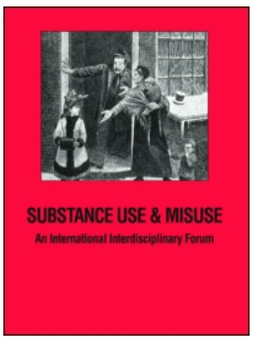

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ORIGINAL ARTICLE

A Comprehensive Examination of the Links between Cannabis Use and Motivation

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ABSTRACT

Background: Cannabis use is widely perceived to produce an "amotivational syndrome" characterized by reduced desire to work or compete, passivity, and lower achievement orientation. The notion that cannabis diminishes motivation has been perpetuated in popular culture, despite the equivocal results of past research. Moreover, previous literature has largely failed to consider the potentially confounding influences of depression, other substance use, and personality, despite known relationships between these variables and cannabis use.

Purpose: The purpose of this study was to elucidate the nature of the relationships between specific aspects of motivation and cannabis use/misuse. Moreover, we sought to determine whether depression, alcohol and other substance use, and/or personality could account for these relationships.

Method: A total of 1,168 participants completed a survey comprising self-report measures of motivation (self-efficacy, apathy, goal orientation, reward-sensitivity, and behavioral inhibition/approach systems) and cannabis use/misuse (cannabis use status, cannabis use frequency, quantity, age of onset of cannabis use, symptoms of cannabis use disorder, problematic cannabis use).

Results: The results revealed small ($r < .30$) but significant correlations between various aspects of cannabis use and motivation, which were largely accounted for by cannabis-related differences in depression, alcohol and other substance use, and personality. However, relationships between cannabis misuse and apathy remained statistically significant after controlling for confounds, indicating that individuals who misuse cannabis may demonstrate higher levels of apathy specifically.

Conclusion: Collectively, these results suggest that differences in depression, substance use, and personality between cannabis users and non-users largely explain differences in motivation between these groups.

KEYWORDS
Cannabis use; motivation; depression; cannabis misuse; personality; substance use

Introduction

Cannabis use is widely perceived to cause an "amotivational syndrome," characterized by "a loss of desire to work or compete" (Smith, 1968, p. 43) as well as passivity, introversion, carelessness, and loss of interest in achievement (McGlothlin & West, 1968). The notion that chronic cannabis use saps users of their motivation has been further perpetuated in popular culture. For example, the IMDb storyline synopsis for the film *Pineapple Express* refers to the main characters as "lazy court-process clerk and stoner Dale Denton" and "equally lazy dealer Saul Silver" (*Pineapple Express*, n.d.). This is just one of many examples of the archetype of the unmotivated cannabis user that has been portrayed in popular culture. Despite the common assumption that chronic cannabis use diminishes motivation, as detailed below, past literature on the link between chronic cannabis use and motivation has produced equivocal results.

Motivation is a multifaceted concept that has been studied using objective behavioral paradigms and academic outcomes, as well as self-report measures of motivation, reward sensitivity, self-efficacy, and apathy. Findings from objective behavioral paradigms have provided mixed evidence. Specifically, Lane, Cherek, Pietras, and Steinberg (2005) compared sober adolescent cannabis users and non-users on a binary choice task and found that the cannabis users switched earlier from a higher effort, more rewarding, progressive ratio schedule to a lower effort, less rewarding, fixed time schedule. Lawn et al. (2016) compared cannabis-dependent adults to a control group matched on substance use and found the two groups performed similarly on the Effort Expenditure for Reward Task which was used to measure motivation to exert effort in exchange for rewards. In this task, participants must choose between a low effort option (i.e. 30 button presses over 7 s), which results in the possibility of attaining a relatively small monetary reward, and a high effort option (i.e. 100 button presses over 21 s), which results in the possibility of attaining a larger monetary reward. However, dependent users performed significantly worse on the Probabilistic Reward Task in which participants are shown abstract faces with two different mouth lengths (8 mm and 9 mm) and have to correctly

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determine whether each mouth is short or long in exchange for probabilistic intermittent monetary rewards. Taken together, these findings indicate that while cannabis dependence is not related to deficits in motivation to expend physical effort for a reward, reward sensitivity may be impaired in dependent cannabis users. Nevertheless, the dependent users had higher levels of depression and used more cigarettes than the control group and controlling for these differences abolished the latter effect. In sum, evidence from laboratory studies on the chronic effects of cannabis on motivation appear to indicate that chronic use may lower reward sensitivity, but these effects may be driven by confounding variables.

There is more cohesive evidence that chronic cannabis use is related to poorer academic outcomes. College students who are heavy cannabis users miss more school, demonstrate lower productivity, procrastinate more, and spend less time studying (Buckner, Ecker, & Cohen, 2010), and frequent users are less likely to earn a Bachelor's degree than infrequent users and non-users (Maggs et al., 2015). Cannabis users are also more likely to delay or take longer to graduate (Suerken et al., 2016), have lower GPAs, and drop out of college than non-users (Arria, Caldeira, Bugbee, Vincent & O'Grady, 2015). Other studies have found that initiation of cannabis use early in life is associated with poorer academic achievement (Hooper, Woolley, & De Bellis, 2014; Horwood et al., 2010; Melchior et al., 2017), while later initiation of cannabis use (Melchior et al., 2017) and lifetime history of use are unrelated to academic achievement (Hooper et al., 2014). While these findings appear to suggest that cannabis users are less motivated, causing them to perform more poorly in school, it is possible that poor academic outcomes drive cannabis use (i.e. people may turn to cannabis to cope with the stress of performing poorly in school) and/or that confounding variables (e.g. depression, alcohol, and other substance use) are contributing to these associations (Cerdá, 2017).

Studies focusing on the relationship between cannabis use and self-reported motivation have been even less conclusive than those using more objective indicators of motivation. For instance, Kouri, Pope, Yurgelun-Todd, and Gruber (1995) found that long-term heavy cannabis users reported lower levels of motivation than occasional users, despite no differences in their mental health status. However, heavy users were far more likely to meet criteria for abuse of, or dependence on, cannabis and other drugs than occasional users, and the extent to which differences in other drug use contributed to this effect is unclear. In contrast, Pacheco-Colón et al. (2017) examined associations between self-reported motivation and lifetime or past 30-day cannabis use in a sample of adolescents. After controlling for various potential confounds, including depression, alcohol and nicotine use, they failed to detect any significant associations between cannabis use and levels of self-reported motivation. Further, a study of high-achieving athletes at an athletic training facility detected no relationship between cannabis use and endorsement of an amotivation syndrome criterion question (Duncan, 1987). However, there were clear methodological flaws in this study as the high-achieving sample displayed elevated motivation by nature, and the measure of motivation consisted of a single binary question which may have lacked sensitivity to detect this relationship.

Research on the link between chronic cannabis use and apathy has also produced mixed findings. Specifically, several studies have failed to detect significant relationships between cannabis use and self-reported apathy (Barnwell, Earleywine, & Wilcox, 2006; Pacheco-Colón et al., 2017; Wright, Scerpella & Lisdahl, 2016). Conversely, others have detected these relationships. For instance, Looby and Earleywine (2007) found that daily dependent cannabis users reported higher apathy than non-dependent daily users. However, the dependent users also displayed higher levels of depression and other drug use which were not controlled for, and as such the degree to which these confounding variables are contributing to the observed effect is unclear. Nevertheless, Meier and White (2018) also found that frequent cannabis users had higher informant ratings of apathy than infrequent users, even after controlling for depression and other drug use.

Present study

The present study was guided by two primary objectives. The first was to elucidate the nature of the relationships between different aspects of motivation (self-efficacy, apathy, goal orientation, reward-sensitivity, and/or behavioral inhibition/approach systems) and cannabis use/misuse (problematic cannabis use, symptoms of cannabis use disorder, cannabis use status [user vs. non-user], frequency, quantity, and age of onset of cannabis use). Previous studies have typically measured only one domain of motivation and may not have not fully captured the complex construct of motivation. Similarly, we sought to explore which aspects of cannabis use are related to motivation, a question which, to our knowledge, has not yet been considered. Indeed, previous studies have generally compared cannabis users to non-users, or dependent users to non-dependent users, but have not considered other characteristics of cannabis use that may be related to motivation, such as frequency, quantity, and age of onset of cannabis use.

Our second goal was to explore the roles that depression, other substance use, and personality play in the putative associations between cannabis use and motivation. Few studies examining "amotivational syndrome" have measured or controlled for symptoms of depression, despite the fact that reduced motivation is a symptom of depression (Center for Substance Abuse Treatment, 2008), and that depression is positively related to cannabis use (Gobbi et al., 2019; Horwood et al., 2012; Lev-Ran et al., 2014; Sexton, Cuttler, Finnell, & Mischley, 2016). While the direction of this relationship remains unclear and may be bidirectional, it is possible that the link between cannabis use and amotivation is largely spurious and driven by cannabis-related elevations in depression. Similarly, cannabis use is often concomitant with alcohol and other drug use (Karriker-Jaffe, Subbaraman, Greenfield, & Kerr, 2018), and these factors

may also account for relationships between cannabis use and motivation. However, alcohol and other drug use have only sporadically been controlled for in previous studies.

Finally, there has been some speculation that personality may partially account for links between cannabis use and motivation (Mellinger, Somers, Davidson, & Manheimer, 1976) but almost no studies have empirically examined this potential confound. Research examining the Big Five personality traits among cannabis users has found that they tend to be more open to experience but less agreeable and conscientiousness than non-users (Allen & Holder, 2014; Fridberg, Vollmer, O'Donnell, & Skosnik, 2011; Hogan, Mankin, Conway, & Sherman, 1970; Terracciano, Löckenhoff, Crum, Bienvenu, & Costa, 2008). Additionally, cannabis dependence is positively correlated with openness to experience and negatively correlated with extraversion (Flory, Lynam, Milich, Leukefeld, & Clayton, 2002). Furthermore, openness to experience, extraversion, conscientiousness, and neuroticism, have been independently linked to various facets of motivation (Komarraju & Karau, 2005). There is also evidence that individuals high in intrinsic achievement motivation tend to be more conscientiousness, open to experience, and extraverted, while individuals high in extrinsic achievement motivation tend to be higher in conscientiousness and neuroticism (Hart, Stasson, Mahoney, & Story, 2007). As such, it is conceivable that cannabis-related differences in these aspects of personality may contribute differences in motivation.

Method

Participants

A total of 1267 undergraduate students were recruited. A student sample was selected because cannabis use is most frequent among young adults (Substance Abuse and Mental Health Services Administration [SAMHSA], 2016). Participants were 18+ years old and were fluent in English. The only exclusion criterion was evidence of random responding, which was assessed using the 10-item deviant responding validity subscale of the Psychopathic Personality Inventory (PPI) (Lilienfeld & Andrews, 1996). This subscale contains a series of items (e.g. "I sometimes forget my name") that assess whether participants are responding to the content of survey items in a valid manner or are simply responding to them haphazardly. A total of 82 participants endorsed five or more of the PPI items in an aberrant manner and were, therefore, deemed random responders and excluded. An additional 17 participants were excluded because they failed to indicate whether or not they had ever used cannabis and did not complete the measures of cannabis use/misuse.

Demographic and other relevant characteristics for the final sample of 1168 participants are provided in Table 1. A total of 874 participants reported using cannabis at least once in their life (cannabis users) and 294 reported that they had never used cannabis (non-users). The cannabis users reported using cannabis, on average, 8.95 days ($SD = 10.49$) of the past month, 2.17 days ($SD = 2.53$) of the past week, and 16.1% of the participants reported using cannabis daily. Average age of first cannabis use was 16.60 years ($SD = 2.57$) and participants had used cannabis for an average of 3.18 years ($SD = 3.13$).

Table 1. Demographic and other relevant characteristics of sample ($n = 1168$).

	Mean or %	Standard deviation	Range
Gender (% Female)	68.2%	–	–
Ethnicity (% White)	68.8%	–	–
Age	20.54	3.60	18–62
Years of University	2.09	1.21	1–6
Depression (Average BDI Score)	0.60	0.52	0–2.62
Alcohol dependence	0.73	0.58	0–3.60
Illicit drug use frequency	0.77	2.04	0–25
Neuroticism	2.08	0.68	0–3.92
Extraversion	2.40	0.54	0.17–3.83
Openness to experience	2.24	0.45	0.67–3.67
Agreeableness	2.50	0.53	0.75–3.75
Conscientiousness	2.52	0.57	0.42–4.00

Procedures

The Office of Research Assurances deemed this study exempt from the need for review by the IRB. Participants were recruited from the Department of Psychology subject pool. After providing informed consent, participants completed an anonymous online survey that required approximately 45 min to complete. Participants who completed the survey were compensated with credit they could apply to an eligible psychology course.

Measures

Demographics

Demographics were assessed using a brief set of questions about age, education, gender, and ethnicity.

The General Self-Efficacy Scale

Self-efficacy is defined as one's belief in their ability to pursue, organize, and execute goal-directed behaviors (Bandura, 1994), particularly when faced with obstacles or novel situations (Schwarzer & Jerusalem, 1995), and has been implicated in motivated behavior (Bandura, 1977). More specifically, these beliefs are necessary prerequisites for many central features of motivation, including the initiation of tasks, allocation of effort toward specific behaviors, and persistence in the face of challenges (Bandura, 1977). Self-efficacy was measured using the General Self-Efficacy Scale (GSE) (Schwarzer & Jerusalem, 1995) which consists of 10 statements (e.g. "I can always manage to solve difficult problems if I try hard enough") for which participants rate their agreement using a 4-point scale (1 = Not at all true, 2 = Barely true, 3 = Moderately true, 4 = Exactly true). Mean scores were computed for each participant, with higher scores indicating higher levels of self-efficacy. The GSE has demonstrated reliability, with Cronbach's alpha ranging between .76 and .90 (Schwarzer & Jerusalem, 1995).

The Apathy Evaluation Scale Self-Rated

Apathy (i.e. lack of motivation to complete goal-directed behavior) was measured using the Apathy Evaluation Scale Self-Rated (AES-S) (Marin, Biedrzycki, & Firinciogullari, 1991). The AES-S consists of 18 statements assessing apathy (e.g. "I am interested in having new experiences") for which participants rate their agreement using a 4-point scale (1 = Not at all true, 2 = Slightly true, 3 = Somewhat true, 4 = Very true). Negatively phrased items were reverse coded before averaging all of the items on the scale, so that higher scores would indicate higher levels of apathy. The AES-S has demonstrated sound psychometric properties, with Cronbach's alpha ranging from .86 to .94 and test–retest reliability coefficients ranging from .76 to .94 (Marin et al., 1991).

Achievement Goal Questionnaire-Revised

Achievement goals (i.e. cognitive goals pertaining to competence and learning) were measured using the Achievement Goal Questionnaire-Revised (AGQ-R) (Elliot & Murayama, 2008), which consists of 12 statements for which participants rate their agreement along a 5-point scale (1 = Strongly disagree, 2 = Somewhat disagree, 3 = Neither agree nor disagree, 4 = Somewhat agree, 5 = Strongly agree). Achievement goal orientation was grouped into three domains: mastery approach, (e.g. "My aim is to completely master the material presented in my classes"), mastery avoidance (e.g. "My aim is to avoid learning less than I possibly could in my courses"), and performance approach (e.g. "I am striving to do well compared to other students in my courses"). Mastery goal orientations (e.g. approach and avoidance) involve task based or interpersonal standards, specifically relating to the intrinsic value of learning, and as such focuses more on learning (Elliot & Murayama, 2008). In contrast, the performance goal orientation relates only to one's performance on a task along normative standards and as such focuses more on avoiding failing (Elliot & Murayama, 2008). Items on each subscale were averaged, with higher scores indicating higher endorsement of academic orientation. Although, the AGQ-R has previously been used with a four-factor model which further divides the performance factor into performance approach and avoidance, a three-factor model was used for analysis due to evidence from large-scale studies indicating that these factors are not distinguishable, and that the aforementioned three-factor model offers a better fit (Cook, Gas, & Artino, 2018; Strunk, 2014). Psychometric properties of the AGQ-R are sound, with Cronbach's alpha coefficients greater than .70 for each domain (Cook et al., 2018).

Behavioral Inhibition System and Behavioral Approach System Scales

Motivational systems and goals which inform behavior were assessed using the Behavioral Inhibition System and Behavioral Approach System Scales (BIS/BAS) (Carver & White, 1994). More specifically, this questionnaire measures BIS, which regulate aversive motives, and BAS, which regulate appetitive motives (Carver & White, 1994). The BIS/BAS consists of 24 statements for which participants rate their agreement using a 4-point scale (1 = Very false for me, 2 = Somewhat false for me, 3 = Somewhat true for me, 4 = Very true for me). BAS items are grouped into the following three domains: drive (e.g. "I go out of my way to get things I want"), fun-seeking (e.g. "I'm always willing to try something new if I think it will be fun"), and reward responsiveness (e.g. "When I'm doing well at something, I love to keep at it"), and BIS items are grouped into a single factor (e.g. "Even if something bad is about to happen to me, I rarely experience fear or nervousness"). Negatively phrased items were reverse coded before averaging the items in each subscale. As such, higher scores indicate higher endorsement of the domain. Previous research has found Cronbach's alpha values between .66 and .76 for each domain (Carver & White, 1994).

The Sensitivity to Punishment and Sensitivity to Reward Questionnaire

Sensitivity to reward and sensitivity to punishment were measured using the Sensitivity to Punishment and Sensitivity to Reward Questionnaire (SPSRQ) (Torrubia, Ávila, Moltó, & Caseras, 2001), which consists of 48 yes/no questions. Even-numbered questions assess sensitivity to reward (e.g. "does the good prospect of obtaining money motivate you strongly to do some things"), and odd-numbered questions assess sensitivity to punishment (e.g. "do you often refrain from doing something because you are afraid of it being illegal?"), with higher scores indicating increased sensitivity to reward and punishment, respectively. The SPSRQ has demonstrated sound psychometric properties. Specifically, it has shown satisfactory internal consistency with Cronbach's alpha values ranging from .75 to .83, as well as good test–retest reliability with coefficients ranging from .87 to .89, .69 to .74, and .57 to .61 after three months, one year, and three years, respectively (Torrubia et al., 2001).

Daily Sessions, Frequency, Age of Onset, and Quantity of Cannabis Use Inventory

Cannabis use patterns were measured using the Daily Sessions, Frequency, Age of Onset, and Quantity of Cannabis Use Inventory (DFAQ-CU) (Cuttler & Spradlin, 2017), which consists of 33 items assessing the following six subscales: daily sessions, frequency of cannabis use, age of onset of cannabis use, as well as the quantity of marijuana, concentrates, and edibles typically consumed. Only frequency, quantity of marijuana, and age of onset were included in analyses in the present study. Subscale items were standardized and averaged to calculate subscale scores, with higher subscale scores indicating greater frequency, quantity, and age of onset of cannabis use. Psychometric properties have been established for the DFAQ-CU, with Cronbach's alpha values ranging from .69 to .95 for each subscale (Cuttler & Spradlin, 2017).

Marijuana Problems Scale

Problematic cannabis use was measured using the 19-item Marijuana Problems Scale (MPS) (Stephens, Roffman, & Curtin, 2000), for which participants rate the severity of possible problems caused by cannabis use over the past month (e.g. "Has marijuana caused you to miss days at work or class?"), using a 3-point scale (0 = No problem, 1 = Minor problem, 2 = Serious problem). Responses were scored by summing the total number of items endorsed as either minor or serious problems, with higher scores indicating increased problematic cannabis use.

Cannabis Use Disorders Identification Test-Revised

Cannabis dependence was measured using the Cannabis Use Disorders Identification Test-Revised (CUDIT-R) (Adamson et al., 2010), an 8-item scale consisting of symptoms of cannabis use disorder (CUD; e.g. "How often during the past 6 months did you find that you were not able to stop using cannabis once you had started?"). Participants respond along a 5-point scale according to their cannabis use over the past 6 months. Item scores were averaged and yielded a possible range of scores from 0 to 4, with higher scores indicating increased symptomology of CUD. The CUDIT-R has demonstrated good psychometric properties. Specifically, it has been shown to have a Cronbach's alpha value of .91, discriminant validity value of .93, and a test–retest reliability coefficient of .85 (Adamson et al., 2010).

Beck Depression Inventory-II

Symptoms of depression were measured using the Beck Depression Inventory-II (BDI-II) (Beck, Steer, & Brown, 1996). The BDI-II presents participants with 21 symptoms of depression (e.g. "Sadness") and a group of statements relating to each symptom (e.g. "I do not feel sad," "I feel sad much of the time," "I am sad all the time," "I am so sad or unhappy that I can't stand it"), and prompts the participant to choose which statement best reflects how they have felt over the past two weeks. Overall means were computed, with higher scores indicative of greater severity of depression symptoms. Psychometric properties for the BDI-II are well established, with internal consistency values near .90 and test–retest reliability coefficients ranging from .73 to .96 (Wang & Gorenstein, 2013).

Alcohol Use Disorders Identification Test

Alcohol consumption and dependence were measured using the Alcohol Use Disorders Identification Test (AUDIT) (Babor, Higgins-Biddle, Saunders, & Monteiro, 2001), which consists of 10 items relating to alcohol use and abuse (e.g. "During the past year, how often have you found that you were not able to stop drinking once you had started?") for which participants respond along a 5-point scale. Item scores were averaged, yielding a possible range of scores from 0 to 4 with higher scores indicating greater alcohol consumption and higher symptomology of alcohol use disorder. The AUDIT has shown sound psychometric properties, with a mean Cronbach's alpha value of .80 across many studies, and a test–retest coefficient of .84 (de Meneses-Gaya, Zuardi, Loureiro, & Crippa, 2009).

Drug History Questionnaire

Use of drugs other than cannabis use was measured using the Drug History Questionnaire (DHQ) (Sobell, Kwan, & Sobell, 1995), which consists of 61 questions about use of stimulants, benzodiazepines, opioids, hallucinogens, inhalants, steroids, and prescription drugs. Participants rate how frequently they have used each drug in the past 6 months using an 8-point scale (0 = No use, 1 = Less than once a month, 2 = Once a month, 3 = 2 to 3 times a month, 4 = Once a week, 5 = 2 to 3 times a week, 6 = 4 to 6 times a week, 7 = Daily). Responses were averaged such that higher scores represent greater overall frequency of drug use. The DHQ demonstrates test–retest reliability values ranging from .37 to .85 for each of the various drug classifications (Sobell et al., 1995).

Neuroticism-Extraversion-Openness Five Factor Inventory of Personality

The Big-5 personality traits were measured using the Neuroticism-Extraversion-Openness Five Factor Inventory of Personality (NEO-FFI) (Costa & McCrae, 1992), which consists of 60 statements for which participants rate their agreement along a 5-point scale (0 = Strongly disagree, 1 = Disagree, 2 = Neutral, 3 = Agree, 4 = Strongly agree). Statements measured personality across the following five domains: neuroticism (e.g. "I often feel tense and jittery"), extraversion (e.g. "I like to have a lot of people around me"), openness to experience (e.g. "I often try new and foreign foods"), agreeableness (e.g. "I try to be courteous to everyone I meet"), and conscientiousness (e.g. "I keep my belongings clean and neat"). Negatively phrased items were reverse coded before averaging the items in each subscale, so that higher scores indicate greater endorsement of each personality factor. Psychometric evaluation of the NEO-FFI has yielded Cronbach's alpha values ranging from .75 to .87 for each domain, and test–retest reliability coefficients ranging from .80 to .87 and .73 to .86 after a six-month time period and thirty-month time period, respectively (Murray, Rawlings, Allen, & Trinder, 2003).

Results

Bivariate correlations

Due to the large sample size and large number of correlations computed, a more conservative alpha of .01 was used. As shown in Table 2, several small but statistically significant correlations were detected between the various measure of cannabis use and motivation.[1] Specifically, cannabis use status (non-users = 0; users = 1) was correlated with

[1]Regression was not used due to concerns with multicollinearity stemming from the overlap among the various measures of cannabis use.

Table 2. Bivariate correlations between various aspects of cannabis use and motivation.

	Non-user (0) vs. user (1) (*N* = 1168)	Frequency (*N* = 874)	Quantity (*N* = 656)	Age of onset (*N* = 873)	CUDIT (*N* = 740)	MPS (*N* = 606)
General self-efficacy	−.019	.005	.024	−.028	−.031	−.133*
Apathy	−.027	.076	.144**	−.050	.169**	.277**
Mastery approach	−.051	−.105*	−.057	.087*	−.131**	−.168**
Mastery avoidance	.047	−.008	−.034	−.052	−.005	.025
Performance	.048	−.101*	−.060	.012	−.080	−.107*
BIS/BAS drive	.021	.011	−.043	−.044	−.001	−.026
BIS/BAS fun	.131**	.073	.016	−.031	.042	.012
BIS/BAS reward	.062	−.066	−.015	.056	−.092	−.093
BIS/BAS BIS	.067	−.052	−.067	.083	−.040	.099
Reward sensitivity	.099**	.076	.028	−.100*	.123**	.090
Sensitivity to punishment	−.007	−.060	−.029	.028	.001	.143**

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

Table 3. Bivariate correlations between potentially confounding variables and various aspects of cannabis use.

	Non-user (0) vs. user (1) (*N* = 1168)	Frequency (*N* = 874)	Quantity (*N* = 656)	Age of onset (*N* = 873)	CUDIT (*N* = 740)	MPS (*N* = 606)
Depression	.141**	.070	.014	−.036	.137**	.289**
Alcohol use	.368**	.233**	.035	−.200**	.206**	.211**
Other drug use	.186**	.201**	.072	−.158**	.135**	.172**
Neuroticism	.099**	.015	−.036	−.006	.069	.257**
Extraversion	.015	−.045	−.021	.016	−.049	−.110**
Openness to experience	.125**	.159**	.022	.008	.128**	.083
Agreeableness	.010	−.103*	−.142**	.132**	−.108*	−.136**
Conscientiousness	−.083*	−.116**	−.108*	.057	−.160**	−.283**

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

increased fun-seeking and reward sensitivity; frequency of cannabis use was associated with decreased mastery approach and performance; quantity of cannabis used was associated with higher levels of apathy; and earlier age of onset of cannabis use was associated with lower mastery approach and increased reward sensitivity. Finally, symptoms of CUD were correlated with higher apathy and reward sensitivity, as well as lower mastery approach; while problematic cannabis use was associated with decreased self-efficacy, mastery approach, and performance as well as with higher levels of apathy and sensitivity to punishment. It is worthwhile to note that the largest correlation detected was between problematic cannabis use and apathy ($r = .277$) and the value of this small sized correlation indicates that 7.67% of the variance in apathy can be attributed to problematic cannabis use.

Partial correlations

As shown in Table 3, depression, alcohol, and other substance use, as well as personality traits were significantly associated with various aspects of cannabis use and misuse, and therefore, represent potentially confounding variables. As such, partial correlation analyses were conducted to control for these confounding differences.

The results of the partial correlation analyses controlling for depression indicated that depression may account for the relationships between problematic cannabis use and self-efficacy, problematic cannabis use and sensitivity to punishment, as well as age of onset and mastery approach, as these correlations were no longer significant after controlling for depression (see Table 4).

As displayed in Table 5, the results of the partial correlation analyses controlling for alcohol and other drug use revealed that these confounding variables were driving the associations between cannabis use status and fun-seeking as well as reward sensitivity; the relationship between frequency of cannabis use and mastery approach; the correlations between age of onset and mastery approach as well as reward sensitivity; the relationships between symptoms of CUD and mastery approach and reward sensitivity; as well as the association between problematic cannabis use and performance.

Table 6 shows the partial correlation analyses controlling for the personality confounds. They indicate that only the correlations between cannabis use status and fun-seeking; quantity and apathy; CUD and apathy; and problematic cannabis use and apathy remain statistically significant after statistically controlling for these personality confounds.

Finally, Table 7 displays the partial correlation analyses controlling for depression, other substance use, and personality. The results indicate that cannabis use status, symptoms of CUD, and problematic cannabis use are significantly associated with apathy. Additionally, cannabis use status is significantly related to fun-seeking and decreased sensitivity to punishment independent of this set of confounding variables.

Discussion

Findings from the present study generally support small but significant links between various aspects of cannabis use/misuse and motivation. However, with the exception of the relationships between apathy and cannabis use/misuse, most of these relationships were driven by confounding variables (i.e. depression, other substance use, personality).

Table 4. Partial correlations between various aspects of cannabis use and motivation after controlling for depression.

	Non-user (0) vs. user (1) ($N = 1168$)	Frequency ($N = 874$)	Quantity ($N = 654$)	Age of onset ($N = 869$)	CUDIT ($N = 736$)	MPS ($N = 603$)
General self-efficacy	.037	.034	.031	−.045	.023	−.027
Apathy	−.109**	.048	.157**	−.037	.119*	.163**
Mastery approach	−.023	−.093*	−.055	.082	−.106*	−.115*
Mastery avoidance	.052	−.005	−.033	−.053	.000	.037
Performance	.066	−.094*	−.058	.007	−.065	−.077
BIS/BAS drive	.049	.025	−.041	−.052	.025	.030
BIS/BAS fun	.155**	.084	.018	−.037	.063	.058
BIS/BAS reward	.087	−.056	−.013	.051	−.071	−.048
BIS/BAS BIS	.004	−.082	−.077	.103*	−.095*	−.004
Reward sensitivity	.094*	.073	.027	−.099*	.118*	.081
Sensitivity to punishment	−.086*	−.107*	−.040	.052	−.074	.006

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

Table 5. Partial correlations between various aspects of cannabis use and motivation after controlling for other substance use.

	Non-user (0) vs. user (1) ($N = 1168$)	Frequency ($N = 874$)	Quantity ($N = 656$)	Age of onset ($N = 873$)	CUDIT ($N = 740$)	MPS ($N = 606$)
General self-efficacy	−.015	.009	.025	−.032	−.028	−.133*
Apathy	−.063	.052	.138**	−.029	.154**	.263**
Mastery approach	.017	−.059	−.047	.048	−.095	−.130*
Mastery avoidance	.054	−.002	−.031	−.058	−.002	.031
Performance	.065	−.096*	−.058	.004	−.074	−.102
BIS/BAS drive	.001	−.001	−.045	−.035	−.012	−.038
BIS/BAS fun	.068	.031	.009	.007	.003	−.029
BIS/BAS reward	.066	−.068	−.014	.057	−.094	−.095
BIS/BAS BIS	.045	−.061	−.068	.092*	−.047	.095
Reward sensitivity	−.016	.003	.017	−.041	.063	.025
Sensitivity to punishment	−.020	−.070	−.030	.035	−.005	.141**

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

Table 6. Partial correlations between various aspects of cannabis use and motivation after controlling for personality.

	Non-user (0) vs. user (1) ($N = 1168$)	Frequency ($N = 874$)	Quantity ($N = 656$)	Age of onset ($N = 873$)	CUDIT ($N = 740$)	MPS ($N = 606$)
General self-efficacy	.011	.014	.028	−.035	.006	−.003
Apathy	−.073	.030	.123*	−.018	.123**	.151**
Mastery approach	−.031	−.074	−.017	.075	−.082	−.068
Mastery avoidance	.042	−.014	−.024	−.060	−.003	.049
Performance	.066	−.075	−.030	.001	−.042	−.048
BIS/BAS drive	.039	−.001	−.087	−.012	.000	.029
BIS/BAS fun	.111**	.045	−.018	−.013	.009	−.006
BIS/BAS reward	.056	−.043	.031	.037	−.065	−.038
BIS/BAS BIS	−.035	.004	.063	−.059	−.015	−.116**
Reward sensitivity	−.036	−.053	.087	.023	.073	−.040
Sensitivity to punishment	−.069	−.075	.002	.029	−.038	−.011

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

Table 7. Partial correlations between various aspects of cannabis use and motivation after controlling for depression, other substance use, and personality.

	Non-user (0) vs. user (1) ($N = 1155$)	Frequency ($N = 862$)	Quantity ($N = 646$)	Age of onset ($N = 861$)	CUDIT ($N = 728$)	MPS ($N = 595$)
General self-efficacy	.003	.005	.030	−.028	.007	.002
Apathy	−.100**	.022	.118*	−.012	.107*	.125*
Mastery approach	.018	−.042	−.012	.049	−.058	−.042
Mastery avoidance	.040	−.013	−.020	−.062	−.002	.054
Performance	.072	−.077	−.029	.001	−.040	−.043
BIS/BAS drive	.035	−.007	−.088	−.007	−.003	.027
BIS/BAS fun	.087*	.025	−.018	.005	−.003	−.015
BIS/BAS reward	.063	−.044	.032	.039	−.063	−.033
BIS/BAS BIS	−.014	−.035	.006	.063	−.060	−.013
Reward sensitivity	.017	−.002	−.039	−.013	.053	−.011
Sensitivity to punishment	−.076*	−.074	.003	.027	−.042	−.016

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

Previous findings pertaining to the relationship between cannabis use and apathy have produced mixed results. However, these studies have been inconsistent in considering possible confounds which may be driving significant relationships. Results from our study revealed significant positive bivariate correlations between apathy and quantity of cannabis used, CUD symptoms, and problematic cannabis use, suggesting that those who use more cannabis per session and who misuse cannabis report higher levels of apathy. Moreover, these relationships remained significant after controlling for the potentially confounding influences of personality, depression, and other substance use. In general, these results suggest that depression, other substance use, and personality are not driving the observed relationships between cannabis use/misuse and apathy. Nevertheless, the largest bivariate correlation detected was .277, which is small and indicates that less than 8% of the variance in apathy can be explained by cannabis misuse. Moreover, it is possible that higher levels of apathy precede cannabis use. Longitudinal research is needed to further establish the direction of these relationships.

Results of partial correlation analyses indicated that confounding differences in depression accounted for correlations between cannabis misuse and self-efficacy, performance goal orientation, and sensitivity to punishment; while alcohol and other substance use accounted for the correlations between cannabis misuse and performance goal orientation as well as sensitivity to reward. Moreover, controlling for differences in personality related to cannabis misuse abolished all of these correlations. These findings indicate that much of the "amotivational syndrome" ascribed to cannabis users may simply reflect cannabis-related differences in personality, use of other substances, and symptoms of depression that are related to decreased motivation. These findings underscore the importance of considering these confounding factors in future examinations of "amotivational syndrome."

Results of bivariate and partial correlations indicate that cannabis users score higher on fun-seeking relative to non-users. Controlling for alcohol and other substance use abolished this effect but it reemerged after controlling for all three sets of confounding variables simultaneously. This suggests that cannabis users are more likely to spontaneously approach new events and seek out entertainment. Nevertheless, the direction of this effect is unclear, and it is possible that individuals higher in fun-seeking find cannabis (and other substances) entertaining, and therefore, seek them out. Finally, we found a significant partial correlation between cannabis use status and diminished sensitivity to punishment after controlling for all three sets of potentially confounding variables. However, the bivariate correlation between these variables was not significant which indicates the presence of a suppression effect. Therefore, it is likely that this significant partial correlation is largely spurious in nature.

The present study had several limitations. Namely, the reliance on a predominantly white, female, student sample limits the ability to generalize the results to other populations. However, this student sample was intentionally sought because this population is known to use cannabis at high rates (SAMHSA, 2016). Further, cannabis use and motivation were assessed retrospectively, and therefore, may be prone to recall bias. Additionally, it is possible that other potentially confounding variables that were not measured in the present study are driving the remaining associations between cannabis use/misuse and apathy. Future research should explore the roles of other potential confounding variables (e.g. other psychological disorders). Finally, the correlational nature of the study precludes the ability to establish causality or directionality. Nevertheless, due to ethical and practical problems associated with randomly assigning participants to use or abstain from cannabis, much of the research on "amotivational syndrome" has been correlational. While the relationships between chronic cannabis use and motivation are almost always interpreted to indicate that cannabis use saps motivation, they may alternatively indicate that individuals with diminished motivation are more likely to use cannabis. Indeed, cannabis can provide a means of entertaining/stimulating oneself in a more passive manner and may, therefore, be more desirable to individuals with lower levels of motivation than seeking out more demanding means of entertainment. Future research should examine motivation in broader samples of cannabis users using longitudinal designs spanning several years to establish the direction of the relationships between cannabis use and motivation, particularly apathy.

Conclusions

The present study revealed associations between various measures of cannabis use/misuse and apathy as well as between cannabis misuse and various aspects of motivation. However, the size of these correlations was small, indicating that cannabis accounts for less than 8% of the variance in motivation. Moreover, controlling for confounding differences in depression, personality, alcohol, and other substance use abolished most of these relationships, indicating that these variables explain much of the "amotivational syndrome" ascribed to cannabis use. Nevertheless, correlations between cannabis misuse and apathy and between cannabis use and fun-seeking remained significant even after controlling for these confounds. While the correlational design precludes the ability to establish the direction of these relationships, the results indicate that individuals who misuse cannabis have higher levels of apathy and those who use cannabis have higher levels of fun-seeking.

Declaration of interest

No potential conflict of interest was reported by the author(s).

Data availability

Upon request.

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