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Review Article

Therapeutic Horizons: Reviewing the Role of Cannabis in Modern Medicine

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ABSTRACT

The potential of cannabis to treat medical problems has drawn more attention. The adverse effects of exposure can be unpredictable because to the variety of cannabis-based products available. Our goal was to perform a scoping assessment of systematic reviews that evaluated the advantages and disadvantages of cannabis-based medications for any kind of illness. While research about the negative side effects of medicinal cannabis use during cancer therapy is still developing, it is prescribed for ailments like pain, epilepsy, nausea, and vomiting. Adverse occurrences (AEs) should be taken into account for their consequences on workplace health and safety (WHS) because they may affect workers' performance. Numerous studies have examined cannabis use disorder in recreational users, and these results are frequently extrapolated to patients who use medical cannabis. The possibility that using medical cannabis could result in dependence is a topic of much debate. Therefore, answering these questions is essential to minimizing the negative effects of medical cannabis use. Access to medicinal cannabis markets, which provide a growing variety of powerful cannabis medicines, is available to 63% of the US population

INTRODUCTION

Cannabis and its derivatives are derived from Cannabis sativa. Cannabis, sometimes referred to as hashish for plant resin blocks and marijuana for dried flower buds, is a multi-compound plant that contains flavonoids, cannabinol, and other bioactive substances. Medical marijuana usage is growing in popularity; in countries where it is lawfully permitted, such as Canada, Germany, and Israel, 40% of cancer patients use it to relieve their pain. The World Health Organization (WHO) estimates that 147 million people, or about 2.5% of the world's population, use marijuana annually,

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making it the most widely grown, trafficked, and abused illegal substance in the world. Perhaps the oldest medication in the world is cannabis. For thousands of years, it has been utilized medicinally, particularly in China and India. In the middle of the 19th century, it was used in Western medicine in a variety of tinctures and extracts. Long-term recreational cannabis usage, particularly in youth, can result in addiction, memory loss, cognitive impairment, hallucinations, and psychosis. IN recent years, there have been significant shifts in the public's perception of cannabis in the United States. Some form of medical cannabis use has been allowed in 30 states and the District of Columbia. AS our understanding of our endogenous cannabinoid system advances, the structures of chemical compounds originating from cannabis are now understood, their mechanisms of action in the nervous system are being clarified, and the efficacy and safety of treatments are being assessed more and more scientifically.

HISTORICAL SIGNIFICANCE :

Cannabis is a botanical product derived from plants that has historical roots in antiquity. There is ample evidence, as previously explained, that it was used more than 5,000 years ago in what is now Romania.1) With the passage of the Compassionate Use Act in 1996, California became the first state to legalize the access to and use of botanical cannabis for medical purposes under a doctor's supervision. As previously mentioned, on January 1, 2017, legislation governing the sale and distribution of medicinal cannabis will be in place in 28 states, Washington, D.C., Guam, and Puerto Rico; 21 states and the District of Columbia will have decriminalized marijuana and lifted the ban on its possession in small amounts; and eight states—Alaska, California, Colorado, Maine, Massachusetts, Nevada, Oregon, and Washington—as well as the District of Columbia—will have legalized the use of marijuana for recreational purposes for adults.2)...3)

THC AND CBD :

THC – Tetrahydrocannabinol

CBD - Cannabidiol

Psychiatric and medicinal CBD is available over-the-counter in a range of forms; up to 14% of Americans are said to have used CBD during the last year4) The inebriating "high" associated with THC-containing cannabinoids is not experienced while consuming CBD, in contrast to cannabis. Additionally, CBD may lessen the possibly negative effects of THC when combined with it 5) A number of significant advancements in the last several years, such as the FDA's approval of a CBD formulation for three types of epilepsy, have raised interest in CBD. Because hemp contains no more than 0.3% THC, the Agriculture Improvement Act of 2018 made it legal to cultivate CBD from hemp and set it apart from the illegal growing of cannabis plants..6) But in a another recent study, when 600 mg/day of CBD was compared to a placebo for six weeks as an adjuvant pharmacotherapy for schizophrenia, CBD did not significantly alter positive symptoms or cognitive function..7) For instance, lorazepam's level or effect will be increased by CBD, so doctors may want to reduce their patient's dosage if they also take CBD in addition to lorazepam. In a recent

investigation, transaminase increases above five times the upper limit of normal were observed in numerous healthy persons receiving high daily doses of CBD (1500 mg/day), highlighting the possibility of chronic CBD treatment causing liver damage.

Subsequent to the act of 1937, cannabis was dropped from the United States Pharmacopoeia in 1942, with legal penalties for possession increasing in 1951 and 1956 with the enactment of the Boggs and Narcotic Control Acts, respectively, and prohibition under federal law occurring with the Controlled Substances Act of 1970. 9) With the passage of the Compassionate Use Act in 1996, California became the first state to legalize the use of botanical cannabis for medical purposes under a doctor's supervision. As previously mentioned, on January 1, 2017, 28 states, along with Washington, D.C., Guam, and Puerto Rico, will have passed laws regulating the sale and distribution of medicinal cannabis; 21 states and the district of Columbia will have decriminalized marijuana and removed the ban on small-scale possession; and eight states—including Alaska, California, Colorado, Maine, Massachusetts, Nevada, Oregon, and Washington—as well as the District of Columbia will have legalized the use of marijuana for recreational purposes by adults..10) 11)

In Ancient Era:-

Possibly one of the earliest plants to be grown for human consumption is cannabis. According to archeological evidence, hemp was cultivated in central Asia as early as 12,000 BCE for use as fiber and rope. Artifacts containing hemp cloth or portraying hemp fiber from many millennia ago have been found throughout China.12). 13)

In Victorian Era:-

In order to promote the therapeutic potential of "tincture of Indian hemp," Irish physician William O'Shaughnessy travelled to India in the early 19th century to study its medical traditions. He returned to Europe with a large supply of cannabis and published his own case reports and studies in dogs for conditions like "rheumatism," "tetanus," "cholera," and "infantile convulsions."...14). 15)

PHARMACOLOGY :

The human body contains endocannabinoids (eCBs) and their receptors throughout the neurological system, internal organs, connective tissues, glands, and immunological cells, among other places. The eCB system, which has been described as "eat, sleep, relax, forget, and protect," has a homeostatic function 16) It is well recognized that eCBs play a protective effect in certain medical states and contribute to the pathophysiology of several illnesses 17) Clinical eCB deficient syndromes (CEDS) have been postulated to include migraine, fibromyalgia, irritable bowel syndrome, and similar diseases. The pathophysiology of depression may potentially entail deficiencies in eCB signaling. Deficits in the eCB system have been linked in human studies to schizophrenia, multiple sclerosis (MS), Parkinson's disease, Huntington's disease, anorexia, persistent motion sickness, and neonatal failure to thrive 18) Cannabis has also been associated with additional noncannabinoid targets. Noncompetitive inhibition at mu and delta opioid receptors, as well as norepinephrine, dopamine, and serotonin, is provided via G-protein- coupled receptors. Ligand-gated ion channels increase glycine receptor activation and produce allosteric antagonistic antagonism at serotonin and nicotinic receptors. Noncompetitive antagonism at nonspecific ion channels inhibits the channels for calcium, potassium, and sodium, and AEA

influences the activation of PPARα and PPARγ at peroxisome proliferator-activated receptors.19)

PHARMACOKINETIC AND ROUTE OF ADMINISTRATION :-

Pharmacology:-

Cannabis is also associated with other noncannabinoid objectives. G-protein-coupled receptors offer noncompetitive inhibition of norepinephrine, dopamine, serotonin, and mu and delta opioid receptors.

Ligand-gated ion channels increase glycine receptor activation and produce allosteric antagonism at serotonin and nicotinic receptors. Noncompetitive antagonism inhibits calcium, potassium, and sodium channels at nonspecific ion channels, and AEA influences the activation of PPARα and PPARγ at peroxisome proliferator-activated receptors 20)

Although THC is the primary psychoactive ingredient in cannabis, its usage is restricted by unfavorable side effects, which are caused by activation of the CB1 receptors in the central nervous system. Other phytocannabinoids with little to no psychoactivity are increasingly acknowledged to have potential as human medicinal agents. As a nonpsychoactive component, CBD is the cannabinoid that has generated the greatest interest21) In contrast to THC, CBD does not significantly activate CB1 and CB2 receptors to produce its pharmacological effects. The antiepileptic, anxiolytic, antipsychotic, anti- inflammatory, and neuroprotective properties of CBD make it highly promising for therapeutic usage. Combining CBD with THC has been approved by regulators in a number of European nations and is now being researched in FDA-registered trials.

Additionally, several jurisdictions have enacted laws permitting the use of most CBD preparations of cannabis for specific pathological disorders, even if there isn't a standard for the amount of CBD and the best way to administer it. 22)

PHARMACOKINETIC:-

It has been difficult to separate molecules of interest from biological matrices and from one another due to low analyte concentrations, quick and extensive metabolism, and physicochemical features. Lower drug recovery is the overall result of molecules of interest adhering to several surfaces. 23)

It has been difficult to separate molecules of interest from biological matrices and from one another due to low analyte concentrations, quick and extensive metabolism, and physicochemical features. Lower drug recovery is the overall result of molecules of interest adhering to several surfaces. 24)

While smoking is still the most popular way to consume cannabis, vaping is becoming more and more popular. Similar effects to smoking are produced via vaporization, which also lessens exposure to combustion byproducts and potential carcinogens as well as unpleasant respiratory symptoms. Due of its high lipophilicity, THC quickly distributes to tissues with high perfusion rates and then to fat. 25)

The way that cannabis is consumed affects how it is metabolized. THC enters the liver after oral ingestion, where the majority of it is broken down or removed. In the liver, CYP2C and CYP3A convert THC into other compounds. These enzymes convert THC to the psychoactive compound 11-OH-THC and ultimately to the non-psychoactive compound 11-COOH-THC. 26)

Approximately 20% of cannabis is eliminated in urine, and over 65% is eliminated in feces. 27)

Within five days, the majority of the cannabis (80% to 90%) is eliminated as hydroxylated and carboxylated metabolites. 28)

The main glucuronide conjugate in urine among the major metabolites is THC metabolite 11-COOH- THC, while the most common form in feces is THC metabolite 11-OH-THC.....29)30)

After passing through the heart, the remaining THC and both of its metabolites enter the bloodstream. Both 11-OH-THC and THC enter the brain at the same time. Ingested THC has a bioavailability of only 4% to 12%. THC has a high solubility in lipids. Fat tissue absorbs it quickly and stores it there. THC gradually returns to the bloodstream from these fat stores. 31)

ROUTE OF ADMINISTRATION:-

Most people smoke or consume cannabis orally. Rectal delivery, sublingual administration, transdermal distribution, ocular drops, and aerosols have only been explored in a small number of studies and have little practical utility in modern medicine. The mode of administration of THC affects its pharmacokinetics.

THC inhalation results in a maximal plasma concentration in a matter of minutes and immediate to long-lasting psychoactive effects. Within 15 to 30 minutes, these effects peak, and they subside in 2 to 3 hours. When taken orally, the effects of the drug become apparent 30 to 90 minutes later, peak in two to three hours, and last for around four to twelve hours, depending on the dosage 32)

Use of edible and vaporized forms of marijuana was also substantially correlated with higher dispensary density and longer duration of medicinal cannabis status. State-level trends in the use of alternate cannabis administration modalities are linked to medical cannabis regulations. 33)

DOSE:

Each 100 µL spray that patients are prescribed for Sativex contains very minute levels of other cannabinoids,

0.04 mg of ethanol, 2.5 mg of CBD, and 2.7 mg of THC (GWPharma, 2019). Thus, Sativex differs greatly from cannabis in terms of substance and formulation. According to the prescribing guidelines, patients should titrate their dose (i.e., number of sprays per day) gradually for the first two weeks, starting at 1 and going up to 12 if necessary. Four sprays, or 10.8 mg THC and 10 mg CBD, are the median number used in ordinary clinical practice; nine sprays were used in clinical research. Thus, the recommendations are established to guarantee patients can self-titrate to

the necessary amount, just as one can self-titrate how much cannabis one inhales.

Numerous factors in cannabis make it difficult to prescribe drugs using the standard medical model. The changes are drastic if the plant is used. Plants differ greatly in their phenotypes, and even the time of harvest influences the types and proportions of cannabinoids found. Heavy smokers may experience a different chemical "smorgasbord" than light smokers, and consumption may change bioavailability. One person may be far more sensitive than another. Though this is starting to change, the majority of cannabis study has focused mostly on THC, with the other cannabinoids being studied to a lesser extent and the mixtures being scarcely studied at all. For medical cannabis users, these combinations are crucial since they may have a variety of beneficial synergistic effects.....34)...35)...36)

Two of the studies that used smoked cannabis in a well-established dosing regimen support our suggested dosages even more. Chang et al. investigated the effects of smoking cannabis five times a day at a level of 10 mg/m2, or 87.5 mg of THC per day for a person of average size. This amounts to the same as 3.6g of cannabis with 15% THC. 37)

In their study, Vinciguerra et al. examined smoked cannabis at a dose of 5 mg/m2 four times per day, or 35 mg of THC per day for the typical individual. This is the same as about 1.4 grams of cannabis with 15% THC. 38)

DRUG INTERACTIONS:-

There are few clinical studies measuring how exogenous cannabinoids affect the metabolism of other drugs; however, prescribing information for pharmaceuticals derived from cannabinoids, like dronabinol (AbbVie [United States]) and Sativex (GW Pharmaceuticals, United Kingdom), may provide information about drug interactions 39) 40)

Although additive pharmacodynamic effects are possible when dronabinol is coadministered with other agents having similar physiological effects (e.g., sedatives, alcohol, and antihistamines may increase sedation; tricyclic antidepressants, stimulants, and sympathomimetics may increase tachycardia), dronabinol use was not linked in clinical trials to clinically significant drug interactions. Furthermore, smoking cannabis may speed up the metabolism of theophylline, much as smoking tobacco does 41) 42)

Medical cannabis and other medications may interact pharmacodynamically and metabolically. Hepatic cytochrome 450 (CYP450) isoenzymes 2C9 and 3A4 are important in the primary metabolism of THC and CBN, while 2C19 and 3A4 may be in charge of the metabolism of CBD, according to quantification of the in vitro metabolism of exogenous cannabinoids, such as THC, CBD, and cannabinol (CBN). 43)

ADVERSE EFFECT :-

Short-term cannabis usage has been linked to changed judgment, poor motor coordination, paranoia or psychosis at large doses, and reduced short-term memory 44)

Heavy or prolonged cannabis use, particularly in those who start when they are teenagers, has been linked to addiction, abnormal brain development, cognitive impairment, poor academic outcomes (such as dropping out of school), and decreased life satisfaction 45)

In addition, long-term or excessive cannabis usage is linked to chronic bronchitis and, in those who

are predisposed to such conditions, an elevated risk of health disorders related to chronic psychosis, such as schizophrenia and depressive variations. 46) 47)

Research on the use of cannabis to treat the symptoms of neurodegenerative illnesses like Parkinson's, Alzheimer's, and multiple sclerosis has shown that these patients' cognitive function is compromised 48) 49)

ACUTE EFFECT:-

Impaired learning, memory, attention, and motor coordination are linked to acute cannabis usage. The mode of consumption is frequently linked to these acute effects 50)

The presence of CB1 receptors in the prefrontal cortex, globus pallidus, substantia nigra, hippocampus, striatum, and cerebellum may contribute to the diverse effects of cannabis 51)

Additionally, acute cannabis use can impact executive functioning, which includes the capacity for organizing, problem-solving, planning, and decision-making 52)

CHRONIC EFFECT:-

Results indicate that long-term cannabis usage is linked to a higher risk of cognitive impairment, mental illness, addiction, and other systemic effects, notwithstanding the possibility of sample bias in this research because people who use cannabis regularly may also have other problems or behaviors that contribute to or are linked to poor health and functioning, sampling bias is a potential confounder. 53)

A dose-dependent correlation between cannabis usage from baseline to the 5-year follow-up and neurodevelopmental problems, such as increased cortical thinning, mainly in prefrontal brain regions, was found in longitudinal research including 799 teenagers. 54)

Although there hasn't been as much research on elder users, one study found that users 35 years of age or older who participated in a nonclinical sample performed noticeably worse than nonusers in all cognitive areas related to attention and working memory (executive functioning and information processing speed). 55)

Impaired neuronal connections, especially in the hippocampus, can result from prenatal and adolescent THC exposure. This could explain the link between early and regular cannabis use and lower IQ. 56)57)

Cannabis use disorder is linked to poor socioeconomic position, which includes reduced income, increased demand for social services, criminal activity, joblessness, and a lower quality of life. 58)

According to a new examination of survey data from 281,650 young individuals between the ages of 18 and 34, cannabis usage was linked to a higher likelihood of suicidal thoughts, plans, and attempts. 59)

Daily users had a 3.2-fold higher risk (95% CI=2.2, 4.1) of developing psychosis compared to control patients who never used cannabis; the odds ratio increased to 4.8 (95% CI=2.5, 6.3) when high- potency cannabis was used. A historical prospective cohort study conducted statewide in Denmark using register-based data revealed that the population-attributable risk fraction of schizophrenia diagnoses linked to cannabis use disorder increased from approximately 2.0% in 1995 to 6.0%–8.0% since 2010. 60)

According to Desai et al., cannabis users with arrhythmias had an increase in all-cause hospital

mortality from 3.7% to 4.4% between 2010 and 2014 ($p<0.001$). 61)

USES :

Although the effectiveness of cannabis and other cannabinoid substances for treating certain conditions is well documented, they are frequently used to reduce symptoms or treat illness. The exact analgesic impact for chronic pain is still unknown. A comprehensive analysis of randomized controlled trials was carried out to investigate the use of cannabinoids, such as smoked cannabis, oromucosal extracts of cannabis-based medication, dronabinol, nabilone, and a new THC analog, in the management of chronic noncancer pain. 62)

While therapeutic agents based on THC (e.g., dronabinol) have been approved for use as an antiemetic in the United States for a number of years, there is not enough evidence to suggest routine use of medicinal cannabis by national or international cancer societies to alleviate nausea and vomiting related to chemotherapy. The effectiveness and safety of cannabis-based medications in treating chemotherapy-induced nausea and vomiting have only lately been studied. Patients who used cannabis-based products reported less nausea and vomiting than those who received placebos in a study of 23 randomized, controlled studies. 63)

According to a Summary of Systematic Reviews for Clinicians published by the American Academy of Neurology (AAN), oral cannabis extract is useful for treating multiple sclerosis (MS) in terms of lowering patient-reported spasticity scores, central pain, and painful spasms. 64)

Medical cannabis has not been found to be effective in treating dyskinesia, dyspnea, or nausea and vomiting brought on by chemotherapy in elderly individuals. THC may help alleviate anorexia and behavioral problems in dementia patients, according to some research. Sedation-like sensations were the most often reported side effects among older persons receiving cannabis medication. 65)

LIMITATION AND FUTURE RESEARCH:-

There are various restrictions that limit the research's conclusions. This study, which was a scoping review, lacked a quality evaluation of the papers it examined.

The fact that the studies chosen were chosen primarily on the basis of their accessibility and suitability for the research's objectives rather than using sound reasoning to draw conclusions may have compromised the study's neutrality.

Lack of research and synthesis on dosage, cannabis kind, and administration route is another drawback. This was outside the purview of this investigation, and several of the included publications omitted information about the kind of cannabis, dosage, and mode of administration. Determining the severity and duration of each adverse occurrence and producing more concrete results for implications on WHS would have been beneficial.

Users of medical cannabis, many of whom are long-term users, are not well sufficiently understood. To examine the use and possible dependence trajectories, longitudinal data are required. Clinical study should cover significantly distinct populations, such as medical users who move from the illegal market versus those who start just after a regulated market is established. In order to better identify potential dangers, including dependence risk factors, future research should

look at patient outcomes over an extended period of time.

There is currently no particular measure in place to evaluate cannabis dependence for medical purposes because the majority of study on the subject has been done in regard to recreational use. The creation of such a scale is essential given the rising global usage of medical cannabis.

In order to particularly address problematic medicinal cannabis use, co-authors of this article (HVC/CH) are currently developing the Cannabis-Based Medicines Questionnaire (CBM-Q). This survey will be used in Project TWENTY21, the largest medical cannabis patient registry in the United Kingdom.

Despite significant obstacles to advancement, research on cannabinoids is still progressing in several fields. Cannabis science has struggled to stay up with policy due to the DEA's classification of cannabis as a Schedule I narcotic, a lack of financing from states, and businesses that profit from cannabis sales.

The following are critical areas for future research: basic science to better understand the mechanism of action of cannabinoids; clinical research to examine the risks and potential therapeutic benefits in psychiatric samples; and policy research to enable access to cannabinoids where clinical indications are supported by research while limiting risk in vulnerable populations.

CONCLUSION:

Although there is still debate, using botanical cannabis for medical purposes marks the resurgence of a historically significant plant in modern medicine.

When most mental health illnesses start in adolescence and early adulthood, when neurodevelopment is still taking place and cognition is critical to maximizing learning and academic success, as well as in pregnant women and drivers, cannabis use should be avoided. On the other hand, cannabidiol may be viewed as a helpful epileptic therapy option for people of all ages to lessen seizures.

When deciding how to regulate the use of cannabis and when organizing a future program for epidemiological or experimental research, researchers and policy makers in the fields of law

and public health should take this evidence synthesis into account. They should also pay close attention to the tetrahydrocannabinol content of cannabis.

RESULT:-

The U.S. Food and Drug Administration (FDA) has not yet approved any psychiatric uses for cannabis, and the evidence in favor of using cannabis therapeutically to treat mental illnesses is scant.

The trials listed a number of adverse events (AEs), the most common of which were drowsiness, nausea/vomiting, dizziness, and euphoria. The most common disorder that was reviewed was both acute and chronic pain.

SUMMARY:-

In addition, the District of Columbia and eight of these states have approved cannabis use for recreational purposes. Cannabis use patterns and perceived levels of danger have significantly changed as a result of these historic regulatory shifts. The health effects of cannabis usage are poorly understood due to a paucity of scientific research, which raises serious concerns for vulnerable groups like teenagers and pregnant women.

REFERENCES

1. Bennett C. Early/ancient history. The Pot Book: A Complete Guide to Cannabis. 2010:17-26.
2. Orenstein DG, Glantz SA. Cannabis legalization in state legislatures: Public health opportunity and risk. Marquette law review. 2020;103(4):1313.
3. Irimescu S. Marijuana Legalization: How Government Stagnation Hinders Legal Evolution and Harms a Nation. Gonz. L. Rev.. 2014;50:241.
4. Brenan M.14% of Americans say they use CBD products. Gallup.
5. Pisanti S, Malfitano AM, Ciaglia E, Lamberti A, Ranieri R, Cuomo G, Abate M, Faggiana G, Proto MC, Fiore D,Laezza C. Cannabidiol: State ofthe art and new challenges for therapeutic applications. Pharmacology &therapeutics. 2017 Jul1;175:133-50.
6. Hurd YL. Leading the next CBD wave—safety and efficacy. JAMA psychiatry. 2020 Apr1;77(4):341-2.
7. Boggs DL, Surti T, Gupta A, Gupta S, Niciu M, Pittman B, Schnakenberg Martin AM, Thurnauer H, Davies A,D'Souza DC, Ranganathan M. The effects of cannabidiol (CBD) on cognition and symptoms in outpatients withchronic schizophrenia a randomized placebo controlled trial. Psychopharmacology. 2018 Jul;235:1923-32.
8. pp.1224-1231.Watkins PB, Church RJ, LiJ, Knappertz V. Cannabidiol and abnormal liver chemistries in healthyadults:results of a phase I clinicaltrial. Clinical Pharmacology & Therapeutics. 2021 May;109(5):1224-31.
9. Incaspro GI, Kim NC, Venema J, de Mars S, Devine J, Celestino C, Feaster CE, Firschein BA, Waddell MS, Gardner SM, Jones Jr E. The advisability and feasibility of developing USP standards for medical cannabis. InPharmacopeial Forum 2016 (Vol. 42, No. 1)
10. Ermasova N. Fiscal and health effects of US marijuana legislation at the state level. The Journal of Social, Political, and Economic Studies. 2020 Apr 1;45(1/2):151-77.
11. Orenstein DG, Glantz SA. Cannabis legalization in state legislatures: Public health opportunity and risk. Marquette law review. 2020;103(4):1313.

12. Jones PG, Falvello L, Kennard O, Sheldrick GM, Mechoulam R. Cannabidiol. Structural Science. 1977 Oct 15;33(10):3211-4.
13. Devane WA, Dysarz F3, Johnson MR, Melvin LS, Howlett AC. Determination and characterization of a cannabinoid receptor in rat brain. Molecular pharmacology. 1988 Nov 1;34(5):605-13.
14. Russo EB. History of cannabis and its preparations in saga, science, and sobriquet. Chemistry & biodiversity. 2007 Aug;4(8):1614-48.
15. Russo EB. The pharmacological history of Cannabis. Handbook of cannabis. 2014 Aug 21;1.
16. McPartland JM, Duncan M, Di Marzo V, Pertwee RG. Are cannabidiol and Δ9-tetrahydrocannabivarin negative modulators ofthe endocannabinoid system? A systematic review. British journal of pharmacology. 2015Feb;172(3):737-53.
17. Kaur R, R Ambwani S, Singh S. Endocannabinoid system: a multi-facettherapeutic target. Current clinicalpharmacology. 2016 May 1;11(2):110-7.
18. McPartland JM, Guy GW, Di Marzo V. Care and feeding ofthe endocannabinoid system: a systematic review of potential clinical interventions that upregulate the endocannabinoid system. PloS one. 2014 Mar12;9(3):e89566.
19. Izzo AA, Borrelli F, Capasso R, Di Marzo V, Mechoulam R. Non-psychotropic plant cannabinoids: new therapeutic opportunities from an ancient herb. Trends in pharmacological sciences. 2009 Oct1;30(10):515-27.
20. Izzo AA, Borrelli F, Capasso R, Di Marzo V, Mechoulam R. Non-psychotropic plant cannabinoids: new therapeutic opportunities from an ancient herb. Trends in pharmacological sciences. 2009 Oct 1;30(10):515-27.
21. Pertwee RG, Howlett AC, Abood ME, Alexander SP, Di Marzo V, Elphick MR, Greasley PJ, Hansen HS, Kunos G, Mackie K, Mechoulam R. International Union of Basic and Clinical Pharmacology. LXXIX. Cannabinoid receptors and their ligands: beyond CB1 and CB2. Pharmacological reviews. 2010 Dec 1;62(4):588-631.
22. Zhornitsky S, Potvin S. Cannabidiol in humans—the quest for therapeutic targets. Pharmaceuticals. 2012 May;5(5):529-52.
23. Huestis MA. Pharmacokinetics and metabolism ofthe plant cannabinoids, delta9-tetrahydrocannabinol,cannabidiol, and cannabinol. Handb Exp Pharmacol. 2005;168:657–690.
24. Huestis MA. Pharmacokinetics and metabolism ofthe plant cannabinoids, Δ 9-tetrahydrocannibinol,cannabidiol and cannabinol. Cannabinoids. 2005:657-90.
25. Hartman RL, Brown TL, Milavetz G, Spurgin A, Gorelick DA, Gaffney G, Huestis MA. Controlled cannabis vaporizer administration: blood and plasma cannabinoids with and without alcohol. Clinical chemistry. 2015Jun 1;61(6):850-69.
26. Abouchedid R, Ho JH, Hudson S, Dines A, Archer JR, Wood DM, Dargan PI. Acute toxicity associated with use of 5F-derivations of synthetic cannabinoid receptor agonists with analytical confirmation. Journal of Medical Toxicology. 2016 Dec;12:396-401
27. Huestis MA, Henningfield JE, Cone EJ. Blood cannabinoids. I. Absorption of THC and formation of 11-OH-THC and THCCOOH during and after smoking marijuana. Journal of analytical Toxicology. 1992 Sep 1;16(5):276-82.
28. Lemberger L, Axelrod J, Kopin IJ. Metabolism and disposition of Δ9-

tetrahydrocannabinol in man. Pharmacological Reviews. 1971 Dec 1;23(4):371-80.
29. Goulle JP, Saussereau E, Lacroix C. Delta-9-tetrahydrocannabinol pharmacokinetics. InAnnales pharmaceutiques francaises 2008 Aug 29 (Vol. 66, No. 4, pp. 232-244).
30. Vandevenne M, Vandenbussche H, Verstraete A. Detection time of drugs of abuse in urine. Acta Clinica Belgica. 2000 Jan 1;55(6):323-33.
31. Huestis MA. Pharmacokinetics and metabolism of the plant cannabinoids, Δ 9-tetrahydrocannibinol, cannabidiol and cannabinol. Cannabinoids. 2005:657-90
32. Grotenhermen F. Pharmacokinetics and pharmacodynamics of cannabinoids. Clinical pharmacokinetics.2003 Apr;42:327-60.
33. Borodovsky JT, Crosier BS, Lee DC, Sargent JD, Budney AJ. Smoking, vaping, eating: Is legalization impacting the way people use cannabis?. International Journal of Drug Policy. 2016 Oct 1;36:141-7.
34. Carlini EA, Karniol IG, Renault PF, Schuster CR. Effects of marihuana in laboratory animals and in man. British journal of pharmacology. 1974 Feb;50(2):299.
35. Fairbairn JW, Pickens JT. Activity of cannabis in relation to its delta'-trans-tetrahydro- cannabinol content. British journal of pharmacology. 1981 Mar;72(3):401
36. Gieringer D. Medical cannabis potency testing project. Bulletin of the Multidisciplinary Association for Psychedelic Studies. 1999;9(3):20-2.
37. Chang AE, Shiling DJ, Stillman RC, Goldberg NH, Seipp CA, Barofsky I, Simon RM, Rosenberg SA. Delta-9-tetrahydrocannabinol as an antiemetic in cancer patients receiving high-dose methotrexate: a prospective, randomized evaluation. Annals of Internal Medicine. 1979 Dec 1;91(6):819-24.
38. Vinciguerra V, Moore T, Brennan E. Inhalation marijuana as an antiemetic for cancer chemotherapy. New York State Journal of Medicine. 1988 Oct;88(10):525-7.
39. Fallon MT, Albert Lux E, McQuade R, Rossetti S, Sanchez R, Sun W, Wright S, Lichtman AH, Kornyeyeva E.Sativex oromucosal spray as adjunctive therapy in advanced cancer patients with chronic pain unalleviated by optimized opioid therapy:two double-blind,randomized, placebo- controlled phase 3 studies. British journal of pain. 2017 Aug;11(3):119-33.
40. Bridgeman MB, Abazia DT. Medicinal cannabis: history, pharmacology, and implications for the acute care setting. Pharmacy and therapeutics. 2017 Mar;42(3):180
41. Stout SM, Cimino NM. Exogenous cannabinoids as substrates, inhibitors, and inducers of human drug metabolizing enzymes: a systematic review. Drug metabolism reviews. 2014 Feb 1;46(1):86-95.
42. Bridgeman MB, Abazia DT. Medicinal cannabis: history, pharmacology, and implications for the acute care setting. Pharmacy and therapeutics. 2017 Mar;42(3):180.
43. Stout SM, Cimino NM. Exogenous cannabinoids as substrates, inhibitors, and inducers of human drug metabolizing enzymes: a systematic review. Drug metabolism reviews. 2014 Feb 1;46(1):86-95
44. Gage SH, Hickman M, Zammit S. Association between cannabis and psychosis: epidemiologic evidence.Biological psychiatry. 2016 Apr1;79(7):549-56.
45. Curran HV, Freeman TP, Mokrysz C, Lewis DA, Morgan CJ, Parsons LH. Keep offthe grass? Cannabis,cognition and addiction.

Nature Reviews Neuroscience. 2016 May;17(5):293-306.
46. Joshi M, Joshi A, Bartter T. Marijuana and lung diseases. Current opinion in pulmonary medicine. 2014 Mar1;20(2):173-9.
47. De Graaf R, Radovanovic M, Van Laar M, Fairman B, Degenhardt L, Aguilar-Gaxiola S, Bruffaerts R, De Girolamo G, Fayyad J, Gureje O, Haro JM. Early cannabis use and estimated risk of later onset of depression spells: Epidemiologic evidence from the population-based World Health Organization World Mental Health Survey Initiative. American journal of epidemiology. 2010 Jul15;172(2):149-59.
48. Karila L, Roux P, Rolland B, Benyamina A, Reynaud M, Aubin HJ, Lancon C. Acute and long-term effects of cannabis use: a review. Current pharmaceutical design. 2014 Aug 1;20(25):4112-8.
49. Turcotte D, Dorze JA, Esfahani F, Frost E, Gomori A, Namaka M. Examining the roles of cannabinoids in pain and othertherapeutic indications: a review. Expert opinion on pharmacotherapy. 2010 Jan 1;11(1):17-31.
50. Monte AA, Shelton SK, Mills E, Saben J, Hopkinson A, Sonn B, Devivo M, Chang T, Fox J, Brevik C, Williamson K. Acute illness associated with cannabis use, by route of exposure: an observational study. Annals of internal medicine. 2019 Apr16;170(8):531-7.
51. Lazenka MF, Selley DE, Sim-Selley LJ. Brain regional differences in CB1receptor adaptation and regulation of transcription. Life sciences. 2013 Mar19;92(8-9):446-52.
52. Crean RD, Tapert SF, Minassian A, MacDonald K, Crane NA, Mason BJ. Effects of chronic, heavy cannabis use on executive functions.Journal of addiction medicine. 2011 Mar1;5(1):9- 15.
53. Gruber SA, Dahlgren MK, Sagar KA, Gönenc A, Killgore WD. Age of onset of marijuana use impacts inhibitory processing. Neuroscience letters. 2012 Mar 9;511(2):89-94.
54. Albaugh MD, Ottino-GonzalezJ, Sidwell A, Lepage C, Juliano A, Owens MM, Chaarani B, Spechler P, Fontaine N, Rioux P, Lewis L. Association of cannabis use during adolescence with neurodevelopment.JAMA psychiatry. 2021 Sep 1;78(9):1031-40.
55. Thames AD, Arbid N, Sayegh P. Cannabis use and neurocognitive functioning in a non-clinical sample of users. Addictive behaviors. 2014 May 1;39(5):994-9.
56. Zalesky A, Solowij N, Yücel M, Lubman DI, Takagi M, Harding IH, Lorenzetti V, Wang R, Searle K, Pantelis C,Seal M. Effect of long-term cannabis use on axonal fibre connectivity. Brain. 2012 Jul1;135(7):2245-55.
57. Meier MH, Caspi A, Ambler A, Harrington H, Houts R, Keefe RS, McDonald K, Ward A, Poulton R, Moffitt TE.Persistent cannabis users show neuropsychological decline from childhood to midlife. Proceedings of the National Academy of Sciences. 2012 Oct 2;109(40):E2657-64.
58. Volkow ND, Baler RD, Compton WM, Weiss SR. Adverse health effects of marijuana use. New England Journal of Medicine. 2014 Jun 5;370(23):2219-27.
59. Han B, Compton WM, Einstein EB, Volkow ND. Associations of suicidality trends with cannabis use as a function of sex and depression status. JAMA network open. 2021Jun 1;4(6):e2113025-.
60. Hjorthøj C, Posselt CM, Nordentoft M. Development overtime ofthe population-attributable risk fraction for cannabis uses disorderin schizophrenia in Denmark. JAMA psychiatry. 2021 Sep 1;78(9):1013-9.
61. Desai R, Shamim S, Patel K, Sadolikar A, Kaur VP, Bhivandkar S, Patel S, Savani S,

Mansuri Z, Mahuwala Z.Primary causes of hospitalizations and procedures, predictors of in-hospital mortality, and trends in cardiovascular and cerebrovascular events among recreational marijuana users: a five-year nationwide in patient assessmentin the United States. Cureus. 2018 Aug;10(8).

62. Lynch ME, Campbell F. Cannabinoids for treatment of chronic non-cancer pain; a systematic review of randomized trials. British journal of clinical pharmacology. 2011 Nov;72(5):735-44.
63. Smith LA, Azariah F, Lavender VT, Stoner NS, Bettiol S. Cannabinoids for nausea and vomiting in adults with cancer receiving chemotherapy. Cochrane Database of Systematic Reviews. 2015(11).
64. Bridgeman MB, Abazia DT. Medicinal cannabis: history, pharmacology, and implications for the acute care setting. Pharmacy and therapeutics. 2017 Mar;42(3):180.
65. van den Elsen GA, Ahmed AI, Lammers M, Kramers C, Verkes RJ, van der Marck MA, Rikkert MO. Efficacy and safety of medical cannabinoids in older subjects: a systematic review. Ageing research reviews.2014 Mar1;14:56-64.

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