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Short Communication

Cannabis species and cannabinoid concentration preference among sleep-disturbed medicinal cannabis users

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HIGHLIGHTS

- Individuals using cannabis to manage nightmares preferred sativa to indica.
- Sativa users were less likely than indica users to endorse cannabis dependence.
- Insomnia and greater sleep latency are associated with using higher CBD cannabis.
- Weekly hypnotic medication use is associated with using cannabis with lower THC.

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ABSTRACT

Introduction: Individuals report using cannabis for the promotion of sleep, and the effects of cannabis on sleep may vary by cannabis species. Little research has documented preferences for particular cannabis types or cannabinoid concentrations as a function of use for sleep disturbances.
Methods: 163 adults purchasing medical cannabis for a physical or mental health condition at a cannabis dispensary were recruited. They provided self-report of (a) whether cannabis use was intended to help with sleep problems (e.g. insomnia, nightmares), (b) sleep quality (PSQI), (c) cannabis use (including preferred type), and (d) symptoms of DSM-5 cannabis dependence.
Results: 81 participants reported using cannabis for the management of insomnia and 14 participants reported using cannabis to reduce nightmares. Individuals using cannabis to manage nightmares preferred sativa to indica strains (Fisher's exact test (2) = 6.83, $p < 0.05$), and sativa users were less likely to endorse DSM-5 cannabis dependence compared with those who preferred indica strains ($\chi^2(2) = 4.09$, $p < 0.05$). Individuals with current insomnia ($t(9) = 3.30$, $p < 0.01$) and greater sleep latency ($F(3,6) = 46.7$, $p < 0.001$) were more likely to report using strains of cannabis with significantly higher concentrations of CBD. Individuals who reported at least weekly use of hypnotic medications used cannabis with lower THC concentrations compared to those who used sleep medications less frequently than weekly ($t(17) = 2.40$, $p < 0.05$).
Conclusions: Associations between sleep characteristics and the type of cannabis used were observed in this convenience sample of individuals using cannabis for the management of sleep disturbances. Controlled prospective studies are needed to better characterize the impact that specific components of cannabis have on sleep.
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1. Introduction

The use of cannabis for medical purposes is rapidly expanding, and one of the primary motivations for medicinal cannabis use is to manage sleep difficulties (Bonn-Miller, Boden, Bucossi, & Babson, 2014; Grella, Rodriguez, & Kim, 2014; Walsh et al., 2013). Cannabis may be beneficial in the promotion of sleep (Babson & Bonn-Miller, 2014), though the extent and mechanisms by which cannabis may improve sleep is unclear (Babson & Bonn-Miller, 2014). Some research has suggested that Δ^9-tetrahydrocannabinol (Δ^9-THC), the primary psychoactive component of cannabis, is responsible for sleep promotion, while other research has shown Δ^9-THC to have an activating effect that can result in poor sleep (Babson & Bonn-Miller, 2014).

The primary limitations of existing work on the use and impact of cannabis for sleep promotion are two-fold. First, the majority of work on cannabis and sleep has focused on administration of isolated

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cannabinoids (e.g., Δ9-THC; Babson & Bonn-Miller, 2014). While this is an important initial step in the literature, cannabis use by the majority of medicinal patients (i.e., smoking the cannabis flower) includes ingestion of a number of additional cannabinoids present in the cannabis plant (e.g., cannabidiol; CBD). Indeed, cannabinoids such as CBD have both psychoactive and non-psychoactive properties, which may interact with Δ^9-THC to produce more nuanced effects (Aizpurua-Olaizola et al., 2014; Englund et al., 2013; Russo, 2011; Vann et al., 2008; Walsh et al., 2013; Zuardi, Hallak, & Crippa, 2012). Similarly, there is a lack of naturalistic observation of cannabis use behavior among those with self-reported sleep problems. Studies have examined sleep effects following laboratory administration of cannabinoids, but laboratory-based studies do not necessarily translate to "real world" behaviors as cannabis choice is not afforded within the laboratory context (Burgdorf, Kilmer, & Pacula, 2011; Mitchell, 2012). As such, it is necessary to document naturalistic choice of particular medical cannabis types among individuals who self-report using cannabis for the treatment of sleep problems.

Cannabis can be categorized by plant sub-species that, within species, can vary considerably with regard to relative cannabinoid concentration. Cannabis strains obtained at dispensaries within the U.S. are typically classified as one of 3 species designations: indica, sativa, and "hybrid" (cross-bred cannabis plants containing characteristics of both indica and sativa varieties). However, little is known regarding differences between indica and sativa in terms of psychoactive effects or variations in cannabinoid concentration (i.e., amount of each cannabinoid). Indeed, cannabinoid concentration can vary widely between cannabis flowers obtained and used by medicinal patients (Hillig & Mahlberg, 2004). Furthermore, little research has documented species or cannabinoid concentration preferences among individuals who use medical cannabis for particular conditions.

The purpose of the present study was to document cannabis species and cannabinoid concentration preferences among medical cannabis users who report using cannabis for the management of sleep problems. Because individuals who use cannabis to improve sleep have been shown to be at increased risk for the experience of negative consequences associated with use (Bonn-Miller, Babson, & Vandrey, 2014), we also evaluated the interaction between the type of cannabis used and diagnosis of cannabis use disorder among study participants.

2. Method

2.1. Procedure

Patients of a medical cannabis dispensary located in California were recruited for the current study. Study staff manned a table in the dispensary two days per week in 2012, and provided patrons with a flyer with study information as they entered. For those who were interested, study procedures were explained and written informed consent was obtained. Individuals under the age of 18 years or unable to provide written informed consent to participate were excluded. Participants completed a series of self-report questionnaires, were debriefed, and then entered into one of four weekly drawings for $100 as compensation for participation. Procedures were approved by the VA and Stanford University institutional review boards.

2.2. Participants

Of the 217 adults (73% male) who participated in a larger study (Bonn-Miller, Boden, Bucossi, & Babson, 2014), 163 provided information on the specific strains of cannabis used for the treatment of their medical or psychiatric disorder(s) and were included in the current study. The mean age of participants was 40.4 (SD = 14.3, range 18–73 years). Most participants were White/Caucasian (67.1%), followed by Black/Non-Hispanic (7.5%), Hispanic (6.8%), Black/Hispanic (3.7%), Asian (3.1%), and "Other" (11.8%). Most had at least a high school education (97%), 39% completed a 2- or 4-year college degree, and 15% had an advanced degree. Participants reported using cannabis for medical purposes for an average of 10.8 years (SD = 10.4, range = 2 months–47 years).

2.3. Measures

2.3.1. Medical use of cannabis

The conditions for which participants were using cannabis, and the strains of cannabis that were most used for these conditions, were assessed with the Medical Marijuana Patient Use Questionnaire (MMPUQ; see Bonn-Miller, Boden, Bucossi, & Babson, 2014). Participants were asked "What condition(s) have led you to seek out medical cannabis (i.e., what is it prescribed for)?" Sleep-related response options for this item included "*insomnia*" and "*nightmares*;" other medical conditions treated with cannabis are discussed by Bonn-Miller, Boden, Bucossi, and Babson (2014). An additional question asked participants to list the names of up to four types of cannabis that they used. Names of the cannabis types provided were matched with dispensary data to identify the cannabis species (i.e. sativa, indica, or hybrid), and the concentrations of THC and CBD. Hybrid plant strains were sub-divided into those that were considered primarily sativa and those considered primarily indica, indicating the dominant species for each plant. Cannabis flower concentrations of THC and CBD were batch tested by the dispensary upon receipt, with testing information (e.g., THC concentration) posted on the dispensary website. Not all cannabis varieties were tested for cannabinoid concentration by the dispensary, though those that were chosen for testing were tested regularly and upon receipt of each new batch. Individual cannabis preference was determined by a count of the species most frequently endorsed from strains reported (e.g. if a participant reported using three sativa/primary sativa hybrid strains and one indica/primary indica hybrid strain, they were said to prefer sativa).

2.3.2. Cannabis use disorder

Cannabis use disorder (CUD) diagnosis was assessed using the Structured Clinical Interview-Non-Patient Version for DSM-IV (SCID-I-N/P; First, Spitzer, Gibbon, & Williams, 1995), modified to be consistent with DSM-5 (see Budney, Hughes, Moore, & Vandrey, 2004). Cronbach's α was .72.

2.3.3. Sleep problems

Self-reported sleep quality was assessed using the Pittsburgh Sleep Quality Index (PSQI; Buysse, Reynolds, Monk, Berman, & Kupfer, 1989). The PSQI is a 19-item questionnaire that provides an index of global sleep quality and seven components of sleep quality. Cronbach's α for the global score was .87 (Backhaus, Junghanns, Broocks, Riemann, & Hohagen, 2002).

2.4. Analytic plan

Fisher's exact test was used to identify whether species preference was associated with binary sleep problems (i.e. nightmares and insomnia). T-tests for binary sleep variables, ANOVAs for categorical or ordinal sleep variables, and correlations for continuous sleep variables were used to evaluate relationships between sleep variables and cannabis (i.e. THC and CBD) concentration. Logistic regression was used to regress CUD on age and χ^2 testing was used to examine associations between CUD and strain preference.

3. Results

3.1. Sample characteristics

On average, participants reported using cannabis nearly twice a day during the past month (M = 58.7 times per month; SD = 65; range =