Emily: I'm Emily Kumler and this is Empowered Health. Have you ever smoked up and realized that you were super horny or have you ever thought about using cannabis to help treat PMS symptoms or cramps? Well, this week we're going to look at how weed impacts the female body, how our experiences are different than men's when we're using cannabis and how the female brain processes this stuff with an interplay with estrogen. So like when you have your period when you're ovulating, you actually can experience this drug differently. We're going to start off by talking to somebody who's done a lot of self-experimentation with marijuana and try to learn from her experiences. Here's Amanda.

Amanda: Hi, my name's Amanda O'Keeffe and I live in Boston. I'm in my twenties and I work in healthcare.

Emily: Hi, welcome to Empowered Health.
Amanda: Hi.

Emily: So you are going to be our N equals oneself experimentation guru for this episode on women and weed. How long have you been using weed?

Amanda: I started a while ago when I was in high school, so I want to say six years ago. Took a break, but recently I've been getting more into it and I've been more of a daily, weekly user recently.

Emily: Okay. So what do you like about it?

Amanda: So sometimes I have trouble getting hungry or I have trouble sleeping. So right now I'm kind of more into the physical perks that it has rather than for fun. So right now I'm into it because I do it before I eat or I like edibles more because it's more of a relaxed kind of high. So I'll take edibles maybe before I get home, wait till they kick in. It helps me sleep better at night and it makes me hungry so I can actually have a better appetite before I eat.

Emily: Great. And one of the things that we're really interested in this episode is talking a little bit about the interplay of estrogen with THC and how we end up talking to one researcher who says that during operation you experience a higher high in that you're sort of estrogen interplay with the THC, makes you experience it more. Do you track your period well enough to know whether you've seen anything like that anecdotally or not?

Amanda: So I track my period and I know when it comes and I actually take more when I get pain and that cramping kind of feeling in the beginning. So I use parallel with that way, but I haven't ever noticed if I take some and it feels like I'm higher or like a different feeling. I haven't really paid attention to that, but I do use it during my period when I track it for cramping and pain reasons.

Emily: When you go to a dispensary, do you say like I need something for menstrual cramps or do you just use the same stuff that you use the rest of the month.

Amanda: So indica and sativa[1] strains. So when I do want to use it for pain and just relax, I would use an indica or an edible because it's less potent and it gives your body more of that relaxed high. So I do tend to go towards the indica strains, I guess you could say for pain purposes. And then if I was trying to go out or do something else, I would go towards the sativa strains that I have and I kind of just go and get variety when I go to the dispensary so I can have that option and choice for the feeling that I want to accomplish.

Emily: And then in terms of sex, do you feel like it makes you hornier or or feel like you want sex more when you use either edibles or smoke?

Amanda: Definitely. I think that it has a huge effect on the way that I feel. I definitely am hornier if I smoke or if I take an edible, it makes my sex drive better because sometimes if you're taking medications or if you don't eat that well, your sex drive can kind of decrease and you're not in the mood. And sometimes you could just get a little lazy and just daily things and pretty much every time that I smoke or if I take an edible, I'll definitely be more in the mood and everything feels better and it's just a better experience. I would have to say

Emily: Amanda's claim that using weed as a way of increasing desire and sexual satisfaction was really interesting because I've heard that from a lot of other people, but I was curious if there was any medical research behind it and Dr. Becky Lynn has a practice where she helps women who are suffering from all kinds of sexual health issues, but in her practice they also treat women who are pregnant and you know for all kinds of other women's normal gynecological OB stuff and they surveyed their population and found that women who use weed before sex have a better time. So I thought we got to talk to her. Here she is.

Dr. Becky Lynn: So I'm Dr. Becky Lynn[2]. I am the director of the Center for Sexual Health at Saint Louis University[3]. I'm also an associate professor of obstetrics and gynecology and I recently published a paper looking at the effects of using marijuana before sex[4] and how it affects sexual function in women.

Emily: Great. Welcome to Empowered Health. I feel like the first thing I want to talk to you about is this paper that you just released because I feel like there is this sort of rumor of, you know, if you use marijuana before sex that it makes you more horny. Or sometimes people will even say like, oh, be careful because it will make you super horny. And I'm like, wow, there

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[1] https://bsapubs.onlinelibrary.wiley.com/doi/abs/10.3732/ajb.91.6.966
[2] https://twitter.com/beckyklynn?ref_src=twsrc%5Egoogle%7Ctwcamp%5Eserp%7Ctwgr%5Eauthor
[3] https://www.slucare.edu/ob-gyn/general-gynecology-obstetrics-and-womens-health/womens-sexual-health.php
[4] https://www.smoa.jsexmed.org/article/S2050-1161(19)30009-1/fulltext

actually is some research behind this. Actually, I don't know anybody else who's studied it. So can you tell us a little bit about how you got into the topic and what you sort of learned in the process of studying this?

Dr. Becky Lynn: In my practice, I see many women with sexual problems, anything from low libido to painful sex to difficulties with orgasm. And I noticed a couple of years ago that my patients would come to me and they would say, well, you know, if I smoke marijuana or use marijuana then I can have an orgasm or my libido's better. And I even had a patient drive to Colorado to get marijuana for her sexual problems. And so that prompted me to wonder, is there any research on this or is it just a big myth that you can find on the Internet? So I went to the internet and all over the Internet. Oh, marijuana is an aphrodisiac. It does this, it does that. All sorts of articles and things. But when I went to the scientific literature, there's really not much research done on humans, obviously because marijuana has been until very recently illegal in many places.[5] You know, I looked through the research and I read some things. The majority of the research is on rats and their mating behaviors. And then there are some questionnaires like you can't give somebody marijuana and say, okay, go have sex and let's look at the before and after. So the human studies were mostly questionnaires. What did people think? There were a bulk of studies done in like the early[6] seventies into[7] the eighties[8] and then there was just like a lack of human studies up until, oh, I don't know, 2016, 2017 maybe there was one or two here or there. But there was really a lack of information. So we decided to put together a patient questionnaire and anybody who walked through our office, no matter if you were there for sexual problems or not, and I have several partners, we have a big academic department, was offered the questionnaire, they didn't have to take it. And we collected over 300 of them. And then we looked at what we found in the questionnaires, basically got some basic information about their overall health, their overall sexual health before it dove into questions about using marijuana. And for those people who said they used marijuana than it asks them about have you used marijuana before sex? And if you did, it asked you about libido, orgasm, lubrication, pain, and the overall sexual experience. So that's what we were asking people about, did it get better, did it get worse? And if so, by how much?

Emily: And what did you find?

Dr. Becky Lynn: What we found was that the majority of women noted that it did improve the overall sexual experience. It did improve libido, it lessened pain, it improved their orgasm, and it did nothing for lubrication. So that was just the majority of women.

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[5] https://www.businessinsider.com/legal-marijuana-states-2018-1
[6] https://www.nature.com/articles/226701a0
[7] https://onlinelibrary.wiley.com/doi/abs/10.1002/1097-4679(197901)35:1%3C212::AID-JCLP2270350135%3E3.0.CO;2-K
[8] https://www.tandfonline.com/doi/abs/10.1080/02791072.1982.10471911?journalCode=ujpd20

Emily: And so going back to the marijuana for a minute, I think what's interesting is this idea that it does create some arousal and then a heightened sexual experience. Can you talk a little more about that please?

Dr. Becky Lynn: Yeah, so we don't know exactly why. There's a lot of theories as to why, but some of the theories are, well first of all, it reduces your anxiety so you might feel more comfortable and it slows down the perception of time and it causes heightened sensations. So whatever touch your feeling seems bigger in your mind. I think those are probably the three most common ways that marijuana can improve that experience. And the other thing I want to mention though is many studies have similar outcomes[9] as to what my study showed. We can't measure exactly what women were doing as far as how much marijuana use, but there are studies that show that if you smoke too much, you won't have the beneficial effects. So I do want to say that.
Emily: But it doesn't increase with dosage, basically?

Dr. Becky Lynn: It doesn't mean smoke more and it's going to be better because eventually you won't be able to move. That's not going to work out.

Emily: In the study, people were smoking?

Dr. Becky Lynn: Yes, it was like 99% smokers, but on our questionnaire we did have a space for like how did you use it? But the majority were smokers.

Emily: And so are you now recommending that patients smoke weed before they have sex?

Dr. Becky Lynn: No, I'm not. I think that I wouldn't say, Oh, you have low libido, this is what- you should smoke weed. Definitely not because Libido is so complex that if you're in a bad relationship, smoking pot is not going to work. Or if you are, you know on hormone blockers because you had breast cancer. No. Okay. Maybe that would work in that instance, but I don't think it's the answer for everybody because sexual interaction is very complex. But also my study is based on women's perception, so that introduces a lot of bias into it. We don't have studies where we say, okay, let's see how the sexual experience was without marijuana and then let's see how the sexual experiences with marijuana. I can't say that oh yeah the data is absolutely shows this. We're really in the beginning of data and I've said before that I'm kind of excited that Canada has legalized pot because now they can actually do those double-blind randomized placebo-controlled trials that are high-quality trials where we can base our recommendations on. And the other thing is that longterm data, we don't have that either, so I wouldn't say that I'm telling everybody to smoke marijuana, definitely not. I think there's a role for marijuana

[9] https://www.sciencedirect.com/science/article/pii/S1743609515339965

Emily: In researching for this episode. We came across Dr. Rebecca Craft's[10] work. She's at Washington State University where she's looking into how the brain, specifically the female brain responds to different substances and so she started her work looking at opioids and now she's really concentrated on THC and she does her work in rodents, but you're going to be interested to learn that it turns out when we ovulate we have a heightened experience at everything in life and that includes drugs.

Dr. Craft: Hi, my name is Rebecca Craft and I'm a professor of psychology at Washington State University. I studied the effects of drugs on behavior. All of my work is in rodents, but some of it does relate to what drugs do in people.

Emily: Great. Welcome to Empowered Health. So one of the things that I was really excited about was that there's a great quote from you where you're sort of talking about how drugs impact the sexes differently, but that women are really not studied very well. And I think that's really the impetus for this podcast is to sort of try and take a look at what data is out there that is specifically looking at female bodies. That there's definitely not enough of it, but there is some interesting work coming out. So I was thrilled to be able to talk to you. I think just to start, it would be really helpful to get a little bit of a background in terms of how we can talk specifically about cannabis or THC impacts the body. Like why is there even a difference in terms of how it would impact me versus say my husband?

Dr. Craft: Well, two mechanisms that I can think of on a basic level with be that sex hormones like testosterone and estrogen can alter the way that we metabolize drugs. [11]So they can either enhance the metabolism or they can inhibit the metabolism of drugs, or they can just change how drugs are handled in our bodies. And then the other way that sex hormones can influence our response to drugs is by their effects on the brain. So hormones can, for example, change how many receptors or sites we have in our brain for drugs to bind to.

Emily: And so in your research, how have you found these drugs play out in terms of the menstrual cycle? There's also a change at sounds like for women depending upon where they are in their cycle.

Dr. Craft: Well, unfortunately this has never actually been studied in women, so we only have the rat model to go by at this point in time. But female rats do have a cycle that is not identical to, but it's similar to humans. It's much shorter because of course they only live for two to three years. So they cycle on a four to five day interval, but what's similar between the road and the human is they do have a peak of hormones just before ovulation and then the hormones drop. And their major hormones that are shifting during the cycle are estradiol and progesterone and those are the same ones that are going up and down in a woman's cycle. So what we found is that female sensitivity to some of the effects of THC, and the one we studied

[10] https://psychology.wsu.edu/people/faculty/rebecca-m-craft/
[11] https://onlinelibrary.wiley.com/doi/abs/10.1016/j.ejpain.2004.01.003

the most is the pain relieving effect or analgesic effect, that estradiol, the primary estrogen in our bodies can enhance females sensitivity to the analgesic effects of THC. So they get about- females experience about a 25% increase in sensitivity to the pain-relieving effects of THC when their estrogen levels are rising[12] and when their progesterone levels come up, then their sensitivity to THC drops back down and is at that point then pretty similar to males.

Emily: So if somebody who is consuming THC in the middle of their menstrual cycle, they would experience this by some sort of chronic pain that they have or something would be alleviated more. Is that correct then, a week or so before or after?

Dr. Craft: Yeah. What my guess would be is that right around the time they're ovulating is when they would be the most sensitive to THC.

Emily: And you've studied this in terms of pain, but there's no reason to think that that it wouldn't be true with many of the effects of THC.

Dr. Craft: I think it probably, it may depend on the effect. So the biggest effect that we've seen is on the pain-relieving effects, and again, it's only about a 25% difference. It's statistically significant, but it's a small shift and it's not clear to me unless we systematically tested women at different stages of their cycle, whether an individual woman would be able to tell a 25% increase in sensitivity. It's a relatively small change in sensitivity,

Emily: But interesting because I also wonder about sort of postmenopausal hormonal changes in women at different stages of life.

Dr. Craft: Right. And when we look at the research that's available in older women, similar to what's available in older men, that drops way off. So not only do we not have enough research on any drug in women, but we also have very little research in older people. So one of the things that my laboratory is interested in studying is female rodents who are essentially menopausal who are past their reproductive period and are no longer experiencing those regular fluctuations and sex hormones

Emily: And may have lower levels of estrogen in general.

Dr. Craft: Yes, they would.

Emily: I also sort of wonder what you think in terms of this application across the board. I was joking with my producer Jill about how maybe you can finally explain to me how I have a glass of wine and I feel loop-de-loop, but then a couple of weeks later I can drink a bottle of wine and

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12 https://www.researchgate.net/publication/45536915_Antinociception_and_sedation_following_intracerebroventricular_administration_of_D9-tetrahydrocannabinol_in_female_vs_male_rats

not feel anything at all. I'm like, maybe this is all related to my menstrual cycle and no one has ever explained this to me before.

Dr. Craft: Yeah, that certainly can have a big impact. Although lots of things like how well hydrated you are can also influence how you experience a drug.

Emily: We're really interested in trying to get women to think about their bodies as biologically different than men and to sort of have an understanding of how poorly researched our bodies have been. But that is starting to change in that it seems more female scientists and researchers are interested in their own bodies and then sort of getting to a position of power where they can actually forge ahead with some of these research projects, which is the optimist in me saying that they know the landscape has changed quite a lot in the last even 10 years. But are there things that you have really been struck by in your work? I mean, it doesn't have to be specifically about, you know, weed and menstrual cycles or I'm sort of curious to hear in your experience, what are some of the things that you have learned about the female body and how it's different that have struck you?

Dr. Craft: Well, when I started doing sex differences research about 25 years ago, I actually wasn't expecting there to be much difference between males and females. I think because I had been trained by male scientists who never used females in research, and in fact I was taught the same thing that everybody else was taught was that, oh, females are too complicated. So we weren't even going to use, even if we were working with rats and mice, we weren't going to use any females because they cycle and therefore they're too complicated. And that could make it difficult for us to tell what the drug is doing. And it's really when you just turn that on its head, of course, well, why wouldn't we be interested in that complexity? Because if it is more complex, that's really important to half the population. But I think when I started doing this work, honestly I was just trying to differentiate myself from and establish myself as a new researcher and I started out looking at opioids because that's what I was most knowledgeable about and was surprised to find that in fact there were some sex differences in the potency of opioids to produce analgesia and some other effects in rodents.[13]

Dr. Craft: Now that work is a lot further along and that work did spur some research in humans comparing men's and women's responses to opioids and some differences have been found, but they're probably not as consistent or robust as what we see in the rodents. And in the rodents. It's the males that are more sensitive to the analgesic effects of opioids. But that's not necessarily true in people.

Emily: And men are more likely to develop substance abuse issues, correct?

Dr. Craft: Yes.

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[13] https://www.ncbi.nlm.nih.gov/pubmed/18837634

Emily: And so do you think that any of this hormonal interplay is a part of that or is that too hard to tease out from societal factors?

Dr. Craft: The biggest factor that probably drives gender differences in abuse and addiction, one is that there are still greater social constraints on use of drugs by women than by men. So we believe there's less social constraint on men and so they're more likely to sample and go on to develop problems. We know that that's been changing. We know that as that has changed, sort of the social perspective on drug use has changed and it has become essentially more accepted for women to use drugs the way that men always have, rates of use and abuse and addiction has gone up in women. And that's true for just about every class of abused substance. However, for most drugs, women's use is still lower[14] and it has been suggested by sociologists and others that there are still more social constraints on women's use than men. But when we've compared taking us out of the social context and we can do that. For example, with animal research, we find that females are actually more likely than males to develop persistent drug use.[15] And that's true for a lot of drugs that have been looked at. And estrogens are definitely a driver of that. And we know that one of the reasons that females are- there's some evidence that suggests this is true in humans as well, that women are more vulnerable to the reinforcing or rewarding effects of wide variety of drugs because estrogen influences a part of our brain that is central to our experience of pleasure and reward.

Emily: Can you talk a little more about that?

Dr. Craft: Yeah, so in the middle of our brains is this so-called reward pathway. One of the primary neurotransmitters that's released in that pathway is dopamine. Lots of people are familiar with that neurotransmitter at this point. And increases in the release of dopamine in our brains is what's associated with drug reward and in fact pleasurable aspects of many things that we do, pleasurable aspects of eating, pleasurable aspects of music and many other things and of sex for example. And women because they have estradiol and estrogen, it can actually increase the activity of that reward pathway

Emily: Increase based on like a prior baseline or increase compared to men? What do you mean by increase?

Dr. Craft: I would say definitely when those hormones are really peaking during ovulation, for example, there's more dopamine activity in that pathway. And this makes females more sensitive to all types of rewarding stimuli including food, drugs, sex, and presumably it evolved to make us more amenable to social interaction when we're ovulating. So when we're most likely to be able to become pregnant. And it has been shown that women's propensity to be social increases around the time of ovulation. And there are various other subtle behaviors that change at the time of ovulation. So one outcropping of that is if you have this- we're the

[14] https://www.samhsa.gov/data/sites/default/files/NSDUH-DetTabs-2016/NSDUH-DetTabs-2016.pdf
[15] https://www.ncbi.nlm.nih.gov/pubmed/22728714

permissive sex essentially- we are regulating our interactions with potential mates and most women don't realize this, but your biology is to some extent influencing your willingness to engage with other people, including potential mates. So having that reward system that's regulated by your hormones means that other things that are rewarding besides people, for example, drugs we can become more sensitive to during that part of our cycle.

Emily: It's been great to learn how THC products can help women, but it's also really important to add the caveat that there are stages of life where THC is not helpful and pregnancy seems to be one of them. Women are using cannabis to treat morning sickness in pregnancy[16] and it turns out that's not a great idea.

Dr. Crume: My name is Tessa Crume and I'm an associate professor of epidemiology at the Colorado School of Public Health and I have a secondary appointment in the Department of Obstetrics and Gynecology in the school of medicine at the University of Colorado.

Emily: Welcome. We're so excited to have you. So I am specifically interested in talking about the article that you published in the Journal of Pediatrics that was looking at marijuana and pregnancy[17] and how it was potentially impacting the unborn child. And so if you don't mind just sort of starting from the top and giving us a little bit of a rundown in terms of what were you guys, that study was done over a couple of years, like how did you do it? What was your hypothesis going into it?

Dr. Crume: Yes, so I worked with our state health department to analyze data collected from the pregnancy risk assessment monitoring survey,[18] which is a population-based surveillance system of women that delivered a live-born infant in Colorado. And I looked at women who participated in the survey in 2014 and 2015 and wanted to see if self-reported cannabis use during pregnancy was associated with breastfeeding patterns or sociodemographic characteristics of the mothers and see if it was associated with any adverse birth outcomes.
Emily: And what did you guys find?

Dr. Crume: So we looked at over 3000 respondents of this over our two year study period and we found that the self-reported prevalence of cannabis use during pregnancy was 5.7% and we were also interested in the prevalence of cannabis use during breastfeeding, which we found to be 5% we looked at if cannabis use during pregnancy was associated with adverse birth outcomes and we found that independent of tobacco use during pregnancy, babies who are born low birth weight in Colorado were 50% more likely to be exposed to cannabis use compared to infants who were born at an adequate birth weight. And so we felt that this was important because Colorado has had a, what we think of as a mature recreational and medical marijuana environment for seven years. We legalized recreational marijuana in 2012[19] and so

[16] https://jamanetwork.com/journals/jamainternalmedicine/article-abstract/2697391
[17] https://www.jpeds.com/article/S0022-3476(18)30181-1/abstract
[18] https://www.cdc.gov/prams/index.htm
[19] https://www.fcgov.com/mmj/pdf/amendment64.pdf

this would have been three years after the legalization of recreational marijuana and we felt it was important to look at associations with birth outcomes in our state at the population level.

Emily: ` I think that's really important to just sort of take a second because you're asking, it's a self-reported study but there isn't necessarily the same stigma that there might be in other states where cannabis use is illegal and so I guess my first question is like is there any other sort of bias that you guys looked for or that you were able to cancel out in terms of people who are using cannabis while pregnant are also doing other activities that might be harmful or might contribute to a low birth weight?

Dr. Crume: We looked at factors that are confounders that are associated both with a higher likelihood of cannabis use during pregnancy and associated with a higher likelihood of adverse birth outcomes which include maternal age, race and ethnicity, the highest level of education for the mother and tobacco use during pregnancy and the pregnancy risk assessment monitoring survey has been considered as far as surveillance systems to have the least reporting bias for exposures during pregnancy because it is collected in a confidential questionnaire with the mother as opposed to other sources of data like medical records or birth certificate data. The mothers would be reporting this at the time of birth in a nonconfidential manner. And so there's been a lot of studies that have looked at the difference in reporting bias between difference surveillance methodologies and PRAMS does have the least reporting bias. There's absolutely some still there, but it would probably be our most– at a population level– our most accurate way at this point of ascertaining cannabis use during pregnancy.

Emily: And so the natural question is why are women using cannabis when they're pregnant? And it seems like most of them, at least the conventional wisdom is it's a cure for nausea or morning sickness, anxiety. Those are the ones that are sort of listed and a lot of that happens in the first trimester. So were you breaking this down by trimester and thinking about the development of the fetus during those periods or is there any connection to be made between that or?

Dr. Crume: So we definitely found that the prevalence of use dropped from the first trimester to the third trimester. The prevalence of use in the first trimester was 4.8% and the prevalence in the last trimester was 2.4% so certainly it is dropping off. But a lot of women use cannabis during pregnancy to deal with other symptoms. So for example, nausea, morning sickness, sleep disruptions, anxiety or depression symptoms that they perhaps were using cannabis for to treat before they got pregnant. And in our state we found that a lot of women view cannabis as a less risky means of treating certain symptoms that they experienced during pregnancy.

Emily: And so, I mean, we know that pregnant women, there's a crazy statistic that's like more than 80% of pregnant women are taking some form of medication and yet they're not allowed to be part of any kind of clinical trials. Do you think that that plays a part in any of this? Like it sounds a little bit like you're making the connection between women who maybe are

suffering from anxiety or depression and feel like maybe smoking weed is better for them than taking Prozac or is that a leap to make or is that sort of your sense of this?

Dr. Crume: I certainly wouldn't say that they feel like cannabis is safer than prescribed medications, but a lot of women self-medicate, they don't necessarily, I mean before women are pregnant, they're just people, they're just women. And so just because you get pregnant does it mean you suddenly don't have any problems and you don't need to take any medications. And so a lot of women that they're not taking cannabis certainly based on a recommendation by a provider. They're taking it as a means of self-medicating, certain symptoms that they have. And we have a very vocal pro-cannabis industry in Colorado that certainly we work with to regulate the statements that they make. But there is a growing acceptance of this substance in populations in which it's being legalized. And the medical industry certainly works to counter misperceptions that are propagated within lay circles. But there are still a lot of misperceptions about if cannabis is efficacious for treating different symptoms.

Emily: Can you talk a little bit more about that?

Dr. Crume: Well, the idea that cannabis would be effective for dealing with morning sickness, no provider is going to recommend to a woman that they take cannabis to deal with morning sickness, but they may be a perception that it is effective in relieving nausea for individuals undergoing cancer treatment and so a pregnant woman could justify, well it should be effective for dealing with morning sickness and if they don't have a strong relationship with their provider and feel like they can go to their provider and ask for a different medication, they may take cannabis to deal with that symptom. But one point I would emphasize is that we don't necessarily think our findings are reflective of women who decided to start using cannabis on a regular basis during their pregnancy. These are most likely individuals that used cannabis on a frequent basis before they got pregnant and they continued their use at some level during their pregnancy.

Emily: Okay. That's an important clarification I think to make, it's not like they're using this as some way of medicating a part of the pregnancy that they don't want. It's that they've been using this for some time and they just are consistent. And then can you explain a little bit more about what the believed method of influencing the fetus is? Like explain it to me as though I know nothing about obstetrics or about how cannabis works. Like, I mean I think a lot of people have an understanding of does it cross the placenta wall or like does it get into the blood somehow? And I had read something about the fat tissue in the brain, but it didn't really make a lot of sense to me. So if you could just explain it in a very simple way, that would be great.

Dr. Crume: So the psychoactive components of cannabis, THC, and there are many different psychoactive components of cannabis. They do cross the placenta [20]and are delivered to the infant during gestation. We don't know a lot about how these cannabinoids affect infant

[20] https://www.ncbi.nlm.nih.gov/pubmed/28847562

development. We're very early in the research of understanding this, but we have a natural internal cannabinoid receptor system. So we have internal cannabinoids, which we call endocannabinoids. And when an infant is exposed to maternal use during pregnancy, they're getting exposed to exogenous cannabinoids. And so that's stimulating their receptor system. And the receptor system in a developing fetus is different than it is in an adult. So there's a different profile of receptors in the brain and they're expressed at a higher frequency in certain developing regions of the fetal brain. And so what the literature seems to suggest is that it would alter brain development and in a way that would affect the structure of neurocircuitry within the brain and lead to differential development of different parts of the brain. And so the part that is of most concern is the prefrontal lobe, which is responsible for higher order reasoning and impulse control. And much of what has been found in other[21] large[22] cohort studies[23] is that the phenotype of an infant exposed to cannabis in utero is symptoms of attention deficit disorder in adolescents, impulse control problems and different problematic externalizing behaviors. But the prefrontal lobe does not fully develop until an individual is in their early twenties so we think of this as a late manifesting exposure one that you would not really be able to see consequences of until, at the earliest, early childhood or adolescence. But ultimately in adulthood there would be differential functioning of the prefrontal lobe.

Emily: And is that the kind of thing that you could see in an MRI? I mean I'm just sort of thinking like somebody who is using cannabis during pregnancy may also have some impulse control issues. And so how do you sort of separate out that sort of growing up in an environment, say with a mom who has impulse control, right. And then that's sort of becomes your natural environment.

Dr. Crume: One of the challenges of life course studies is that it gets very difficult to disentangle the independent effect of the in utero exposure from the effect of the postnatal environment. And so my team now is doing an MRI study where we're enrolling women who are chronically using cannabis during pregnancy. And then we're doing MRIs on their babies at two weeks of age. So we're hoping to see if there is a difference in brain morphology of those specific regions of the early infant brain that we know to have a higher profile of cannabinoid receptors. And we're also looking at structural integrity that connects different regions of the brain. And so our hope is that we're able to identify if there's an independent effect of exposure during pregnancy. And then ideally we'll be able to follow up this group and then look at the impact of, let's say, cannabis exposure through breast milk or a different exposure within the home, a different home environment, different responsive parenting, not just from the mother, but from other members of the family that care for the infant.

Emily: So does cannabis come through breast milk? I mean, you can test breastmilk to figure that out probably, right?

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[21] https://www.perinatology.theclinics.com/article/S0095-5108(14)00085-2/abstract
[22] https://www.ncbi.nlm.nih.gov/pubmed/12009486?dopt=Abstract
[23] https://www.ncbi.nlm.nih.gov/pubmed/15869861?dopt=Abstract

Dr. Crume: Yes, it does.

Emily: It does. Okay. And so there's THC that comes through?

Dr. Crume: Yes.

Emily: Oh Wow. Okay. I didn't know that.

Dr. Crume: Breast milk is an interesting topic in itself. So tobacco is one of the most harmful substances to be exposed to during in utero life.[24] And it is recommended that women who are smoking tobacco still breastfeed their baby, because the benefits of breastfeeding outweigh the risks of substances passing from the breast milk to the baby.[25] And so it is not my personal recommendation that a woman who's using cannabis not breastfeed her baby. We certainly don't have enough research. We know that THC and other cannabinoids are passed in the breast milk, but we certainly don't know if that isolated exposure outweighs the host of benefits that we know about breastfeeding.

Emily: Then I guess in terms of the one other brain kind of question that I have is that if most women are doing this in their first trimester, is there something about the brain development during that period that makes the child more susceptible to potential damage? Like is that a more dangerous time?

Dr. Crume: Yeah, absolutely it is.[26] And unfortunately, a lot of exposures do occur during that first trimester. Often before women even realize they're pregnant. I mean you could potentially not realize you're pregnant until you're eight weeks in or potentially longer than that. So some of the exposure could be inadvertent. They just didn't even know they were pregnant. But that is the first trimester is the period of the most rapid brain development. And so exposures during that period are the most dangerous. And that's why if a woman is considering getting pregnant, it's really recommended that she talk to her doctor about preconception health. That ideal that you want to kind of take an inventory of your habits and your lifestyle and think about how you can maximize that during the period in which you're trying to conceive.

Emily: We've talked a lot about THC products, but the other big buzzy thing around marijuana is CBD. And CBD was recently just made legal everywhere. The farm bill passed[27], having it basically be a crop that people can grow and sell. And so basically anybody anywhere can get CBD, but there isn't any scientific backing to the fact that this is a big pain reliever. However, I happened to be at the Stowe Mountain lodge in the winter with my family, super PMS-y and grouchy saw that in the spa they had these PMS patches [28]that were CBD oil and I thought, why

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[24] https://journals.lww.com/clinicalobgyn/Abstract/2019/03000/Tobacco_Use_During_Pregnancy.16.aspx
[25] https://www.ncbi.nlm.nih.gov/pubmed/17226091?dopt=Abstract
[26] https://www.cdc.gov/ncbddd/birthdefects/facts.html
[27] https://www.agriculture.senate.gov/2018-farm-bill
[28] https://thegoodpatch.com/

not? And so I slapped it on and about an hour later I felt so much better that I thought, I don't even care if this is placebo. It seems to be doing something for my body. There's a company called Ellementa that's all about bringing women together online and talking about cannabis and then also getting them together in groups in real life. And I thought, you know what, they'd probably a great place to start to talk a little bit about CBD and what it does and what it doesn't do.

Aliza: Hi, I'm Aliza Sherman[29] and I'm the CEO of Ellementa. We are a global network to help women understand how cannabis and CBD can be used for health and wellness. And I'm really excited to be here because I feel so strongly that women need to take charge of their health and that we're not only needing to take care of ourselves, but to take care of our loved ones. We're kind of in that role. So knowing what works well to help us all feel better, hey, more power to us. Well, I first have to say that it can be very effective. I also have to admit there's some snake oil out there too, so we have to all be incredibly mindful about what we're getting into. Our bodies are putting onto it. But that said, I am not a doctor. Anything I say today is not going to be medical advice for anybody who's listening. But here are some of the things to think about. The most important piece is something we did not learn in science class and that is something called our endocannabinoid system.[30] Are you pretty familiar with the endocannabinoid system?

Emily: No, not at all.

Aliza: So if you think of cannabinoids that exist in plants and within mammals and you think of terpenes[31] that exist in plants and foods and such, and cannabis has more cannabinoids and more terpenes than any other plant. So therefore it's like a super food. If you really wanted to think about it like that, it's like a natural remedy medicinal plant that just has an abundance of these compounds. Now you gotta break it down a little bit further. CBD is one of these compounds. It is a cannabinoid. It just happens to be one of the well-known ones now because it's all over the news. THC is another cannabinoid, but there's more than just those two.[32] But we focus on those mostly because everyone knows THC is what gets you high and now they're learning that CBD doesn't get you high, but it does things like reduce inflammation.[33] So reducing inflammation I think is really important for many of us who have pain issues and it can help with anti-anxiety. So when you're saying your PMS– all of a sudden you were in a good mood when you had this CBD patch on. Part of that could be because of the anxiety that comes from the hormonal fluctuations. If you think of your endocannabinoid system laying over all systems, including reproduction, including thyroid and different glands, pituitary, that's releasing hormones. If it begins to regulate and not just regulate, but it brings your system into homeostasis, that's the purpose of it. But our endocannabinoid systems are so starved and so depleted from stress, from pollution, from a lack of the right nutrients in our bodies that when

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[29] https://alizasherman.wordpress.com/
[30] https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3820295/
[31] https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5371325/
[32] https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3736954/
[33] https://www.ncbi.nlm.nih.gov/pubmed/17157290 - This study is in rodents

you introduced CBD or you introduce THC or any compound within the cannabis plant, it begins to nourish and regulate that system, which in turn regulates things like your mood.

Emily: Has anybody done any clinical trials or anything to sort of study this?

Aliza: So it's a little bit difficult really to find a lot of good studies in the U.S. because cannabis is federally illegal. And up until the farm bill, just a month or so ago, CBD was categorized as being cannabis and therefore made illegal in some places as well. So the studies really come a lot out of Israel. In fact, the endocannabinoid system was discovered as a partnership through Israeli labs and scientists[34] and also some American scientists and doctors [35]. And then part of it was discovered, I believe in Amsterdam, in the Netherlands as well. So there's a lot of things going on outside of the U.S. And a lot of countries who have done a lot of different studies. In fact, now finally, studies are starting to happen with women specifically.

Emily: Well yeah, cause one of the things I was interested in is that I had read that it was the CBD is processed through your liver. So one of the things that people need to be a little bit concerned about is it can interfere with other drugs that you're taking.

Aliza: Right. So anything you ingest is going to be processed through your liver. Anything that enters into your bloodstream at some point, maybe also processing through your liver. Your liver is like your blood cleanser. So when you drink alcohol, it goes through your liver. Same thing when you consume cannabis or CBD alone, it will do that. So yes. Now if we're just talking about CBD and nothing else, CBD can interfere with medicines that you're taking in particular. They caution you not to take it with SSRIs,[36] so if you're on an antidepressant, even though CBD could help take away anxiety, panic attacks, it can really affect mood in a positive and gentle way. If you're taking an antidepressant, it could counteract, or it could just change the way that antidepressant is working. Anytime you're taking medication and you want to introduce anything, a vitamin or nutrient supplement, you always have to worry about how is it going to interact. So CBD for sure is powerful medicine in particular forms taken in certain ways and it also depends how it's processed. Again, there is stuff out there that really has negligible CBD and there's not going to really affect you. You just have to be careful no matter what you take.

Emily: So it seems like there is potentially a lot of upside to THC products and maybe even CBD products. The sort of women's watchdog in me wants to point out that none of the studies that we have covered today or anything that's available right now has actually looked at the female human body. Right. So like we've talked about rodents and we've talked about people who are filling out surveys, both of which are amazing ways to start out looking at a problem or looking at a cure or looking at a question. They're really the way to form a hypothesis, but they're not something that you can say conclusively. So I think my takeaway

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[34] https://www.ncbi.nlm.nih.gov/pubmed/1470919/
[35] https://www.nature.com/articles/346561a0
[36] http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.626.9711&rep=rep1&type=pdf

caution for everybody is it does seem like there is some interplay in terms of ovulation and substances and so no matter what you're using, you should probably be aware of where you are in your menstrual cycle and how that is impacting your experience on those substances. I also would say, you know, this sort of idea of going slow and low is a good one. You know, if you haven't done this before and you're not really sure, try a little if you want and see how it goes. But be cautious because it seems that it definitely impacts people differently and there really isn't any research per se on people or on females that we can say like this is what happens when you do this. The sort of heightened sexual experience, heightened sense of desire, decrease in anxiety, all sounds awesome but definitely needs more research before we can conclusively say anything. So I hope you guys have enjoyed this episode in terms of looking at what's available in terms of the research and we will certainly follow up when we have more to share. I am Emily Kumler and that was Empowered Health. Thanks for joining us. Don't forget to check out our website atempoweredhealthshow.com for all the show notes, links to everything that was mentioned in the episode, as well as a chance to sign up for our newsletter and get some extra fun tidbits. See you next week.