The Impact of Cannabis on Mental Health

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Community Relations Coordinator
Objectives

• Education on how cannabis interacts with the brain to produce its effects

• Focus on the impact that cannabis has on adolescent brain development and mental health

• Provide education on CBD relative to THC and important distinctions between the two

• Discuss how good cannabis research on adult mental health is lacking and how we need to be mindful of this moving forward
Endocannabinoid System

- Cell receptor network that regulates a variety of bodily functions
- Regulate functions ranging from appetite, sleep, mood regulation, circulation, pain management, and immune function.
- Helps maintain homeostasis (optimal balance and harmony)
- Anandamide and 2-AG (2-Arachidonoylglycerol) play critical roles in this homeostasis
THC vs. Anandamide/2-AG

- THC produces the ‘high’
- Anandamide and 2-AG break down in minutes after binding to receptor
- THC can binds for several days
- THC produces more exaggerated effect
- Anandamide and 2-AG are more wide-ranging and subtle (retrograde signaling)
- 71 year old Scottish woman
Cannabinoid Receptors

Two types of receptor site have been identified:

CB1 receptors – located in CNS (primarily brain)
- Maintenance of homeostasis in health and disease
- Suppression of excessive neuron activity (some reduction in pain and inflammation)
- Inhibits excessive arousal
- Stimulates appetite in GI tract
- The “high”
- Reinstates drug seeking behavior with addiction
Cannabinoid Receptors

Two types of receptor site have been identified

CB2 receptors
- Outside the brain on specific components of the immune system
- Peripheral tissues of spleen, tonsils, and thymus gland
- Localized on immune cells (monocytes, b-cells, t-cells)
- Modulate GI inflammatory response (IBS possibilities?)
Physiological Response
When cannabis is smoked, vaporized, eaten

- THC quickly passes from the lungs into the bloodstream, which carries it to organs throughout the body, including the brain.
- Its effects begin almost immediately and can last from 1 to 3 hours.
- Decision making, concentration, and memory can be affected for days after use, especially in regular users.
- If marijuana is consumed in foods or beverages, the effects of THC appear later—usually in 30 minutes to 1 hour—and may last for many hours.
Neurological Response

• Most of the cannabinoid receptors are found in parts of the brain that influence pleasure, memory, thinking, concentration, sensory and time perception, and coordinated movement.

• Cannabis activates the endocannabinoid system, which causes the pleasurable feelings or "high" and stimulates the release of dopamine in the brain's reward centers, reinforcing the behavior.
How does THC affect behavior? It depends on where the CB receptors are in the brain.

<table>
<thead>
<tr>
<th>Brain Structure</th>
<th>Regulates</th>
<th>THC Effect on User</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amygdala</td>
<td>emotions, fear, anxiety</td>
<td>panic/paranoia</td>
</tr>
<tr>
<td>Basal Ganglia</td>
<td>planning/starting a movement</td>
<td>slowed reaction time</td>
</tr>
<tr>
<td>Brain Stem</td>
<td>information between brain and spinal column</td>
<td>antinausea effects</td>
</tr>
<tr>
<td>Cerebellum</td>
<td>motor coordination, balance</td>
<td>impaired coordination</td>
</tr>
<tr>
<td>Hippocampus</td>
<td>learning new information</td>
<td>impaired memory</td>
</tr>
<tr>
<td>Hypothalamus</td>
<td>eating, sexual behavior</td>
<td>increased appetite</td>
</tr>
<tr>
<td>Neocortex</td>
<td>complex thinking, feeling, and movement</td>
<td>altered thinking, judgment, and sensation</td>
</tr>
<tr>
<td>Nucleus Accumbens</td>
<td>motivation and reward</td>
<td>euphoria (feeling good)</td>
</tr>
<tr>
<td>Spinal Cord</td>
<td>transmission of information between body and brain</td>
<td>altered pain sensitivity</td>
</tr>
</tbody>
</table>

The brain structures illustrated above all contain high numbers of CB receptors.
Higher Dose Effects of THC

- Difficulty thinking/making decisions/solving problems
- Distorted perceptions
- Impaired balance and coordination
- Paranoia
- Problems with Learning/Memory
- Acute Psychosis (Delusions, Panic)
Adolescent Brain Development

- Rapid brain development continues from embryonic stage through mid-20s
  - Synaptogenesis
  - Myelination
  - Apoptosis (pruning)

Synaptic Pruning

- Brain eliminates little-used neurons during adolescence
- Wraps myelin sheath around used neurons to improve efficiency
- Pruning cuts interference between remaining neurons
Cannabis Effects on Teen Brain

- Decreases gray matter in orbitofrontal cortex (OFC)
- OFC contributes to impulse control, decision making, and learning
- Less gray matter indicates lower neuron density or volume
- Correlated with higher scores on Marijuana Problem Survey (psychological, social, occupational, legal problems)
Cannabis and the Brain

• So much attention is being paid to legalization and not enough to impact on teen brain development.

• Hippocampus (memory), amygdala (emotion and anxiety), nucleus accumbens (motivation), hypothalamus (appetite, stress), cerebellum (muscle coordination)

Source: http://www.jneurosci.org/content/34/16/5529.full
Cannabis Effects On Teen Mental Health

- Changes in mood – despair and anhedonia
- Changes in cognition (thinking)
  - Memory
  - Attention
- Increased emergence of psychosis
- Increased vulnerability for more harmful use
Risk for Progression of Use

- Over 90% of adults with a severe substance use disorder began use under age 18.
- Children who begin using at or before age 13 have a 47% risk of developing a severe substance use disorder during their lifetime, age 17 run about 25%, age 21 run 10%

Source: http://www.casacolumbia.org/addiction-research/reports/adolescent-substance-use
Cannabis and Psychosis

• Smoking high-potency cannabis every day 5x risk for developing psychotic disorder (Lancet)
• C/C variant of AKT1 gene (codes for dopamine signaling) 7x higher risk of psychosis
• Increased schizophrenia risk in adulthood for specific variant of COMT enzyme (degrades dopamine and norepinephrine).
Cannabis and Psychosis

- Smoking high-potency cannabis every day increases 5x risk for developing psychotic disorder (Lancet)

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**AKT1 Gene Variations and Psychosis**

- **Never used cannabis**
- **Used cannabis at week ends or less**
- **Used cannabis everyday**

<table>
<thead>
<tr>
<th>AKT1</th>
<th>T/T</th>
<th>C/T</th>
<th>C/C</th>
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</thead>
<tbody>
<tr>
<td>Cannabis Use Chart</td>
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</tbody>
</table>

- **AKT1 (T/T)**
  - Never used cannabis: 1
  - Used cannabis at week ends or less: 1

- **AKT1 (C/T)**
  - Never used cannabis: 1
  - Used cannabis at week ends or less: 1

- **AKT1 (C/C)**
  - Never used cannabis: 0
  - Used cannabis at week ends or less: 0
  - Used cannabis everyday: 7
Genetic Variations in COMT Influences the Harmful Effects of Abused Drugs

Percent with schizophreniform disorder at age 26

- **No adolescent marijuana use**
- **Adolescent marijuana use**

<table>
<thead>
<tr>
<th>COMT genotype</th>
<th>n= (151)</th>
<th>(48)</th>
<th>(311)</th>
<th>(91)</th>
<th>(148)</th>
<th>(54)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Met/Met</td>
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<tr>
<td>Val/Met</td>
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CBD

Abbreviation for Cannabidiol (one of the ingredients in the cannabis plant).

• CBD is not psychoactive (mind-altering) in its pure form

• Doesn’t bind with cannabinoid receptors but increases anandamide levels

• CBD inhibits enzyme that breaks down anandamide

• FDA approved medication for seizures in children with epilepsy
Therapeutic Use of Cannabis

- Scientific literature on therapeutic use of cannabis is underdeveloped
- Cannabis has medicinal potential but gap between hype and evidenced-based research
- Anecdotal/media/industry vs. controlled trials and sound research
- 83 studies from 1980-2018 with the use of cannabis to treat symptoms of mental health conditions (only 40 were randomized controlled trials...small and short. Inadequate evidence)
Cannabis to Treat Mental Health Issues

| Anecdotal Evidence (personal accounts) | Experiments using different chemicals from marijuana in rats |
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