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User characteristics and effect profile of Butane Hash Oil: an extremely high-potency cannabis concentrate

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Background: Recent reports suggest an increase in use of extremely potent cannabis concentrates such as Butane Hash Oil (BHO) in some developed countries. The aims of this study were to examine the characteristics of BHO users and the effect profiles of BHO.

Design: Anonymous online survey in over 20 countries in 2014 and 2015. Participants aged 18 years or older were recruited through onward promotion and online social networks. The overall sample size was 181,870. In this sample, 46% (N = 83,867) reported using some form of cannabis in the past year, and 3% reported BHO use (n = 5,922).

Measurements: Participants reported their use of 7 types of cannabis in the past 12 months, the source of their cannabis, reasons for use, use of other illegal substances, and lifetime diagnosis for depression, anxiety and psychosis. Participants were asked to rate subjective effects of BHO and high potency herbal cannabis.

Findings: Participants who reported a lifetime diagnosis of depression (OR = 1.15, p = .003), anxiety (OR = 1.72, p < .001) a larger number of substance use (OR = 1.29, p < .001) were more likely to use BHO than only using high potency herbal cannabis. BHO users also reported stronger negative effects and less positive effects when using BHO than high potency herbal cannabis (p < .001)

Conclusion: Mental health problems and other illicit drug use were associated with use of BHO. BHO was reported to have stronger negative and weaker positive effects than high potency herbal cannabis.

KEY WORDS: [cannabis concentrate, potency, butane hash oil, THC, user characteristics, profile]

1 Introduction

Cannabis is the most widely used illicit substance globally and this is particularly the case in developed countries. For example, the prevalence of past year cannabis use is 13%, 10% and 12% in the US (SAMHSA, 2014), Australia (AIHW, 2014) and Canada (Rotermann & Langlois, 2015) respectively. There is also evidence that cannabis use has spread to low- and middle-income countries, with a reported prevalence of 7.5% in African countries (UN Office on Drugs and Crime, 2015).

Cannabis users often report relaxation, euphoria, increased sociability and sexual pleasure as the main positive effects (Green et al., 2003). These effects are largely attributable to delta-9-tetrahydrocannabinol (THC), the primary psychoactive constituent in cannabis, but they may also be modulated by cannabidiol (CBD) (Curran et al., 2016; Englund et al., 2017; Iversen, 2001). Cannabis potency is usually defined by THC content, which varies by preparation type (for example, resin, oil or herbal), strain of cannabis and method of cultivation. In 2008, the domestic UK market was dominated by high potency, indoor-grown varieties (e.g. skunk, sensimilla) which contain the highest THC content (approximately 15%), followed by outdoor-grown herbal cannabis (9%) and hash/resin (5%) (Hardwick & King, 2008). Similar results were found for cannabis obtained from UK cannabis users in a naturalistic setting (Freeman et al., 2014), but recent monitoring data are lacking (Freeman & Swift, 2016). In the Netherlands, popular indoor grown herbal cannabis increased in THC content from 9% in 2000 to 20% in 2004 (Pijlman et al., 2005) before decreasing to 15% in 2015 (Niesink et al., 2015). Data from drug enforcement agency seizures (ElSohly et al., 2016) indicated high potency herbal cannabis has become increasingly prevalent in the USA with the overall potency of illicit cannabis rising from 4% in 1995 to 12% in 2014. Based on the results of a single study, the Australian cannabis

market is similarly dominated by high potency herbal cannabis containing approximately 15% THC (Swift et al., 2013). There is some evidence that use of high potency herbal cannabis (e.g. skunk, sensimilla) is associated with greater harms (Hall & Degenhardt, 2015), including higher levels of dependence (Freeman & Winstock, 2015) and an increased risk of developing a psychosis (Di Forti et al., 2015).

More efficient methods of hash/resin production have also been used to produce higher potency products (e.g. 30-40% THC in the United States and Netherlands) (ElSohly et al., 2016; Niesink et al., 2015). Recently, new refined cannabis products with unprecedentedly high THC content (cannabis concentrates) have received increased media coverage in the US (Cavazos-Rehg et al., 2016; Daniulaityte et al., 2015; Stogner & Miller, 2015a, 2015b). Their production appears to have been driven by growth in the medicinal cannabis industry in the US, with the intention of allowing users to limit their exposure to smoked herbal products by using smaller doses of more potent cannabis extracts. Butane Hash Oil (BHO) is one example, commonly referred to as "earwax", "dabs", "butter" and "shatter". It can be prepared through a process called blasting, which involves passing butane through a steel or glass tube packed with dried cannabis trimmings to dissolve the THC. The butane-THC solution is then filtered and BHO obtained by evaporating the butane (Stogner & Miller, 2015b). Alternative methods of extraction include different solvents (e.g. propane) or carbon dioxide extraction. These new methods can produce "cannabis concentrates" with THC content as high as 76% (Raber et al., 2015). The maximum THC content achievable using these new extraction techniques exceeds more traditional methods (e.g. dry extraction to 'kief', water extraction to 'bubble hash') (Raber et al., 2015) and is considerably stronger than high potency herbal cannabis (e.g. 15%). Cannabis concentrate users often obtain a very high dosage of THC in a single hit through a process

known as "dabbing", in which they heat up the product with a blow torch and inhale the vapor via a bong or oil pipe. With e-cigarettes becoming more popular and accessible, a small but significant number of young people report using e-cigarettes to vaporize liquid hash oil (Morean et al., 2015). Additional concerns are that the solvent-based extraction methods (e.g. BHO) pose a significant risk of explosion and associated injury or death during production (Crawford, 2016; Jensen, Bertelotti, et al., 2015). They also leave residual solvents in the final product (Raber et al., 2015). These concerns may be offset by using different extraction methods (e.g. carbon dioxide), but the prevalence of use of these respective methods is currently unclear.

The high THC content in cannabis concentrates and the rapid ingestion of THC might be associated with higher level of dependence, stronger withdrawal and the swifter development of tolerance (Loflin & Earleywine, 2014). While the long term effects of cannabis concentrates such as BHO use are largely unknown, a recent study suggests that their use may heighten short term harms and produce more extreme acute effects, such as fainting (Miller et al., 2016). Use of concentrates has also been associated with an increased incidence of orthostatic hypotension leading to falls and injuries and emergency department visits for burns from explosions caused by overheated elements in "vape pens" (Russo, 2016).

There are other health risks associated with concentrates. A recent study found that up to 70% of pesticide residues may be recruited into the smoked product (Sullivan et al., 2013) even in concentrates produced industrially for markets in US states where use is legal (Russo, 2016). Along with the increased popularity of e-cigarettes and vaping devices, there is an emerging trend for young people to use these devices to vaporise cannabis concentrate (Morean et al., 2015). This might add extra health risk because data from e-cigarette research has shown that the solvents propylene glycol and glycerine, when overheated can produce formaldehyde, a known

carcinogen (Jensen, Luo, et al., 2015). This finding has been confirmed in studies of thinning

agents used by cannabis oil commercial producers in Colorado (Troutt & DiDonato, 2017).

Users also described a qualitative difference between the effects of BHO and traditional herbal

cannabis, with the high produced from BHO more like that achieved by using "harder" drugs

(Miller et al., 2016). Despite public health concerns about the recent popularity of BHO and

other high potency extracts, there is limited research on their effects. To date the few published

studies have been limited by small sample sizes, and these have not yet adequately characterized

users. The aims of this study were to examine the profile and characteristics of BHO users, and

to compare the effect profiles of BHO and high potency herbal cannabis in a very large sample

of drug users recruited in the Global Drug Survey (GDS) in 2015 and 2016.

2   Methods

2.1 Sample

GDS is the largest annual survey of drug use in the world. It uses anonymous, encrypted

online survey methods to provide rapid access to very large numbers of sentinel drug-using

populations (Winstock et al., 2015). As such it is a useful tool for identifying new trends in drug

use, drug-related harms and routes of administration (Barratt et al., 2017; Hindocha et al., 2016;

Winstock et al., 2011). Data from GDS 2015 and GDS 2016 were used for this study. The

overall sample size after data cleaning was 181,870. Sixty three percent of the participants were

males and the mean age was 29.01 (SD = 11.38; Median: 25). Among this sample, 46% (n =

83,867) reported using some form of cannabis in the past year, and 3% reported BHO use (n =

5,922).

2.2 Procedure

GDS 2015 and GDS 2016 were launched in November 2014 and 2015 respectively

through global media partners. Participants were recruited through onward promotion and online

social networks on websites including The Guardian, Vice, Ziet-on-Line, Liberation, Fairfax

Media in Australia and New Zealand and other international publications. The survey was

translated into 10 languages and has partners in over 20 countries. All participants confirmed that

they were aged ≥16 years, and consented for the information they gave to be analysed. Ethical

approval was received from the joint South London and Maudsley and Institute of Psychiatry,

Psychology and Neuroscience National Health Service (NHS) Research Ethics Committee.

2.3 Measures

Cannabis use. Participants were shown pictures of seven forms of cannabis products,

including indoor grown high potency herbal cannabis, resin/ hash, outdoor grown herbal weed/

bush/ pressed, edible cannabis, kief, oil and BHO. Self-reported measures of cannabis type have

previously been validated against objective THC and CBD content (Freeman et al., 2014; van der

Pol et al., 2013). Pictorial aids were used to improve their acceptability among an international

sample with diverse cannabis terminology (Potter & Chatwin, 2012). Participants were asked to

indicate which types of cannabis they had used in the last 12 months, and were then assigned to

four cannabis user groups, *1) Non-user (NON)*, *2) Cannabis user – No high potency herbal

cannabis and BHO use (CANN)*, *3) High potency herbal cannabis users with no BHO use (HI-

POT)*, and *4) BHO users.* These categories were mutually exclusive. Table 1 shows the types of

cannabis used by the four groups. For participants who classified as CANN, 95% used normal

weed and none used high potency herbal cannabis or BHO; for participants who were HI-POT,

all of them used high potency herbal cannabis but no BHO use; BHO users tended to use a wide

range of cannabis products.

Source of cannabis was assessed using the items "How do you acquire your cannabis?" with the following response items: "I buy it", "I grow it" and "I get it on prescription". These responses were not mutually exclusive. For *reasons of use*, participants were asked to choose one of the following reasons "I use cannabis exclusively for recreational (pleasure) purposes", "I use cannabis sometimes for medical reasons and most of the time for recreational purposes", "I use cannabis most of the time for medical reasons and sometimes for recreational purposes" and "I use cannabis exclusively for medical reasons". The subjective effects of BHO and high potency herbal cannabis were measured using 20 items on a 10-point scale (From 1 "Least" to 10 "Maximum"). Example items were "How strong would you rate this type of cannabis overall?" and "How would you rate its overall pleasurable effects?" Only data from participants who reported both BHO and high potency herbal cannabis use were included in the comparison of subjective effects.

Other drug use. Participants were given a list of drugs, including MDMA, Cocaine, Amphetamine/ Methamphetamine, Heroin and LSD, and were asked to indicate if they had used each of them in the past 12 months. *Mental Health.* Participants were asked to indicate if they had received a diagnosis for depression, anxiety and/or psychosis in their lifetime.

2.4 Analysis

Comparisons of types of cannabis users and their demographic variables, mental health variables, other substance use variables, source of cannabis and reasons for use were performed using chi-square tests and ANOVAs. Two multinomial logistic regressions examined the adjusted associations between these variables and group membership. The reference groups in these two models were *CANN* and *HI-POT* respectively. Missing data were accounted for by multiple imputation. Five datasets were imputed to fill in missing values in the data (Rubin,

2009). Paired-sample t-tests were used to compare the subjective effects of high potency herbal cannabis and BHO in those participants who reported use of both types of cannabis. All analyses were done in STATA 13 (StataCorp, 2013).

3   Results

Table 2 shows the demographic profiles of different types of cannabis users. BHO users were younger, more likely to be male, less likely to have attained a higher education, less likely to be heterosexual, and more likely to use cannabis daily/almost daily, than non-users and cannabis users who had not used high potency cannabis use or BHO ($p < .001$).

Tables 3 shows the substance use, mental health and reason for use profiles of BHO users. They were more likely to use MDMA, cocaine, amphetamine/methamphetamine, heroin and LSD ($p < .001$) and were more likely to report a lifetime diagnosis of psychosis, depression and anxiety ($p < .001$). BHO users were more likely to have obtained their cannabis through prescription and to report using cannabis for medical purposes. Both high potency herbal cannabis users and BHO users were also more likely to report growing and purchasing their cannabis.

Table 4 shows the results from multinomial logistic regressions. Compared to *CANN*, participants who were male, OR = 3.07, $p < .001$, transgender, OR = 2.14, $p < 001$, bisexual, OR = 1.19, $p < .001$, had lifetime diagnosis for depression, OR = 1.34, $p < .001$ and anxiety, OR = 1.80, $p < .001$, and used a large number of substances, OR = 1.66, $p < .001$ were more likely to be BHO users. Having a higher level of education ($p < .001$) and being younger, OR = 0.99, $p < .001$ were associated with a lower likelihood of BHO use.

Compared to *HI-POT* users (Last 2 columns in Table 4), participants who were older, OR = 1.01, $p < .001$, male, OR = 1.48, $p < .001$, bisexual, OR = 1.22, $p < .001$, had lifetime diagnosis of depression, OR = 1.15, $p = .003$ and anxiety, OR = 1.72, $p < .001$, and used a larger number of illicit substances, OR = 1.29, $p < .001$, were more likely to be BHO users. Having a higher level of education was associated with a lower likelihood of BHO use, $p < .001$.

Table 5 shows the effect profiles of BHO and high potency herbal cannabis. Users of both types of cannabis generally reported that BHO was stronger than high potency herbal cannabis and they reported more negative and fewer positive effects when they used BHO.

4 Discussion

In the largest study to date, we found that BHO use was strongly associated with higher rates of self-reported anxiety and depression and other illicit drug use than high-potency herbal cannabis. BHO users were more likely to have a lower education level and to be bisexual. These results were generally consistent with previous research showing that users of more potent form of cannabis (higher level of THC) experienced higher level of harms, such as a stronger association between high potency cannabis and psychosis (Di Forti et al., 2015), and higher levels of cannabis dependence (Freeman & Winstock, 2015).

We found a significant association between cannabis potency and mental health profiles. Participants with a lifetime diagnosis of depression were 1.18 more likely to use high-potency herbal cannabis and 1.34 more likely to use BHO. A similar pattern was found for anxiety. Although participants with a diagnosis of anxiety were no more likely to use high potency herbal cannabis, they were 1.80 times more likely to use BHO. BHO use was not associated with lifetime diagnosis of psychosis but this non-significant result should be interpreted with caution

because the rate of psychosis in the sample was very low. Consistent with previous research (Di Forti et al., 2015), use of high-potency herbal cannabis was associated with a greater incidence of psychosis than use of less potent forms of cannabis and no cannabis use.

Our study was cross-sectional and so causality cannot be inferred. It is possible that participants with a worse mental health profile may use BHO to self-medicate symptoms of depression and anxiety (Hall & Degenhardt, 2015). Our finding that BHO users were much more likely to report using cannabis for medical purposes and to obtain their cannabis via prescription was consistent with this self-medication hypothesis. However, the relationship between BHO use and poorer mental health may also be bidirectional. While using cannabis with high THC content may improve mood in the short term, it could exacerbate users' symptom in long term (Hall & Degenhardt, 2015). It may also be that people who use cannabis to treat medical conditions are themselves more likely to report poorer mental health, given the association between chronic physical illness and poorer mental health (De Hert et al., 2011). Further research is needed to determine the incidence of adverse effects of BHO for medical use.

A previous qualitative study found that BHO users were enthusiastic about its effects which they reported as positive and pleasurable (Miller et al., 2016). However, that study was limited by a small sample size (n=6) and only included people involved in treatment for drug-involved offences. By contrast, our large global dataset on participants who had experience with both BHO and high potency herbal cannabis showed that the effect profiles of BHO and high potency herbal were similar but BHO users generally reported more negative experiences, such as being more restless and anxious, and more forgetful when stoned. They also reported fewer positive experiences with BHO, such as feeling less pleasure and less relaxed. Interestingly, the largest difference we found was a lower 'urge to use more when stoned' for BHO than for high

potency herbal cannabis. This finding is consistent with human and animal data suggesting that extremely high doses of THC are less reinforcing (and can be more aversive) than moderately high doses (Curran et al., 2016).

There are several limitations in the current study. Firstly, our sample is a non-probability sample. However, the web-based method used in the GDS was an efficient way of gaining in-depth knowledge of drug use behaviours, and this is best suited to the comparison of use patterns and harms between population sub-segments. While this method allowed us to recruit a large sample who reported BHO use, this might limit the generalizability of our findings to the general population. However, it should be noted that prevalence of BHO use in the general population was low, and the cost of undertaking a general population survey to obtain a comparable sized sample would be prohibitively high. Our sample was from a sentinel drug-using population and provided important information about the characteristics of BHO users. Second, our study was based on cross-sectional self-reported survey, and therefore, causality cannot be inferred. In common with most online surveys, we were not able to assess the mental condition of the participants at the time of the survey, and we were not able to check if the participants gave consent under the influence of any substance. However, since the survey is completely anonymous and participants can withdraw from the study anytime by closing their web browser, there would be minimal risks to the participants. Thirdly, we focused on a single extraction technique (butane) and did not address alternative methods such as carbon dioxide (Raber et al., 2015). We selected BHO as it has been most frequently reported form in the literature to date, and we specifically asked users whether they had used this particular product. However it is possible that some users were unaware of the extraction technique used; some of our BHO sample may have used concentrates that were extracted using alternative methods. Nevertheless,

our cannabis questions (seven different cannabis products, each depicted by text and image) is the most comprehensive we are aware of to date and it excluded alternatives such as traditional cannabis oil and dry extract (kief). Finally, we were unable to verify cannabinoid doses in BHO and other forms of cannabis. This is an important issue, because higher potency cannabis products could potentially reduce respiratory harms if users are able to adjust (titrate) the amount they use. There is some evidence for titration with traditional forms of cannabis, although this is not of sufficient magnitude to entirely offset the increased dose of THC received when using higher potency products (Freeman et al., 2014; van der Pol et al., 2013).

5   Conclusion

BHO is a form of refined cannabis product with a very high level of THC, the primary psychoactive ingredient in cannabis. This is the largest study of BHO users to date and the first to examine BHO user profiles. Although use was reportedly more common among those who used it for medical reasons, it was also associated with poorer mental health and greater use of other illicit substances. BHO was also reported to produce stronger negative and weaker positive effects than traditional high potency cannabis.

6 Acknowledgements

Table 1. Types of cannabis used by different types of cannabis users.

	Non-user (N = 98,003)		Cannabis user - No high potency herbal cannabis and BHO use (N = 25,371)		High potency herbal cannabis users, no BHO use (N = 52,574)		BHO users (N = 5,922)	
	N	%	N	%	N	%	N	%
High potency herbal cannabis	-	-	0	0	52574	100.00	5676	95.85
Resin/ Hash	-	-	10278	40.51	32619	62.04	4485	75.73
Normal weed	-	-	24129	95.10	45104	85.79	4619	78.00
Edibles Group	-	-	4992	19.68	17870	33.99	4321	72.97
Kief Group	-	-	1179	4.65	11735	22.32	4005	67.63
Oil Group	-	-	692	2.73	4039	7.68	3720	62.82
Butane hash oil	-	-	0	0	0	0	5922	100.00

Table 2. Profiles of different cannabis users (Demographic).

Demographic	Non-user		Cannabis user - No high potency herbal cannabis and BHO use		High potency herbal cannabis users, no BHO use		BHO users		
	N	%	N	%	N	%	N	%	Chi-sq
Gender									
Female	41,401	42.96	9,924	39.69	12,880	24.91	1,127	19.49	5567***
Male	54,576	56.63	14.962	59.84	38,582	74.63	4,618	79.85	
Transgender	398	0.41	117	0.47	238	0.46	38	0.66	
Education									
Below high school	12978	13.58	3280	13.29	9423	18.51	1467	26.21	4413***
Finish high school	13091	13.70	4644	18.82	10778	21.17	1370	24.48	
College certificate/ diploma	24454	25.58	6703	27.16	13995	27.49	1207	21.57	
Undergraduate or above	45060	47.14	10049	40.72	16711	32.83	1553	27.75	
Sexual orientation									
Bisexual	6458	6.91	2842	11.61	5510	10.90	796	14.18	1287***
Heterosexual	81587	87.29	20099	82.10	42789	84.67	4630	82.49	
Homosexual	5423	5.80	1540	5.29	2240	4.43	187	3.33	
Daily/ almost daily use (5 or more days a week) of any types of cannabis									
No	-		24065	94.85	46881	89.17	4737	79.99	1387***
Yes	-		1306	5.15	5693	10.83	1185	20.01	
	M	SD	M	SD	M	SD	M	SD	F
Age	31.30	12.29	27.61	10.75	25.80	8.87	25.68	9.43	3118***

***$p < .001$.

Table 3. Profiles of different cannabis users (Past 12 months substance use and mental health).

	Non-user		Cannabis user - No high potency herbal cannabis and BHO use		High potency herbal cannabis users, no BHO use		BHO users		
Past 12 months substance use	N	%	N	%	N	%	N	%	Chi-sq
MDMA use	12549	12.80	8308	32.75	24241	46.11	3071	51.86	22286***
Cocaine use	9101	9.29	5554	21.89	16001	30.44	2530	42.72	13114***
Amphetamine/Methamphetamine use	5570	5.68	3001	11.83	11446	21.77	1416	23.91	9390***
Heroin use	416	0.42	173	0.68	594	1.13	228	3.85	972***
LSD use	2528	2.58	3158	12.45	10844	20.63	2527	42.67	18937***
	M	SD	M	SD	M	SD	M	SD	F-statistics
Number of substance use	0.31	0.77	0.80	1.07	1.20	1.24	1.65	1.35	11467***
Mental health	N	%	N	%	N	%	N	%	Chi-sq
Psychosis	688	0.71	170	0.68	541	1.04	57	1.50	83.59***
Depression	12539	12.96	3363	13.38	7250	13.96	1158	19.90	237.10***
Anxiety	7500	7.75	2183	8.69	4589	8.84	886	15.23	418.32***
Obtaining cannabis			N	%	N	%	N	%	Chi-sq
Purchase			20512	80.85	48249	91.77	5296	89.50	1987***
Grow			1747	6.89	5611	10.67	1068	18.05	723***
Through prescription			205	0.81	535	1.02	425	7.18	1565***
Reason for using cannabis	N	%	N	%	N	%	N	%	Chi-sq
Exclusively for recreational use			20588	84.12	37319	72.17	2425	41.67	4730***
Sometimes for medical and mainly for recreational			3033	12.39	12171	23.54	2649	45.48	
Mainly for medical but sometimes for recreational			690	2.82	2003	3.38	676	11.62	
Exclusively for medical			164	0.67	220	0.43	72	1.24	

*** $p < .001$.

Table 4. Multinomial logistic regression (Ref: Cannabis user - No high potency herbal cannabis and BHO use)

| | Ref: Cannabis user with no high potency cannabis and BHO use | | | | | | Ref: High potency herbal cannabis use, no BHO use | |
| | Non-user | | High potency herbal cannabis users – no BHO use | | BHO users | | BHO users | |
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Age	1.02***	(1.02, 1.02)	0.98***	(0.98, 0.99)	0.99***	(0.99, 0.99)	1.01***	(1, 1.01)
Gender (Ref: Female)								
Male	0.80***	(0.77, 0.82)	2.08***	(2.01, 2.15)	3.07***	(2.85, 3.30)	1.48***	(1.38, 1.59)
Transgender	0.95	(0.76, 1.18)	1.55***	(1.24, 1.94)	2.14***	(1.44, 3.16)	1.38	(0.96, 1.98)
Education level (Ref: Below high school)								
Finished high school	0.78***	(0.74, 0.82)	0.80***	(0.76, 0.85)	0.66***	(0.60, 0.72)	0.82***	(0.76, 0.89)
College certificate/ diploma	0.97	(0.92, 1.02)	0.76***	(0.72, 0.80)	0.43***	(0.40, 0.47)	0.57***	(0.53, 0.62)
Undergraduate or above	1.03	(0.98, 1.08)	0.68***	(0.64, 0.71)	0.42***	(0.38, 0.48)	0.62***	(0.57, 0.67)
Sexual orientation (Ref: Heterosexual)								
Bisexual	0.63***	(0.60, 0.66)	0.96	(0.91, 1.01)	1.19***	(1.09, 1.30)	1.22***	(1.14, 1.35)
Homosexual	0.96	(0.91, 1.02)	0.61***	(0.57, 0.65)	0.41***	(0.35, 0.47)	0.67***	(0.57, 0.77)
Number of substance use	0.59***	(0.58, 0.59)	1.30***	(1.28, 1.32)	1.66***	(1.63, 1.70)	1.29***	(1.25, 1.31)
Psychosis	1.27**	(1.06, 1.51)	1.28**	(1.07, 1.53)	1.11	(0.85, 1.46)	0.89	(0.69, 1.09)
Depression	1.00	(0.94, 1.05)	1.18***	(1.11, 1.25)	1.34***	(1.21, 1.48)	1.15**	(1.03, 1.25)
Anxiety	0.92**	(0.86, 0.98)	1.05	(0.98, 1.12)	1.80***	(1.60, 2.01)	1.72***	(1.55, 1.91)

***$p < .001$; **$p < .01$.

Table 5. Effect profiles of BHO and high potency cannabis (only participants who responded to both set of BHO and high potency cannabis questions were included).

	BHO		High potency herbal cannabis				
	M	SD	M	SD	t	Cohen's D	N (Potential N = 5676)
Urge to use more when stoned	3.91	2.40	4.74	2.53	24.72***	0.39	4014
Taste	6.91	2.43	7.88	2.01	22.16***	0.34	4291
Overall pleasurable effect	7.79	1.89	8.44	1.51	21.12***	0.32	4422
Increase appetite	5.95	2.43	6.64	2.21	21.27***	0.33	4227
Ability to talk comfortably	6.64	2.48	7.13	2.24	16.39***	0.25	4293
Overall strength	8.49	1.57	8.00	1.43	16.41***	0.25	4453
Overall ability to function	6.39	2.42	6.93	2.33	15.35***	0.24	4226
Preoccupied/ distracted	4.82	2.48	4.41	2.32	14.48***	0.23	3939
Forgetful when stoned	5.28	2.44	4.86	2.32	14.27***	0.22	4173
Restless/ Anxious	3.73	2.43	3.22	2.15	12.99***	0.22	3558
Purity	7.42	2.38	8.04	2.34	13.48***	0.21	4075
Harmful effect on lungs	4.40	2.44	4.80	2.35	10.53***	0.17	4023
Worried about talking/looking at you	3.26	2.48	2.95	2.23	10.57***	0.18	3473
Relaxed	7.59	2.10	7.94	1.74	10.57***	0.15	4397
Sedated/ sleepy	5.61	2.29	5.29	2.16	9.33***	0.14	4224
Thought racing	3.67	2.48	3.43	2.39	7.97***	0.13	3575
Hangover effect	2.65	2.15	2.42	2.03	7.52***	0.13	3314
Overall negative effect	2.95	2.04	2.74	1.95	6.69***	0.11	3597
Giggle/laugh	5.74	2.42	5.77	2.49	1.06	0.02	4092
Sensory experience alteration	5.91	2.44	5.92	2.45	0.36	0.01	4098

***$p < .001$.

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