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Risk Factors for Cannabis Use-Related Consequences in Emerging Adults

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Abstract

Cannabis use in Canada is a public health concern, especially it has been legalized for medical and recreational use. Although widely used, it appears there are negative consequences for some, but not all, cannabis consumers, and it remains challenging to predict which individuals will experience difficulties. This study examines the role of several risk factors in predicting negative outcomes of cannabis use in university students with a particular focus on personality and mental health variables. Undergraduate students (N=370) enrolled in a southwestern Ontario university participated in an online study. Preliminary analyses suggested that higher stress and lower conscientiousness were associated with cannabis use. In follow-up analyses, perceived stress was significantly associated with functional consequences of cannabis use when the quantity of cannabis used was accounted for in the analyses. Agreeableness and conscientiousness were significantly associated with overall GPA after controlling for amount of cannabis used. Individuals using low-to-moderate levels of cannabis had fewer functional consequences than individuals using higher amounts of cannabis, but these groups could not be differentiated in terms of their overall GPA. These results address a niche in the field of cannabis research in higher education and have significant implications in terms of policy and clinical practice.

Keywords

cannabis, undergraduates, academic consequences, functional consequences

1. Introduction

With legalization, cannabis use has increased, and it is now the most used substance globally (United Nations Office of Drug and Crime, 2023). Survey data in Canada shows that 26% of the population over the age of 16 have consumed cannabis in the past 12 months (Statistics Canada, 2023) and 31% of students describe themselves as frequent cannabis users (Llewelyn-Williams & Mykota, 2023). Given the considerable proportion of the population reporting cannabis use, it is important that research identify who is at higher risk for poor outcomes.

For many individuals who use cannabis recreationally, there are few, if any, consequences of their cannabis use. For example, some studies suggest that people who use cannabis recreationally demonstrate adequate academic achievement, maintain employment, have functional romantic relationships, and enjoy beneficial social interactions (Allen & Holder, 2014; Luba et al., 2019). Students may experiment with infrequent-to-regular cannabis use in high school or in post-secondary settings, but then moderate their use or desist entirely as they enter the workforce and other adult pursuits (Roussell & Omori, 2016). Most people who use cannabis are typically functioning individuals indistinguishable in the population from those who do not use cannabis (Ogborne & Smart, 2000). This pattern of non-problematic use and tendency toward desistance by adults supported efforts to legalize recreational cannabis consumption in many jurisdictions.

A substantial body of research on recreational cannabis use has focused on the negative consequence and outcomes, particularly in emerging adults whose brains are not yet fully developed and who need full use of their cognitive functions to be successful in their academic work. Harmful consequences experienced by individuals who use cannabis include increased psychosis symptoms (Marconi, Di Forti, Lewis, Murray & Vassos, 2016), increased risk for mental health problems (Buckner et al., 2010; Faria et al., 2021), more frequent cognitive impairments such as memory and problem-solving deficits (Becker, Collins & Luciana, 2014), and increased likelihood of engaging in risky and/or illegal behaviours (e.g., intoxicated driving; Aston, Merrill, McCarthy & Metrik, 2016). The effect of cannabis use on academic achievement can vary; however, recent research has shown that cannabis use can negatively impact academic achievement (Reuter & Forster, 2021; Paramo et al., 2023). Since legalization, especially on university campuses, the normalization of cannabis use and the diminishing perception of risk has led to the rise in frequency of cannabis consumption (Buckner, 2013; Kilwen et al., 2020; Hallett & Chen, 2022). The accompanying potential for cognitive impairments, motivational effects, and mental health concerns associated with increased frequency of cannabis use could exacerbate these negative consequences.

Although there are numerous harmful consequences that may arise from cannabis use, not every university student who uses cannabis experiences problematic outcomes. There are several theories to explain how people who report a problematic pattern of cannabis use might be separated from those who use cannabis but do not experience poor outcomes. It is likely that risk for poor outcomes exists on

multiple levels, including societal norms and expectations, community factors, relational factors, and individual differences (Centers for Disease Control and Prevention, 2019). These levels have a high degree of interaction and are not independent of each other. For example, multiple risk factors may influence the initiation and continuation of cannabis use at a younger age (Von Sydow, Lieb, Pfister, Hofler & Wittchen, 2002), which increases the risk of problematic outcomes. Individuals who report frequent cannabis use tend to show higher negative emotionality (Volkow et al., 2014), which is likely related to decreased reward sensitivity and motivation, as well as increased stress reactivity in some individuals. Cannabis use is associated with subsequent increase in negative affect, especially when used for coping purposes and the individual meets diagnostic criteria for cannabis dependence (Ross et al., 2018). Relatedly, highly anxious individuals who are not currently receiving supportive treatment for their symptoms are at increased risk for academic problems (Wallis et al., 2019). Frequent cannabis use may also be the by-product of chronic stressors, including family dysfunction (Butters, 2002), negative life events (Siqueira, Diab, Bodian & Rolnitzky, 2001) and traumatic events (Houston, Murphy, Shevlin & Adamson, 2011). However, other research has failed to show a relationship between cannabis use and perceived stressful events (Siqueira et al., 2001; Vargas & Trujillo, 2012), especially in populations of individuals who are not substance dependent.

Specific personality traits have also been identified as risk factors for cannabis use. In a study that used the five-factor model of personality, people who use cannabis scored higher on openness to experience and lower on agreeableness and conscientiousness in an epidemiological sample (Terracciano et al., 2008). More recent studies have suggested that developmental stage and prolonged cannabis use over time influences personality developmental and mental health. For example, work by Jones and colleagues (2022) showed that while agreeableness and conscientious typically increase over the course of development, these personality traits decrease across development in people who use cannabis regularly (Jones et al., 2022). Likewise, emotional stability is typically assumed to increase from adolescence and into the young adult years, but it also decreases in both males and females who report regular cannabis use (Jones et al., 2022). It may also be that personality is both influenced by and influences cannabis use. In a meta-analysis, Winters and colleagues (2022) showed that neuroticism and openness to experience increased over time while conscientiousness and agreeableness decreased, albeit only among people who reported a problematic pattern of cannabis use (Winter et al., 2022).

While researchers have investigated possible risk factors for cannabis use, most of the literature has focused solely on comparing those who use cannabis and those who do not. Furthermore, most of this research was conducted prior to legalization of recreational cannabis use. Very few studies have looked at differences among higher education students who use different amounts of cannabis. Thus, there is a gap in the empirical literature in terms of models for the intersection of cannabis use, academic achievement, and individual risk factors in post-secondary settings. With the changing politics and attitudes surrounding cannabis consumption, the most important question is no longer whether young

people will use cannabis. Attention needs to be shifted to what specific factors may predict negative outcomes and why certain people who use cannabis are at a heightened risk for experiencing them.

Therefore, the aim of the current study was to investigate and identify possible risk factors that could contribute to the experience of *negative consequences* of cannabis use in a sample of university students in a jurisdiction where recreational use has been legalized for several years. It was hypothesized that:

1) Higher levels of neuroticism, lower levels of conscientiousness, and greater perceived stress would be associated with greater number of the consequences from cannabis use and lower GPA after controlling for amount of cannabis used;

2) Low-to-moderate use of cannabis would not be associated with increased cannabis-related consequences and lower GPA, but these relations would be significant for individuals using greater amounts of cannabis.

2. Methods

2.1 Participants

Analyses included data from 370 university students between the ages of 19 and 25 years old. The age range was chosen to maximize the likelihood that the participants were in the emerging adult period and had not yet taken on substantial adult responsibilities such as parenting, home ownership, and full-time work in addition to their academic enrollment. Like the department where the research took place, most participants were Caucasian/European Canadian (70.8%), female (86.5%), and in their second (33.4%) or third year (30.0%) of undergraduate study. There were no specific exclusionary criteria for this study, except that only students who could legally use cannabis (aged 19 years and older) were allowed to participate, ensuring participants were not asked to disclose illegal activities during the research. Demographics are summarized in Table 1.

Table 1. Sample Demographics (N=370).

Variable	n (%)	*M*	*SD*	Range
Age		20.46	1.47	19-25
Gender				
Female	320 (86.5)			
Male	45 (12.2)			
Non-Binary	3 (0.8)			
Transgender Male	1 (0.3)			
Race/Ethnicity				
White or European Canadian	262 (70.8)			
South Asian	26 (7.0)			
Middle Eastern	26 (7.0)			
Mixed Race	15 (4.1)			
Black/African Canadian	18 (4.9)			
Latinx	10 (2.7)			
East Asian	11 (3.0)			
Year of Study				
1st	27 (7.3)			
2nd	123 (33.2)			
3rd	111 (30.0)			
4th	94 (25.4)			
5th year of beyond	13 (3.5)			

2.2 Measures

2.2.1 Demographics Questionnaire

Participants were asked to provide their demographic and background information including race, gender, year of study, and overall GPA.

2.2.2 Drug History Use Questionnaire

The Drug Use History Questionnaire (DHUQ; Struble, 2019). The DHUQ is a 17-item self-report measure that assesses the consequences related to an individual's cannabis use. Participants are required to answer either "yes" or "no" to questions about experiencing any of the consequences resulting from their cannabis use. A sample item is "[Because of my cannabis use, I have] missed school". When responses are summed across items, higher scores reflect more consequences experienced.

2.2.3 Cannabis Use Intensity Questionnaire

The Cannabis Use Intensity Questionnaire (MUIQ; White, Labouvie & Papadaratsakis, 2005) is a self-report measure that assess the frequency of cannabis use over the past three years. Participants are asked to rate the frequency and quantity of cannabis use, as well as their frequency of inebriation on Likert scales. Because there were no population norms for this measure (White, Helen, personal communication, March 15th, 2020), a scoring solution based on participant reported data was used instead. A composite score of use intensity was calculated and then participants were grouped according to their use rate (non-use, low-moderate use rate, higher use rate). Collectively, 190 participants (51.9%) reported previous cannabis use within the last three years. These participants were divided into two groups with 25.7% of the total sample reporting low to moderate use while 26.2% of the sample reported greater cannabis use.

2.2.4 Big Five Inventory

The Big Five Inventory (BFI; John, Donahue & Kentle, 1991) is a widely used 44-item self-report measure of five dimensions of personality (i.e., openness to experience, conscientiousness, extroversion, agreeableness, and neuroticism). Participants are presented with a series of characteristics and are required to rate their degree of agreement on a 5-point Likert scale from 1 (*Disagree strongly*) to 5 (*Agree strongly*). John & Srivastava (1999) found the average internal consistency reliability among the five subscales was .83, and convergent and discriminant validity have been established.

2.2.5 Depression, Anxiety, and Stress Scale

The Depression, Anxiety, and Stress Scale (DASS; Lovibond, S.H. & Lovibond, P.F., 1995) is a 42-item self-report measure that assesses the feelings and experiences typically associated with symptoms of depression, anxiety, and stress. Participants were asked to rate how much a series of statements such as “I found it difficult to wind down” applied to them in the last week on a 4-point Likert scale ranging from 0 (*did not apply to me at all*) to 3 (*applied to me very much or most of the* time). Separate scores are available for the three facets. The DASS has been shown to be reliable and valid (Lovibond, S.H. & Lovibond, P.F., 1995).

2.3 Procedure

Participants were recruited through a departmental research pool, which required that they were enrolled in at least one psychology course and permitted bonus points for their courses to be earned in compensation for their participation time. The study was conducted online, and recruitment included only participants over the age of 19 to prevent disclosure of illegal activity. Interested participants were required to sign up for the study and then provided a link to the online survey (hosted by Qualtrics with data housed on the university’s servers). After participants gave their informed consent to participate in the study, they were given access to the questionnaires.

2.4 Data Analysis

SPSS version 28 was used for all data analyses. Data were examined for missingness and were found to be missing completely at random. Because of the large size of the sample, missing data were not replaced or imputed. Prior to analyses, assumptions of independence of observations, homogeneity of variance, and normality were checked. Independence of observations was assumed for all variables. Normality plots were found to be slightly skewed, although these results were expected, and the skew and kurtosis values were found to be within the expected range of ±2 and ±3 respectively. The test for the assumption of homogeneity of variance was significant for several variables and was therefore corrected using Welch test *F* values as necessary. Descriptive statistics for all measures were calculated and are summarized in Table 2.

Table 2. Descriptive Statistics for All Measures

	Range	*M*	*SD*	*a*
Extraversion	9-35	22.57	5.40	.73
Agreeableness	11-45	35.22	5.32	.76
Conscientiousness	18-45	32.44	5.22	.84
Neuroticism	8-38	25.73	6.22	.68
Openness	17-47	33.48	5.70	.67
Depression	7-28	12.81	4.79	.84
Anxiety	7-28	12.43	4.61	.85
Stress	7-28	14.32	4.60	.85
Total cannabis use	1-19	4.09	3.84	.87
Functional consequences	0-16	2.00	3.55	.90
Overall GPA	53-100	78.27	9.48	-

Preliminary correlational analyses for all variables of interest were conducted. Regression analyses using personality (all five facets of the BFI) and mental health variables (three subscales of DASS) after controlling for total cannabis use to predict functional consequences and overall GPA were conducted to test the first hypothesis. Two analyses of variance (ANOVAs) were conducted to test the second hypothesis. For these analyses, those using cannabis in the past three years were divided into two nearly equal sized groups (i.e., low-moderate use and higher use). The groups were used to test the impact of cannabis use on functional consequences. Those who had not used cannabis in the past three years were not included in the first ANOVA because the language of the measure clearly indicated consequences secondary to cannabis use specifically. For the ANOVA testing the impact of level of cannabis use on GPA, those indicating that they had not used cannabis were included in the analysis. Because there were three groups in this analysis, contrast analyses were completed.

3. Result

Results of correlational analyses were checked initially to ensure the variables of interest were within expectancy. Total cannabis use was correlated with functional consequences and with overall GPA. Cannabis use was negatively correlated with conscientiousness and positively correlated with stress. Likewise, functional consequences of cannabis use were negatively correlated with conscientiousness and positively correlated with stress. Overall GPA was positively correlated with conscientiousness. No other correlations were statistically significant after Bonferroni correction. The correlational analyses are summarized in Table 3.

Table 3. Summary of Pearson Correlational Analyses

	Functional Consequences	*Overall GPA*	*Total cannabis use*
Total cannabis use	.65* (p<.001)	-.24* (p<.001)	-
Extraversion	.04 (.41)	<.01 (.96)	.11 (.05)
Agreeableness	-.13 (.02)	.01 (.83)	-.08 (.16)
Conscientiousness	-.21* (<.001)	.23* (<.001)	-.20* (<.001)
Neuroticism	.11 (.03)	-.06 (.24)	.13 (.02)
Openness	.06 (.25)	.04 (.45)	.02 (.65)
Depression	.05 (.34)	-.05 (.36)	.06 (.24)
Anxiety	.10 (.07)	-.12 (.02)	.12 (.02)
Stress	.21* (<.001)	-.07 (.22)	.18* (<.001)

Note. * Statistically significant after Bonferroni correction.

The first hypothesis was partially supported. We hypothesized that individuals with higher levels of neuroticism, lower levels of conscientiousness, and greater perceived stress would report more functional consequences associated with cannabis use and a lower GPA after including the amount of cannabis used in the analyses. Although neuroticism and conscientiousness were not significantly

associated with the functional consequences of cannabis use after controlling for total cannabis use, perceived stress (p=.006) remained a significant predictor. Similarly, neuroticism was not significantly associated with GPA after controlling for total cannabis use, but agreeableness (p=.03) and conscientiousness (p<.001) were significant predictors. The regression analyses are summarized in Tables 4 and 5.

Table 4. Regression Predicting Functional Consequences of Cannabis Use

	Model 1 b* (*p*)	Model 2 b* (*p*)	Model 3 b* (*p*)
Total cannabis use	*.652 (<.001)*		
Total cannabis use		*.637 (<.001)*	
Extraversion		-.035 (.46)	
Agreeableness		-.067 (.17)	
Conscientiousness		-.050 (.32)	
Neuroticism		.017 (.70)	
Openness		.086 (.06)	
Total cannabis use			*.622 (<.001)*
Extraversion			-.056 (.24)
Agreeableness			-.059 (.22)
Conscientiousness			-.054 (.29)
Neuroticism			-.037 (.52)
Openness			.076 (.10)
Depression			-.095 (.15)
Anxiety			-.066 (.31)
Stress			*.218 (.006)*
Adj. R^2	.425	.430	.439
F	230.21	40.22	28.16
DR^2	.425	.016	.015
D*F (p)*	230.21 (.0001)	1.70 (.13)	2.70 (.05)

Note. * Standardized Coefficient b.

Table 5. Regression Predicting Overall GPA

	Model 1 b* (*p*)	Model 2 b* (*p*)	Model 3 b* (*p*)
Total cannabis use	*-.244 (<.001)*		
Total cannabis use		*-.208 (<.001)*	
Extraversion		-.032 (.59)	
Agreeableness		*-.132 (.03)*	
Conscientiousness		*.239 (<.001)*	
Neuroticism		-.016 (.78)	
Openness		.033 (.58)	
Total cannabis use			*-.204 (<.001)*
Extraversion			-.028 (.65)
Agreeableness			*-.133 (.03)*
Conscientiousness			*.242 (<.001)*
Neuroticism			.005 (.94)
Openness			.025 (.67)
Depression			.021 (.83)
Anxiety			-.121 (.16)
Stress			-.049 (.56)
Adj. R^2	.056	.089	.088
F	19.10	5.96	4.23
DR^2	.059	.048	.007
D*F (p)*	19.10 (<.001)	3.20 (.008)	0.79 (.50)

Note. * Standardized Coefficient b.

The second hypothesis was also partially supported. We had hypothesized that low-to-moderate cannabis use would not be associated with more functional consequences and lower GPAs, but these relations would be significant for individuals at higher levels of cannabis use.

The ANOVA for group differences between people who use low-moderate amounts and those who use greater amounts on functional consequences was statistically significant ($F_{(1,184)}$=32.28, p<.001) with a large-sized effect (h^2=.149). Likewise, the ANOVA for group differences among people who do not use cannabis, those who use low-moderate amounts, and those who use higher amounts on overall GPA was statistically significant ($F_{(2, 337)}$=14.16, p<.001) with a medium-sized effect (h^2=.078). Follow-up groupwise comparisons showed that those who do not use cannabis could be separated from those using cannabis on overall GPA but there were not statistically significant differences between those using at the low-moderate level and those using at a higher level. Group descriptive statistics for the ANOVA tests are summarized in Table 6.

Table 6. Group Descriptive Statistics for Functional Consequences of Cannabis Use and GPA

	Functional consequences			Overall GPA		
Cannabis use group	**Mean**	**SD**	**Range**	**Mean**	**SD**	**Range**
Non-use (n=172)	-	-	-	80.95	9.22	63-100
Low-moderate use (n=93)	1.77	2.76	0-15	76.25	9.92	53-100
Higher use (n=97)	4.88	4.45	0-16	75.22	8.07	57-93

4. Discussion/Conclusions

This present study investigated the personality and mental health factors that portend risk for functional and academic consequences associated with cannabis use in university students. The study used concurrent data from undergraduate students enrolled at a comprehensive university in Southwestern Ontario. Results suggest that some personality factors (namely conscientiousness and agreeableness) and self-reported stress are associated with functional difficulties related to cannabis use when cannabis consumption is included in the analyses. Contrary to expectation, neuroticism was not associated with lower academic achievement or functional difficulties.

Although there is a substantial literature on the impact of personality and mental health on cannabis use and on the outcomes associated with cannabis use, the literature is far from conclusive. Some studies have shown that when adolescents and emerging adults experience high levels of stress, they are more likely to use cannabis (Clendennen et al., 2021). In contrast, other studies have suggested that the relation between stress and cannabis use is moderated by other variables, such as emotional reactivity (Cavalli & Cservenka, 2021) or perceptions of risk associated with cannabis use (Chadi et al., 2020). Relatedly, the direction-of-effects are also unclear; does the regular use of cannabis lead to enhanced stress or does greater levels of stress overall predict a greater likelihood of using cannabis to cope? It may also be that these data relations are iterative.

The role of personality and cannabis use is also complicated in the literature. As previously described, there are some studies (Allen & Holder, 2013; Dash et al., 2019; Winters et al., 2022; Jones et al., 2022) that have connected lower levels of agreeableness and lower levels conscientiousness to more cannabis use and consequences of use. Nevertheless, our results suggesting that individuals who are less agreeable and less conscientiousness are also more likely to experience lower GPAs if they use cannabis may align with longitudinal studies showing these relations hold over time. Notably, we had not hypothesized that agreeableness would be a significant factor in our analyses. Contrary to what we hypothesized, neuroticism was unrelated to cannabis use functional outcomes and GPA in our sample. The literature has been equivocal on this intersection with some studies suggesting a strong connection

(Winters et al., 2022; Lee-Winn et al., 2018) and others finding no relation (Terracciano et al., 2008). It may be that our sample, made up largely of psychology majors, was somewhat more emotionally stable due to substantial coursework in mental health and access to multiple levels of healthcare on campus.

The second set of analyses examined the differences between those who do not use cannabis, those who use low-to-moderate levels of cannabis, and those who are using greater amounts of cannabis. Our results indicated that there are significant differences in functional consequences (e.g., missing class after using cannabis) among those using lower levels of cannabis and those using higher levels of cannabis. The measure of functional consequences reflects a range of behaviors from having difficulty concentrating through not being able to stop using cannabis, but there are more items reflecting significant difficulty. Those with lower reported rates of cannabis use not only endorsed significantly fewer items than those reporting greater usage, but their endorsements were also on less severe items, like memory lapses. Notably, all three groups reported fairly low levels of functional consequences of cannabis use, as would be expected in a sample of students currently enrolled in university courses.

The related analysis focused on GPA had slightly different results. Those who reported not using cannabis had higher GPAs than those using cannabis at any level. Furthermore, those using cannabis at lower levels and higher levels were not statistically separable in terms of GPA. It may be that academic performance, as indicated by overall GPA, may be more sensitive to cannabis use at any level. This is in line with some other studies (Martinez et al., 2015). It may also be that individuals who are using cannabis are less engaged overall in academic endeavours, including attending study groups, preparing in advance of lectures, and seeking assistance from faculty, than those who do not use cannabis (Arria et al., 2015).

The most notable limitation in our study is the use of cross-sectional data. Although true random assignment is not possible with this research question, a quasi-experimental design with longitudinal data collection would have allowed us to posit directions of effects in our data. Because our participants are largely Caucasian/European Canadian females, generalizations to people of colour, males, and non-university student populations are less likely to be valid. This is particularly concerning with ongoing issues related to the historical use of data from white participants being inappropriate applied to racialized populations (Ford & Airhihenbuwa, 2010).

The current study, despite the limitations, helps extend the existing research concerning consequences of cannabis use in a new direction. While the consequences of potential cannabis use and abuse among emerging adults are not always substantial, it appears that pre-existing factors may increase the likelihood of these consequences occurring. Theses results highlight the importance of adapting current cannabis use prevention and intervention tactics to reflect these individualized differences. It is important for students, parents, educators, law enforcement and health professionals to recognize that the chances of experiencing negative consequences related to cannabis use are not the same for every person who uses it. This research exemplifies the importance of tailoring the approach taken towards

prevention, intervention, and treatment to focus on those individuals who are at an increased risk of suffering negative consequences and limit the inappropriate generalization of those consequences to every individual.

The results of this study have implications within the cannabis use field and help identify possible risk factors for negative consequences related to cannabis use in university students. These predictors are important for identifying individuals who could be more susceptible to the potential harmful outcomes that accompany cannabis use. The results highlight the importance of shifting the focus towards modified clinical practices and policy changes, particularly in higher education settings, to help combat the potential and observed negative consequences of cannabis use in at-risk individuals. There may be impacts on university policies and practices in the provision of medical and mental health care, opportunities for drug-free events on campus, and the communication that occurs at higher stress points in the academic year, such as during exams. Future studies should expand on risk factor research by replicating the current results with a larger sample size, and shifting focus to other potential risk factors, such as the motivation to use cannabis. Additionally, it will be important to identify potential protective factors, such as the influence of strong social supports, against the more negative consequences of cannabis use.

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