain) and CB2 (localized mainly in the periphery), and Cannabidiol (CBD), a non-psychoactive cannabinoid [1-22]. The endogenous Cannabinoids, known as the Endocannabinoid system (ECS), consist of the endogenous lipid ligands N-arachidonoylethanolamine (anandamide; AEA) and 2-arachidonylglycerol (2-AG), their biosynthetic and degradative enzymes, and the CB1 and CB2 receptors

that they activate [1-20]. Many inflammatory conditions are associated with dysfunction of the immune system. Cannabis has been used for centuries as a medicine in the treatment of a variety of inflammatory disorders including rheumatic arthritis (RA), gastrointestinal (GI) diseases such as Crohn's disease (CD) and inflammatory bowel disease (IBD), and other GI problems such as anorexia, emesis, abdominal pain, diarrhea, and diabetic gastroparesis (1-19). However, it is also evident that cannabis or its constituents, including Λ9-tetrahydrocannabinol (THC) and Cannabidiol (CBD), have some beneficial effects such as improving appetite and food intake in patients with HIV/AIDS and positive effects in patients with hepatic steatosis [1-22].

Today Cannabis continues to be the most used drug in the world. Research showed that cannabis use is associated with a wide range of adverse health consequences that may involve almost every physiological and biochemical system including respiratory/pulmonary complications such as chronic cough and emphysema, impairment of immune function, and increased risk of acquiring or transmitting viral infections such as HIV, HCV, and others [1-20]. Both Medical Cannabis (Marijuana or drug type) and Industrial *Cannabis sativa* hemp is used for controlling numerous diseases, such as chronic pain, asthma, rheumatoid arthritis (RA), wound healing, constipation, multiple sclerosis (MS), cancer, inflammation, glaucome, neurodegenerative disorders (Epilepsy-seizure disorder, Alzheimer's disease, Parkinson's disease, dengue viral disease, Huntington's disease, Tourette's syndrome, Dystonia, Lennox-Gastaut Syndrome (LGS) and Dravet Syndrome (DS), Obesity, weight loss, anorexia, and emesis, osteoporosis, schizophrenia, cardiovascular disorders, sleep disorders, Traumitic brain injury (TBI), Post traumetic stress injury, drug addiction (Marijuana), AIDS Wasting syndrome, Amyotrophic lateral sclerosis (ALS), depression and anxiety, diabetes, migraine (headache disorder), Covid-19 (SARS-CoV-2), Leishmaniasis (Kala‑Azar), and metabolic syndromerelated disorders, to name just a few, are being treated or have the potential to be treated by Cannabinoid agonists/ antagonists/ cannabinoid-related compounds [1-21]. However, Cannabis use is associated with a wide range of adverse economic, social, psychosocial and health consequences. The psychosocial consequences of marijuana use—such as dropping out of school, poor school performance, and antisocial and other behaviours among youth—have been the subjects of many reviews/publications [1-23].

2. Difference between Marijuana and Hemp

Cannabis sativa L., is classified into two types as Industrial *Cannabis sativa*, hemp or Medical *Cannabis sativa* L.(drug or marijuana) based on its Λ9-tetrahydrocannabinol (THC) content [1-23]. Medical *Cannabis sativa* (drug or marijuana) contains very high levels of THC (above 0.3 to 38% of dry weight) and grown inside the greenhouse controlled conditions for the production of unfertilized female flowers [1-21]. On the other hand Industrial *Cannabis sativa* L. (Hemp) contains very low levels of Λ9-tetrahydrocannabinol (THC) (0 to 0.3% of dry weight) grown outside in a large agriculture farms for the production of fibre, seeds and oil [1-21]. Therefore, Industrial hemp differs from marijuana in the level of Λ9-tetrahydrocannabinol (THC) present in the plant [1-21]. Λ9-tetrahydrocannabinol (THC) is the chemical most responsible for the psychoactive properties in marijuana. Industrial hemp has traditionally been defined as having less than 0.3 percent THC, although in some U.S. states it is now defined as having no more than 0.5 % percent THC [1-21]. They have also established a maximum standard of 10 parts per million (ppm) for THC residue in hemp products, including grain, flour, and oil (Agriculture and Agri-Food Canada 2013) [1-21]. However, due to the presence of psychoactive molecules, Λ9-tetrahydrocannabinol (Λ9-THC) and Λ8-tetrahydrocannabinol (Λ8-THC), Cannabis cultivation and its use is restricted/regulated in many countries [1-21]. The official discovery of Δ9-tetrahydrocannabinol (THC) is commonly attributed to Dr. Raphael Mechoulam affectionately referred to as the Godfather of Cannabis Science [1-21]. Δ9-tetrahydrocannabinol (THC) was discovered in 1964 by Dr. Raphael Mechoulam and his colleagues at Israel's Weizmann Institute of Science [1-21]. The credit of the discovery of Cannabidiol (CBD) in 1963 and Δ9-tetrahydrocannabinol (THC) in 1964 isolated from *Cannabis sativa* attributed to Dr. Raphael Mechoulam and his team [1-23]. Another important fact is that industrial hemp production can, at least in some instances, compete with some existing cropping systems on a profitability basis. 1) hemp production can provide environmental and agronomic benefits when incorporated into some existing cropping systems. 2) hemp can compete with many current inputs in industrial production, at least at current prices. Thus, even in United states that do not allow marijuana consumption and production, it is unlikely that commercial hemp production would be confused for marijuana, or vice versa[1-21]. While the plants look similar if not managed, it is different parts of the plants that have value to industrial users as opposed to recreational users[1-23]. Thus, they would not look similar when being cultivated for their specific end uses. It has been estimated that, globally, hemp and hemp by-products can be found in more than 25,000 products that span nine sub-markets: agriculture, textiles, automotive, furniture, food, personal care, construction, paper, and even recycling [1-23].

Industrial hemp and marijuana share the same species, *Cannabis sativa* L, but represent different varieties [1-21]. As such, there are genetic differences that lead to different chemical characteristics, which, in turn, lead to different uses [1-21]. Industrial hemp is grown outside in a large agriculture land for the stalk and seeds, and maximizing yields results

in tall plants with few leaves [1-21]. Marijuana, on the other hand, is grown under controlled conditions in a green house conditions for its leaves and female unfertilized flower known for the parts of the plant with the largest concentrations of THC [1-21]. As a result, Cannabis grown for its psychoactive properties is generally managed to control height and increase bushiness: that is, encouraging many leaves and branches, thus leading to more flowers and buds [1-21]. Cannabis varieties also vary by planting density: marijuana plants are spaced to allow bushiness while industrial hemp plants are planted much closer together to discourage branching and flowering [1-21]. Harvest timing and strategies also vary by variety, again allowing for detection of intended use [1-21]. Thus, even in United states where marijuana is not legal, industrial hemp may be distinguishable from Cannabis grown for marijuana, based on visual appearance [1-21].

According to the one of the business study report, the primary supplier of hemp fiber to the U.S. is China (as is the case for both Canada and the U.K.), but other supplies are also imported from Western Europe, Romania, Hungary, and India [1-21]. The largest hemp seed and oil cake supplier is Canada, and the total value of Canadian imports has grown significantly in recent years [1-21]. As noted earlier, Canada itself is a net importer of hemp fibre, and thus not a major source of fiber for U.S. industries. Because hemp grown for fibre requires fewer chemical inputs than most other fibre crops [1-21]. It has been reported that a lower life cycle impact than other fibre crops such as cotton, and this results in a net environmental benefit [1-23].

When grown for fiber, hemp is seeded at very high densities. Some of the studies recommends seeding at 60 lbs/acre for an eventual plant density of 30 to 35 plants per square foot [1-21]. Because of the planting density and rapid growth, hemp quickly crowds out competing weeds, resulting in little to no herbicide use during the growth phase [1-21]. This potential benefit does dissipate, however, when one manages for seed production because both input and management requirements increase [1-21]. When grown for seed, it was recommend that seeding rates in the range of 20–30 lbs/acre, with an eventual plant density of 10 to 12 plants per square foot, which allows more opportunity for weed pressure [1-21].

Hemp seed production compares more favourably than fibre. Hemp seed on the most productive land would exceed returns from corn/soybeans with corn prices at $5 per bushel or less, soybean prices at $11.25 per bushel or less, and hemp seed prices at $0.80 cents per pound [1-21]. This assumes a corn yield of 175 bushels per acre and a hemp seed yield of 1000 pounds per acre [1-21]. Some of the studies estimated the expected hemp seed yield on ground expected to generate 175 bushels of corn per acre would be 1050 pounds [1-21].

Hemp seed (*Cannabis sativa* L.) contain large amounts of nutrients, e.g. protein, dietary fibre, minerals, and unsaturated fatty acids, which make them a good fortifying component in food production [1-21]. Hemp seeds are a rich source of nutrients. They contain about 35% oil, 25% of protein, 28% of total dietary fiber (TDF) an 5.6% of minerals [1-21]. Hemp protein consists mainly of a storage protein edestin (11S globulin), which accounts for 60–80% of the total protein in this raw material [1-21]. Albumin (2S) constitutes the rest of the protein fraction. Hemp seed protein is highly digestible, ranging from 84–86% for whole seeds to 83–92% for seed meal [1-21]. The main use of hemp seed processing is oil production [1-21]. Oil from hemp seeds can be a very valuable component of the diet due to its high content of unsaturated fatty acids and an appropriate omega-6 to omega-3 ratio (3:1) [1-21]. A by-product of hemp oil production, i.e. hemp oil cake, due to high content of protein (33.5%), dietary fibre (42.6%) and minerals (7.2%) can also be used to improve the nutritional value of foods [1-21]. Hemp cake is usually grounded, which makes it a highly versatile raw material used, among others, in the cereal industry [1-21].

Biodiesel markets are more fully developed, and if hemp is grown for seed, the seed can be crushed and the oil used as an input to the biodiesel process [1-21, 22, -23]. In this case, it would be competing with canola oil and soybean oil [1-23]. Some of the studies reported that hemp produced for seed would be competitive with a corn/soybean rotation if produced on more productive lands. Biodiesel is also produced from waste oils and greases in the U.S., but the supply of these feedstock's is somewhat limited and will not be able to expand if the biodiesel industry continues to grow [1-23].

3. Conclusion

Cannabis sativa is also known as one plant with two different names, Medical Cannabis (Marijuana or drug type) and Industrial hemp. The use of Cannabis has been associated with several psychological, behavioural, and social problems due to the presence of psychoactive molecule, Δ9-tetrahydrocannabinol (THC). In general, the acute toxicity of Cannabinoids is considered to be low. Industrial hemp is commercially used for fibre, hempcrete, hemp plastic, replacing cotton as a fabric material. Hemp seeds and oil is used as functional food and medicine too. On the other hand, Medical Cannabis (Marijuana or drug type) is mainly used as medicine for many human health disorders.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

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