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Marijuana use and its influence on sperm morphology and motility: identified risk for fertility among Jamaican men

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ABSTRACT

Background: The growing international movement legislating medical marijuana has brought renewed interest to the role of marijuana smoking on fertility potential. Although studies have identified that sperm quality can be compromised by marijuana use, little focus has been placed specifically on those trying to conceive. In this study, we aimed to clarify the impact of marijuana use in semen quality in men being investigated for assisted reproduction.

Materials and methods: We conducted a cross-sectional study at a university-based facility in Jamaica. Routine semen analyses were performed on 229 men ages 23–72 years who were new clients. Logistic regression analyses were performed in order to independently predict quantifiable measures of the impact of marijuana use. The main outcome measures were sperm motility, total motile spermatozoa and morphology.

Results: Overall, 47% of the participants reported marijuana use with 21% of these men reporting recent use. Regression analyses showed that recent use and users of large quantities of marijuana were 2.6 times (aOR = 2.6; 95% CI, 1.0–6.8, $p = 0.044$) and 4.3 times (aOR = 4.3; 95% CI, 1.1–15.9, $p = 0.030$) at greater risk of being diagnosed with abnormal motility (asthenozoospermia). Additionally, moderate quantity users were 3.4 times (aOR = 3.4; 95% CI, 1.5–7.9, $p = 0.004$) more likely to be diagnosed with abnormal morphology (teratozoospermia).

Discussion and conclusion: Recent use of marijuana as well as moderate to large quantities had an impact on sperm motility and morphology in men being investigated for infertility. We recommend therefore that men undergoing fertility investigations be routinely asked about their recreational use of marijuana and in particular recent and heavy users counselled to stop.

INTRODUCTION

Global decline in sperm quality has been reported in the literature (Van Waeleghem *et al.*, 1996; Almagor *et al.*, 2003; Haimov-Kochman *et al.*, 2012) and while this does not necessarily impact the fertility rate, it is of concern for men who have borderline fertility potential (Klonoff-Cohen, 2005). Personal habits in particular recreational substance use have been identified as an important modifiable risk factor (Sadeu *et al.*, 2010; ASRM Practice Committee, 22012).

Cigarette smoking and alcohol consumption have been widely studied with results consistently linking excessive consumption with a modest reduction in semen quality (Trummer *et al.*, 2002; ASRM Practice Committee, 2012). Although studies on the impact of recreational use of marijuana on semen quality and fertility potential are growing (Lewis & Maccarrone, 2009), the findings are not as clear. Some studies have identified a negative impact on sperm quality with marijuana use (Lewis & Maccarrone, 2009) with specific focus on motility (Whan *et al.*, 2006; du Plessis *et al.*, 2015) and morphology (Pacey *et al.*, 2014), and others have suggested that marijuana use attenuates semen quality (Schuel *et al.*, 2002).

The growing international movement legislating medical marijuana in both developing and developed countries has brought a renewed focus on the role of marijuana smoking with fertility potential. In Jamaica, reports indicate up to 30% of the population have used marijuana (Wilks *et al.*, 2008) with the most recent national health and lifestyle survey revealing that 17% of Jamaicans are current users, with the majority being young males (Wilks *et al.*, 2017). Media reports of widespread recreational use in Jamaica (2016, June 29) highlight the need for

studying marijuana intake and quantities consumed. In this study, we aimed to further explore the link between quantified marijuana use with sperm motility and morphology in men being investigated for infertility.

METHODS

Setting and participants

All new male clients over a 2-year period (n = 271) who were referred for infertility investigations to the only university-based Fertility Management Unit (FMU) in Jamaica were invited to participate in the study. Sample size determination was based on the FMU receiving on average 15 semen analysis referrals per month from men in a relationship in which the couple is being investigated for infertility and reports of 17–30% of male clients report using marijuana (Wilks *et al.*, 2008; Wilks *et al.*, 2017). Of the men who were approached, 33 declined to participate and nine (9) were excluded, resulting in a sample size of 229 who provided written informed consent. Exclusion criteria were based on the clinical literature and included men with a self-reported medical history of factors known to affect sperm quality such as past diagnosis of mumps, undescended testes, varicocoele/varicocoele repairs and certain diagnosed sexually transmitted diseases. Of note, physical examinations are not routinely performed prior to semen analyses to rule out other excluding factors such as varicocoeles. Ethical approval for the study was received by the University of the West Indies Ethics Committee.

Instruments and procedures

Data were collected between October 2015 and October 2017. The 12 item close-ended questionnaire on marijuana use developed by the primary investigators (embryologist and psychologist) was designed to assess four indices: history of marijuana use, recent use, frequency and quantity consumed. Additionally, we extracted socio-demographic data and self-reported information on general health, lifestyle (including recent use of cigarettes and alcohol) and reproductive history from the standard registration form for infertility investigations used at the fertility unit. Routine semen analyses were performed according to the techniques outlined by the World Health Organization (WHO, 2010) guidelines: normal motility ≥40% (WHO, 2010); normal total motile sperm count (TMSC) $>20 \times 10^6$ spermatozoa (Hamilton *et al.*, 2015); normal morphology >4% of 200 spermatozoa assessed using Kruger's strict criteria (Kruger *et al.*, 1987). Any semen sample that was <200 spermatozoa was categorized as too low to count (TL) and excluded from morphological analyses (n = 12). Semen analysis was performed independent of knowledge of marijuana use.

Study variables

The main independent variables of interest represented quantifiable measures of marijuana indices: ever used, recent use, frequency and quantity. 'Ever used' defined as regular marijuana use within the past five (5) years was categorized as No or Yes. 'Recent use' defined as marijuana use in less than six (6) weeks (the time in which the half-life of some of the metabolites remain active (Greydanus *et al.*, 2013) was categorized as No or Yes. 'Frequency' was examined in three (3) categories as No/Infrequent (occasional) Use, Frequent Use (at most once or twice weekly) and Very Frequent Use (more than twice weekly/several times a day). Similarly, quantity was examined as follows: No/Minimal (0 < 1 g), Moderate Quantity (1–2 g) and Large Quantity (>2 g).

A summative marijuana index was also created by summing responses for each of the indices to provide a combined marijuana score. This summative score represents all prior defined characterizations of marijuana use – ever used, recent use, frequency and quantity of use. For this summative index, values resulted in the interval 0 to 6 inclusive, of which tertiles were determined and defined as follows: Tertile 1 – combined mild marijuana use; Tertile 2 – combined modest marijuana use and Tertile 3 – combined extensive marijuana use.

Other independent variables used in the statistical analyses related to age, body mass index (BMI), time trying for a baby, previous impregnation and alcohol consumption. Cigarette use was excluded as over 10% of the data were missing. The outcome variables were three seminal parameters: motility (%), total motile spermatozoa (10^6) and morphology (%). These parameters were classified as dichotomies with normal parameters (normozoospermia) and the abnormal parameter: motility <40% (asthenozoospermia); low total motile spermatozoa $\leq 20 \times 10^6$ (abnormal); abnormal morphology <4% (teratozoospermia).

Statistical analyses

Percentages within the sample using marijuana were determined after adjusting for missing data. Preliminary Pearson's chi-squared analyses were performed in order to ascertain independent associations of individual and combined marijuana indices with covariates as well as with the seminal parameters. Binary univariate logistic regression analyses were performed in order to determine the unadjusted odds ratios (unOR) and their 95% confidence intervals (CI) for these associations with the semen variables. To select confounders for the final binary multivariate logistic regression model, a liberal significance value of $p < 0.25$ was used as the criterion. Unadjusted and adjusted analyses of motility and morphology parameters across indices of marijuana use along with previously selected confounders were conducted. p-Values from Wald F-tests were reported. All analyses were performed using SPSS Version 20 statistical software (SPSS, Inc., Chicago, IL, USA) and the results presented with 95% CI at $p < 0.05$.

RESULTS

Table 1 presents key characteristics of the sample. Of the 229 participants who consented, 70% were 40 years or younger with ages ranging between 23 and 72 years (M = 37.63, SD = 7.56). Just below half of the participants reported marijuana use (47%) with 21% reporting recent use. When marijuana indices were combined, 45% (n = 104) were identified as mild users (Tertile 1), 29% (n = 66) were modest users (Tertile 2) and 26% (n = 59) were extensive users (Tertile 3). The majority of the sample were obese or overweight, and consumed alcohol (See Table 1). Additionally, just about half (56%) of the participants had at least one abnormal semen parameter.

The frequency and proportion of socio-demographic characteristics and other clinically relevant criteria of the 229 participants are shown by marijuana use status in Table 2. Participants who regularly used marijuana within the past five (5) years, as well as extensive users (as categorized by the summative marijuana index) were more likely to be <40 years of age, be

Table 1 Distribution of relevant clinical, lifestyle and semen characteristics of the study sample (n = 229)

Characteristics	Percentage
Age group (n = 227)	
>40 years	30.0
BMI (n = 189)	
Overweight/Obese (>24.9)	63.5
Time trying for a baby (n = 204)	
>1 year	69.1
Previous impregnation (n = 227)	
Had no previous impregnation	38.3
Alcohol consumption (n = 228)	
Consumes alcohol	64.9
Abnormal semen parameters	
Motility (n = 220)	
Asthenozoospermia (<40%)	18.2
Total motile spermatozoa (n = 220)	
Low total motile spermatozoa (≤20 M)	46.8
Morphology (n = 212)	
Teratozoospermia (<4%)	29.2
Too low for morphological analysis	5.7
Marijuana usage	
Regular marijuana use (n = 229)	
Ever used	46.7
Recent marijuana use (n = 229)	
Recent use (<6 weeks)	20.5

overweight or obese and consume alcohol (Table 2). Additionally, those who used marijuana recently were also more likely consumers of alcohol (Table 2). Results of chi-squared associations between marijuana use and semen parameters are reported in Table 3. The only significant difference noted was between normal and abnormal morphology and those who regularly used marijuana (Table 3).

Identified risk factors for semen parameters are shown in Tables 4 and 5. A liberal $p \leq 0.25$ was used to select covariates for the final regression models. When logistic regression was performed, those who used marijuana regularly were 60% less likely to be categorized with abnormal morphology (teratozoospermia) (unOR = 0.4; CI: 0.2–0.8, $p = 0.009$). Further, time trying for a baby, previous impregnation and alcohol consumption were associated with all semen parameters measured while age was associated with motility only (Tables 4 and 5).

Results of adjusted regression models reported in Table 6 revealed improved statistical significance in associations with marijuana use and abnormal motility and morphology; when compared to a non-recent user, the odds were 2.6 times greater for a recent user (95% CI: 1.0–6.8) and 4.3 times greater for users of large quantities (95% CI: 1.1–15.9) to have abnormal motility (asthenozoospermia). A significant relationship was also found for sperm morphology with moderate quantity use (95% CI: 1.58–7.9). However, we also identified an inverse relationship with sperm morphology and those who regularly used marijuana (Table 6).

DISCUSSION

This is the first study looking at the impact of smoking marijuana on the sperm quality in an Afro-Caribbean sample. In persons seeking infertility investigations, we found recent use and moderate to large quantities of marijuana along with fertility risk factors reduced sperm motility and morphology. We also found that marijuana users were comparatively younger, more likely to consume alcohol and had a higher BMI. Further, our findings that older males, those with a history of no previous pregnancy and difficulty with conception support previous studies identifying these factors as independently associated with poor sperm quality (Eimers *et al.*, 1994; Verón *et al.*, 2018).

It is interesting that the impact of marijuana on morphology and motility was only seen in the presence of other fertility-related factors, in that difficulty with conception in marijuana users seemed to have exacerbated abnormal morphological findings. Lewis *et al.* (2012) found significant differences in the endocannabinoid system (ECS) of fertile and infertile men which may lend support to possible downstream effects of recreational marijuana use on sperm quality. Further, as increased age along with a compromised fertility history contributed to a negative impact of marijuana use on motility, this may speak to additional age-related differences in the ECS system. It could be suggested therefore that men with compromised fertility are susceptible to the negative effects of marijuana consumption. Case–control

Table 2 Characteristics of the study participants by marijuana use

	Ever used marijuana			Recent marijuana use			Combined marijuana use			
	No (n = 122) %	Yes (n = 107) %	p-Value	No (n = 182) %	Yes (n = 47) %	p-Value	Mild use (n = 104) %	Modest use (n = 66) %	Extensive use (n = 59) %	p-Value
Age group										
≤40 years (n = 159)	63.6	77.4	0.024*	68.0	78.3	0.173	64.1	65.2	86.2	0.008**
40 years (n = 68)	36.4	22.6		32.0	21.7		35.9	34.8	13.8	
BMI										
18.5 ≥ BMI ≤ 24.9: Normal (n = 69)	29.1	45.3	0.021*	33.6	48.6	0.087	25.6	44.4	48.9	0.011*
BMI ≥ 25: Overweight/Obese (n = 120)	70.9	54.7		66.4	51.4		74.4	55.6	51.1	
Time trying for a baby										
≤1 year (n = 63)	31.5	30.2	0.844	31.1	30.2	0.917	31.2	30.5	30.8	0.996
> 1 year (n = 141)	68.5	69.8		68.9	69.8		68.8	69.5	69.2	
Previous impregnation										
Had previous impregnation (n = 140)	61.7	61.7	0.998	60.6	66.0	0.498	61.8	56.1	67.8	0.403
Had no previous impregnation (n = 87)	38.3	38.3		39.4	34.0		38.2	43.9	32.2	
Alcohol consumption										
Does not consume alcohol (n = 80)	43.4	25.5	0.005**	39.0	19.6	0.014*	47.1	24.2	25.9	0.002**
Consumes alcohol (n = 148)	56.6	74.5		61.0	80.4		52.9	75.8	74.1	

*p <0.05; **p <0.01

Table 3 Percentage difference between normal and abnormal semen parameters and marijuana use

	Motility (n = 220)			Total motile sperm count (n = 220)			Morphology (n = 200)		
	Normal (≥40%) (n = 180)	Abnormal (<40%) (n = 40)	p-Value	Normal (>20 M) (n = 117)	Abnormal (≤20 M) (n = 103)	p-Value	Normal (≥4%) (n = 138)	Abnormal (<4%) (n = 62)	p-Value
Ever used marijuana									
No	53.3	55.0	0.848	49.6	58.3	0.198	49.3	69.4	0.008**
Yes	46.7	45.0		50.4	41.7		50.7	30.6	
Recent marijuana use									
No	80.6	75.0	0.431	78.6	80.6	0.720	78.3	82.3	0.517
Yes	19.4	25.0		21.4	19.4		21.7	17.7	
Frequency of marijuana use									
No use/Infrequent use	77.2	72.5	0.816	71.8	81.6	0.215	73.9	75.8	0.960
Frequent use	10.6	12.5		13.7	7.8		12.3	11.3	
Very frequent use	12.2	15.0		14.5	10.7		13.8	12.9	
Quantity of marijuana use									
No use/Minimal qty. (0 < 1 g)	65.0	60.0	0.834	62.4	66.0	0.372	68.1	54.8	0.170
Moderate qty. (1–2 g)	24.4	27.5		23.9	26.2		21.0	32.3	
Large qty. (>2 g)	10.6	12.5		13.7	7.8		10.9	12.9	
Combined marijuana use									
Mild use	45.0	47.5	0.885	42.7	48.5	0.083	44.9	50.0	0.578
Modest use	28.9	25.0		24.8	32.0		25.4	27.4	
Extensive use	26.1	27.5		32.5	19.4		29.7	22.6	

*p <0.01

Table 4 Unadjusted odds ratios for simple logistic regression analyses to identify risk factors for semen parameters

	Abnormal motility (Asthenozoospermia) (n = 220)			Abnormal total motile spermatozoa (n = 220)			Abnormal morphology (Teratozoospermia) (n = 200)		
	unOR	95% CI	p-Value	unOR	95% CI	p-Value	unOR	95% CI	p-Value
Ever used marijuana									
No									
Yes	0.9	[0.5, 1.9]	0.848	0.7	[0.4, 1.2]	0.198	0.4	[0.2, 0.8]	0.009[a]
Recent marijuana use									
No									
Yes	1.4	[0.6, 3.1]	0.432	0.9	[0.5, 1.7]	0.721	0.8	[0.4, 1.7]	0.518
Frequency of marijuana use									
No use/Infrequent use									
Frequent use	1.3	[0.4, 3.7]	0.669	0.5	[0.2, 1.2]	0.132	0.9	[0.3, 2.3]	0.816
Very frequent use	1.3	[0.5, 3.5]	0.595	0.6	[0.3, 1.5]	0.296	0.9	[0.4, 2.2]	0.844
Quantity of marijuana use									
No use/Minimal qty. (0 < 1 g)									
Moderate qty. (1–2 g)	1.2	[0.6, 2.7]	0.625	1.0	[0.6, 1.9]	0.913	1.9	[1.0, 3.8]	0.067
Large qty. (>2 g)	1.3	[0.4, 3.8]	0.651	0.5	[0.2, 1.3]	0.181	1.5	[0.6, 3.8]	0.420
Combined marijuana use									
Mild use									
Modest use	0.8	[0.4, 1.9]	0.643	1.1	[0.6, 2.1]	0.690	1.0	[0.5, 2.0]	0.937
Extensive use	1.0	[0.4, 2.3]	0.996	0.5	[0.3, 1.0]	0.060	0.7	[0.3, 1.4]	0.315

[a]$p \leq 0.05$.

studies are needed to clarify the possible mechanism by which recreational marijuana use influences the ECS in the infertile male.

Few studies have previously examined recreational marijuana use on semen quality in men being investigated for infertility and their focus was on morphology (Pacey *et al.*, 2014). Further, marijuana use which the researchers classified as use within 3 months or none at all (Pacey *et al.*, 2014) may not have captured more recent effects of the active metabolites within the reproductive system. In our study, we further quantified use to better capture recency, however, consumption modified by quantity negatively impacted morphology and not recent use. We also found that men who regularly used marijuana were at no greater impaired risk than those who did not use. This unexpected finding may speak to the varying effects of agonists on the ECS as demonstrated by in vitro studies (Schuel *et al.*, 2002; Aquila *et al.*, 2010).

In addition, past studies have shown that components of the ECS are found directly on the spermatozoa itself (du Plessis *et al.*, 2015). Specifically, downstream signalling through the CB1 receptor was shown to inhibit motility (du Plessis *et al.*, 2015) and may explain why we found recent use and large consumption negatively impacted motility. Moreover, in vitro findings by Whan *et al.* (2006), which showed that recreational levels of delta-9-tetrahydrocannabinol (Δ9-THC) decrease sperm motility, lend support to our findings.

Table 5 Unadjusted odds ratios for simple logistic regression analyses to identify risk factors for semen parameters

	Abnormal Motility (Asthenozoospermia) (n = 220)			Abnormal Total Motile Spermatozoa (n = 220)			Abnormal Morphology Teratozoospermia (n = 200)		
	unOR	95% CI	p-Value	unOR	95% CI	p-Value	unOR	95% CI	p-Value
Age group									
≤40 years									
>40 years	1.9	[1.0, 4.0]	0.065**	1.2	[0.7, 2.1]	0.592	1.3	[0.7, 2.4]	0.462
BMI									
18.5 ≤ BMI≤ 24.9: Normal									
BMI ≥ 25: Overweight/Obese	0.8	[0.3, 1.7]	0.530	1.2	[0.7, 2.2]	0.526	0.9	[0.4, 1.8]	0.694
Time trying for a baby									
≤1 year									
>1 year	2.0	[0.8, 5.0]	0.117**	1.7	[0.9, 3.1]	0.096*	2.3	[1.0, 5.2]	0.044*
Previous impregnation									
Had previous impregnation									
Had no previous impregnation	3.2	[1.6, 6.5]	0.001*	1.8	[1.0, 3.1]	0.047*	1.6	[0.8, 2.9]	0.155*
Alcohol consumption									
Does not consume alcohol									
Consumes alcohol	0.4	[0.2, 0.8]	0.007*	0.6	[0.3, 1.0]	0.055*	0.4	[0.2, 0.8]	0.007*

*$p \leq 0.05$. **$p \leq 0.25$.

Table 6 Adjusted odds ratios for multiple logistic regression analyses for sperm parameters

	Abnormal motility (Asthenozoospermia) (n = 192)			Abnormal total motile sperm count (n = 193)			Abnormal morphology (Teratozoospermia) (n = 173)		
	aOR[a]	95% CI	p-Value	aOR[b]	95% CI	p-Value	aOR[b]	95% CI	p-Value
Ever used marijuana									
No									
Yes	1.5	[0.6, 3.3]	0.371	0.8	[0.5, 1.5]	0.527	0.4	[0.2, 0.9]	0.022*
Recent marijuana use									
No									
Yes	2.6	[1.0, 6.8]	0.044*	1.0	[0.5, 2.1]	0.943	0.7	[0.3, 1.7]	0.447
Frequency of marijuana use									
No use/Infrequent use									
Frequent use	2.4	[0.7, 7.9]	0.166	0.6	[0.2, 1.7]	0.371	1.0	[0.4, 3.0]	0.962
Regular use	3.0	[0.9, 10.0]	0.070	0.9	[0.4, 2.2]	0.838	1.3	[0.5, 3.6]	0.636
Quantity of marijuana use									
No use/Minimal qty. (0 < 1 g)									
Moderate qty. (1–2 g)	1.7	[0.7, 4.5]	0.259	1.0	[0.5, 2.0]	0.981	3.4	[1.5, 7.9]	0.004*
Large qty. (>2 g)	4.3	[1.1, 15.9]	0.030*	0.9	[0.3, 2.4]	0.777	2.3	[0.7, 7.5]	0.153
Combined marijuana use									
Mild use									
Modest use	1.0	[0.3, 2.6]	0.922	1.0	[0.5, 2.0]	0.984	1.2	[0.5, 2.8]	0.659
Extensive use	2.2	[0.8, 6.0]	0.121	0.7	[0.3, 1.4]	0.273	1.0	[0.4, 2.2]	0.906

[a]Odds ratios were adjusted for age group, time trying for a baby, previous impregnation and alcohol consumption. [b]Odds ratios were adjusted for time trying for a baby, previous impregnation and alcohol consumption. *$p < 0.05$, **$p < 0.01$.

The recent relaxation of the Dangerous Drugs (amendment) Act 2015 in Jamaica [The Ministry of Justice (Jamaica),], whereby a person is permitted a limited small quantity of marijuana for personal use, has raised concern of more visible and public display of young men openly smoking (The Sunday Gleaner 2016, June 29); a similar concern has been raised relating to the legalizing of medical marijuana worldwide (Phillips *et al.*, 2015; Salas-Wright *et al.*, 2017). Further, with the most recent national health and lifestyle survey in Jamaica reporting that males in their reproductive years are the majority to use marijuana (Wilks *et al.*, 2017), highlights the need for large-scale population studies to clarify reproductive risks of marijuana use.

Our study concentrated on smoking and not on other forms of cannabis use such as edibles and tea drinking, which may deliver to the body cannabinoids without the tar and other potential carcinogenic compounds. An area of future research can be to examine how, if any, the extracted cannabinoids used for medicinal purposes impact sperm parameters and male fertility. Future studies could also aim to capture a more objective assessment of use by measuring the primary psychoactive cannabinoid present in marijuana, Δ9-THC, and other active metabolite levels in blood or urine.

Some possible limitations of our study design warrant mention. The results cannot be generalized to the wider population, as our study was confined to men seeking investigations for infertility. Although our attempts at quantifying recreational marijuana use revealed a link between degree of use and sperm quality, this measure has not been validated. We

were restricted in the information we could gather on other recreational substance use as these items were extracted from a standard intake form. Thus, we were unable to analyse cigarette use because of too many missing data and findings on alcohol consumption and semen quality were unexpected as they did not show a deleterious effect. While this finding may be spurious or attributed to inadequate data collecting using routine intake, some large multi-centre studies investigating men with infertility have shown that both cigarette and alcohol use have little effect on sperm parameters for that population (de Jong *et al.*, 2014; Pacey *et al.*, 2014). Self-reporting of medical conditions and the lack of a physical examination as an exclusion measure must also be taken into account as underlying anatomical abnormalities, such as varicocoeles, which could have compromised semen quality may have gone undetected. However, large-scale (n = 9038) and multi-site studies (34 centres) in which varicocoele was physically examined revealed no association with motility or morphology (WHO, 1992; Pallotti *et al.*, 2018).

In conclusion, we extended previous studies looking at recreational substance use in men being investigated for infertility by capturing a more detailed account of marijuana use and expanded the semen parameters investigated. The findings suggest that men with compromised fertility may be more susceptible to the negative effects of marijuana consumption than men with no identified fertility risk. As motility and morphology are two significant determinants of conception (Tardif *et al.*, 2014; García-Vázquez *et al.*, 2016), this study underscores the clinical relevance of screening for marijuana use to help guide treatment decisions in men or couples with subfertility concerns. We recommend that men being treated for infertility be routinely asked about the practice of smoking marijuana and in particular recent and heavy users counselled to stop.

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CONFLICT OF INTEREST

The authors have no conflict of interest to disclose.

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