

## CONCERNS, CANNABIS AND COGNITION

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### ABSTRACT

*With the legalization of marijuana for medicinal and also recreational benefits, there is much concerns about second hand smoke, children and adolescents observing and modeling their behavior upon seeing their parents and elders utilize marijuana, and even concerns about the impact of cannabis on children in utero. This paper cursorily reviews some of the most recent research and concerns relative to the use of marijuana and its impact on others.*

**Keywords:** *concerns, cannabis, cognition, marijuana*

Of major note in recent years has been the legalization of so called “medical marijuana” and recreational marijuana. Many have expressed concerns about “second hand smoke” and the fact that children and adolescents may be exposed not only to second hand smoke but marijuana use that would impact unborn children. Further, there is concern that a lax, lenient attitude may develop among children who observe parents “getting high” or using “medical marijuana” for recreational or escapist purposes. This paper will review some of the main research articles, many of which contact foundational information for additional investigation.

Cannabis, the pregnant woman and her child: weeding out the myths.

About 180.6 million people between the ages of 15 and 64-year-old use cannabis, making it the most used illegal psychoactive drug in the world. In many parts of the world despite the evidence of its harmful impact on adults and the developing nervous system, cannabis is accepted to be relatively harmless recreational agent. However, cannabis is the most commonly used illegal remedies in pregnancy and lactation. Evidence regarding the effects of perinatal cannabis exposure during pregnancy and lactation is plentiful but ambiguous (Jaques, et al, 2014).

Severe cannabis usage during pregnancy effects the fetus cognitive development. Excessive exposure harmfully impacts the fetus cognitive behavior effecting many brain cells and the blood.

Detecting the cannabis is easy to distinguish within an individual's tissue; although, it is difficult to know if a fetus is affected by cannabis as it takes months after birth to spot. Aggressive behavior is common for adolescences to act on therefore, proper examinations will lead to the diagnosis if the adolescence is affected by a drug substance.

Cannabis is flowering plant substance that consist the following: sativa, indica and ruderalis. It is used most for its fibre (hemp) and for its medicinal and psychoactive effects that are mediated through a unique family of at least 85 different compounds called cannabidiol (CBD) and delta-9-tetrahydrocannabinol (THC) (Jaques, et al., 2014).

Psychoactive drugs, such as cannabis, are small molecules which are able to cross through the blood-brain and other cellular barriers. During animal testing, fetal blood and tissue THC concentrations showed an estimate of 10% lower than maternal blood levels. In the rat studies repeated, particularly at higher doses, resulted in significantly higher plasma concentrations in the fetus as compared with single acute dosing. This suggests that heavy and chronic cannabis use may result in concentration of active cannabinoids in the developing fetus (Jaques, et al., 2014).

In the gravid population, over 75% and generally self-reporting from developed Western countries such as Australia and the United Kingdom, place the frequency of cannabis usage up to 5% of all pregnant women. However, the certainty of these estimates is limited due to the variability of self-reporting rates. Although many illicit drug users stop or decrease drug use during pregnancy, cannabis users often continue to use throughout pregnancy and while breast feeding. Persisting cannabis use throughout pregnancy may, in part, be due to widespread societal acceptance of cannabis as a relatively harmless recreational agent compared with other 'hard' drugs of dependency such as heroin, and certainly more study into why this occurs is warranted (Jaques, et al., 2014).

Immediate cannabis implication on the mother and her child have a crucial impact on the pregnancy and long-term health outcomes. Early detection of drug use during the pregnancy, allows a timely manner of harm-reduction strategies to moderate the drug use and minimize the drug usage on the family. Maternal urine and hair samples can be collected and analyzed for the presence of drug metabolites, but only maternal toxicology screening has any value if the intention to implement harm-minimization strategies early in the pregnancy. Newborn toxicology screening primarily focuses on identifying families at risk of ongoing drug use; and address child protection concerns that may be associated with

parental drug use and provide appropriate treatment for suspected cases of withdrawal or intoxication (Jaques, et al., 2014).

It's difficult to determine the effects of maternal cannabis use on the developing fetus because of regularly high prevalence of other concurrent drug use (ex. Second hand smoking) and other adverse parenting and lifestyle issues: poor nutrition, poverty and stress. Jaques, et al., (2014) provided results, almost 420,000 Australian births over a 5-year period found that womb cannabis exposure increased the risk of neonatal intensive care unit admissions, mainly for prematurity; but there was no relation to any high risks of perinatal death (Jaques, et al., 2014).

Cannabis exposure in the womb may impair long-term growth and neurodevelopment; particularly in cognitive and behavior. Jaques, et al. (2014) want to make it aware to the population, that head growth during the first month of life, is significantly associated with future intelligence quotient.

The levels of cognitive and intellectual deficits are also related to the timing and degree in the womb exposure. The effects of cannabis on future physical growth are still to be determined. The Ponderal Indices of adolescents showed that prenatal cannabis is higher than non-exposed children, but further work needs to be done to better determine their risk of developing clinically important sequelae: appetite problems, dyslipidemia and diabetes, which are all common manifestations in chronic adult cannabis users (Jaques, et al., 2014).

A number of states in the United States have legalized medical marijuana for certain specific indications. However, it is not known whether the long-term effects of prenatal exposure to medicinal cannabis used in a controlled manner; differ from the effects of cannabis used as a recreational drug during pregnancy. Any advice about medicinal cannabis use during pregnancy must take into consideration (1) the potential benefits of the substance with regards to maternal well-being and (2) potential impact of this type of cannabis exposure on the developing fetus (Jaques, et al., 2014).

Depending on how much the mother used cannabis, the cannabis and its metabolites can steadily pass through the breast milk in variable concentrations. When the infant consumes its mother's breast milk during breastfeeding, the mother's milk THC concentrations may be up to eightfold higher than simultaneously measured maternal plasma concentrations. The Academy of Breastfeeding Medicine recommends pregnant mothers to avoid breastfeeding for 30 days, if she intake the drug before birth. This is especially relevant if substance abuse is ongoing post-delivery or if the mother is not engaged in substance abuse treatment programs (Jaques, et al., 2014).

Currently, there are no 'safe' limitation or pharmaceutical treatment to avoid the negative impact on the cognitive development of the fetus during pregnancy.

Further research must be done to understand if cannabis is impacting the development of the fetus and if it's the cause of their rebel behaviors or outburst. There is not enough evidence to verify the implantations it is having during pregnancy. Mothers are advised to not smoke tobacco or cannabis around their children. They should be educated on all the potential risks and factors when using cannabis during pregnancy (Jaques, et al., 2014).

It is not uncommon for health-care professionals caring for pregnant women who encounter the problem of maternal cannabis during the antenatal period. Although, cannabis is viewed to be a harmless recreational drug when compared with other illicit drugs: meth, heroin, cocaine etc. There is rising evidence to suggest that prenatal cannabis exposure can have a negative effect on fetal growth and the exposure to cannabis during critical periods of brain development; particularly during the fetal and adolescent periods (Jaques, et al., 2014).

This next section will explore the various health effects of exposure to second- and third-hand marijuana smoke and discuss some concerns.

There is much concern about the health effects of prolonged exposure to second- and even third-hand marijuana smoke. There are also many issues in this regard. This section will delve into these issues.

First-hand marijuana use entails a number of detrimental health outcomes – increased chance of developing a mental illness, higher likelihood of involvement in a car crash, and developmental issues, particularly for adolescents. While the second-hand and third-hand effects of tobacco have been studied, there is scant research in the indirect exposure to marijuana smoke. One study has shown preliminary evidence on animal endothelial function impairment. For the study in question, animal studies were not included.

One study conducted by Fried, Watkinson and Siegel (1997) looked at 1701 papers but synthesized only eight autonomous studies and, due to the diversity of testing methods, a meta-analysis was not possible yielding a narrative investigation of the eight studies. Four studies showed THC content in the saliva of those exposed to second-hand smoke. While six studies measured enhanced THC content in blood samples of those exposed to second-hand smoke – though lower than that of first-hand smokers.

Higher levels of THC content in second-hand marijuana smoked yielded higher measured THC content in urine sample of two studies.

Two studies focused on psychoactive effects of second-hand smoke. The results of one study were measured on the Drug Effects Questionnaire, validating second-hand marijuana psychoactive effects on participants and showing a higher effect when participants were exposed to smoke from higher THC content marijuana. Another study simply asked for participants to describe their high and found a similar result to Drug Effects Questionnaire study.

Second-hand smoke can lead to residual metabolites to be available in levels abundant enough to register positives in drug tests. Due to the results of measurable metabolites in blood, urine, and saliva along with psychoactive reports, the authors of this study felt that legalization of smoke in unventilated areas was contraindicated. Another concern of the authors was that false positives could occur for marijuana use by second-hand smoke exposure. The determination of metabolites found in first-hand smoker compared to second-exposure has not been made; thus, determining if an individual has direct marijuana use is difficult so leeway or openness to individuals claiming second-hand exposure may be warranted.

The authors of this narrative examination of marijuana studies stated that more research needs to be done in order to determine if the metabolite levels of intoxicants found in second-hand use result in long-term ill health effects as this data was not readily available at the time the study was made (Fried, Watkinson and Siegel (1997).

There are certainly overall physical and medical and health concerns about the ongoing impact of exposure to marijuana smoke. It is difficulty to objectively quantify the amount and specific impact of marijuana smoke on growing children in the home and in other environments.

Holitzki, Dowsett, Spackman Noseworthy and Clement engaged in a systematic review which tested the effects of second- and third-hand marijuana smoke when present in public areas. The way in which they tested this hypothesis was through an animal model, which demonstrated that endothelial function is impaired when exposed to the smoke. An investigation of the possible harmful effects of being exposed to marijuana second-hand is urgent, due to the fact that several states have already legalized marijuana. Those states include: Alaska, Colorado, Oregon, Washington, Washington DC, Nevada, California, Maine, and Massachusetts. Due to the growing trend of state legalization, it is important to provide evidence-informed policy and to support conversations with doctors in order to reduce harm. The analysis consisted of two categories, one of which was a measure of the chemical compounds of marijuana smoke, and the other being the measure of the immediate effects of those exposed to marijuana smoke either second- or third-hand. The immediate affects were then organized into three subcategories, which include metabolites in bodily fluids, cannabinoids, impact of ventilation in relation to the second- and third-hand exposure, and psychoactive effects of exposure when it is passive. The findings included detectable amounts of THC in the blood when someone was exposed to marijuana second-hand. In addition, 4 hours after being exposed to the smoke, 1 out of 5 of the subjects had a maximum concentration (28.3 mL) of cannabinoid metabolites and 1.5% concentration of THC.

Urine THC concentrations and THC levels in the blood were high for those exposed to marijuana smoke second-hand who were contained in an unventilated environment. Psychoactive affects included feeling high, and having eye irritation.

There is also much concern about the effect or effects of Cannabis Exposure on Pubertal Outcomes.

This section will review some of the main concerns and issues.

Cannabis is becoming legalized and often used more in a medicinal and recreational manner.

Although adults are the advertised target, cannabis promotion doesn't deter adolescents. "While the effects of cannabis on pediatric neuropsychological and mental health outcomes have been broadly studied, there are limited data on the physical health effects of cannabis, including endocrine health" (Sims, et al., 2018, pg. 137).

In their systematic research approach, the researchers reviewed 759 records searching to find the answer to the researchers question, what are the effect of cannabis exposure on pubertal outcomes.

However few, if any, lived up to the criteria needed to answer the question. Subsequently, the researchers were left to review animal studies which examined the effects that cannabis had on them.

The criteria included 10 participants that were boys and girls, less than 18 years old and have had previous encounters with medicinal or recreational cannabis. Since the use of cannabis varies, the researchers looked into smoked, ingested, and other methods. The various studies were collected by using "randomized controlled trials, observational studies, prospective and retrospective cohort studies, and case-control studies. Case reports, reviews, and preclinical or animal studies were excluded." (Sims, et al., 2018, pg. 138)

Within this systematic review, the researchers made an extensive search of how cannabis effects the growth in adolescents. Findings included one study that saw plasma concentrations of the luteinizing hormone, testosterone, and cortisol were higher in boys using cannabis, but plasma growth hormone concentrations were lower during puberty in the cannabis group. (Sims, et al., 2018) When compared to the control group, the individuals who used cannabis weighed less and were shorter at the age of 20. However, the abstract that this was found in didn't have a full text publication on the work so the researchers excluded this from their systematic review. This left the researchers with an unknown of their study. However, they did find that frequent cannabis use may effect growth spurts and pubertal development based on animal studies with cannabis with the extensive literature review done. This study also produced an understanding of pubertal hormones and how they contribute to bone health; for example, bone mass.

The study at hand examined existing evidence of how cannabis effects pubertal outcomes in children. When the review was over, the researchers saw that no existing articles provided answers to the question of direct cannabis effects on puberty. Additionally the research examined, failed to assess pubertal outcomes.

With little evidence to solve this problem, animal studies are one of the few models that can provide insights into the inquiry on pediatric endocrine and metabolic health. In regards to female rats, cannabis “leads to delayed sexual maturation and impaired gonadal function.” (Sims, et al., 2018, pg. 137) As for male rats, significant amounts of cannabis led to a reduction in the pubertal growth spurt. (Sims, et al., 2018, pg. 137)

This systematic approach to delve into this inquiry was extensive to say the least. However, little information on answering the question was provided. Therefore, research in this area is needed to view the effects of cannabis on pubertal outcomes. So far, we have information on how it effects animals but not with human subjects, there are little answers that we have. With all the information produced by MEDLINE, Embase, Cochrane Database of Systematic Reviews, Central, PsycINFO, CINAHL, Web of Science, and SPORTDiscus all were excluded because they did not meet the requirements for eligibility.

The researchers asks for longitudinal studies are needed for pediatricians and other health care providers to better understand the effects of Cannabis (Sims, et al., 2018)

## **SUMMARY AND CONCLUSIONS**

This paper has cursorily reviewed four recent articles of concern regarding the impact of second hand Marijuana smoke on unborn children, children exposed to marijuana smoke due to consumption of either medical or recreational marijuana and adolescents who may imitate the behavior of significant others. It is difficult to conduct true experimental methodologies on subjects who may later be impacted quite negatively in terms of cognition and overall functioning. It will be incumbent on future clinicians and school psychologists to attempt to ascertain if memory, cognition, attention and motivational deficits are due to either use of, or exposure to, medical or recreational marijuana. It would seem that state by state and city by city comparisons, when examining exposure to recreational or medical marijuana would help discern the impact of second or even third hand smoke. While many see marijuana as a harmless, recreational drug, the long term use of this substance may be very, very problematic to future generations and we shall see the impact a few decades from now.

**REFERENCES**

- 1) Fried, P.A., Watkinson, B & Siegel, L.S. (1997) Reading and language in 9 to 12 year olds prenatally exposed to cigarettes and marijuana *Neurotoxicology and Teratology*, 19, (3), 171-183.
- 2) Holitzki, H., Dowsett, L.E., Spackman, E., Noseworthy, T., & Clement, F. (2017). Health effects of exposure to second- and third-hand marijuana smoke: a systematic review. *CMAJ OPEN*, 5(4), 814-822.
- 3) Jaques, S.C., Kingsbury, A., Henshcke, P., Chomchai, C., Clews, S., Falconer, J., Feller, J.M., & Oei, J.L. (2014). Cannabis, the pregnant woman and her child: Weeding out the myths. *Journal of Perinatology*, 34(6), 417-424. doi:10.1038/jp.2013.180
- 4) Sims, D.E., Anvari, S., Lee, Y., Samaan, Z., Banfield, L., Thabane, L., & Samaan, C.M. (2018). The Effect of Cannabis Exposure on Pubertal Outcomes: A Systemic Review. *Dove Press Journal*, 137-147.