Cannabis Use Among Women Experiencing Menstrual Cycle Distress

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August 25, 2023

Thesis

Submitted in partial fulfillment of the requirements for the degree of

Master of Arts (Clinical Psychology)

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Acknowledgements

I am deeply grateful to numerous individuals who have contributed their support, guidance, and encouragement throughout the completion of my Master's thesis. Their invaluable contributions have been instrumental in shaping my work and enhancing my academic and personal growth. It is with sincere appreciation that I extend my heartfelt gratitude to the following:

First and foremost, I extend my utmost gratitude to my thesis supervisor Dr. Dwight Mazmanian whose unwavering guidance, expertise, and continuous encouragement were invaluable throughout the process. His input and feedback have been vital in shaping my writing skills and the direction and quality of this thesis. I am extremely appreciative of the time and effort he invested in this project by way of countless meetings, funding application revisions, edits, encouragement of my scholarly independence, and sheer brain power. His pithy insights and humour helped get me through the bulk of challenging times. Dr. Mazmanian's determination in putting his students first does not go without notice and is a reason in which I am grateful to be a proud member of his lab.

A sincere thank you goes to Dr. Kirstin Oinonen for her indispensable insights, recommendations, and critical evaluation of this project. I appreciate all her intrigue and questions which prompted a deeper exploration and evaluation of the topic.

A special thank you to Shayna Cummings who helped get me on my feet when beginning to study cannabis use and also, for welcoming me to the lab with open arms. I wish to extend my endless gratitude to Erika Puiras and Casey Oliver who have made my Master's experience a truly enjoyable one. With their unwavering support, guidance, and complete patience they have shown me ample qualities that encompass what makes a good mentor. I truly could not have made the strides I have without their constant encouragement and support.

Special appreciation goes to those who have been my rocks since the beginning of the program. The constant support, reassurance, critical questions, and drive to have a conducive work environment sustained me throughout the Master's process. I am truly grateful for the joy they provided regardless of what stage of the process I was in. Further, this work represents the culmination of countless hours of research, analyses, and writing, and I am extremely grateful to the one who brought me calmness, encouragement, and reminded me relentlessly of my strengths.

Lastly, I extend my sincerest appreciation to my family for their unwavering beliefs in my abilities. An irreplaceable thank you to my parents and sisters for their undying encouragement, and for understanding the demands of the process and having patience during times when my focus was solely on this endeavor. I extend my gratitude to both my parents and sisters whose wisdom and life experiences have been a source of profound inspiration, I am forever in awe. A special thank you to Landon whose growth encouraged me to see the bigger picture.

Financial Support

I would like to acknowledge the funding I received from the Canadian Institute of Health Research (CIHR) to conduct this project.

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Abstract

Women experiencing menstrual cycle distress might use cannabis for self-medicative purposes. The purpose of this study was to determine whether cannabis use frequency and mode of intake were associated with the type of symptoms experienced (i.e., affective, physiological), throughout the menstrual cycle (i.e., menstrual phase premenstrual phase, and during the remainder of the menstrual cycle). Of secondary interest, we explored women's awareness of cannabinoid content. We additionally explored cannabis use and menstrual cycle distress symptoms across the phases of the menstrual cycle. Participants (N = 147) were recruited through a course credit system, and community and online advertisements. Participants self-reported on their most recent menstrual cycle and cannabis use using a web-based survey. Participants were categorized as current cannabis users (n = 82) versus non-users (n = 65). Results indicated no significant evidence to suggest associations between cannabis use and menstrual cycle distress symptoms. Cannabis users who were aware of the cannabinoid content of their cannabis products used cannabis more days than those unaware of the cannabinoid content. Cannabis users reported experiencing more pain during the menstrual and premenstrual phases, compared to non-users. This difference was not seen for the remainder of the cycle phase. Findings from this study expand on previous research regarding pain severity across the phases of the menstrual cycle by specifically comparing cannabis users and non-users.

Keywords: Cannabis, menstrual cycle, women's health, affect, pain

Cannabis Use Among Women Experiencing Menstrual Cycle Distress

Menstruation is cyclical, repeating approximately every 25-32 days (average of 28 days) for women of reproductive age (Silberstein & Merriam, 2000). It coincides with ovarian activity and the central nervous system's (CNS) coordinated release of hormones (Eisenlohr-Moul, 2019; Silberstein & Merriam, 2000). Gonadotropin-releasing hormone (GnRH), luteinizing hormone (LH), and follicle-stimulating hormone (FSH) are secreted, resulting in the secretion of the reproductive hormones estrogens and progesterone (Hawkins & Matzuk, 2008; Silberstein & Merriam, 2000). The menstrual cycle can be segmented into the follicular phase, ovulatory phase, and luteal phase (Hawkins & Matzuk, 2008). The onset of menstrual bleeding starts at the beginning of the follicular phase, in which there are low levels of estrogen and progesterone (Eisenlohr-Moul, 2019; Hawkins & Matzuk, 2008). Following the follicular phase, ovulation occurs with a peak of both estrogen levels and LH secretion. This sequence of hormonal changes results in a follicle releasing an oocyte (eggs stored in the reproductive tract; Hawkins & Matzuk, 2008). The final phase in the cycle, the luteal phase (spanning approximately 12 to 14 days following ovulation) refers to the time frame prior to menses, leading into the initial days of menstrual bleeding, with progesterone levels increasing and peaking at a plateau throughout the luteal phase, and then dropping dramaticallty to low levels. The follicular phase then begins again (Eisenlohr-Moul, 2019). There is extreme variability in the timing or duration of the menstrual cycle phases among women. Once an individual's limited number of oocytes have been released (based on their lifetime cyclical schedule), the menstrual cycle ceases (Hawkins & Matzuk, 2008).

Premenstrual symptoms distinctly coincide with the late luteal phase of the menstrual cycle while menses coincides with the early follicular phase (American Psychiatric Association [APA], 2013; Eisenlohr-Moul, 2019). Women of reproductive age often have associated

affective or physiological symptoms, if not both throughout their menstrual cycle (Ryu & Kim, 2015; Yonkers et al., 2008). Many individuals struggle with negative affect symptoms more during the premenstrual phase while negative physiological symptoms are predominant during the menstrual period (Boyle & Grant, 1992; Oinonen & Mazmanian, 2001). Preliminary terminology relating to distressing premenstrual symptoms comes from Frank (1931); prior to the commencement of menses, the distress and suffering experienced by those with premenstrual symptoms was deemed *premenstrual tension*. While this terminology was accepted as a means to draw attention to the evident burden women faced in the timeframe preceding menstruation, Greene and Dalton (1953) sought to expand the terminology to *premenstrual syndrome* to be inclusive of not only one symptom (tension), but various possible symptoms resulting in the distress of the individual. The present day term which encompasses a compilation of symptoms is premenstrual syndrome (PMS; Reid & Soares, 2018).

More specifically, PMS can be characterised by recurrent clusters of affective or physiological symptoms presenting during the late luteal (premenstrual) phase of one's hormonal cycle (Richards & Oinonen, 2022). PMS symptoms resolve shortly after menstruation, but not without typically having an impeding influence on individuals' daily work and social lives (Kessel, 2000). For some, their physiological and affective symptoms become prominent enough to require treatment – an approximate 30-40% of individuals with PMS (Ryu & Kim, 2015). For others, the severity of symptoms meets diagnostic criteria for the related mental disorder of premenstrual dysphoric disorder (PMDD). Specifically, PMDD is characterized by affective and somatic alterations from the individual's norm, for most of their menstrual cycles of the previous year. According to the Diagnostic and Statistical Manual of Mental Disorders – Fifth edition, Text Revision (DSM-5-TR), a minimum of five symptoms (presenting the week prior to the onset of menses) is necessary to meet criteria for a diagnosis of PMDD (APA, 2013). Of these

five minimum symptoms, individuals must experience a minimum of one symptom related to affect (e.g., affective lability, anxiety, depressed mood, irritability) and a minimum of one symptom related to physiological concerns (e.g., breast tenderness, muscle pain, weight changes, concentration difficulty, difficulty sleeping, fatigability). That is to say, all five symptoms cannot be related to only one type of symptom (i.e., affective or physiological); rather, both need to be present. Additionally, symptoms must diminish within the initial days of menses followed by minimal or absent presentation of symptoms the week after menses (APA, 2013). The temporal component of symptom presentation is key when considering a PMDD diagnosis as there are overlapping symptom criteria with other depressive disorders. Debilitating depressive thoughts (dysphoria) and somatic discomfort are typical for approximately 3-8% of individuals who experience menstruation (Biggs & Demuth, 2011; Ryu & Kim, 2015). This select population experiences symptoms severe enough to meet criteria for the mood disorder of PMDD (APA, 2013; Eisenlohr-Moul, 2019). Although a provisional diagnosis can be provided using retrospective means, a diagnosis must be made using prospective symptom reporting (APA, 2013).

Women experiencing PMS will have some overlap in symptoms with PMDD (Reid & Soares, 2018). However, women do not need to meet the PMDD five-symptom threshold to be characterized as having PMS (First, 2014). Moreover, First (2014) also suggests there is no requirement for women to experience affective symptoms during the premenstrual phase when presumed to have PMS. Alternatively, PMDD has strict criteria following a medical/psychiatric model. PMDD is described as a disorder that produces clinically significant distress through a mix of symptoms interfering with daily life, in more than one domain of functioning (APA, 2013). Alternatively, the term PMS is used in everyday language to describe the experience of symptoms. For the purpose of the proposed study, menstrual cycle distress encompasses both

PMS and PMDD. Further, menstrual cycle distress encompasses the experience of distress from symptoms at any phase: the menstrual phase, premenstrual phase, and remainder of cycle phase.

Affective Symptoms

Various affect-related symptoms can be experienced by a woman with menstrual cycle distress. Shifting between various mood states (lability), sudden onset of tears and sadness, elevated sensitivity to rejection from others, increased interpersonal conflicts, anger, irritability, guilt, shame, thoughts centered on self-deprecation and hopelessness, dysphoria, tension, and feelings of anxiety or being on edge are all potential symptoms serving to impair daily functioning, predominantly experienced during the premenstrual phase, as opposed to during active menstruation (APA, 2013; Beddig et al., 2019; Eisenlohr-Moul, 2019; Reed et al., 2008; Schmalenberger et al., 2017). Irritability and anger are the most common emotions described by women experiencing distress during the premenstrual phase (Pearlstein et al., 2005; Yonkers et al., 2008). As suggested above, there is a wide range of affective symptoms women can experience throughout the menstrual cycle.

Physiological Symptoms

There are a multitude of physiological symptoms that can be experienced by women throughout their menstrual cycle. Silberstein and Merriam (2000) state that the physiological symptoms of headaches or migraines are common during the menstrual period. Some of the other common somatic symptoms experienced during the menstrual period include: abdominal tension, swelling or bloating, back pain, breast tenderness, alterations in eating patterns, fatigability or insomnia, and cramping or dysmenorrhea (APA, 2013; Braverman, 2007; Ferries-Rowe et al., 2020; Li et al., 2020; Schmalenberger et al., 2017; Woosley & Lichstein, 2014).

Dysmenorrhea is a gynecological problem referring to severe pelvic pain that is most pressing for women of reproductive age (Ferries-Rowe et al., 2020; Harlow & Park, 1996).

Presenting as intense pain or cramping, dysmenorrhea typically onsets at the initial stage of the menstrual phase, if not immediately prior to menstruation in the final stage of the late-luteal (premenstrual) phase. In addition to cramping and pain experienced in the upper thighs, pelvic area and back, supplemental symptoms can also be experienced including bloating, sleep disturbances, diarrhea, and vomiting (Ferries-Rowe et al., 2020; Woosley & Lichstein, 2014). Again, there is large variability in the physiological symptoms women can experience throughout the menstrual cycle.

Influence of Menstrual Cycle on Symptoms of Distress

Past researchers have sought to elucidate how different phases of the menstrual cycle are related to symptoms of distress. Looking across menstrual cycle phases, Oinonen and Mazmanian (2001) investigated the occurrence of physiological symptoms. They further examined whether positive and negative affect were influenced by oral contraceptives using the Positive and Negative Affect Schedule (PANAS; Watson et al., 1988) and Menstrual Distress Questionnaire (MDQ; Moos, 1968). Between-group comparisons found no differences among new, long-time, and non-users of oral contraceptives when it came to the intensity of symptoms experienced. In relation to phase of menstrual cycle however, women experienced heightened intensity of physiological symptoms during the menstrual phase, with less intense physiological symptoms presenting during the premenstrual phase.

In their investigation of symptoms across the menstrual cycle phases, Yonkers and colleagues (2008) discuss the potential antecedent to experiencing physiological symptoms during the premenstrual phase (as it is often a phase associated with affective symptoms). It is not clear whether these symptoms are the consequence of experiencing dysphoric mood, or the nervous system's hormonal mechanisms. Increased dysphoric mood has been suggested to diminish one's capacity to tolerate physical discomfort (this consideration has since been

discussed further; Cunningham et al., 2009). An alternative suggestion however, is that physiological complaints occur during the premenstrual phase as a result of hormonal shifts in the nervous system altering the sensitivity of the body's tissue. Another perspective to consider is that chronic pain and depression can co-occur (Craner et al., 2022). Chronic pain can be described as recurrent pain; the cyclical experience of perimenstrual pain can be likened to the pain experience of those with chronic pain (de Tommaso, 2011). Further, experiencing pain and associated negative cognitions could be an antecedent to experiencing dysphoric mood. More specifically, pain-related catastrophizing, feelings of helplessness, and low self-efficacy contribute to feelings of depressed mood. Based on a variety of perspectives and findings, there is still a lack of clarity around the complexity of physiological and affective symptom presentation. Throughout the phases of the menstrual cycle individuals can experience solely affective symptoms, solely physiological symptoms, or both types of symptoms. These three categories (i.e., affective, physiological, or both symptoms) and the order of presentation of symptoms in the third category may be highly relevant to treatment approaches.

More recently, Schmalenberger and colleagues (2017) investigated affective, psychological, and physiological symptoms predictive of PMDD and the extent to which they impair functioning. Schmalenberger and colleagues (2017) found headache, bloating, and fatigue (physiological symptoms) were predictive of both occupational (e.g., work, home, or school) and recreational (e.g., engaging in hobbies) impairment. However, none of the physiological symptoms were predictive of impairment in relationships. Contrary to other studies that predominantly report physiological complaints during the menstrual period, participants in this study reported noteworthy physiological discomfort during the premenstrual phase. Due to the overlap in symptoms, there have been controversial findings in previous research pertaining to

identification of which symptoms occur during which phase.Furthermore, it is unclear how women may be managing these symptoms.

Cannabis Use

Cannabis is used by approximately 147 million individuals worldwide (World Health Organization, n.d.). Rates of cannabis use have been increasing with a rise in acceptance, an evolving North American market, and increased accessibility compared to illicit drugs (e.g., cocaine; Goodman et al., 2020; World Health Organization, n.d.). Recreational and medicinal cannabis legalization has occurred in only some states in the United States of America (Cuttler & Spradlin, 2017). In Canada, cannabis was first legalized for medicinal purposes in 2001, and it was only recently legalized for recreational use in 2018 (Turna et al., 2021). Prior to legalization of recreational cannabis, 14% of Canadians 15 or older reported cannabis use (Rotermann, 2021). Since the enactment of the *Cannabis Act* in 2018, 17.5% of Canadians reported cannabis use (Rotermann, 2021). According to the Canadian Tobacco, Alcohol and Drugs (CTADS) Survey (Health Canada, 2021; Rotermann, 2019), approximately half of Canadians aged 15 years or older reported having tried cannabis – making it one of the most extensively used substances in Canada. More specifically at the end of 2020, approximately 6.2 million Canadians (20%) aged 15 years or older reported cannabis use within the previous three-month period (Rotermann, 2021). The gap between male and female use of cannabis has been reducing, with 14% of females reporting cannabis use, which is an increase from previous years (Greaves & Hemsing, 2020). This cannabis use by females is concerning when considering problematic substance use and dependence among females (Joyce et al., 2021b). The number of individuals using cannabis has increased over the years and is projected to continue increasing. Thus, it is important to understand women's reasons for use, and any potential benefits and risks.

Cannabinoids

In understanding the adverse effects and potential benefits of cannabis, it is essential to identify the cannabinoids within cannabis products that interact with the CNS (Ameri, 1999). Tetrahydrocannabinol (D^9-tetrahydrocannabinol; THC) and cannabidiol (CBD) are two cannabinoids commonly found in cannabis products (Ameri, 1999; Kalaba & Ware, 2021). The introduction of these two external cannabinoids influences the body in different ways. CBD is predominantly considered a non-psychoactive component of the substance (Kalaba & Ware, 2021). CBD has been identified as a potential treatment option for reducing anxiety and convulsions (anxiolytic and anticonvulsant, respectively) due to its calming effects (Ameri, 1999; Kalaba & Ware, 2021). THC is commonly regarded as the more psychoactive component of the substance. The human body has two receptors that cannabinoids specifically adhere and bind to, altering bodily functioning. The two most commonly referred to receptors are CB1 and CB2. CB1 and CB2 are mainly found in the brain and the peripheral nervous system (PNS; i.e., nerves), respectively. It has been established that the effects of exogenous THC are mediated by CB1 receptors while the proposed anti-inflammatory and immunological outcomes are mediated by CB2 receptors (Boggs et al., 2018).

THC has previously been suggested for use due to its potential as an analgesic (i.e., pain-relieving) agent (Kalaba & Ware, 2021). This is likely due to the ability of THC to hinder the feeling of painful stimuli (i.e., antinociception), an action likely derivative of binding with CB1 receptors in the brain (Ameri, 1999). As previously mentioned, in addition to alterations in pain sensitivity experienced, higher cannabinoids in the human body can provide anxiolytic effects related to psychoactive effects, and anticonvulsant properties when taken in high doses (Ameri, 1999; Boggs et al., 2018). On top of the effects related to the CNS, cannabinoids can influence the PNS. In high doses, cannabinoids (mainly THC) can impair the body's immune response, liver and cardiovascular functioning, and reproductive system (Ameri, 1999). Additionally,

cannabinoids have been investigated with respect to their negative influence on the brain (Lorenzetti et al., 2019). Specifically, there is potential for THC to have neurotoxic effects on the brain, resulting in a decrease in volume of the orbitofrontal cortex (OFC) and hippocampus. However, more research is needed in this area.

There is substantial support among researchers that experiencing a sense of relaxation and euphoria are common psychological effects of cannabinoids (Ameri, 1999). However, experiencing both euphoric and depressant outcomes are also possible. There is also substantial support among researchers that other psychological effects can occur which include distorted thinking, distorted visual and auditory perceptions, impaired cognitive or executive functioning, weakened memory, and altered motor movements (Ameri, 1999).

Influence of Cannabis Use on Symptoms of Distress

Legalization of cannabis has been identified as beneficial for those seeking relief from a medical ailment (Al-Hamdani et al., 2021). There has been an increasing pattern of cannabis use for specifically medicinal purposes (Beaulieu et al., 2016). Due to the range in chronic pain symptoms and varying effectiveness of medications, there is no universal treatment for chronic pain (Boehnke et al., 2016). Thus, researchers have explored alternative methods of alleviating symptoms. In their longitudinal study, Gruber and colleagues (2021) found a reduction in severity of chronic pain after use of medicinal cannabis. Use of THC-dominant cannabis was associated with improvement in chronic pain symptoms while CBD-dominant cannabis use was associated with a decrease in anxiety and mood-related symptoms. The effects were observed continuously throughout the study, including improvements in mood and anxiety ratings, quality of life, and pain-related distress.

Cuttler and colleagues (2018) investigated the effects of cannabis concentrations of THC and CBD, and dose of cannabis on symptom severity reporting, among medicinal users. They

found that THC and CBD concentrations significantly affected participants' ratings of depression symptoms. This was not the case for either anxiety or stress symptoms. Following cannabis use, the greatest reduction in symptoms of depression were reported by those who used cannabis with low levels of THC and high levels of CBD. Participants who used cannabis with both high levels of THC and high levels of CBD reported the greatest reduction in stress symptoms. In regard to dose (i.e., number of puffs) of cannabis, Cuttler and colleagues (2018) found no significant effect of dose on reduction of depression symptoms. In contrast, the authors found that the higher number of puffs taken resulted in more of a reduction of reported anxiety symptoms. Additionally, reduction in stress symptoms was significantly greater among those with higher doses of cannabis. Cuttler and colleagues (2018) included participants whose mode of intake was via inhalation (i.e., vaping, dab bubbler and portable, concentrates, smoking). Findings of Cuttler and colleagues also suggest short-term perceived relief of negative affect. However, the authors caution based on previous research that persistent cannabis use might amplify depression symptoms over the long-term.

Additionally investigating medicinal cannabis users, Cuttler and colleagues (2020) explored whether inhaled cannabis has an effect on self-reported headache and migraine symptom ratings. The authors found significant reductions in participants' reporting of headache and migraine symptoms following cannabis use (with women having less of a reduction in experienced severity of headaches compared to men). For those who experienced migraines, there was a significant increase in dose of cannabis use across time. The authors additionally explored what cannabis-related factors contributed to predicting a decrease in symptoms. For participants that used cannabis flower (i.e., marijuana) to alleviate headaches, Cuttler and colleagues (2020) found an increase in cannabis use across time. In contrast, those whose mode of intake was cannabis concentrates (i.e., a concentrated substance that is often more potent than

cannabis flower; these could include waxes or oils) were found to have a significant decrease in dose of cannabis over time. Thus, mode of intake could influence the dose of cannabis required to feel the intended relief of symptoms.

To specifically explore medicinal use, Kalaba and Ware (2021) investigated patterns of cannabis use among Canadian adults with authorized use of medicinal cannabis. A caveat of this research and potential target of future research is that participants did not indicate whether their selection of cannabis product and content (THC, CBD, or balanced/both) was self-directed or through the authorizing physician. The most commonly reported symptoms being treated with medical cannabis were anxiety, joint stiffness and pain, muscle pain, and insomnia. Although cautioning against possible placebo effects, Kalaba and Ware's findings indicate that cannabis use significantly reduced the severity of participant-reported physical and pain symptoms. Physical symptoms included: chest pain, cramps, dizziness, gastrointestinal pain, joint stiffness, paresthesia, itchiness, diarrhea, numbness/tingling, restlessness, sweating, difficulty breathing, weakness, rigidity, tenderness, and nausea. Pain symptoms included: arm or leg pain, knee pain, upper and lower back pain, joint pain, sciatica, neck pain, muscle pain, breakthrough pain, and nerve pain. To help in treating pain and sleep disturbances, Kalaba and Ware (2021) found participants used THC-dominant products whereas CBD-dominant products were used more for mental health related concerns. The findings concerning CBD-dominant products is consistent with previous research outlining the calming effects of CBD and its anxiolytic properties (Ameri, 1999; Boggs et al., 2018). Kalaba and Ware (2021) also found that the cannabinoid concentration of cannabis products being used differed among ages. CBD-dominant cannabis was more frequently used by those aged 31 and younger. THC-dominant cannabis was more frequently used by those 31 to 39 years old. Balanced (THC and CBD) cannabis was more frequently used by those 41 and older. These findings suggest potential preferences in cannabinoid content

among subsamples of the population, or a tendency to keep using the same products they have always used as opposed to trying new products that might have higher medicinal properties.

With the increase in cannabis use and the contradictory findings regarding adverse and beneficial effects of cannabinoids, Kruger and colleagues (2021) aimed to assess knowledge of cannabinoid content among American adults using cannabis for medicinal purposes, recreational purposes, or both. The findings indicated a lack of knowledge concerning cannabinoids. The majority of respondents reported not knowing the effective dose of either THC or CBD for their related symptom (Kruger et al., 2021). However, men and individuals with medicinal cannabis cards (card given by health care professionals for patients to provide as identification they have been prescribed cannabis as a treatment) were more likely than women and those without medicinal cards to know effective doses to treat their symptoms. The uncertainty in knowing the appropriate dose for intended symptom relief is concerning given that differing doses of cannabinoids can result in a variety of adverse experiences (Kruger et al., 2021). The authors found that, on average, medicinal cannabis use was initiated at approximately 23 years of age. Various modes of intake were reported by participants including capsules, topical products (e.g., creams, oils), vaping, edible cannabis, and smoking. Participants identified seven intended symptoms targeted by use of cannabis: pain, non-pain related back problems, bipolar disorder or depression, sleep disturbances, headache and migraine, anxiety or panic, and other.

Wardell and colleagues (2020) conducted a cross-sectional study to gain a better understanding of adolescent medicinal cannabis use in Ontario, Canada. Although adolescents are under the age of legal purchase and use, many still use cannabis. When compared to solely recreational users of cannabis, medicinal cannabis users presented with higher odds of recreationally using other drugs, pointing to concerns of crossover in drug use (Wardell et al., 2020). Further, medicinal cannabis users were more likely to use cannabis more frequently and

be at risk for dependence on substances. Of the adolescents using cannabis (under the age of legal use), approximately 7% reported self-described medicinal cannabis use (Wardell et al., 2020). However, due to the nature of the study being self-report and participants not being required to identify if the cannabis was medically authorized, the authors suggest only a portion of these reports are likely to truly reflect legal medicinal purposes. This is representative of a greater research problem as there is a general lack of clarity between individuals who are medically prescribed cannabis by health care providers, and those who are simply using cannabis for self-described medicinal purposes. This is of concern due to the potential risks related to self-medication.

Self-Medication Theory: An Explanation for Why Individuals May Use Cannabis to Cope with Distress

Self-medication theory is derived from the notion that substances are used in an effort to reduce suffering from psychological distress (Khantzian, 1997). Further, Khantzian (1997) denotes the significance of distress in one's life being a primary motivator for substance use resulting in misuse or dependence. Various substances can be appealing to individuals for their calming analgesic effects (e.g., opiates like oxycodone, codeine, fentanyl, morphine), short-lasting relief of rigidity and fears of interpersonal interactions (e.g., CNS depressants like alcohol, benzodiazepines, barbiturates), and change in energy or hyperactivity (e.g., stimulants like cocaine, Adderall, methamphetamine, ecstasy). Other common substances that have been used for self-medicative purposes include over-the-counter analgesics (Mehuys et al., 2019), nicotine (Joyce et al., 2021a), alcohol (Carroll et al., 2015; Joyce et al., 2021a; Leeies et al., 2010), and cannabis (Joyce et al., 2021b; Slavin et al., 2017).

Wallis and colleagues (2022) highlight some common self-reported reasons for self-medicating with cannabis: pain alleviation, concentration, and sleep disturbances. Other

commonly reported reasons to self-medicate with cannabis include: endometriosis-associated pelvic pain (Sinclair et al., 2021); anxiety disorders (Bolton et al., 2006; Khantzian, 2003; Turner et al., 2018), mood disorders (Khantzian, 2003; Turner et al., 2018), post-traumatic stress disorder (Khantzian, 2003; Leeies et al., 2010), headache (Mehuys et al., 2019), and unspecified pain (Joyce et al., 2021b; Mehuys et al., 2019). Khantzian (2003) suggests individuals self-medicate based on the specific symptoms being experienced, not distinctly based on the disorder or medical condition. More specifically, there may only be certain symptoms an individual tries to target with self-medication. Other research has also examined symptom relief from cannabis use. Bartel and colleagues (2020) explored cannabis use among Canadian adults; during the initial stages of the COVID-19 pandemic there was an increase in isolation, negative affect, and cannabis use. To measure cannabis use, the Daily Sessions, Frequency, Age of Onset, and Cannabis Use Inventory (DFAQ-CU; Cuttler & Spradlin, 2017) was used. Bartel and colleagues (2020) found that attempting to cope with depressive symptoms was a significant predictor of cannabis use. Further investigating cannabis use among Canadians, Wadsworth and colleagues (2020) sought to identify the relationship between cannabis use and mental health concerns. They found those who use cannabis for medicinal purposes reported more mental health (affect-related) problems compared to those without medicinal cannabis. Further, a large portion of these individuals used cannabis in an attempt to manage their mental health problems, lending support to the notion that cannabis may be sought after, and prescribed, for affective symptoms (i.e., depression and anxiety). Consistent with previous studies, these findings support the theoretical reasoning that women experiencing menstrual cycle distress would be motivated to use cannabis as treatment to attain relief.

Coping with Menstrual Cycle Distress

No treatment has been demonstrated to consistently reduce symptoms of menstrual cycle distress. However, with 90% of women experiencing symptoms of premenstrual distress, it is not surprising that efforts have been made to identify coping mechanisms and ways to reduce symptom severity (Braverman, 2007). Engaging in a regular physical exercise regimen and having effective stress management skills can influence overall wellbeing; these strategies have been shown to reduce PMS-related symptoms (Braverman, 2007; Cunningham et al., 2009; Rapkin, 2003). Emotion-focused group therapy (EFGT; Shareh et al., 2022) and cognitive behavioural therapy (CBT) have also been investigated and found to show improvement in symptoms (Braverman, 2007; Hantsoo & Epperson, 2015; Kleinstäuber et al., 2012; Rapkin, 2003). Alternatively, minerals have been reported to show reductions in women's physiological and affective symptoms (e.g., calcium) and water-retention symptoms (i.e., magnesium) during the premenstrual phase (Braverman, 2007; Cunningham et al., 2009; Rapkin, 2003). Further, vitamins and herbal preparations have been reported as having utility in reducing affective symptoms (i.e., vitamin B_6, vitamin E, chasteberry, St. John's wort), and relieving water retention and breast tenderness (i.e., ginkgo leaf), although there have been conflicting results associated with this type of treatment (Braverman, 2007; Cunningham et al., 2009; Hantsoo & Epperson, 2015; Yonkers et al., 2008).

Alterations in eating habits have also been recommended (Braverman, 2007). Some of the dietary recommendations involve a reduction or complete elimination of caffeine, sodium, and refined carbohydrates. These recommendations are grounded in the observation that specific eating habits are present in individuals with severe PMS. Alternatively, consuming a high fibre and low-fat diet has been suggested to attempt to reduce estrogen levels and consequently reduce associated symptoms. Although there is support for the theoretical effectiveness of a low-fat,

high-fibre diet in reducing symptoms of premenstrual distress, it should be noted that far more research is needed in this area as these dietary alterations have minimal studies supporting the theory (Braverman, 2007).

Ovulation suppression can alter the timing of the menstrual cycle and has been suggested to consequently reduce symptoms (Braverman, 2007; Cunningham et al., 2009; Rapkin, 2003). Using oral contraceptives is a form of ovulation suppression that could be utilized, however, there are controversial findings in regard to aggravation of symptoms (Braverman, 2007; Hantsoo & Riddle, 2021). Hormonal therapy (e.g., use of estrogens, androgens, GnRH, or anti-estrogens) is another form of ovulation suppression that has been studied (Braverman, 2007; Cunningham et al., 2009; Hantsoo & Epperson, 2015; Hantsoo & Riddle, 2021; Wharton et al., 2012; Yonkers et al., 2008). It has also been suggested that undergoing an oophorectomy may be warranted for those who experience cyclical extreme suffering without relief (Cunningham et al., 2009).

In addition to oral contraceptives, other prescription medications have been used to treat menstrual cycle distress (Braverman, 2007). Various types of selective serotonin reuptake inhibitors (SSRIs) have been suggested as another mechanism of symptom relief, however, these can come with side effects (e.g., nausea, libido reduction, suicidal thoughts) which could deter women from seeking these medications for menstrual distress relief (Braverman, 2007; Cunningham et al., 2009; Hantsoo & Epperson, 2015; Hantsoo & Riddle, 2021; Rapkin, 2003; Yonkers et al., 2008). Other prescription medications previously suggested for improving affective and physiological symptoms include benzodiazepines or non-SSRI anti-depressants. It should be noted that these medications are expected to be taken during the luteal phase rather than on a continuous basis (Braverman, 2007; Cunningham et al., 2009; Hantsoo & Riddle, 2021). Alternative methods for relieving menstrual cycle distress are being explored as there are

still a lot of unknowns in the literature as to how to alleviate cycle-related affective and physiological symptoms**.**

Cannabis Use for Coping with Menstrual Cycle Distress

Early investigations of severe menstrual pain (e.g., dysmenorrhea, pelvic tension) also considered cannabis (indica) as a potential treatment (Barrow, 1847; Russo, 2002). With one of the highest concentrations of endocannabinoids being in the female reproductive tract, researchers have long seen the potential value of investigating cannabinoid use for pain relief among women (Jobling et al., 2014; Roques et al., 2012). Evidence has been uncovered from ancient and medieval times that suggests items containing cannabinoids (e.g., hemp seeds, cannabis flower) were used for a number of gynecological and obstetric conditions (Russo, 2002). More recently, there are various anecdotal mentions of individuals with early legal access (e.g., the United Kingdom's Queen Victoria) using cannabis to deal with menstrual distress symptoms due to its healing properties (Frazzetto, 2003; Russo, 2002; Slavin et al., 2017). From early accounts of cannabis use in its different modes of intake for health treatment, cannabis has continuously appeared in the literature as a potential alleviator of various symptoms. Simons and colleagues (1998) identified five main motives for which individuals use cannabis, including social motives, expansion, conformity, enhancement, and coping.

In their review of literature concerning gynecological conditions and cannabis use, Chadi and Levy (2019) discuss the significance of the endocannabinoid system in producing analgesic effects. Since the endocannabinoid system is activated when cannabis is used and external cannabinoids (i.e., THC) enter the body's system, it stands within reason to predict similar analgesic effects from cannabis use. Further discussion concerns the potential beneficial use of cannabis to address physiological (e.g., pelvic pain, inflammation, breast tenderness, fatigue, sleep disturbances) and affective symptoms (e.g., irritability; Chadi & Levy, 2019). There is a

limited amount of research focusing on young women and menstrual cycle distress, however, there is some support for cannabis use as a nonhormonal alternative to treating premenstrual distress.

Some support for the use of cannabis at certain menstrual phases comes from Hanzal and colleagues (2019) who investigated prospectively-reported cannabis use in regard to its applicability to the self-medication theory, to deal with menstrual cycle distress. The authors found that cannabis use increased during the premenstrual phase (luteal), compared to the menstrual period (follicular phase). These findings are consistent with previous findings indicating increased use of cannabis to cope with premenstrual symptoms and a potential distinction in the timing cannabis is used (Joyce et al., 2021a; Mello & Mendelson, 1985). Further information for cannabis use among women comes from a recent study using a Canadian sample of consistent cannabis users that investigated depressed mood and motivated cannabis use (Joyce et al., 2021b). For those with retrospectively identified PMDD, Joyce and colleagues (2021b) found that increased cannabis use may have been explained by individuals wanting to dissipate their distress from symptoms. The investigators speculate that increased cannabis use, in an attempt to reduce symptoms of PMDD, could be attributable to the self-medication theory. Although Joyce and colleagues (2021b) found that depressed mood was associated with higher quantities of cannabis use during menstruation, they did not however examine cannabis use as it relates to physiological symptoms. Research in this area predominantly focuses on affective symptoms, and less on the somatic complaints of women experiencing menstrual cycle distress. Due to the identified potential for women to experience distress associated with their menstrual cycle, researchers have recently been exploring the idea that cannabis could be used in an attempt to self-medicate (Joyce et al., 2021b). This extends to the notion that cannabis use increases

during specific stages of the menstrual cycle, and that cannabis use is associated with the type of symptoms experienced.

Present Study

We explored symptoms of menstrual cycle distress among current cannabis users (i.e., those who indicated present use of cannabis). More specifically, we were interested in those experiencing menstrual cycle distress. Two facets of symptoms (i.e., affective and physiological) were assessed to investigate if there are differences in cannabis use based on symptomology. Further, we explored knowledge of cannabinoid-content of those using cannabis. With cannabis currently legal in Canada, the Canadian participant pool provides a unique opportunity for this type of investigation, without the concern of restricted access or legal risks. Thus, Canadian women who are naturally cycling (sometimes also referred to as free cyclers, without use of hormonal contraception or other hormones) were the principal sample of interest. Although the research on women's health and menstrual cycle symptoms is broadening with the inclusion of PMDD in the DSM-5 (Hartlage et al., 2012), there is a need to determine how cannabis is being used (i.e., frequency and quantity) and the modes of its intake. There is a sparsity of research concerning alternative non-invasive and nonhormonal treatment options for those experiencing menstrual cycle distress (Slavin et al., 2017). Further, to our knowledge, there has yet to be research focusing on potential distinctions between cannabis use specifically for affective versus physiological symptoms across the menstrual cycle, at each phase. The proposed research questions are presented below.

Research Questions

Extrapolating from what we know in regard to the self-medication theory, individuals who are experiencing distress seek relief with substance use (Campbell & McGrath, 1999; Cuttler et al., 2018; Hanzal et al., 2019; Khantzian, 1997; Mello & Mendelson, 1985). We

speculated that individuals are self-medicating with cannabis and moreover, are self-medicating for symptoms of distress related to phases of the menstrual cycle. Thus, our first research question is as follows: are women who experience greater menstrual cycle distress more likely to a) use cannabis more frequently, and b) use a greater quantity of cannabis?. We were also interested in the association between cannabis and specific symptoms of menstrual cycle distress. Thus, our second research question is as follows: what is the association between a) cannabis use and affective symptoms (positive and negative affect), and b) cannabis use and physiological symptoms (pain, water retention, and autonomic reactions)?. Our third research question pertains to mode of cannabis intake: do affective or physiological symptoms of menstrual cycle distress differ by mode of cannabis intake?. The final research question pertains to awareness of cannabinoid content being used: is there a difference in a) menstrual cycle distress between women who are and are not aware of the cannabinoid contents in their cannabis products, b) cannabis use frequency between women who are and are not aware of the cannabinoid contents in their cannabis products, and c) quantity of cannabis used between women who are and are not aware of the cannabinoid contents in their cannabis products?.

Hypotheses

1) There will be a positive association between menstrual cycle distress and cannabis use across all three phases of the menstrual cycle – those with greater menstrual cycle distress (as indicated by total scores on the MDQ– Form C) will have a) greater frequency of cannabis use and b) greater quantity of cannabis use.
2) Women who experience greater negative affect, pain, water retention, and autonomic reactions will report both greater frequency and quantity of cannabis use. Additionally, women who experience greater positive affect will report less frequency and quantity of cannabis use.

3) Women who experience greater physiological symptoms use concentrates (e.g., wax, oil, shatter) more, compared to any other mode of intake.
4) Women with greater familiarity with cannabis (i.e., greater cannabis use frequency and quantity of cannabis used) are more likely to be aware of the cannabinoid content of their cannabis products. Further, women with greater familiarity with cannabis are more likely to have greater menstrual cycle distress.

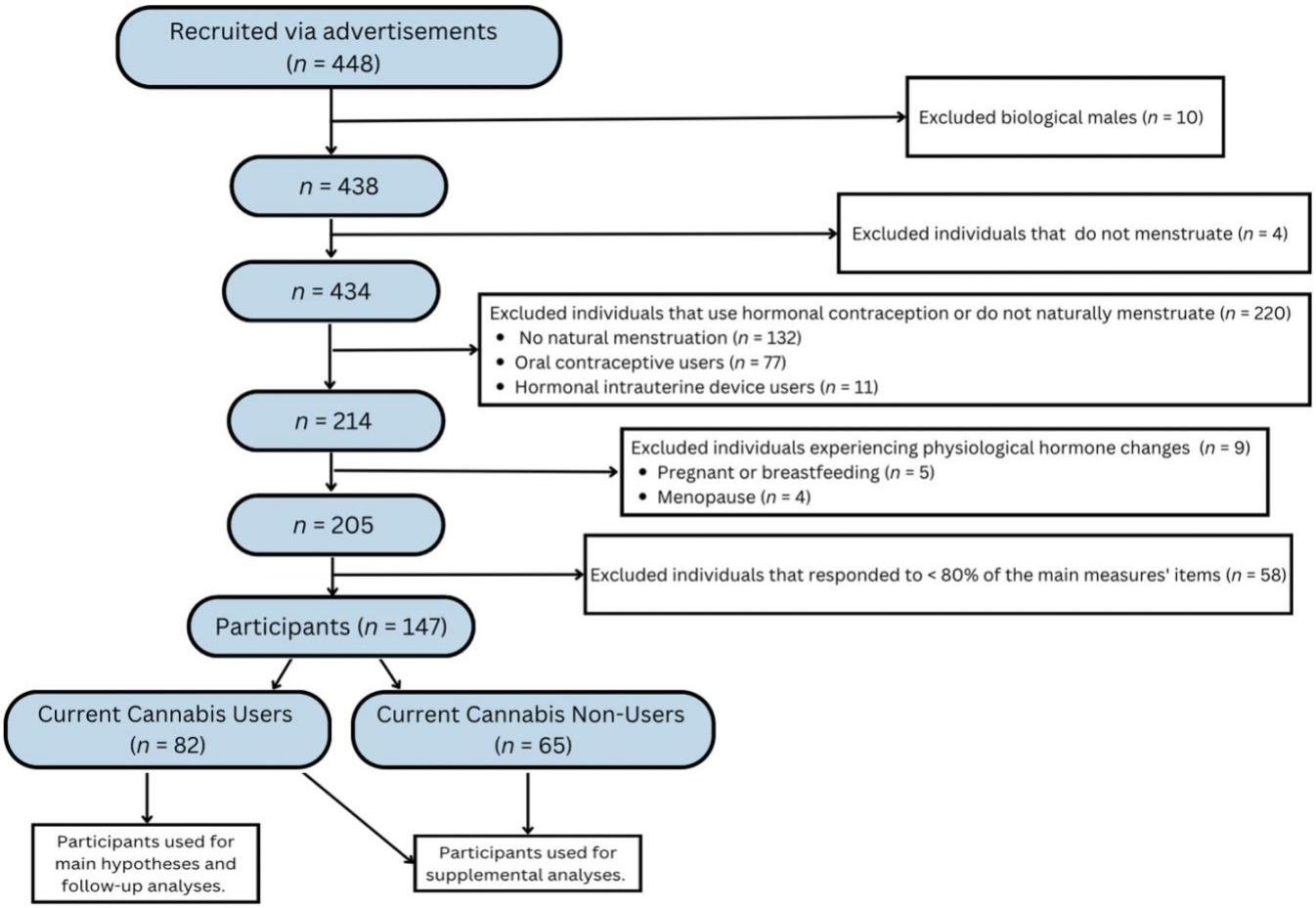
Method

Participants

Participants for this study were taken from two main samples: Lakehead University students (from both the Thunder Bay and Orillia campuses) and community members residing across Canada. Although the main focus was on cannabis use, participants did not need to be cannabis users to participate. Overall, 448 participants were recruited across the two participant samples. Participants were removed from the analyses following the employment of the exclusion criteria (see Figure 1); this substantially dropped the sample size resulting in a combined dataset of 147 biological females. Participants were all women (biologically female) and categorized as current cannabis users (n = 82) or current cannabis non-users (n = 65). Participants were considered *current* cannabis users if they responded "yes" to our initial cannabis use question (i.e., "Do you use cannabis?"). As part of the screening process, women who responded non-purposefully or carelessly, as measured by the Jackson's Personality Research Form - Infrequency Scale (1987), were removed. Non-purposeful or careless responding could be attributed to a variety of reasons including inattention, confusion, potential intoxication, or some form of cognitive impairment. These response styles are a potential when the study's design is reliant on self-reporting. Women were also removed from analyses if they did not respond to a minimum of 80% of the main measures' items (Tabachnick & Fidell, 1996).

Figure 1

Participant Exclusion Flow Chart



Based on the research questions, only individuals who self-identified as current cannabis users were included in all main and follow-up analyses (n = 82). Current cannabis users and non-users were both (N = 147) included in the supplemental analyses for group comparisons. Of the total participants (N = 147), 30 (20.40%) were from the original community sample and 117 (79.60%) were from the original Lakehead University student sample. Of the subsample of current cannabis users (n = 82), 19 (23.20%) were from the original community sample and 63 (76.80%) were from the original Lakehead University student sample. The community and university samples were combined to preserve adequate power to conduct analyses.

The combined sample of university students and community members (N = 147) were examined in relation to their endorsement of substance use. A majority of the sample endorsed current alcohol use (77.60%) and current cannabis use (55.80%; see Table 1). Current cannabis non-users were predominantly young (M = 22.65 years, SD = 4.46 years). The sample of current cannabis non-users was composed of predominantly White (66.20%), South Asian (13.80%), and African (9.20%) individuals. Of the current cannabis users subsample of 82 (100%) biological females, the majority were young (M = 23.93 years, SD = 6.04 years). The sample was composed of mostly White (81.70%) and Indigenous (8.5%) individuals (see Table 2 for demographics of current cannabis users and non-users). The ages of the community current cannabis users sample (M = 24.32 years, SD = 2.93) were not significantly different from the university current cannabis users sample (M = 23.81 years, SD = 6.72), $t(69.63) = -.47$, $p = .641$. The community current cannabis users sample was composed of only White (89.5%) and Indigenous (10.5%) individuals while the university current cannabis users sample was composed of mostly White (79.4%) and Indigenous (7.9%) individuals. The community sample of current cannabis non-users was composed of predominantly White (59.30%), South Asian (16.70%), and African (11.10%) individuals while the university sample of current cannabis non-users was composed solely of White individuals (100%). Additional education and religiosity information of the current cannabis users and non-users subsamples were recorded (see Table 3). In terms of identifying which phase of the menstrual cycle (MC) current cannabis users and non-users were in at the time of survey completion, the majority endorsed being in the remainder of their cycle (47.60% of cannabis users and 50.80 % of cannabis non-users) which is any time that is not menstrual flow or the four preceding days (see Table 7).

Table 1

Participant Substance Use

Characteristic		Value [a]
Cannabis use [b]		
	Yes	82 (55.80)
	No	65 (44.20)
General cannabis use, *M* (*SD*)		
	Days during menstrual flow phase [c]	1.41 (1.08)
	Times of day during menstrual flow phase [c]	1.05 (0.82)
	Days during four days before phase [c]	1.95 (1.14)
	Times a day during four days before phase [c]	1.18 (0.98)
	Days during remainder of cycle phase [c]	8.17 (7.99)
	Times a day during remainder of cycle phase [c]	1.23 (0.81)
Alcohol use		
	Yes	114 (77.60)
	No	33 (22.40)
Alcohol use general frequency		
	Never	1 (0.70)
	Once every 3 to 6 months or 2 to 4 times per year	15 (10.20)
	Once every 2 months or 6 times per year	11 (7.50)
	Once a month or 12 times per year	14 (9.50)
	2 to 3 times a month	30 (20.40)
	Once a week	15 (10.20)
	Twice a week	17 (11.60)
	3 to 4 times a week	7 (4.80)
	5 to 6 times a week	2 (1.40)
	More than once a day	2 (1.40)

[a] Values shown are raw frequencies (%) except where otherwise indicated.
[b] Cannabis use reflects self-identification of general cannabis use by participant.
[c] Values have undergone a square root transformation.

Table 2

Demographic Characteristics of Current Cannabis Users and Non-Users

Characteristic		Users*		Non-Users*	
Age in years, *M* (*SD*)		23.36	(5.42)	22.65	(4.46)
Sampling					
	University	63	(76.80)	54	(83.10)
	Community	19	(23.20)	11	(16.90)
Gender					
	Female	81	(98.80)	65	(100.00)
	Non-binary/Genderqueer/Gender nonconforming	1	(1.20)	-	-
Race/ethnicity					
	African	1	(1.20)	6	(9.20)
	Caribbean	2	(2.40)	1	(1.50)
	East Asian	-	-	2	(3.10)
	Hispanic/Latinx	1	(1.20)	3	(4.60)
	Indigenous (First Nations, Metis, Inuit)	7	(8.50)	1	(1.50)
	South Asian	1	(1.20)	9	(13.80)
	White (Caucasian)	67	(81.70)	43	(66.20)
	Mixed	2	(2.40)	-	-
	Other	1	(1.20)	-	-
Student status					
	Full-time student	62	(75.60)	56	(86.20)
	Part-time student	10	(12.20)	7	(10.80)
	Not a student	10	(12.20)	2	(3.10)
Sexual Orientation					
	Asexual	6	(7.30)	2	(3.10)
	Bisexual	20	(24.40)	5	(7.70)
	Heterosexual	45	(54.90)	50	(76.90)
	Lesbian	2	(2.40)	-	-
	Pansexual	5	(6.10)	1	(1.50)
	Queer	6	(4.90)	2	(3.10)
	Questioning	-	-	1	(1.50)
	Identify as something not represented here	-	-	2	(3.10)
	Prefer not to answer	-	-	2	(3.10)
Marital status					
	Single	46	(56.10)	45	(69.20)
	Married/common-law	13	(15.90)	1	(1.50)
	Separated/divorced	2	(2.40)	2	(3.10)
	In a committed relationship	20	(24.40)	16	(24.60)
	Other	-	-	1	(1.50)
Employment status					
	Employed full-time	13	(15.90)	9	(13.80)
	Employed part-time	46	(56.10)	37	(56.90)
	Unemployed	23	(28.00)	19	(29.20)

*Values shown are raw frequencies (%) except where otherwise indicated.

Table 3

Current Cannabis Users' and Non-Users' Education and Religiosity Information

Characteristic		Users		Non-Users	
		Frequency (%)		Frequencies (%)	
Education					
	High school completed	17	(20.70)	24	(36.90)
	Some college or technical school completed	3	(3.70)	2	(3.10)
	College or technical school completed	16	(19.50)	7	(10.80)
	Some undergraduate training	29	(35.40)	20	(30.80)
	Undergraduate degree completed	12	(14.60)	7	(10.80)
	Some graduate training	2	(2.40)	1	(1.50)
	Master's degree completed	3	(3.70)	4	(6.20)
Religious affiliation					
	Catholic	10	(12.20)	18	(27.70)
	Eastern Orthodox (e.g., Shinto, Jainism)	1	(1.20)	-	-
	Muslim	-	-	2	(3.10)
	Protestant	3	(3.70)	4	(6.20)
	No religious affiliation (e.g., atheist, agnostic)	45	(54.90)	22	(33.80)
	None of these OR prefer not to answer	16	(19.50)	13	(20.00)
	Other	7	(8.50)	6	(9.20)
Strength of religious beliefs					
	Not applicable	33	(40.20)	21	(32.30)
	Not strong at all	14	(17.10)	5	(7.70)
	Not very strong	12	(14.60)	11	(16.90)
	Somewhat strong	18	(22.00)	9	(13.80)
	Very strong	3	(3.70)	12	(18.50)
	Extremely strong	2	(2.40)	5	(7.70)

Table 4

Current Cannabis Users' and Non-Users' Phase of Menstrual Cycle during Survey Completion

Characteristic		Users		Non-Users	
		Frequencies (%)		Frequencies (%)	
Cycle Phase					
	Menstrual flow	23	(28.00)	18	(27.70)
	Four days before flow	12	(14.60)	9	(13.80)
	Remainder of cycle	39	(47.60)	33	(50.80)
	I do not know	8	(9.80)	5	(7.70)

Procedure

Students in psychology undergraduate courses were recruited from Lakehead University using the online SONA system (Thunder Bay and Orillia). They were also recruited using posters mounted around the Lakehead University Thunder Bay campus and the broader community (Appendix A). Student participants in psychology courses were offered one course bonus credit. Alternatively, student participants were given the option to elect to provide their email to be

entered into the prize draw that the community participants were offered. Community members were eligible to provide an email to be entered into a draw for a chance to win an electronic gift card. Community members were targeted using advertisements on Kijiji and other social media platforms. Participants completed a battery of online surveys (approximately 30 minutes to complete), provided on the SurveyMonkey platform. They were initially presented with an information letter and informed consent (Appendix B). Given the nature of the questions (i.e., cannabis use, MC experience) not every question was answered by every participant. Participants were only answering relevant questions as skip-logic was applied to the measures. Following completion of the measures, participants were provided with a debriefing form (Appendix C).

Measures

Demographic Questionnaire

An adapted version of Tanner and Mazmanian's (2016) scale was used as the demographic questionnaire (Appendix D). The questions pertained to participants' age, race/ethnicity, sexual orientation, gender, biological sex, level of education, employment, religious affiliation, strength of religious affiliation, and marital status. Participants were to select from multiple choice options in response to questions (e.g., "what was your biological sex at birth?").

Women's Health Screener

To identify those who experience natural menstrual cycles (experience vaginal bleeding that lasts, on average 5-7 days, once a month without exogenous influence), an adapted 8-item version of the 17-item Reproductive Status Questionnaire (RSQ) was used (Appendix E; Schmalenberger et al., 2021). To obtain these items, questions that were most relevant to the study's research questions were extracted and modified to attain the most relevant information. This allowed for participants to be categorized into those who experience a natural MC and those

who do not. Participants were asked to answer the question, “do you experience a natural menstrual cycle?”. Other questions included in the questionnaire related to potential exclusionary criteria such as, “are you currently using oral contraceptive pills, contraceptive patches, contraceptive implant or injection in your arm, or a contraceptive vaginal ring?” and “are you using a hormonal Intrauterine device (IUD)?”. A list of medications currently being taken by the participant was also requested to account for any further hormonal medications or medications that could influence affect (e.g., anti-depressants).

Positive and Negative Affect Schedule (PANAS)

The 20-item Positive and Negative Affect Schedule (PANAS; Watson et al., 1988) was used to retrospectively measure both positive affect (PA) and negative affect (NA) during participant’s most recent menstrual flow/period/bleeding (Appendix F), during the four days prior to participant’s most recent menstrual flow/period/bleeding (Appendix G), and during the remainder of participant’s most recent MC (Appendix H). PA and NA are reflective of pleasurable and unpleasurable engagement in an individual’s environment, respectively (Tuccitto et al., 2010). Participants were instructed to rate each of the 20 adjectives (i.e., emotions) from “very slightly or not at all” to “extremely” (1 and 5, respectively; Watson et al., 1988). Participants completed these items for each of the three phases of their most recent menstrual cycle. This measure has flexibility in that participants can provide responses that are retrospective (e.g., last week, past few weeks; Tuccitto et al., 2010) so it was adapted to examine each cycle phase. Each factor score (PA and NA) is derived from totalling the corresponding item scores. There are 10 words reflective of positive affect and 10 words reflective of negative affect. Higher scores for each of the factors reflects greater endorsement of the specific construct (Serafini et al., 2016). Words identifying positive affect include for example, “enthusiastic” and “alert”. Alternatively, words identifying negative affect include for example, “guilty” and “distressed”. The PA and NA scales of the

PANAS have been found to show internal consistencies of .90 and .87, respectively (Watson et al., 1988). Further, Watson and colleagues found the PANAS-NA to have high convergent, discriminant, and construct validity. Among substance users specifically, the PANAS has shown good reliability and validity (Serafini et al., 2016). For example, discriminant and convergent validity was demonstrated by strongly correlated NA scores with psychopathology symptoms and PA being strongly and inversely correlated with these symptoms. Further, we manually compared item content from the MDQ-Form C (Moos, 1968) NA and arousal (positive reactions during menstruation) subscales with item content from the PANAS NA and PA subscales, respectively. The PANAS subscales are more comprehensive reflections of PA and NA, covering additional aspects of PA and NA that are not covered in the MDQ-Form C subscales. Additionally, the NA subscale of the MDQ-Form C is generally associated with symptoms related to the premenstrual phase of the menstrual cycle. Thus, in wanting to be inclusive of all phases and related symptoms, we elected to use the PANAS NA subscale over the MDQ-Form C NA subscale, since it has more breadth in item content.

Menstrual Distress Questionnaire (MDQ)

The 47-item Menstrual Distress Questionnaire (MDQ) was used to measure physiological symptoms experienced by participants during their last MC (e.g., cramps, headache, swelling, hot flashes; Moos, 1968; Moos, 1991). The scale yields scores on seven subscales. Three of the seven core subscales were used to reflect physiological distress: pain, water retention, and autonomic reactions (Moos, 1968). The remaining four core subscales of the measure include: negative affect, concentration, behaviour change, and arousal (Hawes & Oei, 1992; Moos, 1991). An eighth scale – control – is included to indicate that symptoms are in accordance with the MC and not generalized feelings or as a result of participants having a tendency to complain. Form C of the MDQ was used for participants to specify presence of symptoms throughout three phases

(4 days before menstrual flow, during menstrual flow, and remainder of cycle) of their most recent MC (Hawes & Oei, 1992; Moos, 1968). Participants retrospectively rated their symptoms from 0 (*No experience of symptom*) to 4 (*Present, severe*). To obtain the symptom scores for each phase, scores were computed by adding them together within the respective phases (Haywood et al., 2002). Participants identified which phase of the MC they were currently in, on the day of measure completion (Appendix I). An additional open-response item (i.e., "in what ways, if any, was your most recent MC unusual?") allowed participants to identify if their most recent MC was inconsistent in any way with their typical menstruation cycles (see Appendix J). The MDQ has been found to have good split-half reliability and test-retest reliability (Markum, 1976). Additionally, Haywood and colleagues (2002) found good test-retest reliability among symptoms between the first recorded cycle and the second cycle, with significant correlations ranging between .57 and .95.

Substance Use Measure

We adapted questions from the original 39-item Daily Sessions, Frequency, Age of Onset, and Cannabis Use Inventory (DFAQ-CU; Cuttler & Spradlin, 2017) to measure patterns of substance use (Appendix K). We added items related to alcohol consumption as it relates to the self-medication theory (Khantzian, 1997). The substance use measure contains questions regarding current cannabis use (e.g.,"do you use cannabis?") and alcohol consumption, (e.g., "do you consume alcohol?"), in addition to asking with what frequency the substances are used (e.g., "on average, how many units of alcohol do you typically consume?"; Boboc, 2022). Participants were provided with alcohol equivalencies (i.e., "when answering the following questions, keep in mind that ONE unit of alcohol is equal to a 1.5 oz distilled alcohol [e.g., vodka, rum, whisky], 5 oz glass of wine, or a 12 oz bottle/can of beer"; Keir, 2015). The remainder of the questionnaire contained 57 items measuring cannabis use (i.e., frequency, quantity), mode of intake, and awareness of

THC/CBD content. Participants responded to a range of questions with varying response options (i.e., multiple choice, Likert-type ratings, sliding scale, write-in answers). Skip logic was used with this measure as suggested by Cuttler and Spradlin (2017). The same item content was repeated three times, one for each of the three phases of the MC (i.e., during your most recent menstrual flow/period/bleeding, during the four days before your most recent menstrual flow, and during the remainder of your most recent menstrual cycle). This was done to parallel past tense time intervals based on the Menstrual Distress Questionnaire (MDQ) – Form C (e.g., "during your most recent menstrual flow, approximately how many days did you use cannabis?"). Thus, participants reported on 1) their current cannabis use (more generally), as well as their cannabis use sprecially during their 2) menstrual phase, 3) premenstrual phase, and 4) remainder of cycle phase.

The original DFAQ-CU has been shown to have good psychometric properties with adequate convergent validity concerning marijuana quantity items (Cuttler & Spradlin, 2017). The predictive and discriminant validity of the original scale's six factors range from good to excellent. The frequency and quantity of cannabis use scores have been shown to have excellent (.95) and good reliability (.81 and .88), respectively.

Personality Research Form – Infrequency Scale

The Infrequency Scale has 16 items (e.g., "sometimes I see cars near my home") reflecting the detection of careless, random, or nonpurposeful responding (Appendix L; Jackson, 1987). These questions detail commonplace occurrences that, upon participants selecting "True" or "False", detect whether they have actually attended to the item. The scale has moderate test-retest reliability (.46; Jackson, 1987).

Statistical Analyses

Data were initially screened and cleaned prior to conducting analyses. Missing values were investigated to evaluate whether the data were missing completely at random using Little's MCAR test (Tabachnick & Fidell, 2018). The missing data were missing completely at random. Thus, mean imputation was used and the series mean replaced missing values for variables with a maximum of 20% missing values. Using Jackson's (1987) Infrequency scale, participant response style was evaluated. Raw scores yielding four or greater were judged to be careless or non-purposeful responding and thus, this participant's data was excluded from analyses.

We assessed for outliers (*z* score of plus or minus 3.29; Field, 2013; Tabachnick & Fidell, 1996; 2018). After identifying an outlier, we changed the score by increasing or decreasing the raw score to either one unit more or one unit less than the distribution's next extreme score (Field, 2013; Tabachnick & Fidell, 1996; 2018). A square root transformation was performed for some variables based on their distribution (e.g., presence of zeros, unequal variances and positive skew; Field, 2013). Values provided in the tables are the back-transformed values. Although non-users of cannabis were eligible to complete the study, cannabis users were the primary interest for the main analyses and as such, non-users of cannabis were removed from the working dataset. Descriptive statistics were computed for age, biological sex, gender, sexual orientation, ethnic background, marital status, education level, religious affiliation, and strength of religious affiliation. We originally planned to investigate the quantity of cannabis use however, based on limited subsample sizes and ineffective standardized method of comparison across modes, these analyses were not feasible. Thus, frequency of cannabis use was the main measure used in relation to cannabis. For all analyses conducted to explore the four main hypotheses, the subsample of *current* cannabis users (n = 82) was explored.

To address the first research question (i.e., "are women who experience greater MC distress more likely to use cannabis more frequently?"), three Pearson product-moment

correlations were conducted to investigate the strength of association between frequency of cannabis use (measured in times per day) and MC distress, for each phase of the menstrual cycle: 1) premenstrual, 2) menses, and 3) remainder of cycle.

Although the first research question addresses MC distress as a whole (measured by total scores on the MDQ-Form C), further Pearson product-moment correlations were conducted to address the second research question (i.e., "What is the association between a) cannabis use and affective symptoms, and b) cannabis use and physiological symptoms?"); looking specifically at the affective (negative and positive affect subscale scores) and physiological (pain, water retention, and autonomic reactions subscale scores, and total physiological score) symptoms of MC distress. Pearson product-moment correlations were computed to investigate the strength of association between frequency of cannabis (measured in times per day) used and positive affect at each phase of the MC (correlations one through three), cannabis use frequency (measured in times per day) and negative affect at each phase of the MC (correlations four through six), cannabis use frequency (measured in times per day) and pain at each phase of the MC (correlations seven through nine), cannabis use frequency (measured in times per day) and water retention at each phase of the MC (correlations 10 through 12), cannabis use frequency (measured in times per day) and autonomic reactions at each phase of the MC (correlations 13 through 15), and cannabis use frequency (measured in times per day) and total physiological distress at each phase of the MC (correlations 16 through 18). Thus, a total of 18 Pearson product-moment correlations were computed.

To address the third research question (i.e., "do affective or physiological symptoms of MC distress differ by mode of cannabis intake?"), a total of 21 one-way between-subjects analyses of variance (ANOVAs) were conducted. Mode of intake was the independent variable with six levels (i.e., no use during specified phase, cannabis flower, concentrates, edibles, other,

two or more modes). Each of the MC distress subscales (PA, NA, pain, water retention, autonomic reactions), as well as total MC distress, and total physiological distress were used as the dependent variable (DV) in their respective ANOVAs. Each DV was used three times to account for the premenstrual, menstrual, and remainder phase of the menstrual cycle.

To address the fourth set of research questions [i.e., is there a difference in: (a) MC distress between women who are and are not aware of the cannabinoid contents in their cannabis products?, and (b) cannabis use frequency between women who are and are not aware of the cannabinoid contents in their cannabis products?], nine independent *t*-tests were conducted to investigate if there is a difference in MC distress between women who are and are not aware of the cannabinoid contents in their cannabis products. Awareness of cannabinoid contents was self-reported. Three independent *t*-tests (i.e., one for each phase of the menstrual cycle) were conducted to investigate if there is a difference in frequency of cannabis use (measured in days) between women who are and are not aware of the cannabinoid contents in their cannabis products. Another three independent *t*-tests (i.e., one for each phase of the menstrual cycle) were conducted to investigate if there is a difference in frequency of cannabis use (measured in times per day) between women who are and are not aware of the cannabinoid contents in their cannabis products. The final three independent *t* tests (i.e., one for each phase of the menstrual cycle) were conducted to investigate if there is a difference in total menstrual distress between women who are and are not aware of the cannabinoid contents in their cannabis products. Following this, 12 *t*-tests were conducted to investigate mode of intake and the individual physiological subscale scores, and total physiological distress. A total of 21 *t*-tests were conducted. Hedge's *g* was used to present effect size as some of the samples were of a smaller size ($n < 20$). Thus, to maintain consistency across the analyses, Hedge's *g* was used to inform all *t*-test effect sizes.

In sum, 21 Pearson product-moment correlations, 21 one-way between-subject ANOVAs, and 21 independent *t* tests were conducted to investigate the hypotheses. We conducted supplemental 28 independent *t*-tests to identify any distincitons between current cannabis users and non-users. We further conducted eight follow-up one-way within-subject ANOVAs to investigate the symptoms of menstrual cycle distress, across the phases of the menstrual cycle. The number of analyses conducted is reflective of the exploratory nature of our reseach questions. We acknowledge that the number of analyses conducted are likely to increase our type I error and thus, we wanted to reduce this possibility by adjusting our alpha levels, reducing them to .01. Maier and Lakens (2022) discuss the applicability of this approach for larger sets of data in which the power is likely to increase, amplifying the potential for an effect to be found that is not a true effect.

Results

The combined sample of university students and community members were examined in relation to their cannabis use throughout the phases of the menstrual cycle. The subsample of *current* cannabis users was used for all main and follow-up analyses. When conducting main analyses that pertained to the three specific phases of the menstrual cycle, if a participant endorsed they used, at a minimum, one mode of cannabis intake during that phase, they would be further considered a cannabis user during that specific phase (e.g., menstrual phase cannabis users, premenstrual phase cannabis users, remainder of cycle phase cannabis users). A combined sample of current cannabis users and non-users were used for supplemental analyses. Frequency of cannabis use was measured using *times per day* during specified menstrual cycle phases (e.g., how many times per day participants used cannabis during the menstrual phase). We originally planned to investigate frequency of use, measured by quantifying days of cannabis use. However, we resorted to not using this additional frequency measurement to interpret the results of the

correlational analyses as there is no standardized measure of days across the three phases of the menstrual cycle. While the menstrual cycle distress measure used (MDQ; Moos, 1991) specifically defines the premenstrual phase timeframe, the other two phases (menstrual and remainder of cycle) are not clearly defined due to variability in women's phase length. We conducted four sets of analyses to explore our hypotheses. Subsequently, supplemental analyses were conducted to compare menstrual cycle distress among cannabis users and non-users. Follow-up analyses were conducted to investigate within-subjects differences across the phases of the menstrual cycle (premenstrual, menstrual, remainder of cycle).

Hypothesis 1: Bivariate Analyses

Pearson product-moment correlations (n = 82) were conducted between frequency of cannabis use (times per day) and total menstrual distress to explore the associations between cannabis use frequency and overall distress experienced during each phase of the menstrual cycle. None of the correlations between total MC distress and frequency of use (times per day) were significant (all $p > .01$; see Table 8). Refer to Table 6 for the variables' sample size, means, and standard deviations.

Table 5

Pearson Product-Moment Correlations for Total Menstrual Distress and Frequency of Cannabis Use by Menstrual Cycle Phase

		Cycle Phase		
		Menstrual Flow	Four Days Before Flow	Remainder of Cycle
	Frequency of Use	Times per Day	Times per Day	Times per Day
		(n = 82)	(n = 82)	(n = 82)
Total Distress[a]		.19	.14	.11
		[-.03, .39] [b]	[-.08, .34] [b]	[-.11, .32] [b]

[a] Total distress during each phase of the menstrual cycle
[b] Confidence intervals

Table 6

Sample Size, Mean, and Standard Deviation of Total Menstrual Distress and Frequency of Cannabis Use by Menstrual Phase

	Cycle Phase								
	Menstrual Flow			Four Days Before Flow			Remainder of Cycle		
	n	*M*	*SD*	*n*	*M*	*SD*	*n*	*M*	*SD*
Total MC Distress	82	62.59	28.17	82	55.67	26.82	82	32.71	16.79
Times per Day	82	1.10 [a]	0.67 [a]	82	1.39 [a]	0.96 [a]	82	1.51 [a]	0.66 [a]

Note. MC = Menstrual cycle

[a] For analyses, these variables were transformed using square root transformation.

Hypothesis 2: Bivariate Analyses

Several Pearson product-moment correlations were conducted to determine the associations between cannabis use frequency (times per day use) and total physiological distress. Additionally, each subscale that makes up total physiological distress was explored. None of the correlations were significant (all $p > .01$; see Table 7). For variable means and standard deviations, see Table 8.

Table 7

Pearson Product-Moment Correlations for PANAS, MDQ Physiological Subscales, Total Physiological, and Frequency of Cannabis Use by Menstrual Cycle Phase

		Cycle Phase		
		Menstrual Flow	Four Days Before Flow	Remainder of Cycle
	Frequency of Use	Times per Day (n = 82)	Times per Day (n = 82)	Times per Day (n = 82)
Variables				
Positive Affect		.02	.24	-.05
		[-.20, .23]	[.03, .44]	[-.26, .17]
Negative Affect		.09	-.05	.17
		[-.13, .30]	[-.26, .17]	[-.05, .34]
Pain		.15	.11	.02
		[-.07, .36]	[-.11, .32]	[-.20, .24]
Water Retention		.04	-.04	.12
		[-.17, .26]	[-.25, .18]	[-.10, .32]
Autonomic Reactions		.12	.20	-.06
		[-.10, .33]	[-.02, .40]	[-.28, .16]
Total Physiological		.13	.10	.05
		[-.09, .34]	[-.12, .31]	[-.17, .26]

Note. PANAS = Positive and Negative Affect Schedule; MDQ = Menstrual Distress Questionnaire.

Table 8

Means, and Standard Deviations of PANAS, MDQ Physiological Subscales and Total Physiological by Menstrual Phase (n = 82)

	Cycle Phase					
	Menstrual Flow		Four Days Before Flow		Remainder of Cycle	
Menstrual Distress	*M*	*SD*	*M*	*SD*	*M*	*SD*
Positive Affect	10.00	7.11	10.18	7.27	16.85	8.68
Negative Affect	13.48	6.99	12.68	7.38	8.30	6.01
Pain	12.60	5.62	9.97	5.42	4.84	4.07
Water Retention	5.95	3.64	5.89	3.72	1.87 [a]	2.58 [a]
Autonomic Reactions	3.39	3.08	1.44 [a]	0.90 [a]	0.45 [a]	0.42 [a]
Total Physiological	21.94	10.30	18.19	9.86	6.20 [a]	1.49 [a]

Note. PANAS = Positive and Negative Affect Schedule; MDQ = Menstrual Distress Questionnaire

[a] For analyses, these variables were transformed using square root transformation.

Hypothesis 3: Between-Subjects ANOVAs

One-way between-subjects ANOVAs were conducted to compare the effect of mode of cannabis intake on not only total MC distress and total physiological distress, but also the physiological subscales, positive affect, and negative affect. Mode of intake was categorized into six groups: no use during specified phase, flower, concentrates, edibles, another unspecified use, two or more modes of intake. Each ANOVA was investigated for each phase of the menstrual cycle (premenstrual, menstrual, and remainder of cycle).

There were no significant effects of mode of intake during the menstrual flow phase (all $p > .01$; see Table 9). Variable sample sizes and frequencies (%) for all phases can be seen in Table 10. There were also no significant effects of mode of intake during the premenstrual phase (all $p >$

.01; see Table 11). Similarly, there were no significant effects of mode of intake during the remainder phase of the menstrual cycle (all $p > .01$; see Table 12).

Table 9

Means, Standard Deviations, and One-Way Analyses of Variance in Mode of Intake during Menstrual Flow

	Mode of Intake								
	No Use	Flower	Concentrates	Edibles	Other	Two or More	F (4, 77)	p	η^2
	M (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)			
MC Distress									
Positive Affect	9.93 (8.16)	8.18 (5.74)	- (-)	14.71 (6.92)	7.42 (6.83)	10.90 (6.21)	1.38	.247	0.07
Negative Affect	13.57 (8.35)	13.12 (6.51)	- (-)	11.14 (6.52)	14.57 (5.06)	14.10 (6.16)	0.28	.890	0.01
Pain	11.45 (6.26)	12.88 (5.45)	- (-)	11.43 (5.38)	14.43 (4.12)	13.92 (5.24)	0.87	.488	0.04
Water Retention	5.39 (4.12)	6.82 (4.01)	- (-)	4.86 (4.14)	5.71 (1.89)	6.55 (2.76)	0.72	.581	0.04
Autonomic Reactions	2.89 (3.12)	2.59 (2.98)	- (-)	2.86 (2.27)	2.57 (1.72)	5.30 (3.17)	2.81	.031	0.13
Total MC Distress	56.09 (31.65)	64.18 (26.29)	- (-)	48.19 (21.97)	65.14 (19.63)	75.47 (24.90)	2.04	.096	0.10
Total PHYS Distress	19.73 (11.53)	22.29 (10.34)	- (-)	19.14 (9.82)	22.71 (5.82)	25.77 (9.20)	1.20	.316	0.06

Note. MC = menstrual cycle; PHYS = physiological.

Table 10

Sample Sizes and Percentages of Cannabis Modes of Intake Among Cannabis Users by Cycle Phase

	Cycle Phase					
	Menstrual Flow		Four Days Before Flow		Remainder of Cycle	
	n	%	*n*	%	*n*	%
Mode of Intake						
No use	31	37.80	28	34.10	18	22.00
Flower	17	20.70	18	22.00	20	24.40
Concentrates	0	0	11	13.40	8	9.80
Edibles	7	8.50	5	6.10	12	14.60
Other	7	8.50	3	3.70	2	2.40
Two or more	20	24.40	17	20.70	22	26.80

Table 11

Means, Standard Deviations, and One-Way Analyses of Variance in Mode of Intake during the Four Days Before Menstrual Flow

	Mode of Intake								
	No Use	Flower	Concentrates	Edibles	Other	Two or More	F (5, 76)	p	η^2
MC Distress	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)			
Positive Affect	9.85 (7.30)	8.33 (7.49)	7.55 (5.07)	15.00 (7.00)	15.33 (3.79)	12.06 (8.05)	1.55	.185	0.09
Negative Affect	13.09 (7.40)	13.67 (8.44)	14.86 (8.77)	8.40 (6.23)	8.88 (6.17)	11.47 (5.52)	0.85	.517	0.05
Pain	9.71 (5.62)	11.56 (5.64)	11.27 (5.52)	10.20 (5.67)	10.33 (5.51)	7.74 (4.67)	1.03	.409	0.06
Water Retention	6.21 (4.37)	6.50 (2.87)	7.00 (4.69)	4.00 (1.41)	6.00 (2.65)	4.53 (3.10)	1.05	.359	0.07
Autonomic Reactions [a]	0.98 (0.89)	1.85 (1.05)	3.31 (0.81)	0.36 (0.55)	0.11 (0.58)	1.72 (0.93)	2.47	.040	0.14
Total MC Distress	50.31 (28.37)	64.92 (25.43)	66.09 (33.93)	43.20 (20.34)	51.00 (16.46)	52.45 (21.33)	1.29	.277	0.07
Total PHYS Distress	17.68 (10.13)	20.94 (10.10)	22.18 (11.95)	14.80 (7.19)	16.67 (8.39)	14.80 (7.93)	1.21	.314	0.08

Note. MC = menstrual cycle; PHYS = physiological.

[a] For analyses, these variables were transformed using square root transformation.

Table 12

Means, Standard Deviations, and One-Way Analyses of Variance in Mode of Intake during the Remainder of the Menstrual Cycle

	Mode of Intake								
	No Use	Flower	Concentrates	Edibles	Other	Two or More	F (4, 77)	p	η^2
MC Distress	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)			
Positive Affect	16.17 (9.87)	16.05 (8.85)	11.71 (7.41)	17.57 (7.68)	25.00 (7.07)	18.86 (8.19)	1.24	.298	0.08
Negative Affect	8.14 (6.60)	6.40 (5.79)	10.13 (5.41)	8.38 (5.85)	9.00 (4.24)	9.39 (6.17)	0.69	.635	0.04
Pain [a]	3.96 (1.74)	3.17 (0.88)	3.39 (1.39)	4.33 (0.92)	3.50 (0.04)	4.24 (0.83)	0.23	.950	0.02
Water Retention [a]	1.28 (1.19)	0.64 (0.64)	0.96 (1.46)	1.21 (0.58)	0.00 (0.00)	1.25 (0.88)	0.80	.553	0.05
Autonomic Reactions [a]	0.71 (0.61)	0.19 (0.48)	0.61 (0.59)	0.48 (0.56)	0.00 (0.00)	0.58 (0.62)	0.98	.439	0.06
Total MC Distress	31.56 (15.86)	29.51 (14.50)	33.50 (20.78)	30.75 (15.39)	21.00 (1.41)	38.46 (19.20)	0.90	.481	0.06
Total PHYS Distress [a]	7.02 (2.37)	4.75 (1.14)	5.76 (1.99)	6.55 (1.51)	3.50 (.04)	7.29 (1.10)	0.55	.737	0.04

Note. MC = menstrual cycle; PHYS = physiological.

[a] For analyses, these variables were transformed using square root transformation.

Hypothesis 4: *t* Tests

Several independent *t* tests were conducted to compare total MC distress and frequency of cannabis use (measured in days and times per day) between cannabis users who were aware of the THC/CBD content of the cannabis they used and cannabis users who were unaware. Each *t* test

was investigated for each phase of the menstrual cycle. Follow up independent *t* tests were conducted to compare the physiological subscales between individuals who were aware and unaware of the cannabinoid content of their cannabis.

Menstrual Flow Phase

Cannabis users that were aware of their cannabis content had a significantly higher frequency of use, measured in days (M = 1.62, SD = 1.05), compared to cannabis users unaware of their cannabis content (M = 0.83, SD = 0.95), with a moderate effect, $t(80) = -3.10$, $p = .003$, $g = 0.77$. Individuals aware of the THC/CBD content in their cannabis products used cannabis more frequently (more days), when compared to individuals who were unaware of the cannabinoid content of their cannabis. The rest of the independent *t* tests for the menstrual flow phase were not significant (all $p > .01$; see Table 13). None of the follow-up physiological subscale independent *t* tests were significant for the menstrual flow phase (all $p > .01$; see Table 14).

Table 13

Independent Samples t Test Comparing Total Menstrual Cycle Distress and Frequency of Cannabis Use during Menstrual Flow Among Those Aware and Unaware of Cannabis Content

Menstrual flow	Awareness of THC/CBD content used					
	Aware		Unaware			
	M	*SD*	*M*	*SD*	*t*(80)	*g*
Total MC distress	63.75	27.41	59.43	30.58	- 0.61	- 0.15
Frequency in days	1.62	1.05	0.83	0.95	- 3.10*	0.77
Frequency in times per day	1.16	0.79	0.74	0.84	- 2.10	- 0.52

Note. THC = tetrahydrocannabinol; CBD = Cannabidiol; MC = menstrual cycle

*$p < .01$ (two-tailed).

Table 14

Independent Samples t Test Comparing Physiological Subscale and Total Scores during Menstrual Flow Among Individuals Aware and Unaware of Cannabis Content

Menstrual Flow	Awareness of THC/CBD content used					
	Aware		Unaware			
	M	*SD*	*M*	*SD*	*t*(80)	*g*
Pain	12.74	5.36	12.23	6.40	- 0.37	- 0.09
Water Retention	5.98	3.65	5.86	3.72	- 0.13	-0.03
Autonomic Reactions	3.33	3.14	3.55	3.00	0.28	0.07
Total Physiological	22.05	10.18	21.64	10.85	- 0.16	- 0.04

Note. THC = tetrahydrocannabinol; CBD = Cannabidiol

Four Days Before Menstrual Flow Phase

None of the main independent *t* tests for the premenstrual phase (four days before flow) were significant (all $p > .01$). As can be seen in Table 15, an independent *t* test was not conducted when looking at frequency of cannabis use (measured in days) since the subsample size for individuals unaware of the cannabinoid content of their cannabis during the premenstrual phase was very small ($n = 1$). Similarly, none of the follow-up physiological subtest independent *t* tests were significant for the premenstrual phase (all $p > .01$; see Table 16).

Table 15

Independent Samples t Test Comparing Total Menstrual Cycle Distress and Frequency of Cannabis Use during Four Days Before Among Individuals Aware and Unaware of Cannabis Content

Four days before	Awareness of THC/CBD content used					
	Aware		Unaware			
	M	*SD*	*M*	*SD*	*t*(51)	*g*
Total MC distress	57.22	24.67	65.45	30.18	0.94	- 0.34
Frequency in days [a]	-	-	-	-	-	-
Frequency in times per day	1.56	0.86	1.73	0.77	0.61	0.20

Note. THC = tetrahydrocannabinol; CBD = Cannabidiol; MC = menstrual cycle

[a] Analyses not conducted (n = 1).

Table 16

Independent Samples t Test Comparing Physiological Subscale and Total Scores during Four Days Before Among Individuals Aware and Unaware of Cannabis Content

Four Days Before	Awareness of THC/CBD content used					
	Aware		Unaware			
	M	*SD*	*M*	*SD*	*t*(51)	*g*
Pain	10.09	5.25	10.27	6.31	0.10	0.03
Water Retention	5.29	3.19	7.73	3.50	2.22	0.74
Autonomic Reactions	1.21	0.96	1.66	0.99	1.37	0.46
Total Physiological	17.73	9.42	21.64	11.37	1.17	0.39

Note. THC = tetrahydrocannabinol; CBD = Cannabidiol

Remainder of Cycle Phase

None of the independent *t*-tests for the remainder of cycle phase of the menstrual cycle were significant (all $p > .01$; see Table 17). None of the physiological subscale independent *t* tests were significant for the remainder of the cycle phase (all $p > .01$; see Table 18).

Table 17

Independent Samples t Test Comparing Total Menstrual Cycle Distress and Frequency of Cannabis Use during Remainder of Cycle Among Individuals Aware and Unaware of Cannabis Content

Remainder of cycle	Awareness of THC/CBD content used					
	Aware		Unaware			
	M	*SD*	*M*	*SD*	*t*(63)	*g*
Total MC distress	33.97	16.32	30.06	19.30	- 0.81	0.23
Frequency in days	10.02	8.15	9.06	7.18	- 0.46	- 0.12
Frequency in times per day	1.29	0.75	1.61	0.60	1.57	0.44

Note. THC = tetrahydrocannabinol; CBD = Cannabidiol; MC = menstrual cycle

Table 18

Independent Samples t Test Comparing Physiological Subscale and Total Scores during Remainder of Cycle Among Individuals Aware and Unaware of Cannabis Content

Remainder of Cycle	Awareness of THC/CBD content used					
	Aware		Unaware			
	M	*SD*	*M*	*SD*	*t*(63)	*g*
Pain	2.00	0.91	1.80	1.00	- 0.77	- 0.22
Water Retention	1.02	0.87	0.82	0.96	- 0.79	- 0.22
Autonomic Reactions	0.62	0.71	0.62	0.85	0.001	0.00
Total Physiological	2.53	1.05	2.23	1.29	- 0.95	- 0.27

Note. THC = tetrahydrocannabinol; CBD = Cannabidiol

Supplemental Analyses

Based on our initial analyses and lack of significant findings, we would be tempted to suggest there is no association between cannabis use and menstrual cycle distress. However, our main sample used for the main analyses only consisted of self-reported cannabis users. In an effort to consider the rest of the sample and exhaust the conclusion that there is no association between use and distress, we sought to generate an answer to the question of whether people who use cannabis products are also people who experience more menstrual cycle distress, in comparison to non-cannabis users. To explore this question, we conducted supplementary independent *t*-tests comparing facets of menstrual cycle distress among cannabis users and non-users. Based on the limited number of supplemental analyses and lack of a priori hypotheses, we used an alpha of .05. In general, there were no significant differences in distress (total MC distress, negative affect, or physiological distress) between cannabis users and non-users (all $p > .05$; as seen in Table 19). When looking more specifically across each phase of the menstrual cycle however, we observed a significant difference in pain scores between cannabis users and non-users during the premenstrual phase (see Table 20) and the menstrual phase (see Table 21). During the premenstrual phase, cannabis users had a significantly higher pain severity ($M = 9.97$, $SD = 5.42$), compared to cannabis non-users ($M = 8.24$, $SD = 4.80$), with a moderate effect, $t(140) = -2.02$, $p = .045$, $g = -0.33$. Similarly, during the menstrual phase cannabis users had a significantly higher pain severity ($M = 12.60$, $SD = 5.62$), compared to cannabis non-users ($M = 10.66$, $SD = 5.47$) during the premenstrual phase, with a moderate effect, $t(140) = -2.10$, $p = .037$, $g = -0.35$. All other analyses were non-significant (all $p > .05$; refer to Table 22).

Table 19

Independent Samples t Test Comparing General Menstrual Cycle Distress Among Cannabis Users and Non-Users

	Cannabis					
	Users		Non-Users			
	M	*SD*	*M*	*SD*	*t*(140)	*g*
PA	37.88	20.08	37.31	18.70	-0.18	-0.03
NA	34.77	16.84	31.92	15.74	-1.03	-0.17
Pain	27.35	12.45	23.76	12.91	-1.68	-0.28
Water Retention	13.80	8.56	12.38	8.62	-0.98	-0.16
Autonomic Reactions	6.86	5.90	7.53	7.79	0.58	0.10
Total Physiological	48.23	22.12	43.77	26.31	-1.10	-0.18
Total MC distress	87.46	38.06	75.84	41.53	-1.74	-0.29

Note. PA = positive affect; NA = negative affect; MC = menstrual cycle

Table 20

Independent Samples t Test Comparing Menstrual Cycle Distress During Four Days Before Menstrual Flow Among Cannabis Users and Non-Users

Four Days Before	Cannabis					
	Users		Non-Users			
	M	*SD*	*M*	*SD*	*t*(140)	*g*
PA	10.18	7.27	10.10	7.08	-0.07	-0.01
NA	12.69	7.38	11.27	6.94	-1.18	-0.19
Pain	9.97	5.42	8.24	4.80	-2.02*	-0.33
Water Retention	5.89	3.73	5.06	3.25	-1.42	-0.23
Autonomic Reactions[a]	1.20	0.95	1.22	1.02	0.11	0.02
Total Physiological	18.19	9.86	15.81	9.49	-1.48	-0.25
Total MC distress	32.63	16.03	27.66	15.23	-1.87	-0.32

Note. PA = positive affect; NA = negative affect; MC = menstrual cycle

*$p < .05$

[a] Square Root Transformed Values

Table 21

Independent Samples t Test Comparing Menstrual Cycle Distress During Menstrual Flow Among Cannabis Users and Non-Users

Menstrual Flow	Cannabis					
	Users		Non-Users			
	M	*SD*	*M*	*SD*	*t*(140)	*g*
PA	10.00	7.11	10.54	6.68	0.47	0.08
NA	13.48	6.99	12.90	5.95	-0.54	-0.09
Pain	12.60	5.62	10.66	5.47	-2.10*	-0.35
Water Retention	5.95	3.64	4.98	3.32	-1.66	-0.27
Autonomic Reactions	3.39	3.08	3.34	3.42	-0.09	-0.01
Total Physiological	21.94	10.30	18.99	10.59	-1.71	-0.28
Total MC distress	37.52	15.36	32.26	17.24	-1.86	-0.31

Note. PA = positive affect; NA = negative affect; MC = menstrual cycle

*$p < .05$

Table 22

Independent Samples t Test Comparing Menstrual Cycle Distress During Remainder of Cycle Among Cannabis Users and Non-Users

Remainder of Cycle	Cannabis					
	Users		Non-Users			
	M	*SD*	*M*	*SD*	*t*(140)	*g*
PA	16.85	8.68	15.91	9.02	-0.64	-0.11
NA	8.30	6.01	8.30	6.45	-0.00	-0.00
Pain	1.95	1.02	1.73	1.35	-1.09	-0.19
Water Retention[a]	1.00	0.94	1.14	1.09	0.82	-0.13
Autonomic Reactions[a]	0.67	0.75	0.83	1.06	1.05	0.17
Total Physiological	2.50	1.23	2.41	1.82	-0.36	-0.07
Total MC distress	16.18	12.06	15.31	16.87	-0.36	-0.06

Note. PA = positive affect; NA = negative affect; MC = menstrual cycle

[a] Square Root Transformed Values

Follow-Up Analyses: Within-Subjects ANOVA

A series of eight within-subjects ANOVAs were conducted to compare frequency of cannabis use, total menstrual cycle distress, affect, total physiological distress, and the individual physiological distress symptoms, across the three phases of the menstrual cycle (see Table 23). Recall the three phases of the menstrual cycle include the premenstrual (four days before flow), menstrual, and remainder of the cycle phase. Depending on the results of Mauchly's Test of Sphericity, either the Wilk's Lambda or Greenhouse-Geisser values were used. If sphericity was violated ($p > .05$), the Greenhouse-Geisser values were assessed for significance. Paired samples *t* tests were performed to assess post hoc comparisons between conditions.

Table 23

One-Way Within-Subjects Analyses of Variance in Frequency of Cannabis Use, Total Menstrual Cycle Distress and Distress Subscales Across the Menstrual Cycle Phases

	Phases of the Menstrual Cycle					
	Four Days Before	Menstrual Flow	Remainder			
	M (*SD*)	*M* (*SD*)	*M* (*SD*)	*F*	df	η_p^2
MC Distress						
Frequency in Times per Day	1.18 (0.98)	1.05 (0.82)	1.23 (0.81)	2.85	2.00, 80.00	0.07
Positive Affect [a]	10.18 (7.27)	10.00 (7.11)	16.85 (8.68)	48.60*	1.79, 144.88	0.38
Negative Affect	12.68 (7.38)	13.48 (6.99)	8.30 (6.01)	36.97*	2.00, 80.00	0.48
Pain	9.97 (5.43)	12.60 (5.62)	1.95 (1.02)	167.96*	2.00, 80.00	0.81
Water Retention [a]	5.89 (3.73)	5.95 (3.64)	1.00 (0.94)	150.85*	1.48, 120.18	0.65
Autonomic Reactions [a]	1.20 (0.95)	3.39 (3.08)	0.67 (0.75)	63.01*	1.13, 91.61	0.44
Total MC Distress [a]	55.67 (28.82)	62.59 (28.17)	32.72 (16.83)	114.80*	1.71, 138.79	0.59
Total Physiological Distress [a]	18.19 (9.86)	21.94 (10.30)	2.49 (1.21)	221.01*	1.78, 144.01	0.73

Note. MC = menstrual cycle

*$p < .01$ (two-tailed).

[a] Greenhouse-Geisser value used.

Frequency of Cannabis Use (Times per Day)

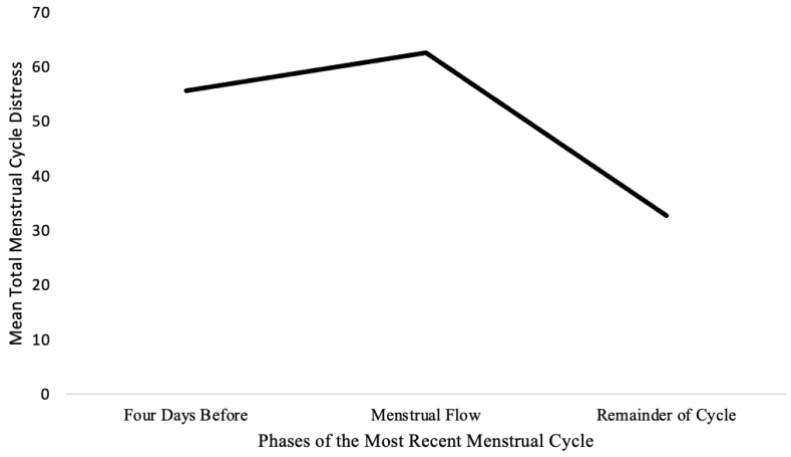
There were no significant differences in frequency of cannabis use (measured in times per day) across the three phases of the menstrual cycle ($p = .064$).

Total Menstrual Cycle Distress

There was a significant difference in women's total MC distress experienced across the phases of the menstrual cycle, F (1.71, 138.79) = 114.80, $p < .001$. As can be seen in Figure 2, women's total MC distress was significantly higher during the menstrual phase (M = 62.59, SD = 28.17), compared to both the premenstrual (M = 55.67, SD = 26.82) and remainder of cycle (M = 32.72, SD = 16.83) phases ($p < .001$). Further, the severity of the women's total MC distress was greater in the premenstrual phase compared to the remainder of cycle phase ($p < .001$).

Figure 2

Mean Total Menstrual Cycle Distress Across the Phases of the Menstrual Cycle

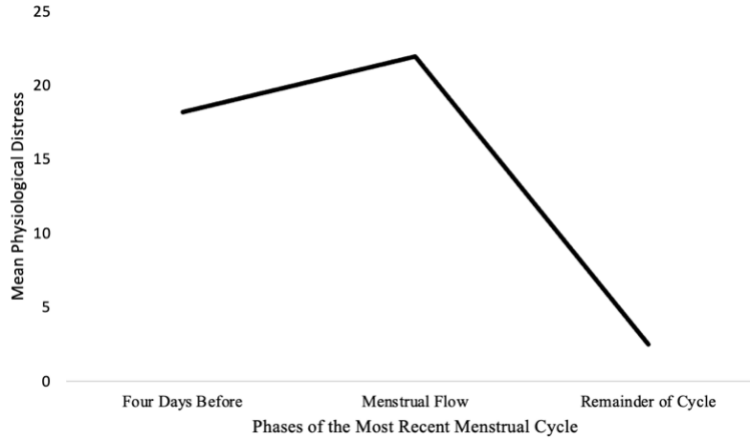


Total Physiological Distress

There was a significant difference in women's total physiological distress experienced across the three phases of the menstrual cycle, F (1.78, 144.01) = 221.01, $p < .001$ (see Figure 3). Women's total physiological distress was significantly higher during the menstrual phase (M = 21.94, SD = 10.30), compared to both the premenstrual (M = 18.19, SD = 9.86) and remainder of cycle (M = 2.49, SD = 1.21) phases ($p < .001$). The severity of women's total physiological distress was greater premenstrually compared to the remainder of cycle phase ($p < .001$).

Figure 3

Mean Total Physiological Distress Across the Phases of the Menstrual Cycle

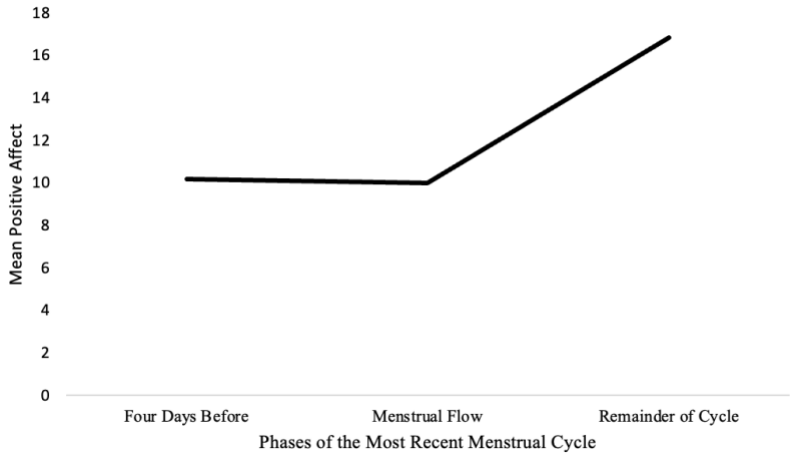


Positive Affect

There was a significant difference in positive affect across the phases of the menstrual cycle, $F(1.79, 144.88) = 48.60$, $p = <.001$ (see Figure 4). Women's positive affect during the remainder of the cycle phase ($M = 16.85$, $SD = 8.68$) was significantly greater than the premenstrual ($M = 10.18$, $SD = 7.27$) and menstrual flow ($M = 10.00$, $SD = 7.11$) phases (both, $p < .001$).

Figure 4

Mean Positive Affect Across the Phases of the Menstrual Cycle

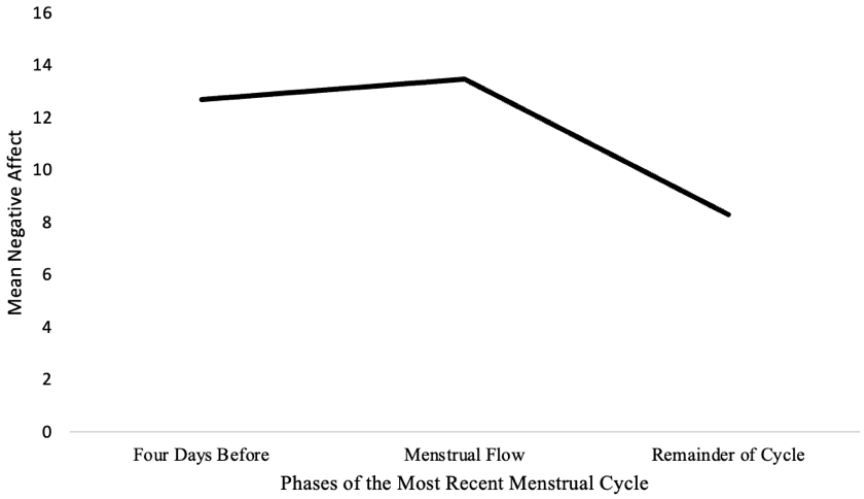


Negative Affect

There was also a significant difference in negative affect across the phases of the menstrual cycle, F (2, 80) = 36.97, p <.001 (see Figure 5). Women's negative affect was significantly higher (p < .001) in the premenstrual (M = 12.68, SD = 7.38) and menstrual (M = 13.48, SD = 6.99) phases of their cycle, compared to the remainder of cycle phase (M = 8.30, SD = 6.01).

Figure 5

Mean Negative Affect Across the Phases of the Menstrual Cycle

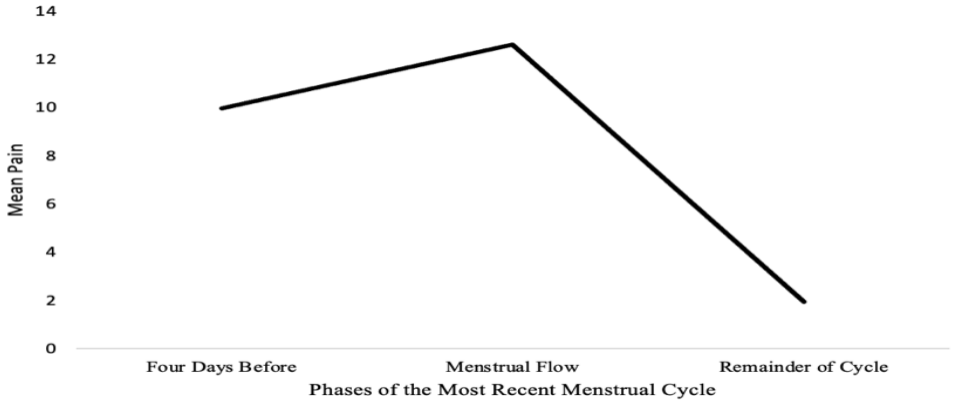


Pain Subscale

There was a significant difference in women's severity of pain symptoms across the phases of the menstrual cycle**,** F (2, 80) = 167.96, p < .001 (see Figure 6). Women's pain was significantly higher during the menstrual phase (M = 12.60, SD = 5.62) compared to both, the premenstrual (M = 9.97, SD = 5.43) and remainder of cycle (M = 1.95, SD = 1.02) phases (p < .001). Further, women's pain was significantly higher during the premenstrual phase, in comparison to the remainder of the cycle phase (p < .001).

Figure 6

Mean Pain Across the Phases of the Menstrual Cycle

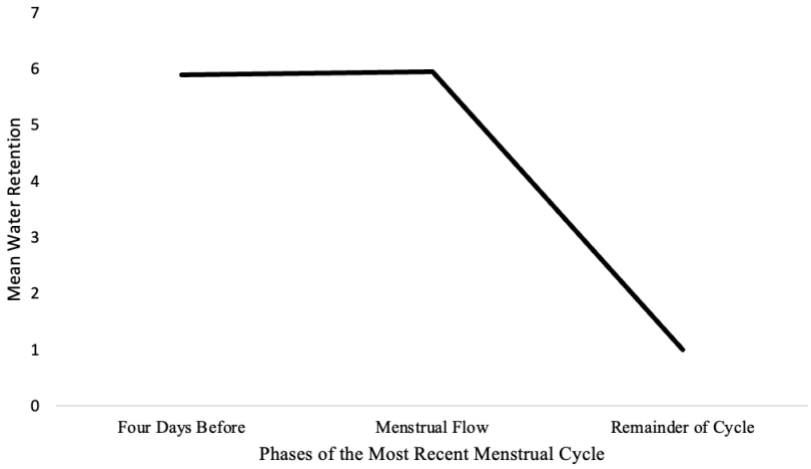


Water Retention Subscale

There was a significant difference in women's severity of water retention across the phases of the menstrual cycle**,** F (1.48, 120.18) = 150.85, p <.001 (see Figure 7). Women's experience of water retention symptoms was significantly higher during the premenstrual (M = 5.89, SD = 3.73) and menstrual (M = 5.95, SD = 3.64) phases, compared to the remainder of cycle (M = 1.00, SD = 0.94) phase (p < .001).

Figure 7

Mean Water Retention Across the Phases of the Menstrual Cycle

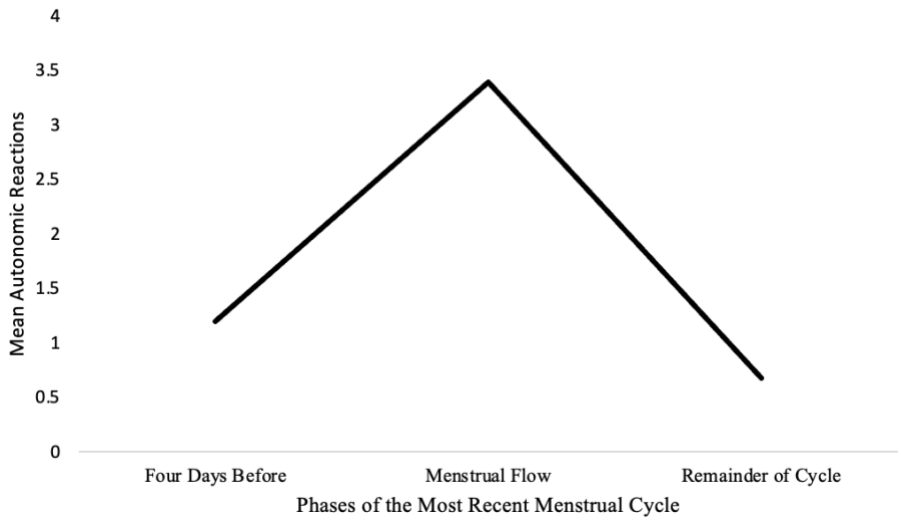


Autonomic Reactions Subscale

There was a significant difference in women's experience of autonomic reactions across the phases of the menstrual cycle, F (1.13, 91.61)= 63.01, $p < .001$ (see Figure 8). Women's autonomic reactions were significantly higher ($p < .001$) during the menstrual phase (M = 3.39, SD = 3.08), compared to both the premenstrual (M = 1.20, SD = 0.95) and remainder of cycle (M = 0.67, SD = 0.75) phases. Further, the severity of the women's autonomic reactions was greater in the premenstrual phase compared to the remainder of cycle phase ($p < .001$).

Figure 8

Mean Autonomic Reactions Across the Phases of the Menstrual Cycle



Discussion

The main purpose of this study was to examine cannabis use and mode of intake among women experiencing a natural menstrual cycle (free from use of hormones). We were especially interested in exploring across the three phases of the menstrual cycle: premenstrual (four days before flow), menstrual, and remainder of the cycle. We investigated two facets of menstrual cycle distress: affective and physiological distress.

Total Menstrual Cycle Distress and Frequency of Use

It was hypothesized that women with a greater severity of MC distress (includes affective and physiological symptoms) would have greater cannabis use across the three phases of the cycle. We found no significant evidence to support our hypothesis regarding the associations between frequency of cannabis use and total MC distress (at any of the three phases of the menstrual cycle). All of the associations were positive, albeit the associations were not significant ($p > .01$).

We predicted positive associations between menstrual distress symptoms and cannabis use based on the connections that have been made in the literature related to the concept of the self-medication theory (Khantzian, 1997). Cannabis has been identified as a common substance used for self-medicative purposes (Corsi et al., 2020; Joyce et al., 2021b; Slavin et al., 2017; Wallis et al., 2022). Individuals experiencing symptoms of a medical condition or mental health problem often use substances to mitigate the severity of presenting symptoms. Many symptoms experienced throughout the menstrual cycle mimic those experienced with other mental health disorders and medical conditions that individuals use cannabis for (e.g., general and pelvic pain, mood and anxiety, headache; Bolton et al., 2006; Mehuys et al., 2019; Sinclair et al., 2021; Turner et al., 2018; Wallis et al., 2022). Thus, it is not without reason to expect to see an increase in frequency of cannabis use when women are experiencing symptoms during the menstrual cycle (the more severe, the more frequency of use expected). Again, due to a lack of statistically significant findings, we found no evidence to support the association between cannabis use frequency and total distress experienced, at any of the three phases of cycle.

Specific Distress Symptoms and Frequency of Use

Looking at the subscales of MC distress, we hypothesized that participants who experienced greater negative affect and physiological symptoms (total physiological distress and physiological distress subscales) would report greater frequency of cannabis use, as these are

symptoms individuals often attempt to cope with, regardless of menstrual cycle distress (Ferguson et al., 2021; Joyce et al., 2021b; Wadsworth et al., 2020). We found no evidence to support an association between frequency of cannabis use and any of the affective symptoms, physiological distress symptoms, or total physiological distress.

Our findings regarding negative affect are inconsistent with previous findings from Bartel and colleagues (2020) and Wadsworth and colleagues (2020). Although these authors were not specifically targeting women's symptoms throughout the menstrual cycle, they were assessing symptoms of distress that are often experienced throughout the menstrual cycle. In their predominantly female sample, Bartel and colleagues (2020) found coping with depression (comparable to negative affect) was predictive of cannabis use, using the original cannabis use measure we adapted for our study (DFAQ-CU; Cuttler et al., 2017). Similarly investigating depression, Wadsworth and colleagues (2020) found the majority (88.20%) of cannabis users without medical authorization reported using cannabis in an effort to reduce their emotional (negative affect), or mental health problems. These findings provide theoretical context for our predictions; however, these authors were not focused on women's health. Bartel and colleagues (2020) and Wadsworth and colleagues (2020) had larger sample sizes, used different statistical analyses, included male participants, and did not exclude hormone users as they were not specifically interested in the menstrual cycle; these factors could help to explain the differential findings from our study.

In addition to assessing negative affect, we also evaluated the individual subscales (pain, water retention and autonomic reaction) of physiological distress that encompass the physiological symptoms that can be experienced throughout the menstrual cycle. There could be distinct differences in intended cannabis use based on the specific symptoms women are experiencing (potentially influenced by the phase of the menstrual cycle the woman is in). Khantzian (2003)

pinpointed this notion early-on in discussing self-medicative practices being related to specific symptoms as opposed to, in response to a specific disorder or medical condition (e.g., women might use cannabis more when experiencing nausea rather than swelling). Further exploration concerning intended cannabis use to target specific symptoms of menstrual distress is needed. More specifically, further investigation into physiological symptoms is required to better understand cannabis use intentions as most of the literature focuses on the relationship between cannabis use and negative affect. Implementation of a prospective, longitudinal research design with a greater sample size of natural-cycling women could provide more clarity on the directionality of the relationships between cannabis use frequency and specific symptoms of distress experienced throughout the menstrual cycle.

Mode of Intake

In considering mode of cannabis intake, it was hypothesized that women who experience greater physiological symptoms of MC distress would use concentrates more as their mode of intake, compared to the alternative modes of intake (i.e., dried flower, edibles, or other). This hypothesis was not statistically supported for any phase of the menstrual cycle. We found no significant effects of mode of intake for any of the menstrual distress symptoms. Our prediction that individuals who experience a greater severity in symptoms would be those using concentrates was based on work from Cuttler and colleagues (2020). They found a greater reduction in severity of headache among those using concentrates. Cuttler and colleagues (2020) discussed the importance of concentrate products being of high potency (in comparison to cannabis dried flower) and thus, it could be expected that there be a stronger effect on reduction of symptoms. However, Cuttler and colleagues (2020) caution against this interpretation of higher potency resulting in a greater reduction in symptom as there are limited studies to have closely assessed the influence of concentrate use. Moreover, Cuttler and colleagues (2020) further discuss the potential

differences in tolerance between cannabis flower and concentrates, pointing to the importance of future investigations into the differential modes of cannabis intake.

There is limited research focusing on how long the effects of cannabis concentrates have on the body and to what extent individuals build a tolerance to concentrates (e.g., waxes or oils), in comparison to other modes of intake, is limited. It is important to take into consideration individual preferences of use, as this is likely to dictate choice in product and potentially give insight into individuals' perceptions of what products they experience relief with (Stith et al., 2019). Through their investigation of cannabis use and symptom relief, Stith and colleagues (2019) found no evidence of experiencing different effects based on mode of intake; however, some subsamples of individuals preferred use of high-CBD concentrate products based on their suggested calming effects. Perceived effect of relief might outweigh actual observed reductions in severity ratings when choosing which cannabis products to use.

There has been an increase in availability and popularity of a variety of modes of intake and cannabis products which could contribute to the dilution of current cannabis preferences, singular-mode use, and lack of differences found between modes of intake (Knapp et al., 2019). Knapp and colleagues (2019) found the smoking of cannabis to be the most consistent method of use, among a United States teenage sample. Although smoking cannabis was the method endorsed most by youth, vaping (concentrate-derived) and edibles were substantially used to intake cannabis as well. The popularity of smoking cannabis among youth, as well as the propensity to use several modes of cannabis intake is similar among young adults (Wadsworth et al., 2022). There is limited research currently focusing on intentional selection of cannabis modes of intake, and even less specifically for self-medicative purposes and among women. Further investigation is required to better understand cannabis selection practices among women with distress. Additionally, we did not include a substantive qualitative component to our study however, qualitative exploration of

intentional mode of intake selection could be one method in which greater context could be provided regarding what modes of cannabis intake women are electing to use and why.

Cannabinoid Awareness

In regard to women's cannabinoid awareness, it was hypothesized that women who have more familiarity with cannabis, through frequency of use, would be more aware of the cannabinoids in their cannabis products being used. This hypothesis was supported, specifically for when individuals were in the menstruation phase; women who were aware of the THC/CBD content of their cannabis products being used during menstrual flow used cannabis more days, on average, than women unaware of the cannabinoid content of their products. One interpretation of this finding might be that women are more aware of their cannabinoid content during the menstrual phase in an effort to specifically target the reduction of menstrual distress symptoms. It is critical when discussing cannabis use to consider cannabinoid content and dosage. We were particularly interested in exploring cannabinoid content awareness as there is a scarcity of this literature to date. More recently, Gruber and colleagues (2021) discussed the differences between cannabinoid effects. The effects could influence which cannabinoids are sought after when individuals are selecting their cannabis products. Gruber and colleagues (2021) found that THC-dominant cannabis was associated with reduced pain reports and CBD-dominant cannabis was associated with reduced negative affect and anxiety reports. These findings are consistent with previous discussions regarding the effects of the main cannabinoids sought after with cannabis: THC and CBD (Boggs et al., 2018).

Our findings are somewhat inconsistent with previous research findings from Kruger and colleagues (2021). Through their investigation of cannabis knowledge and use, Kruger and colleagues (2021) found those who used cannabis frequently had limited accuracy in their knowledge of cannabinoid content. Of these participants, the most knowledgeable however, were

those receiving cannabis for medicinal purposes and had medicinal cannabis cards (it was suggested that these individuals are likely to have access to professionals with knowledge on the topic or resources they can access). Medicinal cannabis card holders are likely to be familiar with what cannabis products they are selecting. A potential reason for the discrepancy between our findings and the findings from Kruger and colleagues (2021) might be that the current study used a Canadian sample while Kruger and colleagues (2021) used an American sample. The American sample of participants might have had restricted exposure to cannabis dispensaries or resources with associated cannabinoid content information, as cannabis is not legalized in every state and has varying acceptance rates. We found no further significant evidence to support a difference in the means between those aware and unaware of the cannabinoid content.

Another consideration regarding awareness of cannabinoids and general cannabis use also comes from the findings of Kruger and colleagues (2021) in which there was a consistency in individuals overestimating the effective cannabinoid dosage needed to dissipate distressing symptoms. This overestimation of how much cannabinoid content was needed is suggestive that individuals were using cannabis with heightened cannabinoid dosages (hazardous dosages) and thus, using more than what was actually needed to experience its effects. We see great value in exploring cannabinoid content awareness as women might be self-medicating for menstrual cycle distress with cannabis, however, having a lack of awareness of the cannabinoid content they are putting into their body could have multiple influences: 1) increased risk of unintended effects, 2) ineffective reduction in symptoms they are trying to target, and 3) unknown hormonal interactions.

Comparing Current Cannabis Users and Non-Users

Although we did not intend to compare cannabis users and non-users, that is, our intention was to only look at cannabis users, the availability of cannabis non-users with the same

measurement scales gave us the opportunity to further explore this subsample. During the premenstrual and menstrual phases, individuals with more severe pain were those who used cannabis. While we have previously seen differences in pain across the menstrual cycle phases (Hellström & Anderberg, 2003; Ozgocer et al., 2017), the current study expands on these findings by not only looking at women in general but more specifically comparing cannabis users and non-users. Based on previous findings, it is not surprising to see differences in pain severity across the phases of the menstrual cycle. However, the finding that there was a difference between users and non-users during the menstrual and premenstrual phase, but not the remainder of cycle phase, is compelling. Cannabis users having higher pain severity than non-users is an area of further exploration regarding the difference cannabis use might make at different phases of a woman's menstrual cycle, and in regard to cannabis' association with pain.

Findings suggest cannabis users and non-users are not equivalent in their pain severity. One possible explanation for this finding is that those experiencing greater pain severity are using cannabis in an effort to self-medicate. Recent findings from Yang and colleagues (2023) give some context to this possibility as the authors found that the majority of cannabis users (77%) had initiated cannabis use in an effort to reduce pelvic pain based on their typical treatments not working. However, due to the nature of our analyses we cannot exclude alternative perspectives; another possible explanation could be that individuals using cannabis experience greater pain sensitivity as a result of cannabis use. Although the latter explanation is one that needs to be further investigated using an experimental, longitudinal design, several authors have discussed the analgesic effects of cannabis use pointing to one's perception of pain being diminished when using cannabis, as opposed to heightened (Chadi & Levy, 2019; Kalaba & Ware, 2021). Further exploration of the contributing factors to the difference in pain severity during the menstrual and

premenstrual phases, between cannabis users and non-users is necessary to increase our understanding of cannabis use, pain, and the menstrual cycle.

Across the Phases of the Menstrual Cycle

When conducting follow-up analyses to investigate whether there were differences in symptoms of distress, we found several significant differences across the phases of the cycle. These findings lend support to our hypotheses by demonstrating there was significant variability in distress across the phases, as expected. From these follow-up results we can rule out the potential that no significant findings were found in our initial analyses due to a lack of variability in menstrual cycle distress. Extrapolating on our follow-up analyses, our finding that women experienced the greatest severity of total MC distress during the menstrual phase contributes to the controversy seen within the literature (Oinonen & Mazmanian, 2000; Schmalenberger et al., 2017). Total MC distress includes all scores from the completion of the MDQ (Moos, 1968). Similarly to the investigation of total MC distress, we found that women's total physiological distress was greatest during the menstrual phase and was the least severe during the remainder of the menstrual cycle phase. Recall, total physiological distress is an aggregate of the three physiological subscales (pain, water retention, and autonomic reactions; Moos, 1968). Early authors found similar findings to ours in that, women experienced greater physiological symptoms during the menstrual phase (Oinonen & Mazmanian, 2000). More recently however, Schmalenberger and colleagues (2017) found that women experienced greater physiological symptoms during the premenstrual phase, rather than the menstrual phase. These findings lend support to previous findings that women experience the least severe distress during the remainder of the cycle when women are less likely to experience symptoms associated with the fluctuations of hormones associated with menstruation and the days preceding it.

Women's positive affect was greatest during the remainder of the menstrual cycle phase. These findings are consistent with the reports from Joyce and colleagues (2021a) that positive affect is greatest when women are ovulating (i.e., during the remainder of cycle phase). There is strong hormonal influence in that women experience a peak in estrogen levels during ovulation (part of the remainder phase). It is not surprising that women experienced less positive affect during the premenstrual and menstrual phases of their cycle, as these are time frames in which there are shifts in estrogen and progesterone. During the menstrual phase, estrogen and progesterone are depleted, often resulting in lower mood. Additionally, women are likely to experience less severity of symptoms during the remainder phase of the cycle (Joyce et al., 2021a), as opposed to the premenstrual and menstrual phases (consistent with our previously discussed findings that less severity of symptom was observed during the remainder of cycle phase). Thus, their affect might not be influenced as negatively as it would be when experiencing symptoms or feelings of distress. Joyce and colleagues (2021a) expand on the reward-sensitivity theory which states that when women experience heightened positive affect during ovulation (or, remainder of cycle), there is a rise in addictive behaviours, or substance use. This theory is a potential area of further exploration given our findings from the follow-up analyses and associated interest in cannabis use.

Contrary to positive affect, negative affect was lowest, on average, during the remainder of the cycle phase. This finding is consistent with previous literature as reviewed by Joyce and colleagues (2021a). Women have an increased risk of depression and other mood disorders developing (Wharton et al., 2012). Not only are women in general, at risk for negative affective symptoms, the premenstrual phase in particular has been identified as a period of increased risk for suicide and suicidal thoughts (APA, 2013; Chan et al., 2021; Osborn et al., 2021). In unison with what was previously discussed concerning positive affect, women are more likely to experience

less severity of symptoms during the remainder of cycle phase of the menstrual cycle and thus, their negative affect is likely to be higher during the menstrual and premenstrual phases when they experience a greater severity of distress.

Exploring the physiological subscales that contribute to total physiological distress, we found the experience of pain was greatest during the menstrual phase. The autonomic reactions symptom severity was greatest during the menstrual phase, followed by the premenstrual phase. Women on average had the least severe pain experience, water retention, and autonomic reactions during the remainder of cycle phase. This cyclical presentation of physiological symptoms at specified phases of the menstrual cycle is consistent with what has previously been discussed in the literature (Carr-Nangle et al., 1994; White et al., 2011). Taken as a whole, findings from our follow-up analyses are consistent with previous literature pertaining to distress women experience throughout their menstrual cycle. Our findings provide evidence to support the experience of various symptoms and feelings during specified phases of the menstrual cycle (i.e., associated with biological changes to the biological female's body throughout the menstrual cycle; Joyce et al., 2021a).

As previously mentioned in the results section, it was our intention to investigate quantity of cannabis use in addition to frequency of use however, due to insufficient subsample sizes we elected to only assess the latter. Our sample size restriction is one that is consistent in the literature which results in a mix of findings among the limited research being done regarding women's health and cannabis use (Joyce et al., 2021a). One of the main reasons we sought to explore the quantity of cannabis use was because of the general scarcity of literature on the topic. There are various methodological and practical issues with measuring quantity of cannabis use. One issue pertains to mode of intake; quantity of cannabis can alter considerably depending on the mode of cannabis intake an individual is using (e.g., dried flower, oils, food products). Not only can the

quantity differ, the concentration of cannabinoids can differ as well, which makes measurement highly challenging. We attempted to capture the quantity of cannabis use by identifying which mode of intake women were using and the quantity of the specific mode. However, there is not an established method for equating the modes of cannabis use or rather, its effect on one's body, thus making it challenging to compare quantities of cannabis at this time.

Based on previous research and anecdotal qualitative reports, there are differences in the modes of cannabis intake however, the specifics of these differences are still largely unknown. One difference that has evidence to support it is that cannabis flower typically has a greater number of terpenes and phytocannabinoids in comparison to some concentrate products (Cuttler et al., 2020). It is suggested that the effects of cannabis flower might be mitigated by these additional heightened components (terpenes and phytocannabinoids) and thus, this might contribute to why the use of concentrates might result in a different experience. Depending on which types of terpenes and phytocannabinoids are in the cannabis, there are different effects they can have on the relief of distress symptoms (Baron et al., 2018). Further, the production process of each mode of intake can contribute to their suggested effects.

As with any research on substance use, it is important to consider the short- and long-term effects, especially since the legalization of cannabis in Canada and as we are seeing a consistent rise in use (Cuttler et al., 2020; Matheson & Foll, 2020). The modes of intake individuals elect to use may have specific influences on their health. Cardiovascular problems, respiratory. problems, and Cannabinoid Hyperemesis Syndrome (CHS; e.g., vomiting, dehydration, abnormalities in electrolyte levels) are all potential risks of concentrate use being investigated (Richards, 2018; Stith et al., 2019). CHS risk is specific to concentrate use based on the process of extracting solvents (e.g., butane, ethanol) and their typical use in cannabis concentrates. Awareness of what cannabis products women are using and their effects not only on their symptoms but body as a

whole, could help inform their decision-making practices regarding cannabis use. Investigating women's cannabis use is an important component of generating a greater understanding of cannabis and its effects. Women are thought to be especially at risk of substance misuse due to what is referred to as telescoping. Telescoping is characterized as a quicker progression to problematic cannabis use from its initial use, in comparison to males (Chadi & Levy, 2019). Should women be using cannabis in an effort to dissipate their symptoms of MC distress, they could be at a greater risk of cannabis-related health concerns.

Limitations

There were various limitations to the current investigation of cannabis use among women across the phases of the menstrual cycle. First, the study used a retrospective, cross-sectional design. In completing retrospective self-report measures, participant recall is subject to error which can potentially result in inaccurate reporting (Shiffman et al., 1997). Retrospectively reporting on the menstrual cycle might be more reflective of participants' theories or beliefs about their symptom changes, as opposed to accurately reflecting their experiences (Boyle & Grant, 1992). To try and attain accuracy in reporting, for both the substance use and menstrual cycle distress questionnaires, specific language was used to indicate to participants the specific timeframe we were requesting them to report on (i.e., "four days before your most recent menstrual flow", "your most recent menstrual flow", and "during the remainder of your most recent menstrual cycle").

This design did not allow for any temporal investigations which could provide specific context as to what specific symptoms women experienced, symptom severity, how soon after experiencing symptoms women were using cannabis, and the perceived effect. Further context that is missed when not using a prospective design is what activity individuals are engaging in at the time of experiencing symptoms of distress. For example, if a woman is at work and experiences

MC distress, the woman might be less likely to use cannabis due to its potential effects. Although we attempted to guide participants into considering the specific phases of their most recent menstrual cycle we wanted participants to report on, the retrospective design is susceptible to recall bias.

Secondly, we did not ask participants to report what the terpene content was that they had in their cannabis. Terpenes have a variety of suggested effects and can be specifically selected to target specific medical and mental health concerns (Baron et al., 2018; Cuttler et al., 2020). One major barrier to collecting this data is the lack of knowledge regarding terpenes in the general public, making it challenging to assess this information accurately. Using an experimental design or prospective self-report design would likely allow participants to seek out what terpenes are in their cannabis products.

Thirdly, this study was based on participants self-reporting their information via questionnaire. Although self-reported information can provide quantitative data, exploring cannabis use among naturally cycling women using qualitative reports could allow for more nuanced information to be obtained (e.g., specific symptoms, effects of cannabis, terpenes, access to cannabis, stigma) that could provide context as to what factors contribute to whether women are self-medicating with cannabis to deal with menstrual cycle distress. Moreover, this information could inform the creation of a novel cannabis use measure that is more applicable across a variety of research investigating cannabis use.

Finally, a major limitation to this study is reflective of a larger issue for investigating cannabis use. The inconsistent manner in which cannabis use is measured and lack of standardized quantity measurement (or dose measurement) across modes of intake is problematic. It is challenging to draw equivalent quantities between edibles and inhaled smoke for example, making it difficult to compare methods. Although frequency of cannabis use is often measured in days of

use, this can impose restrictions on the interpretations that can be drawn as the phases of the menstrual cycle have varying days, making an exact comparison across phases challenging. This is especially the case with retrospective self-report data which encompasses the majority of this research due to the cost, time, and resource restrictions of prospective and experimental research designs. Although it provides contextual information as to how many days during each of the phases of the menstrual cycle women are using cannabis between samples, frequency measured in days is not an appropriate measure of cannabis use frequency when comparing within samples.

Future Directions

The development of a valid and reliable cannabis use measure that can be used with a retrospective design is vital. While the use of a prospective design is consistently suggested to be the most appropriate method for investigating cannabis use across the menstrual cycle, limitations in funding, time, and resources among investigators will result in the continued use of retrospective designs (Joyce et al., 2021b). Thus, it is important for an appropriate alternative measure to be standardized for use among investigators. Future development of a measure should also include a standardized measure of quantity of cannabis use, which requires further research into comparing across modes of intake and routes of administration, and how they influence the quantity of cannabis in the body (e.g., absorption, length of effect).

There is an ongoing need to investigate across the modes of cannabis intake. There is a scarcity of investigations focusing on women, and more specifically the menstrual cycle, concentrating on methods of use and potential effects on symptoms biological females are experiencing. Not only is there a need for further investigation into biological females and throughout the phases of the menstrual cycle, there is a need for further exploration among general cannabis users. Cannabis concentrate use exposes individuals to high potencies of THC and CBD, with more perceived ease of use and more immediate effects (Knapp et al., 2019; Loflin &

Earleywine, 2014). These factors might make this mode of intake more appealing to some users. However, these factors could also make withdrawal and tolerance of concentrate use (via vaping) more likely to occur and more likely to reinforce concentrate use for its effects. However, limited awareness of cannabis use effects and products could contribute to substance misuse. Based on our findings regarding cannabis mode of intake, a potential area of further exploration for future work is looking at the relationship between individuals who use cannabis and experience higher autonomic menstrual cycle symptoms during the menstrual and premenstrual phases but not the remainder of cycle phase.

Future cannabis use investigations across the menstrual cycle require a prospective design using *in vivo* reports of cannabis use frequency, quantity, and mode of intake. Moreover, experimental research (including randomized control trials) could provide researchers with laboratory control of what cannabis is being used (e.g., frequency, quantity, mode of intake, cannabinoid content) and could allow for very specific questions regarding cannabis use to be investigated. Further, additional factors potentially contributing to how cannabis is used in the body could be controlled for including activity being engaged in, body fat percentage, and hormone level.

The current literature regarding cannabis use among women is heavily concentrated with investigations of negative affect, across the phases of the menstrual cycle, and the effects of cannabis use on affect symptoms (Joyce et al., 2021b). One reason for this is the lack of a commonly used standardized method for measuring physiological symptoms of distress women experience. Future research should continue to explore frequency of cannabis use and its effects on the physiological symptoms women experience throughout the menstrual cycle. Further, future research should continue to explore whether women are selecting specific cannabis modes of intake or cannabinoid content to target a reduction in physiological symptoms, in comparison

to affective symptoms. Further exploration of this study's hypotheses, using alternative methods, could help to inform our understanding of women's cannabis use (e.g., frequency, quantity, mode of intake, knowledge) throughout the menstrual cycle and further, the distress associated with each phase. Findings from the current study provide preliminary insight into our understanding of women's awareness of THC and CBD content of the cannabis products they are using.

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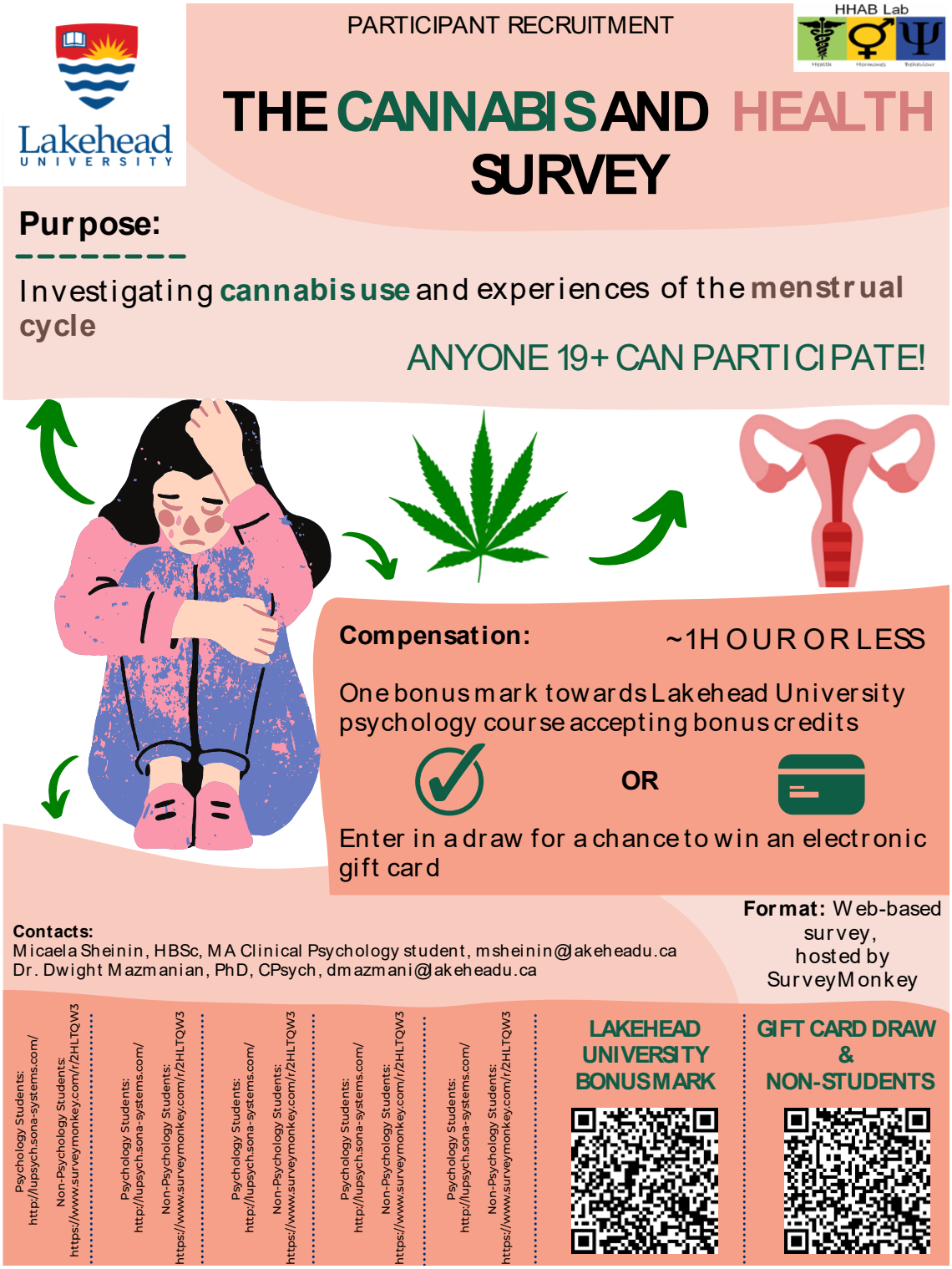
Appendix A

Participant Recruitment Poster



Appendix B

Information Letter and Informed Consent

Lakehead UNIVERSITY

Dear Potential Participant,

Thank you for your interest in the "Cannabis and Health Study". You have been invited to participate in this study so that we can better understand people's cannabis use and health-related symptoms.

Taking part in this study is voluntary. Before you decide whether you would like to take part in this study, please read this information carefully to understand what is involved. If you have any questions, please ask one of the research team members (see the contact information at the end of this letter).

PURPOSE

The main purpose of this study is to examine participants' cannabis use and experience of their menstrual cycle. However, participants do NOT have to use cannabis to participate. Participants also do NOT need to experience menstrual cycles to participate.

WHAT INFORMATION WILL BE COLLECTED?

Information related to cannabis use (i.e., frequency, quantity, and mode of intake) will be collected, as well as information on distress experienced throughout the participant's menstrual cycles.

WHAT IS REQUIRED OF ME AS A PARTICIPANT?

Participants will partake in an online questionnaire. It is anticipated that the survey will take up to one hour to complete.

WHAT ARE MY RIGHTS AS A PARTICIPANT?

You are under no obligation to participate and are free to withdraw at any time without prejudice to pre-existing entitlements. Your decision to participate will also not affect your academic status. You may also refuse to answer any question or questions while partaking in this study.

WHAT ARE THE RISKS AND BENEFITS?

There are no known physical risks associated with participating in this study. However, some of the material in the questionnaire asks questions on sensitive subject matter that might result in some minor psychological discomfort for some people. If this occurs and you would like some extra support, you may contact Student Health and Wellness at 1-807-343-8361 (Thunder Bay) or at 1-705-330-4008 ext. 2116 (Orillia). For the Thunder Bay Crisis Response Service through the Canadian Mental Health Association, you may also contact 1-807-346-8282, or for the Ontario Mental Health Helpline, please contact 1-866-531-2600.
As a token of our gratitude for participating in this research, you may elect to receive:

- One bonus credit towards an eligible Lakehead University psychology course for completing the survey
- an entry into a draw for a $25 electronic gift card to a location of your choosing out of Walmart, Amazon, or Tim Hortons for completing the study.

If you elect to receive the one bonus mark, you must access this survey through the Sona system (http://lupsych.sona-systems.com). If you elect to be entered into a draw for a chance to receive an electronic gift card, we ask that you provide your email address at the end of the study. This email will not be associated with your responses.

There are additional potential benefits to participating in this study. Benefits might include the opportunity to reflect on your substance use and health which may not normally be attended to. Another potential benefit is that you might find the study to be educational in that you can gain direct experience with the research process.

The current research can benefit society through gaining a better understanding of the scope of menstrual cycle distress and substance use which will add to the limited research on the subject. More scholarship on the subject can then help to inform legal, educational, and preventative strategies, as well as health interventions for women dealing with menstrual cycle distress.

HOW WILL MY CONFIDENTIALITY BE MAINTAINED?

Your anonymity will be maintained throughout this study and the principal investigator (Dr. Mazmanian) will not know which students have participated in this study. All data will be coded with a number and no identifying information will be associated with responses or research results. Only Dr. Mazmanian (principal investigator), Micaela Sheinin (student investigator), Dr. Kirsten Oinonen (collaborator), Erika Puiras (student research teach member), and Casey Oliver (student research team member), will have access to the anonymized data.
The online survey tool used in the study (SurveyMonkey.com) is hosted by a server located in the USA. The US Patriot Act permits U.S. law enforcement officials, for the purpose of anti-terrorism investigation, to seek a court order that allows access to the personal records of any person without the person's knowledge. In view of this, we cannot absolutely guarantee the full anonymity of your data.
With your consent to participate in this study, you acknowledge this.

WHAT WILL MY DATA BE USED FOR?

The data obtained in this research will be used for the master's thesis of the student investigator, Micaela Sheinin, and the findings will also be used for research publications and/or presentations at scholarly conferences. Please know that we may also conduct additional or exploratory analyses regarding cannabis use or experiences of the menstrual cycle. Your identity will remain anonymous throughout these processes.

WHERE WILL MY DATA BE STORED?

All raw data will be securely stored at Lakehead University for seven years.

HOW CAN I RECEIVE A COPY OF THE RESEARCH RESULTS?

A summary of the results can be made available to you email once the study has been complete. If you are interested in receiving these research results, please email the researcher at [msheinin@lakeheadu.ca] with the subject heading "Results Summary Request – Cannabis and Health". We will email you a copy of the Results Summary once it is made available which may take up to two years after you complete the study.

WHAT IF I WANT TO WITHDRAW FROM THE STUDY?

Your participation in this research is completely voluntary, and should you choose not to participate, you may do so without consequence or the need for justification. Similarly, you may also discontinue your participation at any time without explanation or penalty. However, once you submit your data it cannot be withdrawn due to its anonymity.

RESEARCH TEAM CONTACT INFORMATION:

If you have any further questions regarding this study, you may contact:
Micaela Sheinin, HBSc, Clinical Psychology Graduate Student: msheinin@lakeheadu.ca
Dwight Mazmanian, PhD, Professor, Department of Psychology: dmazmani@lakeheadu.ca

Please note that funding for the student investigator has been provided by the Canadian Institutes of Health Research.

RESEARCH ETHICS BOARD REVIEW AND APPROVAL:

This research study has been reviewed and approved by the Lakehead University Research Ethics Board. If you have any questions related to the ethics of the research and would like to speak to someone outside of the research team, please contact Sue Wright at the Research Ethics Board at 807-343-8283 or research@lakeheadu.ca.

Thank you for your interest and participation. It is greatly appreciated!

Consent Form for Participants

MY CONSENT:

I agree to the following:

- I have read and understand the information contained in the information letter.
- I agree to participate.
- I understand the risks and benefits to the study.
- Participation is voluntary. I can withdraw from the study at any time and may choose not to answer any question. (Please note that after you submit your responses they cannot be retrieved due to the anonymous nature of the study.)
- That the data will be securely stored at Lakehead University for a minimum of 7 years following completion of the research project.
- I understand that the research findings will be made available to me upon request. We anticipate the study results will be available within 2 years after you complete the study.
- I will remain anonymous.
- All of my questions related to the study have been answered.

By consenting to participate, I have not waived any rights to legal recourse in the event of research-related harm.

I have read and agree to the above information, **I am at least 19 years of age if living in Ontario (at least 18 if residing in Alberta, or at least 21 if residing in Quebec)**, and by completing and submitting this study agree to participate.

If you consent to participate in the study, please click the "Next" button at the bottom of the page to continue.

Appendix C

Debriefing Form

(Please print this page for your information)

Thank you for your participation in this research project on cannabis use and menstrual cycle experiences. We hope that this study will help better understand patterns of cannabis use in relation to symptoms experienced by those with a menstrual cycle. Information regarding the relationship between cannabis use and the menstrual cycle can help inform inexperienced cannabis users, physicians, and public health officials.

Information about study results:

A summary of the results can be made available to you by email once the study has been completed. If you are interested in receiving these results, please email the Student Investigator, Micaela Sheinin, at [msheinin@lakeheadu.ca] with the subject heading "Results Summary Request". We will email you a copy of the Results Summary once it is available. Please note that this may take up to 2 years from the time of your participation.

SONA Bonus Mark or Gift Card Draw:

In order to show our appreciation for participating in this research, you may choose to receive one bonus mark towards an eligible Lakehead University psychology course if you are a student at Lakehead University. Your instructor must allow the acquisition of bonus marks to receive one from this study.
If you want to be entered into a draw for a $25 electronic gift card to a location of your choosing out of Walmart, Amazon, or Tim Hortons, you will be asked for your name and email address in a separate survey at the end of this study in order to be informed should you win.

Contact Information:

If you have specific questions about the survey, you may contact the Student Investigator, Micaela Sheinin, [msheinin@lakeheadu.ca] or the Principle Investigator, Dwight Mazmanian, PhD, C. Psych, [dmazmani@lakeheadu.ca, 807-343-8257].

Other Resources:

If completing this survey has raised any issues about mental health concerns that you would like to discuss, you may contact the Canadian Mental Health Association at 416-646-5557. You may also contact Crisis Services Canada at 1-833-456-4566. If you are a student at Lakehead University, you may also contact Student Health and Wellness at 1-807-343-8361 (Thunder Bay) or at 1-705-330-4008 ext. 2116 (Orillia).

Thank you for your participation!

Appendix D

Demographic Questionnaire

#	Question	Response Format
1	What is your age?	_____ years old (numerical)
2	What was your biological sex at birth?	1. Female 2. Other 3. Prefer not to say
3	What is your gender?	1. Female 2. Gender fluid 3. Male 4. Non-binary/Genderqueer/Gender nonconforming 5. Questioning 6. Transgender 7. Two-Spirit 8. I identify as (text box) 9. Prefer not to answer
4	What is your race/ethnicity?	1. African 2. Caribbean 3. East Asian 4. Hispanic/Latinx 5. Indigenous (First Nations, Metis, or Inuit) 6. Middle Eastern 7. Pacific Islander 8. South Asian 9. White (Caucasian) 10. Mixed 11. Other: please specify
5	What is your sexual orientation?	1. Asexual 2. Bisexual 3. Gay 4. Heterosexual (“straight”) 5. Lesbian 6. Pansexual 7. Queer 8. Questioning 9. Two-Spirit 10. I identify as (text box) 11. Prefer not to answer

6	What is your work/employment status?	1. Employed full-time 2. Employed part-time 3. Unemployed

7	What is the highest level of education you have completed?	1. None 2. Elementary school 3. Some high school 4. High school completed 5. Some college or technical school completed 6. College or technical school completed 7. Some undergraduate training 8. Undergraduate degree completed 9. Some graduate training (e.g., Masters, Doctoral) 10. Master's degree completed 11. Doctoral or Professional degree completed
8	Are you currently a student at a university or college?	1. Yes – full time 2. Yes – part time 3. No * skip logic
9a	What is your current school average (0-100)? If this is your first semester at Lakehead, please use/estimate your exiting grade point average from the last educational institution you attended (e.g., high school, college).	1. Numerical, open response
10	What is your marital status?	1. Single 2. Married/common-law 3. Separated/divorced 4. Widowed 5. In a committed relationship (not married or common law) 6. Prefer not to say 7. Other: please specify

11	What is your religious affiliation?	1. Buddhist 2. Catholic 3. Eastern Orthodox (e.g., Shinto, Jainism) 4. Jewish 5. Muslim 6. Protestant 7. Sikh 8. No religious affiliation (e.g., atheist, agnostic) 9. None of these OR prefer not to answer 10. Other
12	What is the strength of your religious beliefs?	1. Not applicable 2. Not strong at all 3. Not very strong 4. Somewhat strong 5. Very strong 6. Extremely strong

Appendix E

Women's Health Screener

1. Do you experience a natural menstrual cycle?
   Note. **Natural menstrual cycle** refers to experiencing menstrual (vaginal) bleeding lasting on average 5-7 days, approximately once a month, WITHOUT taking hormonal contraceptives or other medications intended to regulate your cycle. Often referred to as: period, menstrual flow, and menses.

   o Yes o No

2. Are you currently using oral contraceptive pills, contraceptive patches, contraceptive implant or injection in your arm, or a contraceptive vaginal ring?

   o Yes o No

3. Are you using a hormonal Intrauterine device (IUD)?

   o Yes o No

4. What is the name of the IUD you use?
   If unknown, please type "I do not know". _____

5. Are you pregnant or breastfeeding?
   o Yes o No

6. Are you currently experiencing symptoms of menopause?
   o Yes o No o I don't know

7. How many days does your typical menstrual cycle last?
   Note. Start counting from the first day of menstrual bleeding (or when menstrual bleeding typically occurs) until the day before your next start of menstrual bleeding).
   _____

8. Please list all medications you are currently taking, including dosages and purpose. (Examples: anti-depressants, pain medication, cholesterol medication, testosterone or other hormones)

Medication name	dose	purpose

Appendix F

Positive and Negative Affect Schedule (PANAS)

Please rate how you feel in general, that is on average, for each of the following words **during your most recent menstrual flow/period/bleeding:**

#	Question	Response Format
1	Interested	1. Very slightly or not at all 2. A little 3. Moderately 4. Quite a bit 5. Extremely
2	Distressed	1. Very slightly or not at all 2. A little 3. Moderately 4. Quite a bit 5. Extremely
3	Excited	1. Very slightly or not at all 2. A little 3. Moderately 4. Quite a bit 5. Extremely
4	Upset	1. Very slightly or not at all 2. A little 3. Moderately 4. Quite a bit 5. Extremely
5	Strong	1. Very slightly or not at all 2. A little 3. Moderately 4. Quite a bit 5. Extremely
6	Guilty	1. Very slightly or not at all 2. A little 3. Moderately 4. Quite a bit 5. Extremely
7	Scared	1. Very slightly or not at all 2. A little 3. Moderately

		4. Quite a bit 5. Extremely
8	Hostile	1. Very slightly or not at all 2. A little 3. Moderately 4. Quite a bit 5. Extremely
9	Enthusiastic	1. Very slightly or not at all 2. A little 3. Moderately 4. Quite a bit 5. Extremely
10	Proud	1. Very slightly or not at all 2. A little 3. Moderately 4. Quite a bit 5. Extremely
11	Irritable	1. Very slightly or not at all 2. A little 3. Moderately 4. Quite a bit 5. Extremely
12	Alert	1. Very slightly or not at all 2. A little 3. Moderately 4. Quite a bit 5. Extremely
13	Ashamed	1. Very slightly or not at all 2. A little 3. Moderately 4. Quite a bit 5. Extremely
14	Inspired	1. Very slightly or not at all 2. A little 3. Moderately 4. Quite a bit 5. Extremely
15	Nervous	1. Very slightly or not at all 2. A little

		3. Moderately 4. Quite a bit 5. Extremely
16	Determined	1. Very slightly or not at all 2. A little 3. Moderately 4. Quite a bit 5. Extremely
17	Attentive	1. Very slightly or not at all 2. A little 3. Moderately 4. Quite a bit 5. Extremely
18	Jittery	1. Very slightly or not at all 2. A little 3. Moderately 4. Quite a bit 5. Extremely
19	Active	1. Very slightly or not at all 2. A little 3. Moderately 4. Quite a bit 5. Extremely
20	Afraid	1. Very slightly or not at all 2. A little 3. Moderately 4. Quite a bit 5. Extremely

Appendix G

Positive and Negative Affect Schedule (PANAS)

Please rate how you feel in general, that is on average, for each of the following words **during the four days before your most recent menstrual flow/period:**

#	Question	Response Format
1	Interested	6. Very slightly or not at all 7. A little 8. Moderately 9. Quite a bit 10. Extremely
2	Distressed	6. Very slightly or not at all 7. A little 8. Moderately 9. Quite a bit 10. Extremely
3	Excited	6. Very slightly or not at all 7. A little 8. Moderately 9. Quite a bit 10. Extremely
4	Upset	6. Very slightly or not at all 7. A little 8. Moderately 9. Quite a bit 10. Extremely
5	Strong	6. Very slightly or not at all 7. A little 8. Moderately 9. Quite a bit 10. Extremely
6	Guilty	6. Very slightly or not at all 7. A little 8. Moderately 9. Quite a bit 10. Extremely
7	Scared	6. Very slightly or not at all 7. A little 8. Moderately

		9. Quite a bit 10. Extremely
8	Hostile	6. Very slightly or not at all 7. A little 8. Moderately 9. Quite a bit 10. Extremely
9	Enthusiastic	6. Very slightly or not at all 7. A little 8. Moderately 9. Quite a bit 10. Extremely
10	Proud	6. Very slightly or not at all 7. A little 8. Moderately 9. Quite a bit 10. Extremely
11	Irritable	6. Very slightly or not at all 7. A little 8. Moderately 9. Quite a bit 10. Extremely
12	Alert	6. Very slightly or not at all 7. A little 8. Moderately 9. Quite a bit 10. Extremely
13	Ashamed	6. Very slightly or not at all 7. A little 8. Moderately 9. Quite a bit 10. Extremely
14	Inspired	6. Very slightly or not at all 7. A little 8. Moderately 9. Quite a bit 10. Extremely
15	Nervous	6. Very slightly or not at all 7. A little

		8. Moderately 9. Quite a bit 10. Extremely
16	Determined	6. Very slightly or not at all 7. A little 8. Moderately 9. Quite a bit 10. Extremely
17	Attentive	6. Very slightly or not at all 7. A little 8. Moderately 9. Quite a bit 10. Extremely
18	Jittery	6. Very slightly or not at all 7. A little 8. Moderately 9. Quite a bit 10. Extremely
19	Active	6. Very slightly or not at all 7. A little 8. Moderately 9. Quite a bit 10. Extremely
20	Afraid	6. Very slightly or not at all 7. A little 8. Moderately 9. Quite a bit 10. Extremely

Appendix H

Positive and Negative Affect Schedule (PANAS)

Please rate how you feel in general, that is on average, for each of the following words **during the remainder of your most recent menstrual cycle**:

#	Question	Response Format
1	Interested	11. Very slightly or not at all 12. A little 13. Moderately 14. Quite a bit 15. Extremely
2	Distressed	11. Very slightly or not at all 12. A little 13. Moderately 14. Quite a bit 15. Extremely
3	Excited	11. Very slightly or not at all 12. A little 13. Moderately 14. Quite a bit 15. Extremely
4	Upset	11. Very slightly or not at all 12. A little 13. Moderately 14. Quite a bit 15. Extremely
5	Strong	11. Very slightly or not at all 12. A little 13. Moderately 14. Quite a bit 15. Extremely
6	Guilty	11. Very slightly or not at all 12. A little 13. Moderately 14. Quite a bit 15. Extremely
7	Scared	11. Very slightly or not at all 12. A little

		13. Moderately 14. Quite a bit 15. Extremely
8	Hostile	11. Very slightly or not at all 12. A little 13. Moderately 14. Quite a bit 15. Extremely
9	Enthusiastic	11. Very slightly or not at all 12. A little 13. Moderately 14. Quite a bit 15. Extremely
10	Proud	11. Very slightly or not at all 12. A little 13. Moderately 14. Quite a bit 15. Extremely
11	Irritable	11. Very slightly or not at all 12. A little 13. Moderately 14. Quite a bit 15. Extremely
12	Alert	11. Very slightly or not at all 12. A little 13. Moderately 14. Quite a bit 15. Extremely
13	Ashamed	11. Very slightly or not at all 12. A little 13. Moderately 14. Quite a bit 15. Extremely
14	Inspired	11. Very slightly or not at all 12. A little 13. Moderately 14. Quite a bit 15. Extremely
15	Nervous	11. Very slightly or not at all

		12. A little 13. Moderately 14. Quite a bit 15. Extremely
16	Determined	11. Very slightly or not at all 12. A little 13. Moderately 14. Quite a bit 15. Extremely
17	Attentive	11. Very slightly or not at all 12. A little 13. Moderately 14. Quite a bit 15. Extremely
18	Jittery	11. Very slightly or not at all 12. A little 13. Moderately 14. Quite a bit 15. Extremely
19	Active	11. Very slightly or not at all 12. A little 13. Moderately 14. Quite a bit 15. Extremely
20	Afraid	11. Very slightly or not at all 12. A little 13. Moderately 14. Quite a bit 15. Extremely

Appendix I

Identification of Current Menstrual Cycle Phase

1. Which phase of the menstrual cycle are you in today?
   - **Menstrual flow**: experiencing menstrual bleeding or is the timeframe in which you would typically experience bleeding (i.e., your period or menstruation).
   - **Four days before menstrual flow**: the four days leading up to menstrual bleeding. This is often referred to as the premenstrual period (often associated with experiencing premenstrual syndrome, or PMS).
   - **Remainder of cycle**: anytime during the rest of your menstrual cycle in which there was no menstrual bleeding (excluding the four days leading up to your most recent flow).
   - I do not know
   - I do not experience menstruation (i.e., no active bleeding) *skip logic

2. Approximately how many days did your most recent menstrual flow/period/bleeding last (i.e., how many days did you experience bleeding or should have been experiencing bleeding)? _____

Appendix J

Menstrual Cycle Distress Questionnaire (MDQ) – Form C

The following questions show common symptoms and feelings associated with menstruation. For each question, choose the descriptive category, from the box below, that best describes your experience during each of the three time periods indicated. That is, for each item, decide whether you have "no experience of symptom", or whether your experience is "present, mild," "present, moderate," "present, strong,", or "present, severe". If none of the categories exactly describes your experience, choose the one that most closely matches what you feel. Be sure to rate every time.

Descriptive Categories:
0 No experience of symptom
1 Present, mild
2 Present, moderate
3 Present, strong
4 Present, severe

Note. In responding to the questions below, please think of your **most recent menstrual cycle.**

Note. **Most recent flow** refers to the last time you experienced menstrual bleeding or the timeframe in which you would typically experience bleeding (i.e., your period).

Note. **Four days before** refers to the four days leading up to the last time you experienced menstrual bleeding. This is often referred to as the premenstrual period (often associated with experiencing premenstrual syndrome, or PMS).

Note. **Remainder of cycle** refers to the rest of your most recent menstrual cycle in which there was no menstrual bleeding (excluding the four days leading up to your most recent flow).

#	Question	Each Time Period
1	Muscle stiffness	Most Recent Flow Four Days Before Remainder of Cycle
2	Weight gain	Most Recent Flow Four Days Before Remainder of Cycle
3	Dizziness, faintness	Most Recent Flow Four Days Before Remainder of Cycle

4	Loneliness	Most Recent Flow Four Days Before Remainder of Cycle

5	Headache	Most Recent Flow Four Days Before Remainder of Cycle
6	Skin blemish or disorder	Most Recent Flow Four Days Before Remainder of Cycle
7	Cold sweats	Most Recent Flow Four Days Before Remainder of Cycle
8	Anxiety	Most Recent Flow Four Days Before Remainder of Cycle
9	Mood swings	Most Recent Flow Four Days Before Remainder of Cycle
10	Cramps	Most Recent Flow Four Days Before Remainder of Cycle
11	Painful or tender breasts	Most Recent Flow Four Days Before Remainder of Cycle
12	Nausea, vomiting	Most Recent Flow Four Days Before Remainder of Cycle
13	Crying	Most Recent Flow Four Days Before Remainder of Cycle
14	Backache	Most Recent Flow Four Days Before Remainder of Cycle
15	Swelling (breasts, abdomen)	Most Recent Flow Four Days Before Remainder of Cycle

16	Hot flashes	Most Recent Flow Four Days Before Remainder of Cycle
17	Irritability	Most Recent Flow Four Days Before Remainder of Cycle
18	Tension	Most Recent Flow Four Days Before Remainder of Cycle
19	Fatigue	Most Recent Flow Four Days Before Remainder of Cycle
20	Feeling sad or blue	Most Recent Flow Four Days Before Remainder of Cycle
21	General aches and pains	Most Recent Flow Four Days Before Remainder of Cycle
22	Restlessness	Most Recent Flow Four Days Before Remainder of Cycle
23	Insomnia	Most Recent Flow Four Days Before Remainder of Cycle
24	Poor school or work performance	Most Recent Flow Four Days Before Remainder of Cycle
25	Affectionate	Most Recent Flow Four Days Before Remainder of Cycle
26	Feelings of suffocation	Most Recent Flow Four Days Before Remainder of Cycle
27	Forgetfulness	Most Recent Flow Four Days Before Remainder of Cycle
28	Takes naps, stay in bed	Most Recent Flow Four Days Before Remainder of Cycle
29	Orderliness	Most Recent Flow Four Days Before Remainder of Cycle
30	Chest pains	Most Recent Flow Four Days Before Remainder of Cycle

31	Confusion	Most Recent Flow Four Days Before Remainder of Cycle
32	Poor judgement	Most Recent Flow Four Days Before Remainder of Cycle
33	Stay at home	Most Recent Flow Four Days Before Remainder of Cycle
34	Excitement	Most Recent Flow Four Days Before Remainder of Cycle
35	Ringing in the ears	Most Recent Flow Four Days Before Remainder of Cycle
36	Difficulty concentrating	Most Recent Flow Four Days Before Remainder of Cycle
37	Avoid social activities	Most Recent Flow Four Days Before Remainder of Cycle
38	Feelings of well-being	Most Recent Flow Four Days Before Remainder of Cycle
39	Heart pounding	Most Recent Flow Four Days Before Remainder of Cycle
40	Distractible	Most Recent Flow Four Days Before Remainder of Cycle
41	Decreased efficiency	Most Recent Flow Four Days Before Remainder of Cycle
42	Bursts of energy, activity	Most Recent Flow Four Days Before Remainder of Cycle
43	Numbness, tingling	Most Recent Flow Four Days Before Remainder of Cycle
44	Minor accidents	Most Recent Flow Four Days Before Remainder of Cycle
45	Blind spots, fuzzy vision	Most Recent Flow Four Days Before Remainder of Cycle

46	Poor motor coordination	Most Recent Flow Four Days Before Remainder of Cycle
47	Increased appetite	Most Recent Flow Four Days Before Remainder of Cycle
48	Was your most recently menstrual cycle fairly typical/usual?	Yes No
49	In what ways, if any, was your most recent menstrual cycle unusual?	Open response

Appendix K

Substance Use Questionnaire

Please answer the following questions regarding substance use.

1. Do you consume alcohol?
   0 = No
   1 = Yes
*skip logic

2. Which of the following best captures the average frequency you currently consume alcohol?
   1 = Never
   2 = less than once a year
   3 = once a year
   4 = once every 3-6 months (2-4 times/yr))
   5 = once every 2 months (6 times/yr)
   6 = once a month (12 times/yr)
   7 = 2 – 3 times a month
   7 = once a week
   8 = twice a week
   9 = 3 – 4 times a week
   10 = 5 – 6 times a week
   11 = once a day
   12 = more than once a day

When answering the following questions, keep in mind that ONE unit of alcohol is equal to a 1.5 distilled alcohol [e.g., vodka, rum, whisky], 5 oz glass of wine, or a 12 oz bottle/can of beer.

3. On average, how many units of alcohol do you typically consume?
   0 = < 1 unit
   1 = 1 – 4 units
   2 = 5 – 10 units
   3 = 11 – 15 units
   4 = 16 - 20 units
   5 = 21+ units

4. Which of the following best captures the quantity of alcohol you currently consume?

   1 = a lot less than I typically consume
   2 = less than what I typically consume
   3 = what I typically consume
   4 = more than I typically consume
   5 = a lot more than I typically consume

Note. **cannabis** has many other names including marijuana, weed, dope, pot, hash/hashish.

5. Do you use cannabis?
   0 = No
   1 = Yes
*skip logic

Thank you for your previous responses, now we will be asking you about the same time intervals regarding your most recent menstrual cycle that you just reported on.
For the following questions, please **think of your most recent menstrual cycle.**

The following questions concern **your most recent menstrual flow.**
Note. **Most recent flow refers** to the last time you experienced menstrual bleeding.
Note. Four days before refers to the four days leading up to the last time you experienced menstrual bleeding. This is often referred to as the premenstrual period (often associated with experiencing premenstrual syndrome, or PMS).
Note. Remainder of cycle refers to the rest of your most recent menstrual cycle in which there was no menstrual bleeding (excluding the four days leading up to your most recent flow).

1. During your most recent menstrual flow, approximately how many days did you use cannabis? Please enter a numerical value. _____

2. During a typical day of your most recent menstrual flow, how many times a day did you use cannabis? Please enter a numerical value. _____

3. Which of the following best captures the quantity of cannabis you used during your most recent menstrual flow?

    1 = a lot less than I typically consume
    2 = less than I typically consume
    3 = what I typically consume
    4 = more than I typically consume
    5 = a lot more than I typically consume

4. During your most recent menstrual flow, did you regularly use marijuana flower?

0 = Yes
1 = No

*Skip logic

Note. **Marijuana flower** refers to the cannabis buds (as seen in the photo below). Marijuana flower is typically ground into smaller pieces and can be used with various methods of intake (e.g., rolled joints, bongs, pipes).
Note. **Cannabis concentrates** refers to cannabis that has been processed into oils, waxes, shatter, butane hash oil, dabs, and topical products.
Note. **Edibles** refers to food products that contain cannabis THC or CBD.
Note. **Other** refers to any form of cannabis other than flower, concentrates, or edibles (e.g., CBD-infused drinks).

Please use the image below to refer to various quantities of marijuana. The image is not to scale; the dollar bill is included to help provide size perspective.

For the following question, clearly indicate the number of grams of marijuana you use with a number between 0 – 100. Do NOT include other forms of cannabis you may use (such as concentrates). You may use up to 3 decimals to indicate amounts under 1 gram.

Note: 1/8 of a gram = 0.125 grams, ¼ of a gram = 0.25 grams, ½ of a gram = 0.5 grams, ¾ of a gram = 0.75 grams. 1/8 of an ounce = 3.5 grams, ¼ of an ounce = 7 grams, ½ ounce = 14 grams, 1 ounce = 28 grams

4. On a typical day you used marijuana during your most recent menstrual flow, how much did you personally use? _____

5. Are you aware of the THC/CBD content of the marijuana you used during your most recent menstrual flow?

0 = No
1 = Yes

6. What was the average THC/CBD content of the marijuana you typically used during your most recent menstrual flow?

Exclusively THC, no CBD About 50/50 THC and CBD Exclusively CBD, no THC

7. During your most recent menstrual flow, did you regularly use concentrates (e.g., Oil, Wax, Shatter, Butane Hash Oil, Dabs)?

0 = Yes
1 = No

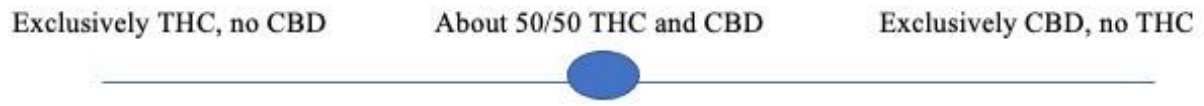
*Skip logic

8. On a typical day you used cannabis concentrates during your most recent menstrual flow, how many hits did you personally take? ____

9. Are you aware of the THC/CBD content of the concentrates you used during your most recent menstrual flow?

0 = No
1 = Yes

10. During your most recent menstrual flow, what was the average THC/CBD content of the concentrates you typically used?



11. During your most recent menstrual flow, did you regularly use edibles?

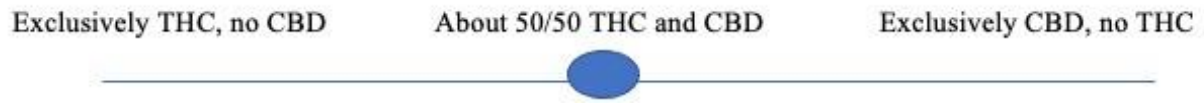
0 = Yes
1 = No
*Skip logic

12. On a typical day you used edibles during your most recent menstrual flow, how many times in that day did you consume edibles? _____

13. Are you aware of the THC/CBD content of the edibles you used during your most recent menstrual flow?

0 = No
1 = Yes

14. During your most recent menstrual flow, what was the average THC/CBD content of the edibles you typically used?



15. During your most recent menstrual flow, did you regularly use another form of cannabis?

0 = No
1 = Yes
*Skip logic: Please indicate what other form(s) of cannabis you used during your most recent menstrual flow: _____

16. On a typical day you used another form of cannabis during your most recent menstrual flow, how many times in that day did you use the other form of cannabis? _____

17. Are you aware of the THC/CBD content of the other form of cannabis you used during your most recent menstrual flow?

0 = No
1 = Yes

18. During your most recent menstrual flow, what was the average THC/CBD content of the other form of cannabis you typically used?

19. During your most recent menstrual flow, approximately how many days did you consume alcohol? _____

The following questions concerns **the 4 days before your most recent menstrual flow.**
Note. Most recent menstrual flow refers to the last time you experienced menstrual bleeding.
Note. **Four days before** refers to the four days leading up to the last time you experienced menstrual bleeding. This is often referred to as the premenstrual period (often associated with experiencing premenstrual syndrome, or PMS).
Note. Remainder of cycle refers to the rest of your most recent menstrual cycle in which there was no menstrual bleeding (excluding the four days leading up to your most recent flow).

20. During the 4 days before your most recent menstrual flow, approximately how many days did you use cannabis? Please enter a numerical value. _____

21. During the typical 4 days before your most recent menstrual flow, how many times a day do you use cannabis? Please enter a numerical value. _____

22. Which of the following best captures the quantity of cannabis you used during the 4 days before your most recent menstrual flow?

1 = a lot less than I typically consume
2 = less than I typically consume
3 = what I typically consume
4 = more than I typically consume
5 = a lot more than I typically consume

23. During the 4 days before your most recent menstrual flow, did you regularly use marijuana flower?

0 = Yes
1 = No
*Skip logic

Please use the image below to refer to various quantities of marijuana. The image is not to scale; the dollar bill is included to help provide size perspective.

For the following question, clearly indicate the number of grams of marijuana you use with a number between 0 – 100. Do NOT include other forms of cannabis you may use (such as concentrates). You may use up to 3 decimals to indicate amounts under 1 gram.

Note: 1/8 of a gram = 0.125 grams, ¼ of a gram = 0.25 grams, ½ of a gram = 0.5 grams, ¾ of a gram = 0.75 grams. 1/8 of an ounce = 3.5 grams, ¼ of an ounce = 7 grams, ½ ounce = 14 grams, 1 ounce = 28 grams

23. On a typical day you used marijuana during the 4 days before your most recent menstrual flow, how much did you personally use? _____

24. Are you aware of the THC/CBD content of the marijuana you used during the 4 days before your most recent menstrual flow?

0 = No
1 = Yes

25. What was the average THC/CBD content of the marijuana you typically used during the 4 days before your most recent menstrual flow?

Exclusively THC, no CBD About 50/50 THC and CBD Exclusively CBD, no THC

26. During the 4 days before your most recent menstrual flow, did you regularly use concentrates (e.g., Oil, Wax, Shatter, Butane Hash Oil, Dabs)?

0 = Yes
1 = No
*Skip logic

27. On a typical day you use cannabis concentrates during the 4 days before your most recent menstrual flow, how many hits did you personally take? ____

28. Are you aware of the THC/CBD content of the concentrates you used during the 4 days before your most recent menstrual flow?

    0 = No
    1 = Yes

29. During the 4 days before your most recent menstrual flow, what was the average THC/CBD content of the concentrates you typically used?

30. During the 4 days before your most recent menstrual flow, did you regularly use edibles?

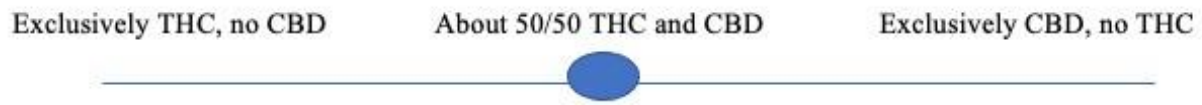
0 = Yes
1 = No
*Skip logic

31. On a typical day you used edibles during the 4 days before your most recent menstrual flow, how many times in that day did you consume edibles? _____

32. Are you aware of the THC/CBD content of the edibles you used during the 4 days before your most recent menstrual flow?

    0 = No
    1 = Yes

33. During the 4 days before your most recent menstrual flow, what was the average THC/CBD content of the edibles you typically used?



34. During the 4 days before your most recent menstrual flow, did you regularly use another form of cannabis?

0= No
1= Yes
*Skip logic: Please indicate what other form(s) of cannabis you used during the 4 days before your most recent menstrual flow: _____

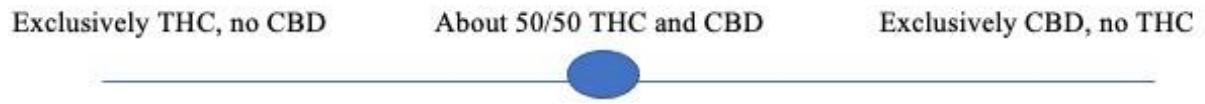
35. On a typical day you used another form of cannabis during the 4 days before your most recent menstrual flow, how many times in that day did you use the other form of cannabis?

_____

36. Are you aware of the THC/CBD content of the other form of cannabis you used during the 4 days before your most recent menstrual flow?

0 = No
1 = Yes

37. During the 4 days before your most recent menstrual flow, what was the average THC/CBD content of the other form of cannabis you typically used?



38. During the 4 days before your most recent menstrual flow, approximately how many days did you consume alcohol? _____

The following questions concerns **the remainder of your most recent menstrual cycle.**
Note. Most recent menstrual flow refers to the last time you experienced menstrual bleeding.
Note. Four days before refers to the four days leading up to the last time you experienced menstrual bleeding. This is often referred to as the premenstrual period (often associated with experiencing premenstrual syndrome, or PMS).
Note. **Remainder of cycle** refers to the rest of your most recent menstrual cycle in which there was no menstrual bleeding (excluding the four days leading up to your most recent flow).

39. During the remainder of your most recent menstrual cycle, approximately how many days did you use cannabis? Please enter a numerical value. _____

40. During the typical remainder of your menstrual cycle, how many times a day do you use cannabis? Please enter a numerical value. _____

41. Which of the following best captures the quantity of cannabis you used during the remainder of your most recent menstrual cycle?

1 = a lot less than I typically consume
2 = less than I typically consume
3 = what I typically consume
4 = more than I typically consume
5 = a lot more than I typically consume

42. During the remainder of your most recent menstrual cycle, did you regularly use marijuana flower? *Skip logic

0 = Yes
1 = No

Please use the image below to refer to various quantities of marijuana. The image is not to scale; the dollar bill is included to help provide size perspective.

For the following question, clearly indicate the number of grams of marijuana you use with a number between 0 – 100. Do NOT include other forms of cannabis you may use (such as concentrates). You may use up to 3 decimals to indicate amounts under 1 gram.

Note: 1/8 of a gram = 0.125 grams, ¼ of a gram = 0.25 grams, ½ of a gram = 0.5 grams, ¾ of a gram = 0.75 grams. 1/8 of an ounce = 3.5 grams, ¼ of an ounce = 7 grams, ½ ounce = 14 grams, 1 ounce = 28 grams

42. On a typical day you used marijuana during the remainder of your most recent menstrual cycle, how much did you personally use? _____

43. Are you aware of the THC/CBD content of the marijuana you used during the remainder of your most recent menstrual cycle?

    0 = No
    1 = Yes

44. What was the average THC/CBD content of the marijuana you typically used during the remainder of your most recent menstrual cycle?

Exclusively THC, no CBD About 50/50 THC and CBD Exclusively CBD, no THC

45. During remainder of your most recent menstrual cycle, did you regularly use concentrates (e.g., Oil, Wax, Shatter, Butane Hash Oil, Dabs)?

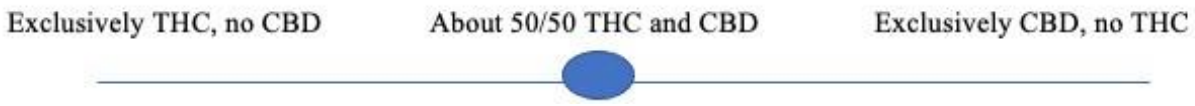
0 = Yes
1 = No
*Skip logic

46. On a typical day you use cannabis concentrates during the remainder of your most recent menstrual cycle, how many hits did you personally take? _____

47. Are you aware of the THC/CBD content of the concentrates you used during the remainder of your most recent menstrual cycle?

0 = No
1 = Yes

48. During the remainder of your most recent menstrual cycle, what was the average THC/CBD content of the concentrates you typically used?



49. During remainder of your most recent menstrual cycle, did you regularly use edibles?

0 = Yes
1 = No
*Skip logic

50. On a typical day you used edibles during the remainder of your most recent menstrual cycle, how many times in that day did you consume edibles? _____

51. Are you aware of the THC/CBD content of the edibles you used during the remainder of your most recent menstrual cycle?

0 = No
1 = Yes

52. During the remainder of your most recent menstrual cycle, what was the average THC/CBD content of the edibles you typically used?

53. During the remainder of your most recent menstrual cycle, did you regularly use another form of cannabis?

0= No
1= Yes
*Skip logic: Please indicate what other form(s) of cannabis you used during the remainder of your most recent menstrual cycle: _____

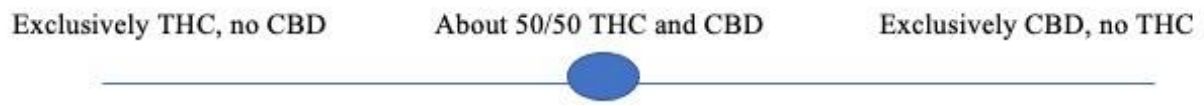
54. On a typical day you used another form of cannabis during remainder of your most recent menstrual cycle, how many times in that day did you use the other form of cannabis?

_____

55. Are you aware of the THC/CBD content of the other form of cannabis you used during the remainder of your most recent menstrual cycle?

0 = No
1 = Yes

56. During the remainder of your most recent menstrual cycle, what was the average THC/CBD content of the other form of cannabis you typically used?



57. During the remainder of your most recent menstrual cycle, approximately how many days did you consume alcohol? _____

Appendix L

Personality Research Form - Infrequency Scale

Read each statement and decide whether or not it describes you. If you agree with the statement or decide that it does describe you, answer TRUE. If you disagree with a statement or feel that it is not descriptive of you, answer FALSE. Answer every item either true or false, even if you are not completely sure of your answer.

0 = False; 1 = True

1. I have never bought anything in a store.
2. I could easily count from one to twenty-five.
3. I can run a mile (1.6km) in less than four minutes.
4. I have never talked to anyone by telephone.
5. I usually wear something warm when I go outside on a very cold day.
6. I make all my own clothes and shoes.
7. I have never brushed or cleaned my teeth.
8. Things with sugar in them usually taste sweet to me.
9. Sometimes I see cars near my home.
10. I have never had any hair on my head.
11. I have traveled away from my home town.
12. I have never ridden in an automobile.
13. I have never felt sad.
14. I try to get at least some sleep every night.
15. Sometimes I feel thirsty or hungry.
16. I have attended school at some time during my life.