Sex Differences in Cannabis Use and Effects

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ABSTRACT

Cannabis, the most widely used illicit substance globally, has seen a significant increase in usage, driven by the growth of the cannabis industry and evolving public opinion on potential risks. Understanding the differential effects of cannabis on males and females is becoming increasingly significant. This paper aims to investigate the sex differences in cannabis use, including patterns, motivations, and physiological responses, and their impact on health and well-being. Usage patterns exhibit variations between genders, with men using cannabis more frequently, in larger quantities, and starting at a younger age. Conversely, women tend to experience a "telescoping effect," progressing more rapidly from initial use to dependence. Sex differences are observed in the effects of cannabis, including increased heart rate and heightened sensitivity in women, and long-term consequences like Cannabis Use Disorder (CUD) and cognitive impairment in men. Cannabis use has also been linked to negative effects on reproductive health in women, as well as sexual function and testosterone levels in men. Mental health concerns are also prevalent, with women at a higher risk of developing dependence and experiencing severe withdrawal symptoms. Conversely, heavy cannabis use may exacerbate anxiety and depression in men. Further research is imperative to inform the general population and the healthcare industry, enabling informed decision-making regarding the potential benefits and risks of cannabis use. This knowledge will facilitate the development of gender-specific prevention and treatment strategies for cannabis use disorders, promoting the overall well-being of individuals.

Introduction

Over the last decade, cannabis use has increased tremendously. According to the NIH (National Institute of Health); the proportion of young adults who reported past-year cannabis use reached 43% in 2021, compared to 34% five years ago (2016) and 29% 10 years ago (2011). The cannabis industry has also been rapidly expanding and providing convenient access to a variety of user-friendly cannabis products, and there has been a noticeable trend in the general population's changing opinions about the potential hazards of cannabis. In addition to cannabis use increasing, concentrations of Δ9-tetrahydrocannabinol (THC) have also increased across cannabis products; possibly increasing the probability and speed of any side effects. Due to these reasons, it is becoming increasingly important to conduct research to fully understand cannabis use and effects in males and females. This knowledge will help the general population, and the healthcare industry make informed decisions about the benefits and risks in using cannabis. Sex differences in cannabis use and its effects are an understudied but critical area of research, as men and women differ in their motivations for use, patterns of use, and physiological responses to cannabis, eventually impacting their health and well-being.

Sex differences in motivations for use

One of the key areas of difference between males and females in cannabis use is the motivations for use. Several studies have found that men and women use cannabis for distinct reasons. For example, men are more likely to use cannabis for social and recreational purposes, while women are more likely to use it to cope with stress and anxiety

(Bonn-Miller et al, 2014), (Cuttler et al, 2016). This is an important finding, because women are more likely to experience anxiety and mood disorders than men (McLean et al, 2011), which makes them more susceptible to marijuana effects in this context. It is important to understand the motivations for cannabis use in males and females, as it can help develop sex specific interventions for patients suffering from CUD. Interestingly, cannabis used by juvenile females is typically obtained through their social relationships with juvenile males, which could support the conclusion that females smoke marijuana to impress males, whereas males use marijuana to feel the intended effects (Fattore and Fratta, 2010). This is an interesting finding because females are generally judged more harshly, in terms of using any mind-altering substances, but it is deemed acceptable when they are pushed to do things that may "impress" the opposite gender. This is debilitating for the female mind, because if they are interested in partaking in certain things (e.g. going to clubs or drinking), they are judged harshly unless it is pushed on by or deemed appropriate by males. Similarly, women who use cannabis are more likely to report using it to cope with negative emotions and stress, while men are more likely to use it for enjoyment and social situations (Cuttler et al, 2016; Subbaraman and Kerr, 2015). This juxtaposition is extremely intriguing, and it can be inferred that since women are most likely to use cannabis in a more vulnerable state than men, cannabis affects them differently, and might even make them more susceptible to negative effects [in their already vulnerable state]. These differences in motivations for cannabis use may provide further insight for the development of CUD, as well as ways to develop effective interventions to prevent and treat cannabis use disorder.

Sex differences in pattern use

It has been consistently established that men are more likely to use and become dependent on cannabis, use cannabis for medicinal purposes and initiate use at a younger age than women (Fairman, 2016; Gfroerer and Epstein, 1999; Gfroerer et al, 2002; Pope at al, 2003). Anonymous online surveys also found that there were significant differences in the percentages of men and women who indicated using cannabis for recreational purposes (73.4% men; 65.5% women, $p<0.001$), and men and women who indicated using cannabis for medicinal purposes (54.3% men; 64.1% women, $p<0.001$) (Cuttler et al, 2016). Their results also showed that men use cannabis more frequently and in high quantities, but even though men are more likely to become dependent on cannabis, women show a faster progression in first use to dependence; demonstrating a "telescoping effect." Additionally, research indicates that women were twice as likely as men to report first using cannabis after the age of 30 (Cuttler et al, 2016). On the other hand, in a sample of adults diagnosed with cannabis use disorder in their lifetime, men met a greater number of cannabis abuse criteria than women, which correlates with cannabis use rates among adolescents aged 12–17; as 9.0% account for males versus 6.7% for females (Khan et al, 2013). These findings indicate that females tend to develop more short-term patterns of use concerning cannabis while males develop more prolonged patterns that eventually lead to a higher number of males being diagnosed with CUD. This is a concerning finding, because males are less likely to seek medical care than females, (Novak et al, 2019), which could result in prolonged debilitating effects from CUD. These differences in patterns of cannabis use may contribute to the development of cannabis use disorder between the sexes and could aid in developing more effective strategies in sex specific treatment plans.

Sex differences in effects

Marijuana effects have consistently shown to manifest differently in men and women. Women are more likely to experience the acute effects of cannabis, including increased heart rate (Huestis et al, 2001), and they were found to be more sensitive to the analgesic effects of cannabis, (Cooper and Haney, 2016). men may be more vulnerable to the long-term effects of cannabis use, such as the development of cannabis use disorder as men aged 18 or older have almost twice the rate of substance dependence as adult women, according to the 2011 National Survey on Drug Use

and Health. Among near-daily cannabis smokers, females are more sensitive to the subjective effects that may contribute to maintaining cannabis smoking relative to males (Cooper and Haney, 2014). All these findings are essential for the ability to develop sex specific treatment for CUD. In line with findings in sex differences of different human processes, it can be reasonably inferred there are sex differences in cannabis effects on other brain processes as well. There has also been discussion concerning the emergence of sex differences in how female or male cannabis users compare to same-gender non-users (Calakos et al, 2017). Findings include differences in brain structure; with less grey matter volume and cortical thickness observed in female users compared to female non-users. Other findings include differences in brain functions; with blunted methylphenidate-induced enhancement of glucose metabolism in hippocampus and frontal cortex, in female cannabis users compared to female non-users, an effect not observed in males. An electroencephalogram study was conducted where female cannabis users showed altered visual processing at low frequency stimulation compared to female controls, an effect not observed in male cannabis users (Skosnik PD et al, 2006). These findings further suggest that cannabis affects males and females differently and could have further underlying effects on their bodies, which have not been discovered yet. It is important to conduct research to increase knowledge on how cannabis affects males and females differently, to efficiently treat either sex when it comes to cannabis disorders and their effects.

Sex differences in health and quality of life

The sex differences in cannabis use and its effects can have important health consequences for men and women. For example, women may be more vulnerable to the negative effects of cannabis use on reproductive health, including impaired fertility and adverse pregnancy outcomes (Ryan et al, 2021). This can, in turn, severely affect their mental and emotional health as well, especially since women are widely made to feel like their worth is tied to having children and being a mother. Additionally, women are more likely to use cannabis to cope with menstrual symptoms, which may also have implications for their overall health and well-being, according to an NIH factsheet on *Substance Use in Women*. Considering there is insufficient research on how different medications and other substances affect women's reproductive (and overall) health, this is another issue which could have more severe implications than previously known. Several studies have also suggested that women are more vulnerable to the negative effects of cannabis use than men as women who use marijuana are more likely to develop dependence, have more difficulty quitting, and experience more severe withdrawal symptoms than men. As previously mentioned, women who use cannabis are more likely to report using it to cope with negative emotions and stress (Calakos et al, 2017); which can have several negative implications on mental health. This can lead to faster progression to CUD, substance abuse disorder, and possible development of behavior and mood changes due to the side effects of marijuana on women. Conversely, it has been suggested that men may exhibit greater vulnerability to the effects of cannabis use on sexual function and testosterone levels. This hypothesis is supported by research conducted on rhesus macaques, where chronic exposure to THC resulted in notable testicular atrophy in a dose-dependent manner, accompanied by elevated serum gonadotropin levels and diminished serum sex steroids. These findings indicate a potential occurrence of primary testicular failure (Hedges et al, 2022). Cannabis use can also reduce sperm count and motility, which can lead to infertility in some males (Gunder et al, 2015; Du Plessis et al, 2015). Another negative effect of cannabis use on males is on mental health. Even though cannabis is often used to treat anxiety and depression, heavy cannabis use may worsen these conditions, (Hasin et al, 2017; Patel, 2016). These findings show how cannabis implicates health and quality of life in males and females in diverse ways, and it is important to keep conducting research to be able to inform the general population, and the healthcare industry, allowing them to make informed decisions about the benefits and risks in using cannabis.

Conclusion

In conclusion, the use of cannabis is growing to be an important topic of research, given its increasing prevalence in society, and expanding industry. Sex differences in cannabis use and its effects are an understudied but critical area of research, as men and women differ in their motivations for use, patterns of use, and physiological responses to cannabis, ultimately impacting their health and well-being. Men are more likely to use cannabis for social and recreational purposes, use cannabis more frequently and in higher quantities, and are more vulnerable to the effects of cannabis use on sexual function and testosterone levels. In contrast, women are more likely to use cannabis to cope with stress and anxiety and are more susceptible to the negative effects of cannabis use on reproductive health, and on mental health. These sex differences in cannabis use and its effects may contribute to the development of cannabis use disorder and its implications on health and quality of life. For these reasons, it is important to conduct further research to understand the sex differences in cannabis effects and uses, to aid in developing sex-specific interventions for the prevention and treatment of cannabis use effects and disorders.

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