Medicinal use of cannabis

Introduction

Earlier in 2015, the Obama administration reduced prohibiting restrictions on cannabis research. These new laws will help researchers study the drug's medicinal uses and improve their understanding of how it impacts the body. (Welsh & Loria, 2014) This news came at a crucial time in the United States of America (US), where more states are exploring the possibility of legalizing the access to medical marijuana. (The Economist, 2016) For decades, researchers have been trying to determine which diseases, symptoms, and conditions could benefit from the use of cannabis and its related products. While more studies would be beneficial in this regards, existing research suggests that medical marijuana can help with some conditions.

Pharmacology of Cannabis

To understand how cannabis could alleviate symptoms and conditions related to certain diseases, one has to review the compounds of cannabis. The Cannabis plant produces a resin containing compounds not found in other plants called cannabinoids, in addition to other compounds found in plants, such as terpenes and flavonoids. The highest concentration of cannabinoids is found in the female flowers of the plant. As per (Alhamoruni, Lee, Wright, Larvin, & O'Sullivan, 2010), cannabinoids are terpenophenolic compounds derived from Cannabis sativa (phytocannabinoids) or produced endogenously in the body (endocannabinoids). Over 60 different cannabinoids have so far been identified and the most prevalent phytocannabinoids include 9-tetrahydrocannabinol (THC), which has pain-relieving (and other) properties, and cannabidiol (CBD), which seems to impact the brain without a "high". (Welsh & Loria, 2014), These chemical components of Cannabis activate specific receptors throughout the body (endocannabinoid system or the "EC System") to produce pharmacologic effects, particularly in the central nervous system and the immune system. (The Science of the Endocannabinoid System: How THC Affects the Brain and the Body, 2011) The two primary cannabinoid receptors are CB1 and CB2. (Grotenhermen & Müller-Vahl, 2012) Both receptors are found predominantly in the brain and nervous system, as well as in peripheral organs and tissues, and are the main molecular target of THC. One other main endocannabinoid is 2-Arachidonoylglycerol (2-AG), which is active at both cannabinoid receptors, along with its

own mimetic phytocannabinoid, CBD. 2-AG and CBD are involved in the regulation of appetite, immune system functions and pain management (Wikipedia)

Marijuana's therapeutic effects depend on the concentration of THC in a given formulation as well as the ratio of THC to CBD because of CBD's ability to mitigate the psychoactive effects of THC. As a result, the THC-CBD ratio for many strains of marijuana has been engineered to achieve desired effects (Hill, 2015)

Cannabis and the treatment in cancer

There are plenty of research articles that show the effectiveness of cannabis in the treatment of cancer and effecting cancer remission. To understand the process of how the cancer cell dies, it would be beneficial to understand what metabolic processes provide life to the cells.

There are two structures in most cells that sustain life: the mitochondria and the endoplasmic reticulum (ER). The mitochondria primarily produce adenosine triphosphate (ATP) that provides the necessary energy in cells. The endoplasmic reticulum (ER) is a loosely bound envelope around the cell nucleus that synthesizes metabolites and proteins directed by the nuclear DNA that nourish and sustain the cell.

Tetrahydrocannabinol (THC) is a natural fit for the CB1 cannabinoid receptor on the cancer cell surface. When THC hits the receptor, the cell generates ceramide that disrupts the mitochondria, starving the cell of energy. The disruption of the mitochondria releases cytochrome c and reactive oxygen species into the cytosol, enhancing cell death. This process is specific to cancer cells, as healthy cells have no reaction to THC at the CB1 receptor. The increase in ceramide also disrupts calcium metabolism in the mitochondria, completing the demise to cell death. The other cannabinoid, which is effective in killing cancer cells, is cannabidiol (CBD). In cancer cells, CBD disrupts the endoplasmic reticulum through disrupting of the calcium metabolism, pushing calcium into the cytosol. (Ryan, Drysdale, Lafourcade, Pertwee, & Platt, 2009) This always results in cell death. Another pathway for CBD to effect cancer cell death is the Caspase Cascade, which breaks down proteins and peptides in the cell. When this happens the cell cannot survive. As with THC, normal cells are not affected, as these processes are specific to cancer cells. (Shrivastava, Kuzontkoski, Groopman, & Prasad, 2011) "Metastasis is the final and fatal step in the progression of breast cancer. Currently, available therapeutic strategies at this stage of

cancer progression are often nonspecific, have only marginal efficacy, and are highly toxic." (McAllister, Christian, Horowitz, Garcia, & Desprez, 2007) In studies by (Solinas, Cinquina, & Parolaro), CBD potently and selectively inhibits the proliferation of human breast cancer cells.

It is clear from the research mentioned that a combination of THC and CBD are potent inhibitors of both cancer growth and spreading.

Cannabis in the treatment of HIV for pain and other medical symptoms

HIV or AIDS affects over 40 million people in the world (Global HIV and AIDS statistics, 2015). 25.8 million people living with HIV are in sub-Saharan Africa, accounting for 70% of the global total. Only 54% of all people living with HIV know that they have the virus.

Although there is still no cure available for this disease, remarkable improvements in the survival of HIV-infected individuals have been achieved. This survival has lead to an increasing prevalence of individuals with HIV infection, many on long-term treatment with combinations of antiretroviral therapies. This has increased the clinical focus on the management of chronic symptoms associated with both HIV and the side effects of antiretroviral medication. These chronic symptoms include loss of appetite, medically intractable pain and nausea. A large number of HIV positive outpatients have reported that cannabis improved symptom control in a study done in 2005 in London, United Kingdom (Emily Woolridge, Simon Barton, Jonathon Samuel, Jess Osorio, Andrew Dougherty, & Anita Holdcroft, 2005). The findings of (Ellis, et al., 2009) suggest that cannabinoid therapy may be an effective option for pain relief in patients with medically intractable pain due to HIV-associated distal sensory predominant polyneuropathy (DSPN). The data in research by (Margaret Haney, et al., 2007) over a 4-day period of cannabis product administration produced a range of very positive effects such as increased food intake and body weight.

Cannabis in the treatment of other medical conditions

- Chronic pain (Hill, 2015)
- Muscle spasms (including those related to multiple sclerosis) (Fox & Zajicek, 2002)
- Epilepsy (Reddy & Golub, 2015)
- Gastrointestinal diseases (Alhamoruni, Lee, Wright, Larvin, & O'Sullivan, 2010)

Conclusion

From the peer-reviewed research above, one can see that the use of cannabis derivatives in the treatment of multiple life-threatening and debilitating illnesses is emerging in the international fields of medicine and pharmacology. The scope for the use of these derivatives is vast and this form of treatment on the cutting edge

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