Guest Articles

Chemical Aspect of Cannabis

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Cannabis spp. contains a highly complex mixture of compounds, and up to 568 unique molecules are identified in the cannabis.[5] Among these compounds, Δ^9-tetrahydrocannabinol (Δ^9-THC), cannabinol (CBN), and cannabinodiol (CBND) are known to be psychoactive (Figure 01). Because of that, Cannabis spp. plants and their derivative products are either regulated or banned in many countries. In some countries like Canada, cannabis has been made available for medicinal purposes since 1999.

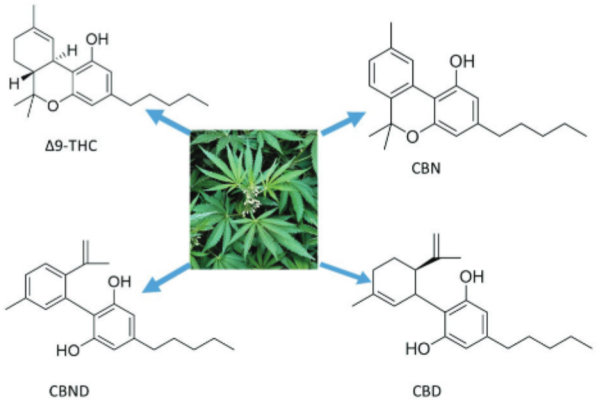

Figure 01: Chemical structures of psychoactive phytocannabinoids

Concentrations of all of these compounds may not even be at the detectable levels or may not be present in many commercial cannabis strains; hence, physiological significance of all of these compounds is irrelevant, except the ones that are present in detectable levels. Other cannabinoids such as cannabidiol (CBD) are nonpsychoactive compounds.

Cannabinoids exert their physiological effects through a variety of receptors including adrenergic receptors, cannabinoid receptors (CB1 and CB2), and a variety of other recently discovered G protein-coupled receptors (GPCRs) such as GPR55, GPR3, and GPR5. Patients consume medical cannabis, often with little medical evidence, for the treatment of or to seek relief from a variety of clinical conditions including pain, anxiety, epileptic seizures, nausea, appetite stimulation, and so on.

Cannabis-derived extracts (resins) are becoming commercially available popular products, and many of the patients prefer to use these extracts, as they do not involve smoking.

Phytocannabinoids in dried cannabis generally carry a carboxylic acid moiety and undergo spontaneous loss of this carboxyl moiety when subjected to high temperature (either direct sunlight, smoking, hot oven, and similar heat sources). Cannabinoid acids generally bind at the cannabinoid receptors, CB1 and CB2, with weaker affinity and exhibit weaker activity, but the corresponding decarboxylated phytocannabinoids exhibit higher potency at these receptors. Thus, dried cannabis in general is subjected to activation (*via* decarboxylation) prior to consumption by the patients for maximal *in vivo* efficacy.

Δ^9-THC characteristically produces, in a dose dependent manner, hypoactivity, hypothermia, spatial and verbal short-term memory impairment. But, CBD, does not affect locomotor activity, body temperature or memory on its own. However, higher doses of CBD can potentiate the lower doses of Δ^9-THC by enhancing the level of CB1R expression in the hippocampus and hypothalamus.[6] Literature depicts that the two main compounds, Δ^9-THC and CBD, whilst having similar effects in certain domains, also have almost opposite effects to one another in other aspects.[7]

Melissa et al. in 2017 has identified several phytocannabinoids extracted from dried cannabis using supercritical fluid extraction (SFE), which can be carried out at ambient temperature. They have identified several phytocannobinoids shown in figure 02.

As per their study, analysis of commercial medical cannabis extract in its native form and after subjecting it to heat to decarboxylate phytocannabinoids

carboxylates into their active form, revealed 16 unique mass spectral signals representing upto 58 compounds in the decarboxylated cannabis extract, including various phytocannabinoids, flavonoids, terpenes, and miscellaneous compounds.[8]

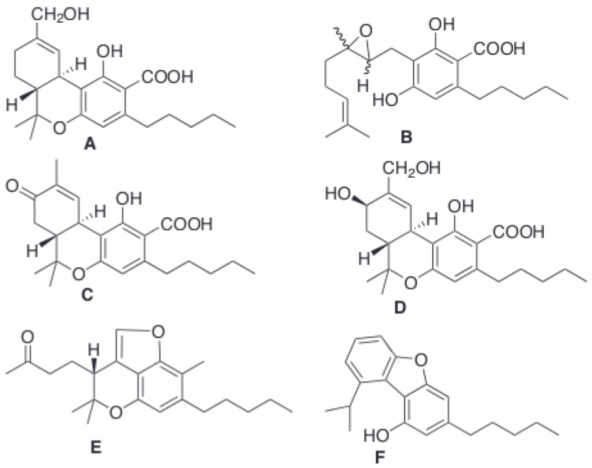

Figure 02: Chemical structures of the phytocannabinoids, (A) 11-hydroxy-Δ^9-tetrahydrocannabinolic acid A, (B) (±)-6,7-*cis*/*trans*epoxycannabigerolic acid, (C) 8-keto-Δ^9-tetrahydrocannabinolic acid A, (D) 8β,11-bis-hydroxy-Δ^9-tetrahydrocannabinolic acid , (E) (−)-7R-cannabicourmaronic acid , and (F) cannabifuran.

Among these potential 58 compounds, up to 36 compounds are found to be in the native cannabis extract (prior to decarboxylation) as well, and did not change due to the decarboxylation process. The remaining 22 compounds in the decarboxylated cannabis extract were not present in the native cannabis extract (prior to decarboxylation), and admittedly, most of these new compounds are the decarboxylated forms of phytocannabinoid acids. The other categories of compounds in the activated cannabis extract includes sesquiterpene, β-caryophyllene oxide, and stearidonic acid. Two fatty acids, roughanic acid and α-linolenic acid, were observed in the native cannabis extract but were absent after subjecting the extract to heating for decarboxylation.[8]

When one correlates the above chemical changes, effect of controlled heating, changes in the chemical composition in addition to decarboxylated phytocannabinoids, and attempt to correlate the pharmacological effects, it is imperative to think that inconsistency in the extracts and decarboxylation could have profound effects for the patient. Furthermore, basic and clinical sciences supporting proper dosage forms yielding adequate pharmacological activity and outlining the potential adverse effects and risks of cannabis consumption, are also urgently needed; but these are immensely dependent on the chemical constituents of the extracts consumed by the patients. Healthcare practitioners would benefit from predictable dosing, a better understanding of the pharmacological activity and knowledge of the common adverse events. Given the inconsistency and misrepresentation of cannabis in the marketplace in general, new metered dosing modalities would be welcomed by healthcare practitioners and patients.

Relative to dried cannabis material, cannabis extracts and edibles pose a significant measurement challenge because of their high complexity and diversity. For instance, food products such as chocolate create difficulties with cannabinoid extraction due to the high fat content and also yield a multitude of interference peaks that can hinder accurate quantitation.

The White House recently completed its review of pending Food and Drug Administration (FDA) guidance on marijuana and CBD research—though it remains to be seen whether the draft document will ultimately be released to the public.[9] It is very important to develop guidelines for Sri Lankan researchers to carry on further studies under the guidance of government.

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Guest Articles

Chemical Constituents of Murunga Tree

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It is obvious to introduce ***Moringa oleifera*** (MO) or "Murunga" as the "**miracle tree**", since every part of it has a prodigious medicinal value. *Moringa* is a genus of medicinal plants that consists of 13 species. *Moringa* species show anti-inflammatory, anticancer, antioxidant, antidiabetic and antihyperglycemic properties; mainly owing to the high content of flavonoids, glucosides and glucosinolates. Traditional uses of MO are healing skin infections, anxiety, asthma, wounds, fever, diarrhea and sore throats.

MO is a fast-growing, slender trunked, deciduous plant native to tropical Asia but also naturalized in Africa and tropical America, with 10-12 m in height. It can be cultivated in any tropical or subtropical region of the world. People introduce MO as a "**never die tree**" because its uses seem to be endless and trees may survive despite high altitudes or very dry and arid deserts with annual rainfall less than 400 mm. This natural powerhouse can be used to achieve goals such as good health and well-being.

Chemicals present in *Moringa oleifera*

Phytochemicals are known as special chemical compounds, which are produced by plants through primary or secondary metabolic pathways. Phytochemicals (*e.g.* alkaloids, phytosterols, polyphenols, terpenoids *etc.*) play a vital role in improving the health due to their medicinal and pharmacological properties. Each part of this tree consists of a unique chemical composition; hence, the application of the plant component depends on the chemical nature of it. These compounds are mainly useful to build up a self-defense system against microorganisms and several diseases. Over 100 phytochemicals have been isolated from MO and some of them showed positive biological activities against various diseases.

Leaves

Most of the botanists and chemists pay more attention to carry out research on MO leaves relative to other parts because leaves are the centre of this powerhouse. Even though taste of the leaf is similar to