Recreational Cannabis Use and Adolescent Development

Adolescence is a period of cognitive and biological development. During adolescence, important brain regions develop and coincide with improved cognitive abilities.[1] It is thought that exposure to substances during this period could be particularly harmful to adolescents due to the brain not being fully matured yet.[2]

How does cannabis get you high?

the "high" from using cannabis is the result of **delta9-tetrahydrocannabinol (9-THC)** binding to cannibinoid receptors in the brain.[3]

Cannabis use is associated with a range of cognitive deficits including, difficulty learning, attention problems, memory impairments and more.[4][41]

Despite concerns for adolescent development; with the legalization of cannabis, the perceived risk of marijuana amongst teens has decreased to a **historic low.**[5]

The average age of first marijuana use has decreased from 17.8 to 17 years.[6]

43% of highschoolers have tried marijuana by 12th grade.[7]

Animal studies suggest that exposure to marijuana during adolescence can result in deficits that last into adulthood.[8]

Brain Areas, Cannabis and Cognitive Development

Frontal lobe
The development of the frontal lobe during adolescence, particularly the prefrontal cortex, is associated with better executive functioning, impulse control, and better emotional regulation.[35]

Hippocampus
The hippocampus continues to develop throughout adolescence and is primarily associated with memory and is important for learning.

Amygdala
The amygdala plays an important role in emotional responses and in processing the emotional value of objects.[36]

Limbic System
This region is a center for responding to emotions and memory. During adolescence, the limbic system is more mature than other regions of the brain.[37]

These areas are home to many cannabinoid receptors, making them more susceptible to the effects of cannabis and cannabis thought to disrupt the normal development of these areas.[8]

The adolescent may know better.

But in situations where emotion is involved, their emotional limbic system may "win" over their rational prefrontal cortex, resulting in undesirable behaviour.[40]

What develops during adolescence?

Adolescences is a period of "fine-tuning" of cognitive abilities,[10] such as:

Executive Functioning[12]

Executive functioning refers to a variety of abilities, including impulse control, self-regulation, controlling attention, thinking and planning. **When someone has problems with executive functioning, they may have trouble handling their emotions, focusing, following directions, and planning for the future.**

Memory

Adolescence is a time where new brain cells are being formed in the hippocampus.[11] This is important for learning, memory, and more. It also plays a role in working memory, which is another cognitive function that develops in adolescence.[13]

When someone struggles with working memory, they may have trouble holding onto information long enough to use it (i.e., remembering a phone number long enough to write it down)

Problem-solving

Throughout adolescence, individuals become better at abstract thinking and problem-solving.[42] **Someone who struggles with abstract thinking may struggle with imagining solutions to a problem or generating new ideas.**

What Areas of Development are Impacted by Cannabis Use?

01 Inhibition

Inhibition is the ability to control impulses in favour of goal-directed behaviour. This ability improves throughout childhood and adolescence.[14]

Cannabis use is linked with lower levels of activity in the areas of the brain associated with impulse control in adolescents.[15]

Studies suggest cannabis use during adolescence impacts inhibition in two ways: [16]

1. **Impairing Consequence Sensitivity** — Responding to an immediate reward, rather than considering outcomes.[17]
2. **Impairing Response Inhibition** — The failure to stop a an already initiated response.[18]

However, it is difficult to tell whether or not impulsivity is due to cannabis use or if it existed before cannabis use.[19]

INHIBITION IN EVERYDAY LIFE

Response inhibition is an important aspect of everyday life. For example, the ability to stop a mid response is useful when driving and seeing a light suddenly turn red.

02 Attention

Attention is the ability to choose and focus on relevant information and ignore the unnecessary.

Studies suggest that cannabis use during early adolescence may derail the healthy development of attentional control, even more so than inhibitory control.[36]

3 Marijuana use is associated less accurate attentional processing in adolescents, even after **3 weeks of abstinence.**[20]

ATTENTION AND LEARNING

Someone who struggles with attention may have trouble focusing on relevant information (like a teacher speaking) and may be prone to distractions. They may also have trouble switching their attention to different tasks.

03 Memory

Cannabis and Memory

The memory center of the brain, the hippocampus, is home to many cannabinoid receptors, making it very susceptible to the effects of cannabis.[21]

Cannabis use during adolescence has been linked to damage in the hippocampus, which could lead to lasting long- and short-term memory problems.[22]

One study found hippocampal damage in adolescents even after they had abstained from cannabis use for an average of **over SIX months.**[23]

Adolescence is a critical time for development, meaning that the learning and growth that takes place during this period is essential for adulthood. A growing amount of research suggests consumption of cannabis during adolescence is harmful.[9]

Does Age of Use Matter?

The memory deficits in adolescent cannabis users mirror the deficits seen in adults after **DECADES** of use.[24] This suggests that cannabis use as an adolescent is particularly harmful to development.

Research in adults suggests that cognitive deficits can resolve after periods of abstinence, but this may not be true for adolescents due to the development that takes place during this time. [25]

Overall, research suggests that early onset cannabis use is associated with worse cognitive outcomes.[26]

Even though some studies have found cognitive impairments in adolescent drug-users, these changes may not be visible in day-to-day functioning.[25]

Preventing Cannabis Use in Adolescents: Talking to Teens

Use calm and respectful language to encourage open conversations.[27] Adolescents are capable of making informed choices; however, their still-developing prefrontal cortex may make it difficult to listen rationally during emotional situations.[28]

Adolescence is a time of social development. Debunking the "everybody is doing it" myth may be an effective way to prevent risky behaviours in young adolescents.[29]

Avoid patronizing and condescending talk.[30]

- ✗ "You're not understanding me"
- ✗ "It should be obvious that this is a poor decision"
- ✗ "I am only trying to help you, why don't you understand that?"

Phrases like this should be avoided, as they are belittling and create a one-sided lecture, rather than a conversation

Emphasize facts rather than fear. Adolescents appreciate the need for balanced information. If information comes off as too one-sided (i.e., only discussing the negative effects), they may be resistant to it.[31]

Focus on short-term consequences.[32] Middle adolescence is a time of heightened risk-taking and reward-driven behaviour. Encouraging adolescents to analyze behaviour and reflect on decision-making may be beneficial.[33]

Encourage respectful, open conversations and actively listen to their responses.

- "These are my expectations. What can I do to support you?"
- "I want you to make your own decisions for your wellbeing, but I do want to make sure you have all the facts."
- "Let's talk about the possible benefits and disadvantages of cannabis use."

Overall, additional research is needed to determine whether cannabis use during adolescence results in alterations to cognitive functions that continue into adulthood.[34]

Ashtari et al. (2011). Medial temporal structures and memory functions in adolescents with heavy cannabis use.

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Resources