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REVIEW OPEN ACCESS

Chronic Cannabis Use Impacts Mood and Anxiety Levels in Young Adults Compared to Nonconsumers: A Literature Review

Camille Kahwaji, HBSc Student [1]*

[1] Department of Psychology, McGill University, Montreal, Quebec, Canada H3A 0G4

*Corresponding Author: camomille.kahwaji@mail.mcgill.ca

Abstract:
The rising prevalence of cannabis use among young adults, fueled by legalization and changing social attitudes, raises concerns about its impact on mood and anxiety levels. This article explores the relationship between regular cannabis consumption and mental health outcomes, focusing on individuals aged 15 to 25. We examine the neurodevelopmental changes occurring during young adulthood, highlighting the potential risks associated with cannabis use, particularly in relation to the endocannabinoid system. Direct effects of cannabis, including heightened symptoms of anxiety and depression among heavy users, are discussed alongside the implications of tolerance and the seemingly contrasting effects of THC and CBD. Indirect effects, such as neurocognitive deficits and the influence of socio-economic factors, are also considered. The review emphasizes the need for a nuanced understanding of how both individual and environmental factors contribute to the varying impacts of cannabis on mental health. Ultimately, while regular cannabis use may exacerbate mood and anxiety disturbances in some individuals, others may experience reduced anxiety over time. Future research should focus on the interplay of these factors to inform public health initiatives and mental health interventions for young adults.

Keywords: drugs; adolescence; mood; anxiety; tetrahydrocannabinol; cannabidiol; young adults; chronic use; cannabis; socioeconomic status

Introduction

Recreational cannabis partaking has significantly increased in the past few years, mainly due to the depenalization of its consumption, and sometimes of its commercialization by state-sanctioned organs, in many parts of the world [1]. It is a drug known to relieve feelings of anxiousness and to cause feelings of 'high' that are described as deep senses of calm and joy. However, it has been relayed in the literature that these symptoms may morph into their adverse counterparts, causing mood or anxiety disorders, depending on, notably, the potency and the frequency of consumption [2,3]. More specifically, results have linked cannabis use to heightened depressive and manic symptoms in the general population, along with an increased risk of developing major depressive disorder (MDD) and bipolar disorder (BD) [4].

Regular cannabis consumption-related phenotypic or behavioral changes in young adulthood vary greatly from one individual to another. A myriad of factors, layered to cannabis usage, may affect one's mood and anxiety levels, such as socio-economic status (SES) and precarity, which have been tied to depression, anxiety, attempted suicide, cigarette dependence, illicit drug use and episodic heavy drinking in adolescents [5]. For instance, stressful factors and significant life events, such as parental separation, early parental loss, as well as mental and social conflicts, have also been associated with the development of cannabis dependence [6]. Therefore, in understanding the mechanisms by which cannabis acts on the human body, it is paramount to look at instances of regular cannabis consumption, how differential responses to the drug might arise, and indeed why, taking into consideration both one's environment and genetic profile. In that, we first start by outlining how cannabis affects brain development and directly acts on the central nervous system through its different mechanisms of action to give an idea of its potential effects. We then explain how these effects are moderated by factors such as potency and frequency of use, highlighting the heterogeneity of cannabis consumption with regards to individual profile and drug composition. In the results section, we further elaborate on ways through which the environment shapes cannabis consumption.

The Brain in Young Adulthood

The developing brain from adolescence to young adulthood undergoes many neurodevelopmental changes. For example, brain regions associated with executive functioning such as the prefrontal cortex, which is involved in processes like attention, planning and reasoning, are

subjected to pruning events well into the mid-20's. Furthermore, white matter volume, which comprises axon bundles and fibers underlying the brain's connectivity, is known to increase up until the early 30's [7]. All this evidence further highlights the importance of these critical years that include adolescence and early adulthood in healthy brain development, which could be hindered by the deleterious effects of sustained cannabis consumption [7]. As Jacobus & Tapert (2014) reported, neurocognitive disadvantages and abnormalities in neural functioning resulting from cannabis use is exacerbated by earlier use onset and more frequent use [8]. The brain also seems to be exposed to more stressors during young adulthood [9], affecting the hypothalamic-pituitary-adrenal (HPA)-axis' regulation and day-to-day cortisol levels. This could be further exacerbated by cannabis consumption, which psychoactive compounds primarily interact with the endocannabinoid system (ECS) of the endocrine system.

Molecular Mechanisms of Cannabis and Their Effects

Cannabis comprises two main psychoactive ingredients, namely Δ-9 tetrahydrocannabinol (THC) and cannabidiol (CBD). THC is a partial agonist for cannabinoid type I and II receptors (hereafter CB1R and CBR2, respectively), meaning that it increases their activation, which can lead to neurotransmitters' release inhibition, potentially affecting mood, behavior and perception [10,13]. Activation of CB1Rs by THC also leads to the psychoactive effects commonly associated with cannabis use, such as euphoria, altered time perception, and enhanced sensory experiences, due to THC's ability to modulate the release of dopamine in key brain regions like the striatum. CB1Rs are also found in the pituitary gland and hypothalamus, where their activation by THC influences various endocrine responses. This includes modulating the stress response through the HPA axis, leading to fluctuations in cortisol levels that can impact anxiety and mood [10]. CBD, the other psychoactive agent in cannabis, is a negative allosteric modulator of CB2Rs. This means that while CBD binds to the receptor at a site distinct from the primary active site (the orthosteric site), it decreases the receptor's ability to be activated by endogenous cannabinoids or other agonists [11]. The allosteric modulation of the CB2R receptors by CBD has implications for its anti-inflammatory and immunomodulatory effects, as CB2 receptors are primarily expressed in immune cells [12]. By negatively modulating these receptors, CBD can indirectly affect the immune response without directly blocking or activating the receptor in the same way an antagonist or agonist would.

Frequency, Dosage, Potency and Strain

Chronic cannabis use may have differential effects depending on the THC to CBD ratio, which defines potency. Indeed, cannabis products with higher THC concentrations are said to be considered more potent, with THC content of 9% regarded as high-potency cannabis [13]. Potent cannabis has been shown to elicit more potent psychoactive effects, characterized by amplified euphoria, altered perception, and cognitive impairment [13]. These high-THC variants exert stronger effects due to their partial agonism of CB1 receptors, which mediates cannabis' primary psychoactive actions [14]. Additionally, the use of high-potency cannabis is associated with a greater incidence of adverse psychological outcomes, such as anxiety, paranoia, and, in extreme cases, psychosis, reflecting THC's capacity to disrupt normal cognitive processes and emotional regulation (e.g., attention and memory deficits) [13]. At lower doses however, THC has been reported to help decrease pain and anxiety in some people [15]. On the other hand, cannabis products with higher CBD content have long been thought to induce feelings of mellow and sleepiness [16], and attenuate the anxiogenic effects of THC, albeit a recent study has shown a negative interaction between CBD and THC in a CBD-dominant product. Participants who had consumed a CBD and THC (ratio 32:1 – 640mg:20mg) brownie, along with an enzymes cocktail, reported increased self-reported anxiety, memory difficulty, and showed more pronounced impairment of cognitive and psychomotor performance [17], compared to those who had consumed a THC-only brownie (ratio 0:1 – 20mg) and placebo.

Frequent consumption of cannabis, particularly in high potency forms, often results in the development of tolerance, necessitating increased doses to achieve comparable psychoactive effects. This process underpins the potential for cannabis use disorder (CUD), where chronic use progressively heightens the risk of psychological and physical dependence. Consequently, the cessation of cannabis use in dependent individuals can lead to mild withdrawal symptoms such as irritability, sleep disturbances, and intense cravings [18]. Over time, repeated high-dose usage contributes to cumulative cognitive deficits, particularly in memory and executive functioning, and significantly raises the likelihood of dependence [4,19]. In contrast, acute exposure to large doses of cannabis in a short time frame is more likely to result in significant short-term adverse effects, including hallucinations, confusion, and severe anxiety or panic attacks [20].

This review aims to investigate whether chronic cannabis use during young adulthood is associated with differing levels of mood and anxiety compared to individuals who do not use cannabis. We seek to clarify whether regular cannabis use may contribute to increased or decreased symptoms of anxiety and mood disturbances, or whether there is a neutral effect. We will briefly explore potential moderating factors such as social or environmental influences and co-occurring mental health conditions. We conclude by emphasizing the importance of studying cannabis use in young adulthood in understanding the intricacies of neural development and promoting mental health among youth.

Methods

The following review was conducted by assessing and incorporating multiple articles, as well as reliable sources, that were deemed pertinent to the topic of this paper. Several databases were used such as PubMed, Springer and Wiley Online Library. Keywords of our searches included, but were not restricted to: cannabis use, mood, anxiety, young adulthood, adolescence, CUD, cognitive impairments, cortisol levels, socio-cultural context. The selection process for said sources was based on the following definitions as eligibility criteria, thereby effectively fine tuning the results of our searches for homing in on specific issues regarding regular cannabis consumption in young adulthood. For instance, articles that did not have a participant sample including at least one of the ages set in the age range below were not included. Initially, 73 articles and other reliable sources were screened, from which 43 were included in this review.

Selection Criteria

The selection criteria for articles were based on the following definitions, which limited the articles to our population of interest and the specific effects we aimed to investigate. We defined 'regular cannabis consumption' hereof as an intake of cannabis, whether by inhalation or ingestion, which are the most popular ways of consuming this drug [1], as "[...] happening repeatedly in a fixed pattern, with equal or similar amounts of space or time between one and the next." [21]. We let the schedule parameter of consumption range from once a day to once a month, at more or less similar intervals, for a sustained period of time that may vary. Since chronicity and tolerance vary between individuals, these broader definitions accommodate multiple consumption patterns, allowing for a more comprehensive perspective on the effects of chronic cannabis use. Likewise, we set 'young adulthood' as ranging approximately from 15 to 25 years old to encompass a fuller range of brain developmental stages, yielding a more extensive set of findings while acknowledging the increased heterogeneity of results. 'Cannabis' was defined as any substances produced or derived from the *Cannabis sativa* or *Cannabis indica* plant, which contains the psychoactive chemical THC and other similar psychotropic compounds such as CBD [22]. Finally, mood is defined as being a "pervasive and sustained feeling tone that is endured internally and which impacts nearly all aspects of a person's behavior in the external world" [23], while anxiety, on the other hand, is a transient and possibly overwhelming feeling of worry or fear that is experienced internally, often affecting a person's thoughts, emotions, and behavior [24]. When this feeling becomes excessive and interferes with daily functioning, it can lead to various anxiety disorders, such as generalized anxiety disorder (GAD), panic disorder, social anxiety disorder, and specific phobias.

Results

To examine the impact of regular cannabis use on mood and anxiety in young adults, we first investigated the direct effects of sustained cannabis consumption. We then explored how indirect effects might manifest through mediation or moderation.

Direct Effects of Regular Cannabis Use in Young Adults

Literature indicates that heavy cannabis users around 21 years of age differed significantly from controls in terms of depression symptoms and attention-deficit/hyperactivity disorder (ADHD) symptoms, whereby such symptoms were exacerbated in regular cannabis users [25]. Specifically, at baseline, heavy cannabis users had a mean Beck Depression Inventory score of 7.1 compared to 4.3 in the control group ($p < 0.001$), and an ADHD self-rating scale score of 5.7 compared to 2.9 ($p < 0.001$). Furthermore, a review by Crippa and colleagues (2009) suggested that frequent cannabis users often have a high prevalence of anxiety disorders, and patients with anxiety disorders have relatively high rates of cannabis consumption overall [26]. In one study, THC was found to be an anxiogenic agent in a dose-dependent manner among female occasional (less than 11 uses in the past month) cannabis users participants (18-35 years old), wherein significant increases of anxiety levels were only observed in the 15mg dosage condition compared to placebo control, which might highlight an increase in tolerance for cannabis [27]. Additionally, recent studies largely indicate that THC administration tends to produce anxiogenic effects in healthy adults. However, these effects appear attenuated among individuals who use cannabis regularly, and when it is used alongside CBD [28] [29]. Indeed, CBD has long been thought of as an anxiolytic agent, helping contribute to the reduction of anxious feelings, but both the paucity of significant results and the heterogeneity of aforesaid results, as well as recent literature have contributed to refute such findings concerning healthy patients. For instance, in one study, the administration of CBD did not reduce visual analog scale (VAS, self-report measure) ratings of anxiety in healthy participants after a stress induction paradigm through a mental arithmetic task [30]. Nonetheless, CBD effects as an anxiolytic were significant for patients with CUD, effectively reducing their anxiety symptoms upon administration, either chronic or acute, of 800mg of CBD [31]. These anxiolytic effects have also been reported in samples consisting of individuals at clinical high risk (CHR) of psychosis, which has been understood as having both a genetic and environmental basis [32,33]. The latter result is particularly interesting given that some studies have demonstrated a relationship between daily use of cannabis, in particular high-potency cannabis, and the earlier onset of psychosis in cannabis users. Indeed, those who started consuming cannabis chronically before age 15 show earlier onset of psychosis compared to those who started after this age [34]. In contrast, in Cousijn et. al.

(2013), the mean age of cannabis use onset (CUO) for the sample participants was 18.9 years of age [25].

Indirect Effects of Regular Cannabis Consumption

Foremost, past research has shown that regular cannabis use which onset ranges from 15 to 25 years of age is oftentimes associated with neurocognitive deficits [35]. Indeed, two longitudinal studies tracking adolescents with substance use disorders over eight years found that higher cannabis consumption during this period was strongly associated with poorer performance in attention and verbal memory tasks [36,37]. In Meier et. al. (2012), participants who met the criteria for CUD at least once during the follow-up period, with those exhibiting more persistent cannabis use, showed the most significant decline in IQ [38]. Specifically, those diagnosed with cannabis dependence on three or more occasions showed an average IQ decline of 5.8 units compared to controls. After adjusting for confounding factors such as gender, nicotine use, comorbid schizophrenia, and alcohol use, persistent cannabis dependence was linked to deficits in sustained attention, verbal list learning, psychomotor speed and executive functioning, the latter including skills such as planning, decision-making, and impulse control [38]. Such impairments can make it challenging for individuals to cope with stressors, leading to increased anxiety and mood disturbances. In addition, Gruber et. al. (2013) reported that heavy cannabis users had statistically significant increases in their scores on the total Barratt Impulsivity Scale (BIT) compared to controls (average age of both groups = 25 years old), indicating that chronic users in young adulthood may have heightened impulsivity. This has implications for interpersonal relationships: impulsivity can translate into poor decision-making, which can strain relationships and increase stress levels, leading to greater anxiety and mood disruptions [39].

Initial Precarity and Vulnerability

It is important to take into consideration the upbringing of the two groups of interest to this review in trying to grasp differences in mood and anxiety levels. Looking at early life SES, we see that low-SES subjects, which experience prolonged exposure to various psychological stressors and environmental challenges, often show increases in cortisol levels in daily life, as well as a down-regulation of genes involved in events of anti-inflammatory action in the immune system [40]. This can intensify neuropsychiatric disorders, including substance use disorders (SUD) [41]. This connection underscores the importance of understanding how chronic stress impacts mental health and addiction vulnerabilities. Recent epidemiological data suggests that 32% of people with a mood disorder have concurring SUD [42], and Merikangas et. al. found that anxiety disorders generally precede the onset of comorbid SUD [43]. Hence, it is paramount to keep in mind that the association between cannabis and anxiety & mood disruptions is bidirectional rather than unidirectional, with multiple factors interacting in a feedback loop.

Discussion

In the developing brains of adolescents and young adults, neurodevelopmental changes proceed at rapid and distinct rates; even minimal cannabis or other drug use can disrupt this delicate balance. As psychotropic agents, THC or CBD alter this balance; at high (potent) doses, THC has consistently been identified as an anxiogenic agent across multiple studies, demonstrating its capacity to increase anxiety levels in young adults [27,28,29]. Conversely, CBD has been associated with anxiolytic properties under specific conditions [31], and with potentiating anxiogenic effects under others [17], as found by Zamarripa et. al. Although the interaction between these two substances is still unclear, they reported an increase in the area under the curve for plasma concentration of THC and its metabolites plotted against time when ingested with CBD. This could underlie a mechanism of inhibition of THC metabolization by the liver carried out by CBD, which sequesters them in the systemic circulation for longer. This interaction might moderate increases in anxiety levels and mood disturbances reported in chronic cannabis use. In contrast, young adults who do not consume cannabis, or seldom partake in its consumption, appear to show lower levels of anxiety and mood disturbances [25]. This underscores the complexity of cannabis's psychoactive effects and their combined impact on mental health. Considering these findings, CUO emerges as a critical factor in evaluating cannabis' effects on mood and anxiety [34]. These results altogether might suggest an interaction between the CHR of psychosis and earlier cannabis consumption in both the development of psychosis and the effects CBD and THC exert on the brain. These data highlight the need to consider that while regular cannabis use appears to contribute to mood and anxiety disturbances, such symptoms may also precede cannabis use, arising in response to environmental stressors and potentially leading to patterns of use that culminate in frequent cannabis use or CUD. Thus, the aforementioned results do not merely represent the differences in mood and anxiety levels in young adulthood for chronic cannabis users compared to those who do not consume any: rather, they might also reveal how larger social inequalities can affect biological processes that, in turn, influence mental health. Ultimately, this underscores the complex interplay between social environment, biological responses to stress, and substance use behaviors, in shaping mental health outcomes.

Conclusions

It is clear that the effects of cannabis are still not fully understood, with individual responses varying widely based on factors such as gender, age, cannabis use onset, potency, and dosage. Current evidence suggests that young adults

who regularly consume cannabis may experience greater disturbances in mood and anxiety levels compared to those who do not use cannabis or are not chronic users. However, as consumption continues and tolerance develops, feelings of anxiety may be diminished. Given these complexities, future research should explore the long-term consequences of cannabis use on mental health across diverse populations. Understanding the dynamics between the social, the exogenous, and the body, the endogenous, is crucial for informing effective interventions and public policies aimed at supporting young adults' mental health in the context of increasing cannabis use. Access to mental health resources and supportive community networks can also help mitigate the psychological effects of cannabis use, thereby effectively damping down deleterious symptoms and aid young adults deal with the disturbances that arise in their age.

Limitations

Focusing solely on English-language papers introduces a language-based selection bias, as it excludes studies conducted in non-English-speaking countries. This could lead to a narrow view of regular cannabis consumption's impact, as cultural, legal, and social contexts differ widely across regions, influencing both cannabis use patterns and related mental health outcomes. Additionally, the predominance of studies from WEIRD (Western, Educated, Industrialized, Rich, and Democratic) countries could skew findings. Populations in these regions have unique sociocultural and economic characteristics, which may not generalize to young adults from non-WEIRD societies, where factors such as social stigma, legal restrictions, or access to mental health resources could modulate cannabis's effects differently. Thus, these biases may limit the review's ability to capture the full spectrum of cannabis-related outcomes across diverse populations.

Moreover, some studies cited below rely on self-reported cannabis use, which may introduce recall bias, as individuals might misremember or misreport the frequency, duration, or quantity of their cannabis consumption. This issue can be exacerbated by social desirability bias, where participants underreport use to align with perceived social norms or legal considerations, especially among young adults who may feel pressure to downplay their usage. Such biases can lead to inaccurate data, which may distort findings on cannabis's influence on mood and anxiety by underestimating or overestimating its effects. Consequently, conclusions drawn from these studies must be interpreted with caution, as they may not fully capture the relationship between cannabis use and mental health outcomes.

Future Directions

To expand our understanding of the effects of chronic cannabis consumption in young adults on mood and anxiety & to better explore the interplay between social factors and usage patterns, future research should consider incorporating a broader range of variables into their models. This approach could help explain more variance in individual outcomes. Specifically, partitioning different patterns of cannabis consumption and analyzing them separately may yield more nuanced results. Additionally, longitudinal studies may be especially valuable, as they can provide insights into the long-term effects of regular cannabis use, which may manifest as cognitive or psychological deficits later in life. By pursuing these avenues, future studies can provide a more comprehensive understanding of cannabis' long-term impact on young adults' levels of mood and anxiety.

Overall, assessing these effects is inherently complex due to substantial individual variability. These responses can be influenced by genetic predispositions and social contexts, exacerbating the drug's impact. Thus, as research continues to deepen our understanding, it remains essential to approach generalizations with caution.

List of Abbreviations Used

ADHD: attention-deficit/hyperactivity disorder
BD: bipolar disorder
BIT: Barratt impulsivity scale
CB1R: cannabinoid type I receptors
CBD: cannabidiol
CBR2: cannabinoid type II receptors
CHR: clinical high risk
CUD: cannabis use disorder
CUO: cannabis use onset
ECS: endocannabinoid system
GAD: generalized anxiety disorder
HPA: hypothalamic-pituitary-adrenal
MDD: major depressive disorder
SES: socio-economic status
SUD: substance use disorders
THC: Δ-9 tetrahydrocannabinol
VAS: visual analog scale
WEIRD: Western, Educated, Industrialized, Rich, and Democratic

Conflicts of Interest

The author declare that they have no conflict of interests.

Ethics Approval and/or Participant Consent

This study is a narrative review based on previously published research and publicly available data. As no new data collection or direct involvement of human or animal participants was undertaken, ethics approval and participant consent were not required. All included studies were evaluated for their adherence to ethical standards as described in their respective publications.

Authors' Contributions

CK: was responsible for conducting the literature review, analyzing and synthesizing the findings, and writing the manuscript. All aspects of the work, including drafting, revising, and approving the final version, were carried out by the author.

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