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Research Article

Effects of Maternal Cannabis use on the Newborn at Delivery and the Perinatal Period

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ABSTRACT

Background: To evaluate if Activity Pulse Grimace Appearance Respiration (APGAR) scores and birthweight at delivery are different amongst newborns exposed to cannabis in utero compared to those who were not exposed to cannabis in utero. Also the rate of perinatal complications to the newborn was examined.

Methods: This is a retrospective cohort study utilizing patient's electronic health records that gave birth at a community hospital in the central valley of California in 2019. Exposure was defined as cannabis detected on universal urine toxicology testing completed on admission to hospital prior to birth/delivery. This was compared with urine toxicology testing that was negative for cannabis exposure.

Results: No significant difference between mothers who use cannabis and mothers who do not use cannabis during pregnancy in terms of the newborn's one minute or five minute APGAR score.

A significant difference between mothers who use cannabis compared to mothers who did not was found, in terms of the newborn's birthweight. The rate of perinatal complications to the newborn was negligible at delivery and in the immediate perinatal period in our particular study.

Conclusion: There was a significant difference between mothers who use cannabis compared to mothers who did not in regards to birthweight in the newborn. Mothers who used cannabis in pregnancy had lower birthweight newborns. The rates of complications to the newborn in the perinatal period were negligible showing cannabis use in the short term period has no evident complications to the newborn.

Keywords: Cannabis; Marijuana; Newborn; Pregnancy

INTRODUCTION

Cannabis is considered a natural product of the earth. Cannabis, also known as marijuana originated in Central Asia but now is currently grown throughout the world. It is an illicit drug in many states yet used by many people from different racial and ethnic backgrounds. Many people with varying levels of education and socioeconomic status also partake in its use. In 2013, 19.8 million people in the United States reported utilization of cannabis within the past month of questioning [1]. In various states throughout the United States, cannabis use is deemed medically beneficial for certain disorders and diseases. In 1970, with passage of the Controlled Substances Act, cannabis was classified by Congress as a Schedule-I controlled substance [2]. Schedule-I controlled substances are distinguished as having no accepted medical use in the United States. Recreational and medicinal utilization of cannabis remains illegal by federal law in the United States, the U.S. Food and Drug Administration (FDA) has not approved medicinal cannabis use. However, on a state level, the legalization of medical and recreational cannabis use is surging upward steadily. The American College of Obstetricians and Gynecologists (ACOG) recommends against cannabis use in pregnancy [3]. Additionally, the American Academy of Pediatrics (AAP)

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recommends that women avoid the controlled substance during pregnancy and breastfeeding [4]. Many states have recently legalized the use of cannabis recreationally. Because of the legalization of cannabis, people may feel it is safe to use. Likewise, because cannabis is considered a natural plant, people may deem it is safe to use as well. At a community medical center in the central valley of California, where this study was conducted, the recreational use of cannabis has been legalized since 2018 yet minimal research exists on its effects on the unborn fetus. More women now report using cannabis either recreationally or to treat nausea and vomiting from pregnancy [5]. Cannabis has certain chemical components including Cannabidiol (CBD), a cannabinoid with non-psychogenic properties and an analog of delta-9-Tetrahydrocannabinol (THC), the main active psychogenic component of cannabis [4]. Whether cannabis is smoked, vaped, or eaten, chemicals transfer to the baby. THC gets passed along to the baby during pregnancy by passing freely through the placenta and after birth through breastfeeding. Adverse effects on perinatal outcomes and fetal neural development may have an association with cannabis use [1]. Endocannabinoid receptors form very early in fetal life (i.e., 14 weeks gestation) and have critical functions in fetal and postnatal brain development, neuronal connectivity, and glial cell differentiation [6]. The exogenous supply of cannabinoids resulting from THC exposure can adversely affect fetal growth as well as structural and functional neurodevelopment [6]. However, the data garnered from previous research is not uniform. With cannabis utilization, there may be an association with preterm birth, stillbirth, fetal growth restriction in utero, and other perinatal outcomes of that nature. The aim of this study was to determine if Activity Pulse Grimace Appearance Respiration (APGAR) scores and birthweight at delivery are different amongst newborns exposed to cannabis in utero from those who were not exposed to cannabis in utero. The rate of complications at delivery and in the perinatal period to the newborn was also examined.

METHODOLOGY

We conducted a retrospective cohort study of babies born to mothers that gave birth at a community hospital in the central valley area of California in 2019. There are various OBGYN medical groups that are associated/have privileges at this community hospital. Within these particular medical groups, there are various diverse patient populations, socioeconomic statuses, and health disparities seen/noted. To have a more balanced heterogeneous patient population, the data from these various populations was obtained for analysis. This study was approved by the Dignity Health Regional Institutional Review Board (IRB). Women presenting at the various clinics underwent universal urine toxicology testing at the first prenatal visit in the first trimester. They received consistent prenatal care during the antenatal period. The toxicology test was subsequently completed again at admission for delivery. The urine toxicology that was performed on admission for delivery was utilized in this particular study. If the urine returned back positive for cannabis, it was then subsequently sent to another external laboratory to quantify the amount of cannabis found in the urine as carboxy acid THC confirmation in nanograms per milliliter (ng/ml). The THC confirmation number was used in this study to ascertain if an association could be found in cannabis use in pregnancy and the level of THC in the urine as it relates to outcomes/complications in the newborn at delivery and in the immediate perinatal period. A thorough review of maternal and neonatal charts in the Electronic Health Record (EHR) was completed to verify cannabis exposure and components of the primary outcome that were to be measured/analyzed. Data for maternal age, race/ethnicity, urine carboxy acid THC level in ng/ml, gestational age of newborn at delivery, method of delivery, AGPAR scores at one and five minutes respectively, newborn birthweight, Newborn Intensive Care Unit (NICU) admission, complications at delivery and the immediate perinatal period were extracted meticulously from the medical record and subsequently analyzed. Maternal characteristics and subsequent pregnancy outcomes were compared between women who were exposed to cannabis compared to women who were not exposed. A two sample t-test or chi-square test was used, as appropriate. Women with a multiple gestation pregnancy, history of significant co morbidities (i.e., diabetes mellitus, hypertension, asthma), pregnancy-induced conditions (i.e., diabetes mellitus, hypertension), polysubstance use (i.e., tobacco, alcohol, cocaine), or identified chromosomal abnormalities were excluded due to the associated outcomes with these specific populations. A p-value of <0.05 was considered statistically significant. No adjustment to the p-value was made based on multiple comparisons. To bolster the results of the study and to allow for adequate validity of the results, certain patient and environmental variables were excluded from the study. Extremes in maternal age were excluded. In the obstetrics and gynecology literature, advanced maternal age is 35 years and older as there is associated risks that are heightened through the aging process. Women younger than 18 years were also excluded so as to prevent extremes in study results that cannot be generalized to the population at large. Also excluded were pregnancies complicated with preexisting comorbidities medical diagnosis/disease processes that can inadvertently effect results i.e., hypertension, asthma, diabetes mellitus type I and II, hyperlipidemia. Pregnancies complicated with gestational hypertension, preeclampsia, gestational diabetes, and other pregnancy induced conditions were all excluded. Due the effects of illicit drug use in the human body and the compounding effects of co and multi-use of illicit drugs, no use of tobacco, alcohol or illicit drug utilization during pregnancy i.e., cocaine, opioids (heroin), methamphetamines were included. Tobacco use is an important confounder and was defined in this study as reporting any tobacco use after diagnosis of pregnancy or one or more cigarettes through daily use in any trimester. If there was no documented urine toxicology results in the electronic medical record or there was a lack or limited routine prenatal care, then these patients were also excluded.

RESULTS

We identified 100 women who received prenatal care and subsequent delivery from three OBGYN medical groups. Of these, 50 women were identified as cannabis negative and 50 per cannabis positive through universal urine toxicology screening

prior to birth/delivery. All mothers, regardless of cannabis use or not, on average were in their mid-twenties with a gestational age of 39 weeks at delivery.

No admissions to the Newborn Intensive Care Unit (NICU) were noted in babies born to mothers who were cannabis positive on urine drug screening. All babies that were exposed to cannabis were cared for in the postpartum unit/newborn nursery and did not require a higher level of care.

Using a two sample t-test for analysis, we found a significant decrease in the newborn birth weights from mothers who used cannabis (mean=3117.9 grams) compared to those mothers who did not use cannabis during pregnancy (mean=3397.7 grams), a 279.8 gram difference.

However, we found that there was no significant difference in the one-minute or the five-minute APGAR scores between mothers who used cannabis compared to those mothers who did not use cannabis during pregnancy (Table 1).

	C+	C-		
	Mean SD**	Mean SD**	CI*	p-value
Mother's age	25 3.6	26.2 4.6	-0.49- 2.81	0.08
Newborn Birth weights	3117.9 362.6	3397.7 362.6	74.01- 485.59	0.004
APGAR (one minute)	8.2 0.6	8 0.8	-0.42 – 0.13	0.146
APGAR (5 minute)	8.9 0.2	8.9 0.3	-0.17 – 0.06	0.163

Note: C+=cannabis positive mothers; C-=cannabis negative mothers; SD=Standard Deviation; CI=Confidence Intervals.

Table 1: Significant difference showing in the one-minute or the five-minute APGAR scores between mothers who used cannabis compared to those mothers who did not use cannabis during pregnancy.

The rate of perinatal complications to the newborn was negligible at delivery and in the immediate perinatal period so this particular variable was not analyzed in this particular study. Some of the perinatal complications include Preterm Premature Rupture of Membranes (PPROM)/prematurity, Intrauterine Growth Restriction (IUGR), miscarriage, and fetal demise. Due to the small sample size, race/ethnicity was divided into two groups. One group was Caucasians and the other non-Caucasians. Using two sample t-test, we found no difference in newborn birth weights and urine carboxy acid THC levels between these two groups. We then used the Chi-Square test and determined that there was no difference in cannabis use between Caucasians versus non-Caucasians (Table 2).

	Caucasians	Non-Caucasians		
	mean SD	mean SD**	CI*	p-value
Newborn Birthweights	3288.6 624.5	3227 426.9	-274.24- 151.05	0.283
Urine THC levels	403.4 467.2	381.3 606.6	-334.5- 290.25	0.444

Table 2: Significant difference showing between Caucasians versus non-Caucasians.

DISCUSSION

Research conducted July 2019 in Colorado, looked into young mothers (13-22 years old) with singleton pregnancies [3]. In this particular study, cannabis exposure was associated with adverse outcomes related to pregnancy and the newborn. Hypertensive disorders of pregnancy in the mother and sponateous preterm birth, stillbirth, and Small for Gestational Age (SGA) newborns were outcomes seen in the study.

With gestational hypertension there is the associated risk of Intrauterine Growth Restriction (IUGR) leading to risks for Small Gestational Age (SGA) and/or Low Birth Weight (LBW) newborns [3]. A retrospective medical record review of singleton births was conducted between August 2013 through December 2014 which explored cannabis use in pregnancy based on urine drug screen and the association with infant birthweight. Urine drug screens were collected at the beginning of prenatal care and at delivery.

Infants born to mothers with cannabis utilization during pregnancy through positive urine testing at presentation for prenatal care and delivery were found to have a significantly lower median birthweight compared to those with negative urine testing.

From past research, there is a similar trend in lower birthweight seen in newborns exposed to cannabis during pregnancy as opposed to newborns that were not [3]. The risks for complications perceptible not only in the newborn but also in the mother; made evident in previous research conducted. A study conducted at the University of Colorado discovered lower birthweight and Small for Gestatational Age (SGA) newborns as a result of cannabis use in pregnancy. Their sample included 1206 young women, with 211 identified as using cannabis during pregnancy.

Our study utilized a medical database to identify 50 women of reproductive age who used cannabis during pregnancy compared to 50 women who were identified as not using cannabis during pregnancy. These women were chosen for our study through meticulous data identification and collection to ensure the subjects met specific inclusion criteria. The difference in sample size does factor into the results of the studies and their ability to be applicable to the general population. However, in our study the immediate complications at delivery and during the perinatal period for the newborn were negligible.

Previous data suggest cannabis affects glucose and insulin regulation and may affect the fetal growth trajectory [5]. In a study completed in October 2017, researchers examined maternal cannabis use and adverse pregnancies outcomes. Results were significant for neonatal morbidity but not specific to any disease or disorder. A meta-analysis completed July 2019 delved into reviewing and summarizing the existing literature in regards to cannabis use in pregnancy and its effects on the newborn if any.

The results showed a level of developmental disruption with increased risk for adverse outcomes to neurodevelopment and increased risk of fetal growth restriction in the newborn. Most of the prenatal research was completed in the 1980s and the usage, frequency and quantities of THC in cannabis used during that particular time period were markedly decreased than present day cannabis. As the potency of cannabis continues to increase, it will be critical to systematically evaluate the long term outcomes of THC exposed children [6]. The paucity of research and evidence has led to many unknowns in that area. Previous research related to cannabis use in pregnancy has followed women throughout pregnancy longitudinally. In a one year prospective study, a decrease in cannabis use was noted beginning in the first trimester at 32%. Continuing on into the third trimester; a 16% decline in the utilization of cannabis was noted [1]. These particular mothers knew they were being followed throughout their pregnancy, so it is possible the Hawthorne Effect had played a part in the results of this study. In our particular research study, which is retrospective in nature, the Hawthorne Effect was virtually eliminated. It is imperative that research be conducted to take into consideration present day cannabis utilization and its frequency of use. Once the effects of cannabis are thoroughly delineated and characterized, patient education and antenatal surveillance can be conducted to assuage the impact on fetal and newborn outcomes.

Little is known about the effects of cannabis on the unborn child and therefore this study's goal was to investigate measures at delivery to determine if differences are seen amongst those who used cannabis during pregnancy from those who did not.

Interestingly enough, we found there was no significant difference between caucasians and non-caucasians, in terms of the level of THC found in the urine during universal screening completed on admission for delivery. Gestational age at birth in those with positive urine testing compared to those with negative urine testing showed no significant difference which does not appear to have the ability to be applied to clinical practice. The rate of perinatal complications to the newborn was negligible at delivery and in the immediate perinatal period, therefore a sub analysis could not be conducted. Therefore, no difference in the rate of complications in regards to the level of THC in the urine was evident. We found an association between maternal cannabis use and birthweight with lower birthweights seen with cannabis use versus non cannabis use. There is significant cannabis use in pregnancy which could also mean clinical significance in regards to preconception counseling of couples during the prenatal period. With increases in medical knowledge regarding cannabis use in pregnancy and its outcomes in pregnancy and the newborn, adequate teaching/counseling can be developed to help ensure proper resources to the family. Biggest strength of the study was utilizing urine toxicology results alone in data collection and subsequent analysis. This allows for stronger veracity of study results with the hope of utilizing and applying the results to the general population. In addition, we eliminated confounders at the beginning of the study in order to estimate the true impact of cannabis use in perinatal outcomes in the newborn.

Exclusion criteria attempted to be a thorough as possible to eliminate confounders in the results of the study. Hypertensive disorders in pregnancy and prior to pregnancy have an association with Intrauterine Growth Restriction (IUGR) [3]. Tobacco use in pregnancy is associated with lower birthweight in infants as well [7,8]. Limitations in regards to this study are due to not quantifying the frequency of cannabis use in pregnancy and the method of use/intake. We only had the levels of THC found in the urine by carboxy acid Tetrahydrocannabinol (THC) level in nanograms per milliliter (ng/ml) that was gathered on admission for delivery. The focus of our study was on the outcomes for the newborn at delivery and the immediate perinatal period without looking into growth and development in the newborn and growing infant. In addition, tobacco use was determined by self-report rather than using biological sampling of cotinine. This may have resulted in an underestimation of the effect of tobacco use in pregnancy. Lastly, our sample size may have been small and a larger study may help reveal more delivery complications associated with cannabis use.

CONCLUSION

As cannabis potency continues to increase, it will be of utmost importance to systematically evaluate the long term outcomes of THC-exposed children through the childhood years seen as dysregulated arousal and motor difficulties at birth to disturbed sleep, memory impairment, aggression, and other developmental and behavioral concerns have been evident.

With lower birthweight in newborns, initial growth and development may be delayed/restricted in the immediate postnatal and neonatal period. It is of great importance to ensure that adequate and thorough information in regards to cannabis utilization in pregnancy, its risks and the unknowns of potential adverse physiological, psychosocial, physical effects in the growing child be explained and taught to women of child bearing age and their significant other/spouse. Essentially, better patient information and education coupled with more efficient antenatal surveillance strategies can guide the ability to minimize neonatal morbidity and mortality in the postnatal period.

An aim in regards to understanding factors linked to the motivation for cannabis use during pregnancy i.e., perceptions in regards to medicinal, recreational use, euphoric, harmful, addictive processes would be beneficial to future research endeavors to create a robust and thorough look into perceptions that play a part in the utilization of cannabis in pregnancy. Further research will help to guide interventions in women of child bearing age in regards to illicit drug use in pregnancy particularly cannabis utilization. The medical knowledge of cannabis use in pregnancy is growing steadily and through continued further research, the body of knowledge can continue to grow in regards to outcomes in the newborn and the growing child.

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All authors give consent to participate and to publish.

This study was approved by the Dignity Health Institutional Review Board on December 19, 2019. No animals were used in the research process.

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The authors have no conflict of interests relevant to this article.

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