NORTHERN ILLINOIS UNIVERSITY

Effects of Marijuana on the Fetus and Breastfeeding Infants

A Capstone Submitted to the

University Honors Program

In Partial Fulfillment of the

Requirements of the Baccalaureate Degree

With Honors

Department Of

Nursing

By

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DeKalb, Illinois

December 15, 2019
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Abstract

Drugs consumed during pregnancy has the potential to affect the fetus and cause conditions involving growth and development. With the recent legalization of marijuana in various states as well as its high use among pregnant women, healthcare professionals have begun to question whether maternal use can cause negative outcomes for neonates. According to Ryan, Ammerman, O’Connor & AAP Committee on Substance Use and Prevention, “data from 2016 reported in the National Survey on Drug Use and Health (NSDUH) revealed that ... among 18 through 25-year-old pregnant women, 8.5% reported past month marijuana use” (2018, p. 1). This paper aims to examine the outcomes of marijuana use on the fetus and breastfeeding infants. It also explores to what degree of effect marijuana produces. Outcomes such as neonatal growth parameters, birth weight, head circumference, and length are assessed. Additionally, the relationship between marijuana use and the occurrence of ectopic pregnancy is analyzed. Neurodevelopment, as well as behavioral outcomes, are reviewed from birth into adulthood. This paper also explores if any neonatal irregularities arise from the use of marijuana when breastfeeding. Data was formulated by secondary analysis from various articles discussing the effects of marijuana use during pregnancy and breastfeeding. Results revealed subtle differences in individuals prenatally exposed to marijuana. Additionally, Ryan et al. (2018) stated that maternal marijuana use can “enhance the placental barrier permeability to pharmacologic agents and recreational substances, potentially placing the fetus at risk from these agents or drugs” (p. 3). Various confounding factors such as the use of tobacco and alcohol limited the accuracy of data. While this subject is still being investigated, researchers have proven that marijuana readily crosses the placenta and is expressed in breastmilk, thus,
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increasing the risk for negative outcomes. Until further research is conducted, healthcare professionals discourage the use of marijuana while pregnant or breastfeeding.

*Keywords: marijuana use, pregnant, breastfeeding*

**Literature Review**

Delta-9-tetrahydrocannabinol (THC) which is the main psychoactive cannabinoid in marijuana, travels rapidly to the brain and fat tissue throughout the body. It is predominantly used for its euphoric effect as well as its ability to alleviate nausea and enuresis during pregnancy. This psychoactive cannabinoid increases dopamine levels in the body and functions as a neurotransmitter. It also can cause alterations in mood and cognitive functioning (The Association of Women’s Health, Obstetric and Neonatal Nurses, 2018). THC can be identified in the blood for up to 30 days and has a half-life of 8 days. Friedrich, Khatib, Parsa, Santopietro, & Gallicano (2016) explains that it “readily crosses the placenta, which, in conjunction with slow fetal clearance, results in prolonged fetal exposure to THC, even after consumption is discontinued” (p. 1). THC functions through G protein-coupled receptors known as cannabinoid receptor type 1 (CB1) and cannabinoid receptor type 2 (CB2). Both receptors are located throughout the female reproductive system and activated by both endogenous and exogenous manipulation. CB1 was studied more precisely being that it is “found in the oviduct, uterus, and from the late two-cell stage through the blastocyst stage of the embryo” (Fried et al., 2019, p. 4). Mice were utilized in this study to evaluate the effects of decreased and increased cannabinoid signaling. Results showed embryos with asynchronous development with no cannabinoid signaling. Furthermore, “increased cannabinoid signaling via CB1 agonists has shown to lead to decreased blastocyst viability and a reduced number of trophectoderm cells, a decreased rate of zone-hatching, and inhibition of implantation” (Fried et al., 2016, p.
Implantation of the embryo is also dependent upon these receptors. They aid in facilitating the timely transport of embryos from the oviduct to the uterus. Disruption of this process can lead to an increased risk for ectopic pregnancy. In addition, venous cord blood retrieved from women after an ectopic pregnancy showed elevated cannabinoid levels. This suggests that there is a relationship between the use of marijuana and the transport of the embryo to the uterus. Additionally, increased cannabinoid signaling can cause relaxation in the uterine lumen which also increases the risk for ectopic pregnancy (Friedrich et al., 2016).

Prenatal exposure to marijuana results in a decreased dopamine receptor D2 mRNA expression, which is a key brain reward region. Decreased expression of these receptors causes epigenetic changes. These changes increase the risk for exposed individuals to develop an addiction and other psychiatric disorders later in life (DiNieri et al., 2011). The study conducted by Cherlet & Scott (2002) revealed that exposure to THC in utero can induce several changes in the mechanism of the fetal pulmonary system. Results showed that marijuana disrupts the functioning of surfactant synthesis as well as prematurely releases stored surfactant. This can result in an infant’s inability to adapt to extraterine life at birth (Cherlet & Scott, 2002).

One of the growth parameters evaluated in the articles reviewed was alterations in birth weight. Some studies found that increased use resulted in lower birth weights while other studies showed higher birth weights (Zhang, Marshall, Kelsberg, & Safranek, 2017). Additional outcomes noticed at the time of birth were altered arousal patterns, regulation, and excitability (Ryan et al., 2018). Following delivery, few abnormalities were observed in infants exposed to marijuana during embryonic development. Abnormalities seen were increased tremors and prolonged and exaggerated startle reflexes. Ryan et al. (2018) explained that these outcomes “were observed in the first week of life and persisted at 9 and 30 days of life” (p. 5).
Later outcomes of marijuana use were analyzed in two longitudinal studies conducted by
the Ottawa Prenatal Prospective Study (OPPS) and the Maternal Health Practices and Child
Development Study (MHPCD). Subjects demonstrated noticeable outcomes beginning at the age
of 4, which continued into adulthood. Most outcomes were noted in the area of cognitive
functioning affecting information processing and retention. Ryan et al. (2018), states that
“initial observable effects at the age of 4 years included lower scores in verbal reasoning
and memory tasks. At 6 years of age, children exposed to marijuana, compared to
nonexposed children in the control group, showed deficits in global measures of language
comprehension, memory, visual and/or perceptual function, and reading tasks that require
sustained attention” (p. 5).

Additional data was collected from this cohort as they progressed through adulthood. Between
the ages of 9-12, the focus shifted to deficits in the area of executive function tasks and visual
problem-solving and showed a higher incidence of inability to sustain impulse control (Ryan et
al., 2018). From the age of 13 to 16, “problems were seen in attention, problem-solving, visual
integration and analytic skills required sustained attention” (Ryan et al, 2018, p. 5).

Numerous studies imply maternal marijuana use has minimal effects on newborn
behavior and outcomes. The article presented by Zhang et al. (2017) also evaluated the clinical
trial conducted by OPPS and MHPCD. Both articles “found essentially no differences associated
with prenatal marijuana at birth, throughout infancy, and through age 3 years” (Zhang et al.,
2017, p. 462). An article written by Hill & Reed (2013), also evaluated the OPPS and MHPCD
study and reviewed the effects of marijuana on the fetus. Similar results were noted and
determined that impalpable effects were present from the use of marijuana. Hill and Reed (2013)
explained that “subtle effects were suggested in the ability of children to comprehend language at
age 2 years. At this age, the children of moderate users performed better at motor tasks. On the other hand, testing also showed the decreased ability of children to analyze visual stimuli” (p.713).

To further determine the effects of maternal marijuana use, infants exposed to marijuana through breastfeeding were also analyzed in these studies. Breastfeeding, which is the expression of milk from a woman’s breast, has been recognized as the ideal feeding method for infants. It provides children with the necessary nutrients and immunity needed in their first few months of life. It is recommended that infants are “exclusively breastfed for the first 6 months of life with continued breastfeeding along with the introduction of appropriate complementary foods for 1 year or longer” (Center for Disease Control and Prevention, 2019, p.5).

Breastfeeding has numerous benefits, both short and long-term for mothers and infants. Benefits include:

“decreased infections, such as gastroenteritis, ear infections, and severe respiratory diseases; decreased obesity and diabetes mellitus; decreased rate of sudden infant death syndrome; improved intellectual development; decreased postpartum blood loss; increased child spacing; and decreased risk of type 2 diabetes mellitus for the mother” (Ryan et al., 2018, p. 8).

There are a variety of drugs that have been identified as harmful while breastfeeding due to the ability of excretion through breastmilk. Factors such as ionization, molecular weight, solubility in lipids and water, and the pH of the drug all contribute to the pharmacokinetics of marijuana in human milk (Ryan et al, 2018). Ryan et al. (2018) described that “THC is 99% protein-bound, is lipid-soluble, and has a molecular weight of 314” which makes it transferable through breastmilk (p. 8). Although most findings were insignificant, Ryan et al. (2018) found that “in multivariate
regression analysis, the infant’s exposure to marijuana during breastfeeding in the first month was associated with $14 \pm 5$ points decrease in motor scores after controlling for tobacco, alcohol, and cocaine use during pregnancy and lactation” (p.9). Additionally, in the article analyzed by Hill & Reed (2013), there were noticeable abnormalities noted in the motor skills of infants aged 1.

**Conclusion**

Though this topic is continually being studied, results have shown that marijuana readily crosses the placenta, leaving the fetus at an increased risk for negative outcomes. Research displayed that marijuana exposure can lead to abnormal birth weights, altered time of arousal, and the decreased synthesis of surfactant production. Additionally, it can cause alterations in gene expression associated with opiate reward in adulthood. This leads to a higher risk of addiction and psychiatric disorders. Marijuana use also predisposes women to an increased risk of ectopic pregnancy. This is due to the disruption in the movement of the embryo to the uterus, as well as relaxation of the uterine lumen. Marijuana can also affect infants being exposed through breastfeeding. Deficiencies were seen in the area of motor skills in infants from birth until the age of 1. Additionally, safety was a major concern when using marijuana. It can cause a delayed reaction in cognitive, motor, and emotional response, thus posing a safety risk for both mother and baby (Hill & Reed, 2013). Though differences have been noted in individuals exposed to marijuana, various confounding factors were present that could have also contributed to these outcomes. In addition, the inability to collect information on children that were exposed to marijuana in utero limited the amount of reliable data. Until further information is collected, health care personnel are advising mothers to abstain or significantly decrease marijuana use while they are pregnant or breastfeeding to decrease infant’s exposure.
References


