MEN'S SEXUAL HEALTH

A Survey Exploring the Relationship Between Cannabis Use Characteristics and Sexual Function in Men

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ABSTRACT

Introduction: Cannabis is the most commonly used drug in the United States; however, the effects of cannabis use on male sexual function are poorly understood.

Aim: To characterize the contemporary landscape of cannabis use and to assess the associations between male sexual function and the frequency of use, the primary method of consumption, or cannabis chemovar (tetrahydrocannabinol or cannabidiol) among current users.

Methods: We surveyed adults who visited a single cannabis dispensary for baseline demographic information, medical history, cannabis use habits, and sexual function as assessed by the International Index of Erectile Function (IIEF). An IIEF-5 < 21 was considered erectile dysfunction.

Main Outcome Measures: The main outcome measure of the study was male sexual function via the IIEF domain scores.

Results: A total of 325 men completed the survey with a mean age of 46.7 years. 71.1% of the men were Caucasian and 52.6% were married. 13 men (4%) were never users; 29 men (8.9%) used 1−2 times/week; 51 men (15.7%) used 3−5 times/week, and 232 men (71.4%) used 6+ times/week. The average IIEF-5 score was 22.3 with 19.4% of the men having erectile dysfunction. In univariate analysis, men using cannabis more frequently had a higher overall IIEF (65.36 vs 60.52, $P = .001$), erectile domain (27.32 vs 25.74, $P = .03$), orgasm domain (9.08 vs 8.12, $P < .001$), intercourse satisfaction domain (12.42 vs 11.31, $P = .006$), and overall satisfaction domain (8.11 vs 7.05, $P = .002$). In multivariable analysis, compared to men who used cannabis 0 times/week, those who used 6 times/week had an increased overall IIEF (69.08 vs 64.64, P-value adjusted $= 0.02$), intercourse satisfaction domain (P-value adjusted $= 0.04$), and overall satisfaction domain (P-value adjusted $= 0.02$). The primary method of consumption (eg, smoking, edibles, etc.) and cannabinoid composition (eg, cannabidiol vs tetrahydrocannabinol dominant) were not associated with sexual function.

Conclusion: We report an association between the increased frequency of cannabis use and increased male sexual function. However, while the increased frequency of use was statistically significant with regard to the IIEF scores, the clinical significance of this is likely low, and selection bias may limit the generalizability of these findings. The method of consumption and cannabis chemovar were not associated with sexual function. **Bhambhvani HP, Kasman AM, Wilson-King G, et al. A Survey Exploring the Relationship Between Cannabis Use Characteristics and Sexual Function in Men. J Sex Med 2020;8:436−445.**

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Key Words: Cannabis; Orgasm; Erectile dysfunction; SHIM

INTRODUCTION

In 2019, Illinois became the 11th state to legalize adult use cannabis in the United States (US), continuing a recent trend toward increasing legalization.[1] The impact of cannabis policy on trends in utilization is evident, with a higher prevalence of use in states that have legalized adult use.[2] Indeed, between 2002 and 2014, past-month cannabis use in the US increased from 17.3% to 19.6% among adults aged between 18 and 25 years and from

4.0% to 6.6% among adults older than 25 years.[3] Cannabis is now the most commonly used drug in the US today with an estimated 22.2 million people using it within the last month.[4] Notably, the greatest demographic increase in cannabis utilization has been observed among those in the older adult population aged 50 years and older, particularly unmarried men with chronic diseases.[5] As adult use of cannabis continues to become more prevalent, it is imperative to understand the potential short- and long-term associations with health.

With regard to male sexual function, the data are inconsistent, with conflicting reports of both benefit and detriment. Indeed, some studies have suggested a higher prevalence of erectile dysfunction (ED) among chronic cannabis users, whereas others have reported a prevalence that is equal to nonusers.[6–8] In a recent report, most male and female cannabis users endorsed increased sexual satisfaction, sensitivity, and orgasm intensity, with only a small fraction reporting orgasmic difficulty and some even reporting increased ability to orgasm.[9] Simultaneously, a large survey of Australian men found that daily cannabis use was associated with an inability to orgasm as desired, with either rapid ejaculation or delayed ejaculation.[7] These contrasting reports of beneficial and detrimental sexual effects underscore the potential for cannabis to have either a positive or negative impact on sexuality, a bifurcation that may depend on the frequency of use, strain, and method of consumption. Surprisingly, however, none of these studies or others have attempted to quantitatively establish a relationship with the frequency of cannabis consumption and the degree of male sexual dysfunction, nor have any studies assessed the potential influence of the method of consumption (eg, edibles vs smoking) or cannabis chemovar, which refers to the relative composition of cannabidiol (CBD) versus tetrahydrocannabinol (THC) in a particular strain. To our knowledge, there are currently no data refuting or supporting a role of cannabis chemovar in male or female sexual function, although it is widely accepted that CBD and THC have separate receptors and therefore distinct neurophysiological effects and modulate behavior in different ways.[10,11] Therefore, studies investigating the effect of cannabis chemovar on sexual function are warranted.

As no current studies have assessed the current landscape of cannabis users after wide-spread legalization, we sought to describe current users' baseline demographics, health status, and adult use patterns. In addition, we sought to assess for a frequency-response relationship between cannabis consumption and male sexual function and investigate potential sexual associations with the consumption method and cannabis chemovar.

METHODS

Study Population

Adults who visited a single partner cannabis dispensary with multiple locations were invited to participate in an uncompensated, anonymous online survey designed by the authors using the Qualtrics (Provo, UT) survey platform between October 20th, 2019, and March 12th, 2020. The partner dispensary was chosen based on its large customer base and willingness to distribute our survey. The survey was distributed at all locations of the partner dispensary. Clientele of the partner dispensary included both recreational and medical users. Dispensaries provided the survey link to customers on purchase of cannabis. This study was approved by the intuitional review board at the Stanford University School of Medicine.

Survey Instruments

All participants were administered the same survey. The survey was administered in the English language. Informed consent was waived given the online nature of the survey, and waiver of documentation was provided before proceeding with the survey. The first half of the survey queried men for demographic information, prior medical history, and adult drug use habits. In the latter half of the survey, we deployed the validated the International Index of Erectile Function (IIEF).[12] The IIEF is a validated survey instrument designed to examine male sexual function and consists of 15 questions, each of which is awarded a Likert scale score from 0 to 5. As such, the maximum possible overall score is 75, which is divided into 5 functional domains as follows: erectile function (30 points), orgasmic function (10 points), sexual desire (10 points), intercourse satisfaction (15 points), and overall satisfaction (10 points). From the IIEF, we also extrapolated the Sexual Health Inventory for Men (SHIM) score as it consists of 5 IIEF questions.

Covariates

Demographic variables included the age, race, home region (international or per US census divisions), and relationship status. Clinical variables included the height, weight, number of visits to a primary care provider (PCP) in the last 3 months, tobacco smoking history, and the presence/absence of 13 of the most common comorbidities within the US (ie, hypertension, diabetes, heart disease, arthritis, lung disease, kidney disease, thyroid disease, hypercholesterolemia, cancer, neurologic disease, liver disease, depression, and anxiety).[13] Yes/no responses to these variables were collapsed to a single categorical variable, "total comorbidities," with 4 levels—0, 1, 2, or 3+ for the analysis. The complete distribution of these comorbidities is illustrated in Supplemental Table 1.

Cannabis use variables included the frequency of use in the last month, primary method of consumption, cannabis chemovar (CBD/THC), and reason for use. The frequency of use options were 0 times per week, 1–2 times per week, 3–5 times per week, and 6+ times per week. To assess a frequency-response relationship in our regression analyses, we converted this categorical variable to a continuous variable as follows: never users were assigned a value of 0, 1–2 times per week a value of 1.5, 3–5 times per week a value of 4, and 6+ times per week a value of 6.1. These continuous variable values were chosen as the

Table 1. Overall cohort stratified by the frequency of cannabis use

Characteristic	Overall N (%)	The frequency of cannabis use		P value
		≥3-5 times/wk	≤1-2 times/wk	
Total	325	283	42	
Age (years)				.128
<30	47 (14.5)	46 (16.3)	1 (2.4)	
30−39	74 (22.8)	62 (21.9)	12 (28.6)	
40−49	63 (19.4)	51 (18.0)	12 (28.6)	
50−59	53 (16.3)	47 (16.6)	6 (14.3)	
60+	83 (25.5)	72 (25.4)	11 (26.2)	
Unknown	5 (1.5)	5 (1.8)	0 (0.0)	
Race				.693
White	231 (71.1)	202 (71.4)	29 (69.0)	
Black/African	19 (5.8)	15 (5.3)	4 (9.5)	
Hispanic/Latino	44 (13.5)	38 (13.4)	6 (14.3)	
Other	31 (9.5)	28 (9.9)	3 (7.1)	
Home region				.187
US West	115 (35.4)	104 (36.7)	11 (26.2)	
International	39 (12.0)	31 (11.0)	8 (19.0)	
US Midwest	35 (10.8)	27 (9.5)	8 (19.0)	
US Northeast	70 (21.5)	64 (22.6)	6 (14.3)	
US South	60 (18.5)	52 (18.4)	8 (19.0)	
Unknown	6 (1.8)	5 (1.8)	1 (2.4)	
Relationship status				.479
Married	171 (52.6)	147 (51.9)	24 (57.1)	
In a relationship	67 (20.6)	62 (21.9)	5 (11.9)	
Single	86 (26.5)	73 (25.8)	13 (31.0)	
Unknown	1 (0.3)	1 (0.4)	0 (0.0)	
Weight (mean (SD))	191.52 (47.02)	189.32 (43.70)	206.38 (63.86)	.028
Height (mean (SD))	178.16 (8.11)	177.90 (8.03)	180.04 (8.50)	.149
The number of PCP visits in the last 3 months				.197
0	170 (52.3)	153 (54.1)	17 (40.5)	
1	108 (33.2)	92 (32.5)	16 (38.1)	
2+	47 (14.5)	38 (13.4)	9 (21.4)	
Tobacco smoking history				.118
Never smoker	118 (36.3)	97 (34.3)	21 (50.0)	
Current smoker	52 (16.0)	48 (17.0)	4 (9.5)	
Former smoker	155 (47.7)	138 (48.8)	17 (40.5)	
Cannabis use frequency				<.001
0 times/week	13 (4.0)	0 (0.0)	13 (31.0)	
1-2 times/week	29 (8.9)	0 (0.0)	29 (69.0)	
3-5 times/week	51 (15.7)	51 (18.0)	0 (0.0)	
6+ times/week	232 (71.4)	232 (82.0)	0 (0.0)	
The primary method of consumption				<.001
Smoking flower	174 (53.5)	157 (55.5)	17 (40.5)	
Edibles	21 (6.5)	17 (6.0)	4 (9.5)	
Smoking concentrates or extracts	28 (8.6)	26 (9.2)	2 (4.8)	
Tincture or oils	28 (8.6)	21 (7.4)	7 (16.7)	
Unknown	4 (1.2)	0 (0.0)	4 (9.5)	
Vaping	57 (17.5)	53 (18.7)	4 (9.5)	
Other	13 (4.0)	9 (3.2)	4 (9.5)	
Cannabis chemovar				<.001
THC dominant	193 (59.4)	173 (61.1)	20 (47.6)	

(continued)

Table 1. Continued

Characteristic	Overall N (%)	The frequency of cannabis use ≥3-5 times/wk	≤1-2 times/wk	P value
CBD:THC 1:1	96 (29.5)	89 (31.4)	7 (16.7)	
CBD dominant	30 (9.2)	21 (7.4)	9 (21.4)	
Unknown	6 (1.8)	0 (0.0)	6 (14.3)	
The primary reason for use				.001
Medical	249 (76.6)	226 (79.9)	23 (54.8)	
Adult use	76 (23.4)	57 (20.1)	19 (45.2)	
IIEF scores (mean (SD))				
Overall score	64.74 (9.10)	65.36 (8.02)	60.52 (13.84)	.001
Erectile domain	27.12 (4.42)	27.32 (4.10)	25.74 (6.04)	.03
Orgasm domain	8.95 (1.66)	9.08 (1.42)	8.12 (2.66)	<.001
Sexual desire domain	8.42 (1.60)	8.43 (1.50)	8.31 (2.20)	.638
Intercourse satisfaction domain	12.27 (2.45)	12.42 (2.26)	11.31 (3.37)	.006
Overall satisfaction domain	7.97 (2.05)	8.11 (1.87)	7.05 (2.87)	.002
Erectile dysfunction (SHIM < 21)	63 (19.4)	50 (17.7)	13 (31.0)	.068
Total comorbidities				.021
0	106 (32.6)	94 (33.2)	12 (28.6)	
1	92 (28.3)	72 (25.4)	20 (47.6)	
2	64 (19.7)	60 (21.2)	4 (9.5)	
3+	63 (19.4)	57 (20.1)	6 (14.3)	

Comorbidities assessed included hypertension, diabetes, heart disease, arthritis, lung disease, kidney disease, thyroid disease, hypercholesterolemia, cancer, neurologic disease, liver disease, depression, and anxiety.
US = the United States; PCP = primary care physician, THC = tetrahydrocannabinol, CBD = cannabidiol, IIEF = International Index of Erectile Function; SHIM = Sexual Health Inventory for Men.

average weekly use frequency of their respective categorical variables. Options for the primary method of consumption were smoking flower, edibles, smoking concentrates/extracts, tincture/oils, vaping, and other. Options for cannabis chemovar were THC dominant, CBD:THC 1:1, and CBD dominant. Finally, based on a review of the literature, participants were allowed to select up to 9 options of reasons for use: relax/unwind, improve mood, help with pain, help with sleep, help with stress, help with depression, glaucoma, nausea/loss of appetite, and neurologic condition.[14] As many participants selected both adult use (eg, relaxation) and medical (eg, glaucoma) reasons, we separately grouped all men who listed a medical reason (ie, medical use) or did not (ie, adult use) in the primary reason for use variable. The complete distribution of the reason for use is illustrated in Supplemental Table 1.

Statistical Methods

Patient characteristics and survey responses were analyzed using descriptive statistics, including the proportions, median, and mean ± standard deviation. Categorical variables were analyzed by the χ^2 test or Fisher's exact test as appropriate. Normally distributed continuous variables were analyzed by Student's t-test, whereas skewed continuous variables were analyzed by the Wilcoxon rank-sum test.

We used multiple linear regression to identify factors associated with an overall IIEF score, as well as each IIEF domain.

Finally, we used multivariable logistic regression to identify factors associated with ED. In this analysis, ED was defined as a SHIM score of less than 21.

A power analysis for multiple linear regression was conducted using 0.05 alpha, 10 tested predictors, and a relatively small effect size ($f^2 \geq 0.06$). With our sample size (N = 325), there was 89.3% power to detect an association between the IIEF scores and covariates of interest.

All data were analyzed using R v3.5.3 (R Foundation for Statistical Computing). The significance level for all statistical tests was set at <0.05, and all tests were 2-sided.

RESULTS

Study Population

A total of 325 men completed the survey. Participant demographics, clinical characteristics, and details of cannabis use are outlined in Table 1. Notably, participants were most frequently aged 60+ years (n = 83, 25.5%), white (n = 231, 71.1%), and married (n = 171, 52.6%). Most participants had not seen their PCP in the last 3 months (n = 170, 52.3%) and had zero comorbidities (n = 32.6%). Participants most frequently used cannabis 6+ times per week (n = 232, 71.4%), consumed cannabis primarily by smoking flower (n = 174, 53.5%), and used only THC-containing cannabis (n = 193, 59.4%).

Stratification of the Cohort by Cannabis Use Frequency

In univariate analysis, men using cannabis more frequently had higher IIEF scores (Table 1). Specifically, the frequent use was associated with a higher overall score (65.36 vs 60.52, $P = .001$), erectile domain (27.32 vs 25.74, $P = .03$), orgasm domain (9.08 vs 8.12, $P < .001$), intercourse satisfaction domain (12.42 vs 11.31, $P = .006$), and overall satisfaction domain (8.11 vs 7.05, $P = .002$). In addition, although not reaching statistical significance, more frequent users had a lower prevalence of ED (17.7% versus 31.0%, $P = .068$). More frequent users were more likely to smoke flower (55.5% vs 40.5%) or vape (18.7% vs 9.5%) as a primary method of consumption ($P < .001$). Finally, more frequent users were more likely to consume THC-dominant cannabis (61.1% vs 47.6%) or CBD:THC 1:1 cannabis (31.4% vs 16.7%) and less likely to consume CBD-dominant cannabis (7.4% vs 21.4%) ($P < .001$).

Factors Associated With the IIEF: Multivariable Linear Regression

Factors associated with the overall IIEF and domain scores in multivariable analysis are illustrated in Table 2. Notably, as compared to men who used cannabis 0 times/week, those who used 6 times/week had an increase in the overall IIEF (69.08 vs 64.64, P-value adjusted $= 0.02$), intercourse satisfaction domain (13.30 versus 12.25, P-value adjusted $= 0.04$), and overall satisfaction domain (7.44 versus 6.76, P-value adjusted $= 0.02$). Individual step changes for an increase in the frequency of use by 1/week are given in Table 2 as β. The primary method of consumption, cannabis chemovar, and indication for use were not associated with the IIEF scores. Compared to married men, single men had a lower overall IIEF (60.69 versus 64.34, P-value adjusted $= 0.003$), erectile domain (26.45 versus 28.40, $P = .001$), and overall satisfaction domain (6.76 versus 5.40, P-value adjusted < 0.001). Compared to participants who had not seen their PCP in the last 3 months, those who had seen their PCP 2+ times had a lower overall IIEF (60.68 versus 64.64, P-value adjusted $= 0.01$), erectile domain (26.56 versus 28.40, P-value adjusted $= 0.01$), and orgasm domain (8.20 versus 8.91, P-value adjusted $= 0.008$). Finally, compared to never tobacco smokers, those who currently smoke tobacco had lower intercourse satisfaction (11.01 versus 12.25, P-value adjusted $= 0.003$).

Factors Associated With ED: Multivariable Logistic Regression

Multivariable logistic regression was used to identify factors associated with ED (Table 3). An increase in the cannabis use frequency by one additional use per week was associated with the decreased odds of ED (OR $= 0.81$, 95% CI: 0.67−0.98, $P = .03$). Importantly, ED was not associated with the primary method of consumption or cannabis chemovar. Compared to married men, single men had higher odds of ED (OR $= 3.21$,

95% CI: 1.46−7.28, $P = .004$). Compared to men who had not seen their PCP in the last 3 months, those who had seen their PCP 2+ times had increased odds of ED (OR $= 3.35$, 95% CI: 1.36−8.30, $P = .008$). No other participant characteristics were associated with male sexual function.

DISCUSSION

In this study of over 300 men, we report, for the first time, evidence of a frequency-response relationship between cannabis use and sexual function, with increasing use associated with an increased overall IIEF score, intercourse satisfaction domain, and overall satisfaction domain. Similarly, more frequent cannabis use is associated with lower odds of ED. Importantly, the primary method of consumption, cannabis chemovar, and indication for use are not associated with sexual function.

While others have examined the association between male sexual function and cannabis use, most studies have not used validated measures of erectile function. Despite this, our findings of increased intercourse satisfaction domain and overall satisfaction domain with increased cannabis use are consistent with subjective reports of increased sexual satisfaction, sensitivity, and orgasm strength among most cannabis users reported by some studies.[9,15] The largest survey of sexual health among male cannabis users was conducted by Smith et al in Australia and included over 4,000 men.[7] Although the authors did not use a validated measure of erectile function, they found that subjectively there was no association between the frequency of cannabis use and self-reported trouble keeping an erection. The current report also found no change in erectile function; however, we did identify improvements in other domains of sexual function and a lower prevalence of ED with more cannabis use. Smith et al also found that daily cannabis use in men was associated with difficulty to achieve orgasm as desired. Although the authors did not discuss any potential mechanisms underpinning this association, it is possible that an altered cognitive state induced by cannabis consumption may contribute to difficulty in attaining orgasm. A recent qualitative survey of both men and women reported that some participants were unable to orgasm as desired on cannabis because of a lack of focus or altered mindset.[16]

To our knowledge, only one study, by Kumsar et al, has investigated male sexual health associations with cannabis using the complete IIEF survey.[17] Here, the authors surveyed men with substance use disorder presenting to a dedicated substance abuse treatment center in Turkey. They found no differences in the overall IIEF score or any domain scores between cannabis users and nonusers. However, this study of 20 cannabis users had limited power to identify differences between the control population and was not able to identify the frequency of cannabis use.

A few studies have used the SHIM as an outcome measure, allowing for proper comparison with our results. In a survey of 2,507 Swiss men aged between 18 and 25 years, Mialon et al

Table 2. Multivariable linear regression models of the IIEF scores and subject characteristics

Characteristic	Overall IIEF β (SE)	P-value	Erectile domain β (SE)	P-value	Orgasm domain β (SE)	P-value	Sexual desire β (SE)	P-value	Intercourse satisfaction β (SE)	P-value	Overall satisfaction β (SE)	P-value
Age (years)												
<30	Ref		Ref		Ref		Ref		Ref		Ref	
30–39	3.37 (1.68)	.047*	0.55 (0.83)	.51	0.64 (0.29)	.03*	0.49 (0.31)	.12	0.92 (0.45)	.041*	0.77 (0.38)	.042*
40–49	2.91 (1.78)	.1	0.33 (0.87)	.71	0.74 (0.31)	.018*	0.78 (0.33)	.019	0.39 (0.48)	.41	0.68 (0.4)	.09
50–59	1.91 (1.91)	.32	0.28 (0.94)	.76	−0.07 (0.33)	.84	0.5 (0.35)	.16	0.35 (0.51)	.5	0.85 (0.43)	.047*
60+	1.36 (1.83)	.46	−1.13 (0.9)	.21	0 (0.32)	1.00	0.76 (0.34)	.026*	0.48 (0.49)	.33	1.25 (0.41)	.002**
Race												
White	Ref		Ref		Ref		Ref		Ref		Ref	
Black/African	−0.68 (2.18)	.76	−0.14 (1.07)	.9	−1.06 (0.38)	.005	−0.22 (0.4)	.59	0.64 (0.58)	.27	0.1 (0.49)	.84
Hispanic/Latino	0.54 (1.57)	.73	−0.01 (0.77)	.99	−0.14 (0.27)	.61	0.28 (0.29)	.34	−0.14 (0.42)	.75	0.54 (0.35)	.13
Other	−1.95 (1.72)	.26	−0.37 (0.84)	.66	−0.97 (0.3)	.001	−0.11 (0.32)	.73	−0.15 (0.46)	.75	−0.35 (0.38)	.36
Relationship status												
Married	Ref		Ref		Ref		Ref		Ref		Ref	
In a relationship	−0.1 (1.34)	.94	−0.14 (0.66)	.83	−0.27 (0.23)	.24	−0.28 (0.25)	.25	0.19 (0.36)	.59	0.4 (0.3)	.18
Single	−3.65 (1.23)	.003**	−1.95 (0.6)	.001**	−0.39 (0.21)	.07	0.18 (0.23)	.43	−0.13 (0.33)	.69	−1.36 (0.27)	<.001***
Home region												
US West	Ref		Ref		Ref		Ref		Ref		Ref	
International	−2.69 (1.69)	.11	−1.13 (0.83)	.17	−0.27 (0.29)	.35	−0.32 (0.31)	.31	−1.09 (0.45)	.016*	0.13 (0.38)	.74
US Midwest	−0.87 (1.81)	.63	−0.35 (0.89)	.69	0.35 (0.31)	.27	−0.23 (0.33)	.5	−0.42 (0.48)	.38	−0.22 (0.4)	.58
US Northeast	−0.72 (1.41)	.61	−0.06 (0.69)	.93	−0.3 (0.25)	.22	0.1 (0.26)	.71	−0.23 (0.38)	.54	−0.22 (0.31)	.49
US South	0.54 (1.44)	.71	−0.21 (0.71)	.77	−0.06 (0.25)	.81	−0.06 (0.27)	.82	0.56 (0.39)	.15	0.31 (0.32)	.33
Tobacco smoking history												
Never smoker	Ref		Ref		Ref		Ref		Ref		Ref	
Current smoker	−2.54 (1.57)	.11	−1.06 (0.77)	.17	−0.04 (0.27)	.88	−0.54 (0.29)	.06	−1.24 (0.42)	.003**	0.34 (0.35)	.33
Former smoker	−0.35 (1.12)	.76	−0.1 (0.55)	.85	0.24 (0.19)	.22	−0.43 (0.21)	.037*	−0.13 (0.3)	.65	0.08 (0.25)	.74
# of PCP visits in the last 3 months												
0	Ref		Ref		Ref		Ref		Ref		Ref	
1	−2.23 (1.14)	.05	−1.01 (0.56)	.07	−0.19 (0.2)	.35	−0.23 (0.21)	.28	−0.67 (0.3)	.029*	−0.14 (0.25)	.59
2+	−3.96 (1.52)	.01*	−1.84 (0.74)	.014*	−0.71 (0.26)	.008**	−0.14 (0.28)	.61	−0.76 (0.41)	.06	−0.52 (0.34)	.13
Total comorbidities												
0	Ref		Ref		Ref		Ref		Ref		Ref	
1	−1.06 (1.29)	.41	−0.38 (0.63)	.54	−0.17 (0.22)	.45	−0.24 (0.24)	.31	−0.06 (0.34)	.86	−0.2 (0.29)	.49
2	−1.92 (1.45)	.19	−0.39 (0.71)	.58	−0.39 (0.25)	.12	−0.43 (0.27)	.11	−0.36 (0.39)	.36	−0.35 (0.32)	.27
3+	−2.32 (1.54)	.13	−1.14 (0.75)	.13	−0.04 (0.27)	.88	−0.2 (0.28)	.48	−0.57 (0.41)	.16	−0.37 (0.34)	.28

Table 2. Continued

Characteristic	Overall IIEF β (SE)	P-value	Erectile domain β (SE)	P-value	Orgasm domain β (SE)	P-value	Sexual desire β (SE)	P-value	Intercourse satisfaction β (SE)	P-value	Overall satisfaction β (SE)	P-value
Cannabis use frequency (continuous)*	0.74 (0.32)	.021*	0.24 (0.16)	.12	0.1 (0.06)	.08	0.06 (0.06)	.34	0.17 (0.08)	.04*	0.17 (0.07)	.018*
Cannabis chemovar												
THC dominant	Ref		Ref		Ref		Ref		Ref		Ref	
CBD:THC 1:1	−0.08 (1.16)	.94	0.03 (0.57)	.96	−0.07 (0.2)	.72	0.16 (0.22)	.45	−0.22 (0.31)	.48	0.02 (0.26)	.94
CBD dominant	−1.73 (2.09)	.41	−1.12 (1.02)	.27	−0.01 (0.36)	.97	0.35 (0.39)	.37	−1.35 (0.56)	.016	0.41 (0.47)	.38
The primary method of consumption												
Smoking flower	Ref		Ref		Ref		Ref		Ref		Ref	
Edibles	−2.16 (2.05)	.29	−0.92 (1.01)	.36	−0.3 (0.36)	.41	−0.05 (0.38)	.9	−0.62 (0.55)	.26	−0.28 (0.46)	.55
Smoking concentrates or extracts	−0.55 (1.86)	.77	0.18 (0.91)	.85	−0.56 (0.32)	.09	−0.2 (0.34)	.57	−0.08 (0.5)	.87	0.11 (0.42)	.8
Tincture or oils	0.3 (2.1)	.88	-0.39 (1.03)	.71	0.48 (0.36)	.19	−0.31 (0.39)	.43	0.11 (0.56)	.85	0.41 (0.47)	.38
Vaping	−1 (1.4)	.47	−0.49 (0.69)	.48	0.06 (0.24)	.8	−0.47 (0.26)	.07	−0.35 (0.37)	.35	0.24 (0.31)	.43
Other	−3.55 (2.79)	.2	−1.27 (1.37)	.35	−0.57 (0.48)	.24	−0.79 (0.52)	.13	−0.36 (0.74)	.63	−0.56 (0.62)	.37

US = the United States; PCP = primary care physician; THC = tetrahydrocannabinol; CBD = cannabidiol; IIEF = International Index of Erectile Function.

*$P < .05$, **$P < .01$, ***$P < .001$.

*One-unit increase translates to one additional time using cannabis per week. Comorbidities assessed included hypertension, diabetes, heart disease, arthritis, lung disease, kidney disease, thyroid disease, hypercholesterolemia, cancer, neurologic disease, liver disease, depression, and anxiety.

Table 3. Multivariable logistic regression: identifying factors associated with erectile dysfunction

Characteristic	OR	95% CI	P-value
Age (years)			
<30	Ref		
30—39	0.31	0.09—1.01	.06
40—49	0.41	0.12—1.29	.13
50—59	0.43	0.10—1.63	.22
60+	1.77	0.59—5.51	.32
Race			
White	Ref		
Black/African	2.20	0.61—7.40	.21
Hispanic/Latino	8.51	0.28—2.36	.76
Other	0.83	0.24—2.56	.75
Relationship status			
Married	Ref		
In a relationship	1.33	0.49—3.45	.56
Single	3.21	1.46—7.28	.004**
Home region			
US West	Ref		
International	2.07	0.71—5.95	.18
US Midwest	0.70	0.18—2.41	.59
US Northeast	0.91	0.35—2.31	.84
US South	0.64	0.22—1.73	.39
Tobacco smoking history			
Never smoker	Ref		
Current smoker	2.25	0.79—6.46	.13
Former smoker	8.50	0.40—1.84	.68
# of PCP visits in the last 3 months			
0	Ref		
1	1.41	0.65—3.07	.38
2+	3.35	1.36—8.30	.008**
Total comorbidities			
0	Ref		
1	1.26	0.51—3.19	.62
2	1.91	0.69—5.26	.21
3+	1.84	0.66—5.23	.24
Cannabis use frequency (continuous)*	0.81	0.67—0.98	.03*
Cannabis chemovar			
THC dominant	Ref		
CBD:THC 1:1	1.17	0.52—2.57	.7
CBD dominant	0.68	0.18—2.36	.55
The primary method of consumption			
Smoking flower	Ref		
Edibles	0.89	0.16—3.66	.88
Smoking concentrates or extracts	1.82	0.49—6.00	.34

(continued)

Table 3. Continued

Characteristic	OR	95% CI	P-value
Tincture or oils	1.24	0.31—4.52	.75
Vaping	0.86	0.32—2.23	.77
Other	4.85	0.95—24.28	.053

Comorbidities assessed included hypertension, diabetes, heart disease, arthritis, lung disease, kidney disease, thyroid disease, hypercholesterolemia, cancer, neurologic disease, liver disease, depression, and anxiety.
US = the United States; PCP = primary care physician, THC = tetrahydrocannabinol, CBD = cannabidiol.
*P < .05, **P < .01, ***P < .001.
*One-unit increase translates to one additional time using cannabis per week.

found that there was no association between cannabis use and ED in a bivariate analysis.[18] However, the age of the population may limit the prevalence of sexual dysfunction. In contrast, Elbendary et al found that adult drug use, which mostly consisted of cannabis use in their cohort, was associated with increased odds of ED in multivariable analysis.[19] However, the lack of granularity with regard to the type or frequency of use may have confounded the association between cannabis use and ED. Thus, the literature suggests that the effects of cannabis on sexual function can be either positive or negative and may vary by the dose and frequency of use.

Although we found statistically significant associations between the increasing frequency of cannabis use and increases in the overall IIEF, intercourse satisfaction domain, and overall satisfaction domain scores, the clinical significance of these results is unclear. The minimal clinically important difference for the erectile domain of the IIEF is widely considered to be an increase by 4 points.[20] To our knowledge, however, no other studies have assessed what constitutes a minimal clinically important difference for the overall IIEF or other domain scores. Given the point increases conferred by the increasing frequency of cannabis by 6 additional uses per week ranged from a 4.44-point increase for the overall IIEF to a 0.68-point increase for overall satisfaction, it is likely that these modest increases in the IIEF scores are not clinically significant. At a minimum, these results suggest that the increasing frequency of cannabis consumption does not impair sexual function. Furthermore, our results must not be interpreted as implying a causal relationship between the increased frequency of cannabis use and improved sexual function; rather, the results of the present study simply identify a correlation.

Taken together, our findings suggest that there exists a relationship between the increasing frequency of cannabis use and slight sexual benefit to men in the realms of intercourse satisfaction and overall satisfaction, while the primary method of consumption and chemical composition are not associated with sexual function. The mechanisms underlying sexual enhancement from cannabis use are as yet poorly understood. It is postulated that the aphrodisiac-like properties of cannabis,

including increased sensitivity, sexual satisfaction, and orgasm strength, involve altered perception of the sexual encounter and activation of cannabinoid receptors in the central nervous system.[21] Indeed, a study of noncopulating male rats demonstrated that pharmacologic activation of the central nervous system's endocannabinoid network resulted in sexual behavior in 50% of the population.[22] In humans, a study using functional magnetic resonance imaging revealed that cannabis intoxication modulates the response of the right nucleus accumbens to visual erotic stimuli.[23] The nucleus accumbens is involved in the processing of the rewarding effects of sexual behavior, and activation of dopamine receptors in this brain region is shown to increase sexual motivation even among sexually satiated rodents.[24,25] The cannabinoid composition of consumed cannabis may modulate the effect on sexual behavior, as well. In one study of male mice, chronic CBD exposure resulted in a decreased sexual behavior, as demonstrated by a reduced number of mounts and ejaculations, whereas THC exposure has been linked to a heightened sexual behavior in female mice.[26,27] Ultimately, the effect of cannabis chemovar on sexuality is not well defined and should be further explored. Finally, cannabis use can induce an altered perception of time, potentially leading to artificially prolonged feelings of sexual pleasure and excitement.[28]

This study should be considered in the context of its limitations. First, our cohort is a population of men who made a purchase at a dispensary and represents a select population of cannabis users, which excludes individuals receiving cannabis through other means and therefore may not be generalizable. Indeed, the erectile function scores of men in the present study are higher than what would be expected of a typical cohort of men, roughly half of whom are at least 50 years old. Furthermore, the rates of use in the present study are high, with most men using 6+ times per week. Reassuringly, however, the population is geographically diverse and does not apply to a single region in the US, as can be seen from the home region data in Table 1. Second, there is inherent volunteer bias among men who chose to complete the surgery. Third, although we used a validated questionnaire for erectile function, the responses are still subjective and self-reported, as opposed to objectively measured. Fourth, it is possible that some of the self-reported responses, in particular cannabis chemovar, were inaccurate as the accuracy of self-reporting of chemovar is unknown. Fifth, while the frequency was assessed, the dose of the cannabis chemovar was not assessed in the survey; therefore, it is possible that less-frequent users may have been consuming higher doses. Sixth, the lack of a large, widely representative control group prevents robust comparison between heavy users and nonusers. Finally, although users were asked about their experiences in the last 4 weeks, we did not discriminate between new and chronic users.

CONCLUSIONS

Nevertheless, our results suggest the existence of a relationship between the increasing frequency of cannabis use and increasing

male sexual function, including improved sexual satisfaction and lower prevalence of ED based on the IIEF scores; however, the clinical significance of this remains unclear. Furthermore, any potential benefit of cannabis on sexual function must be considered in the context of a variety of potential adverse effects, including short-term cognitive impairment.[29] No associations were found between the primary method of consumption or cannabis chemovar and male sexual function. While the current report does suggest that cannabis use does not impair sexual function, future studies should continue to examine the cannabis dose, frequency, method of consumption, and cannabis chemovar to determine any therapeutic potential.

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SUPPLEMENTARY DATA

Supplementary data related to this article can be found at https://doi.org/10.1016/j.esxm.2020.06.002.