Beyond the Bong: Edible Marijuana Use among College Students

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ABSTRACT

Marijuana use is a prevalent behavior among college students. Little is known regarding edible marijuana use among this population. Further, limited research on attitudes towards legalization among edible users is available. The present study examines edible marijuana use among college students and attitudes towards use and legalization. A survey instrument was developed by the research team to investigate the study purpose. Participants included a total of 291 students at one Midwestern, urban university. Results indicated that one in four (26.3%) college students reporting using edible marijuana in their lifetime. No significant differences were found based on sex and race/ethnicity. Significant differences were found based on driving behaviors, family use of marijuana, and friends' use of marijuana. In addition, edible users were significantly more likely than non-users to want marijuana to be legal for recreational and medicinal purposes and were more likely to vote in an upcoming election due to marijuana being on the ballot. Such high rates of edible marijuana use may be a cause for concern for health professionals. Prevention and risk reduction programs may be warranted.

Key words: marijuana, edibles, college student, legalization, voting intention

Research trends indicate that marijuana use among college students is increasing in the US (Substance Abuse and Mental Health Services Administration, 2015). National studies found almost half (48.5%) of college students used marijuana in their lifetime whereas one in five (20.8%) reported using in the past 30 days (Johnston, O'Malley, Bachman, Schulenberg, & Miech, 2015). Although smoking marijuana remains the most common route of administration, variant forms of marijuana use also exist (Higher Education Center for Alcohol and Drug Misuse Prevention and Recovery, n.d.). Additional forms include edible marijuana, drinkable marijuana, marijuana vaporizers, and dabbing of marijuana.

Edible marijuana may be increasing in popularity. Specifically, edible marijuana refers to any food item that includes cannabis (Gourdet et al., 2017). Typical items consumed include brownies, cookies, other baked goods, suckers and hard candies, and gummy candies among others. Research indicates that approximately 30% of marijuana users have consumed an edible form of marijuana (Schauer, King, Bunnell, Promoff, & McAfee, 2016). Additional trends demonstrate higher rates of edible marijuana in states that have legalized marijuana for medical purposes (Borodovsky et al., 2016). Some researchers speculate edible marijuana users choose to eat rather than smoke marijuana to avoid negative consequences associated with inhaling marijuana smoke (University of Wisconsin Colleges, 2014).

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Others hypothesize that consuming edibles is less noticeable than smoking marijuana (Higher Education Center for Alcohol and Drug Misuse Prevention and Recovery, n.d.). However, limited information is available regarding the extent of edible marijuana use among students.

In Colorado and Washington, the selling of edibles has been robust ever since the legalization of recreational marijuana (Gourdet et al., 2017). In 2014, almost 50% of total marijuana sales in Colorado were of edibles with almost 3 million units of edibles and nearly 2 million units of medicinal edibles being bought at medical marijuana shops (Brohl, Kammerzell, & Koski, 2015).

As multiple states have legalized medical marijuana and several legalized marijuana for recreational purposes, increasing attention has been placed on marijuana use and policy initiatives (Schuermeyer et al., 2014). Greater than half (53%) of US citizens support decriminalizing marijuana whereas 2 in 3 Americans (63%) report marijuana as less harmful than alcohol (Pew Research Center, 2015). Of the 4 states and the District of Columbia to legalize marijuana for recreational use, individuals in those areas must be 21 or older to legally purchase and use marijuana. However, research indicates that diversion of medical marijuana to adolescents as well as increases in overdoses of children exists (16 to 22). Furthermore, studies indicate adolescents in states that passed medical marijuana laws are more likely to perceive marijuana as less harmful (Keyes, et al., 2016). Thus, it is important to investigate use patterns among college students as well as attitudes towards legalization.

Negative consequences of marijuana use exist and affect both physical and mental health status. Cognitive deficits and deleterious impact on brain development have been identified and particularly affect youth and young adults (Griffith-Lendering, Huijbregts, Vollebergh, & Swaab, 2012). Marijuana smoking has been linked to respiratory problems and other chronic diseases such as cancer (Owen, Sutter, & Albertson, 2014). Additional research found correlates between marijuana use and psychological issues including depression and anxiety (Crippa et al., 2009; Degenhardt, Hall, & Lynskey, 2003; Lev-Ran et al., 2014; Moore et al., 2007; Richardson, 2010). Individuals who are heavy marijuana users report lower levels of life satisfaction and greater relationship difficulties than light users or those who never use marijuana (Fergusson & Boden, 2008). Moreover, home preparation of THC, which results in edible hash oil, involves the use of butane, or lighter fluid, which has resulted in home fires and explosions, and subsequent serious burns (Romanowski et al., 2017).

Less is known about effects of consuming edible marijuana. Whereas smoking marijuana tends to produce the same physical effect for users, the physical effects of consuming marijuana vary (University of Wisconsin Colleges, 2014). In edibles, levels of tetrahydrocannabinol (THC) may vary producing differing psychoactive effects (Washington Poison Center, n.d.). On average, the effects of edible marijuana tend to last longer than inhaled marijuana. It may also take up to 4 hours for an edible user to feel the effects of marijuana compared to immediately for users who smoke marijuana (Colorado Department of Public Health & Environment, 2015; Washington Poison Center, n.d.). This can result in the user over consuming edibles, as the effect is not immediate, and therefore the increase in THC can cause a state of psychosis until the drug wears off (Hudak, Severn, & Nordstrom, 2015).

Purpose of the Present Study

Limited research on edible marijuana use among college students is available. Identifying the extent and potential trends in use is important for prevention specialists and others to reduce negative consequences associated with use. Therefore, the purpose of the present study was to investigate edible marijuana use and identify potential correlates to use. A 2015 ballot initiative was introduced to Ohio voters to legalize marijuana for recreational and medical use. Primarily, one political action committee, Responsible Ohio, lead the efforts to legalize marijuana in Ohio (Lucy Burns Institute, 2015). A secondary aim of the study was to examine attitudes of edible marijuana users towards legalization. More specifically, the following research questions were assessed: 1) What percent of students used edible marijuana in their lifetime? Past year? Past 30 days?, 2) Is edible marijuana use associated with risky driving

behaviors?, and 3) Does edible use differ based on sex, grade, race/ethnicity, perceived harm, parents and friends' use, intention to vote, and knowledge of Responsible Ohio?

METHOD

Participants

Study participants included students in general education classes at one Midwestern urban university. All student participation was voluntary. The Institutional Review Board (IRB) granted approval for the current study.

Instrumentation

To assess research questions, a survey was developed to determine participants' edible marijuana use and attitudes towards marijuana use and attitudes towards voting. The survey was also created to assess risky driving behaviors, which is defined as driving while using marijuana as well as riding in a car with a driver who is intoxicated via this drug. The first section assessed student edible marijuana use including lifetime, past year, and past month use.

The next section of the survey examined risky behaviors associated with marijuana use including unsafe driving behavior including: (1) In your lifetime, have you ever used marijuana and driven a car?; (2) During the past 30 days, did you use marijuana and drive a car?; (3) During the past 30 days, did you ride in a car with a driver who had been using marijuana?

The next section assessed family and friends use of marijuana, items included: (1) I have a family member that uses marijuana; (2) I have a friend who uses marijuana; (3) My group of friends uses marijuana. The fourth section examined student knowledge and involvement with Responsible Ohio, the political action committee leading legalization efforts in Ohio. This section included the following items: (1) I am familiar with Responsible Ohio; (2) I attended a Responsible Ohio event; (3) I have seen Responsible Ohio campaign materials. Each section of the survey instrument requested students to respond by checking the appropriate box (yes/no). The attitudes towards marijuana and marijuana legalization included two items and requested students to respond using a Likert-type scale (1 = strongly disagree; 5 = strongly agree). Attitudes towards voting and harm included four items and required students respond via the same five point, Likert-type scale. These items include: (1) Medical marijuana should be legal in Ohio; (2) Marijuana should be legal in Ohio; (3) In general, marijuana is harmful to your health; (4) I usually vote in elections; (5) I intend to vote in November; (6) I intend to vote in November because there is a marijuana law on the ballot. Lastly, students were asked to provide demographic and background information including grade, sex, race/ethnicity, grades received, and living location. Students were asked to check the box next to the appropriate response.

Procedures

To establish reliability, the survey was distributed in one classroom two weeks apart. Kendall's tau-b correlation coefficients were computed for non-parametric items, which resulted in coefficients greater than .70. Similarly, Cronbach Alphas were computed to establish reliability for each of the parametric data, which yielded coefficients greater than .70. Lastly, internal consistency reliability analyses were also calculated resulting in a coefficient greater than .80.

For the study, in each class one member of the research team explained the purpose of the study and informed students that all responses would be anonymous. Students were also informed that by completing the survey and turning it in, participants granted approval to participate in the study. The survey took approximately 5 to 10 minutes.

The survey was distributed to a panel of five experts including three survey researchers and two college health professionals to establish content validity. Each panel member was asked to review the survey and provide feedback. All comments were subsequently reviewed by the research team and incorporated into the final instrument.

Data Analysis

Data was analyzed using the Statistical Package for the Social Sciences (SPSS) (Version 23.0). Descriptive statistics (frequencies, means, standard deviations, ranges) were used to describe the demographic information. Logistic regression was also conducted to determine if edible marijuana use differed based on demographic and background characteristics. In addition, a series of multivariate analysis of variance (MANOVA) were calculated to determine whether edible marijuana use differed based on attitudes towards marijuana and marijuana legalization, and attitudes towards voting.

RESULTS

Sample Description

The present study included 291 students at a Midwestern, urban, public university (see Table 1). Of 295 students approached to participate, only four declined to complete the survey, resulting in a response rate of 98%.

Table 1. Demographic and Background Characteristics of Participants

Item	N (%)
Sex	
Male	175 (60.1)
Female	116 (39.9)
Grade Level	
Freshman	183 (63.1)
Sophomore	66 (22.8)
Junior	27 (9.3)
Senior	12 (4.1)
Graduate Student	2 (0.7)
Race/Ethnicity	
African American	28 (9.8)
Asian	18 (6.3)
White	222 (77.6)
Hispanic	2 (2.8)
Multiracial	10 (3.4)
Living Location	
On campus	163 (56.2)
Off campus	87 (30.0)
At home with parents	38 (13.1)
Other	2 (0.7)
Grades Received	
Mostly As	132 (46.3)
Mostly Bs	130 (45.6)
Mostly Cs	23 (8.1)

Notes: $N = 291$

Extent of Edible Marijuana Use and Use based on Demographic Characteristics

Of the students who participated in the study, 26.3% reported using edible marijuana in their lifetime. Moreover, 15.5% cited using edibles in the last year and 5.8% stated they used in the last month. Results were not significant for edible marijuana use based on sex with 31.9% of males and 22.5% of females reporting edible use in their lifetime (see Table 2). Results also indicated there were no significant differences based on grade with 25.1% of freshman/sophomores reporting use compared to 34.1% juniors/seniors/graduate students. The results also found no significant differences based on race/ethnicity with 28.1% of white students reporting edible use compared to 20.3% of nonwhite students.

Extent of Risky Driving Behaviors

The data revealed that students who had ever consumed edible marijuana were more likely to use marijuana and drive (55.3%) than choose to not engage in that particular risky driving behavior (44.7%). Significant differences on lifetime edible use was found based on using marijuana and driving χ^2 (1, $N = 291$) = 59.588, $p < .001$. Findings also revealed that of the students who ever consumed edibles, 21.1% used marijuana and drove in the past 30 days and 43.4% rode with a driver who used marijuana within the last month of survey distribution. Results indicated significant differences for use based on recently using marijuana and driving χ^2 (2, $N = 291$) = 35.098, $p < .001$, as well as recently riding in a vehicle with a driver who has been using this drug χ^2 (2, $N = 291$) = 23.715, $p = p < .001$.

Edible Marijuana Use based on Parent and Peer Use of Marijuana

The majority of participants that reported ever using edibles also cited having a family member that uses marijuana (55.3%) in contrast

Table 2. Odds Ratios for Ever Used Edible Marijuana based on Background and Demographic Characteristics, Family and Friend Use, and Awareness of Responsible Ohio

Item	OR	(95% CI)	χ^2	*p*
Sex				
Male [a]	.621	(.366, 1.054)	3.134	.077
Female				
Grade				
Freshman/Sophomore [a]	1.547	(.763, 2.137)	1.481	.224
Junior/Senior				
Race				
White [a]	.654	(.333, 1.285)	1.534	.216
Nonwhite				
Family Use				
No [a]	1.0			
Yes	2.524	(1.478, 4.309)	11.840	.001
Group of Friends Use				
No [a]	1.0			
Yes	4.839	(2.618, 8.944)	27.993	<.001
Awareness of Responsible Ohio				
No [a]	1.0			
Yes	3.245	(1.30, 5.753)	17.114	<.001

Note. [a] Indicates Referent.

to having family members that did not use this substance (44.7%) (see Table 2). Significant differences on edible use was found based on family's use of marijuana χ^2 (1, N= 291) = 11.840, p = .001. Comparably, lifetime edible use was higher among students who had a group of friends that use edibles (78.9%) than those who did not have a group of friends who use this particular substance (21.1%). Significant differences were found based on group of friends use χ^2 (1, N= 291) = 27.993, p < 0.001.

Knowledge of Responsible Ohio

Concerning Responsible Ohio, results indicate that individuals who ever used edibles accounted for 42.1% of those who are familiar with this campaign, whereas only 18.3% of those who did not use the substance were aware of the campaign (see Table 2). Findings denoted significant differences for knowledge based on lifetime use χ^2 (1, N= 291) = 17.114, p < .001. In addition, 6.6% of the students who used this drug and 2.3% who do not use attended a Responsible Ohio event. Students who use edibles accounted for 43.4% of those who have seen materials related to the campaign as opposed to 23.5% of non-users citing they had seen campaign materials. Significant differences were not found for attending an event based on use χ^2 (1, N= 291) = 3.002, p = .083 although significant differences were indicated for seeing materials based on use χ^2 (1, N= 291) = 10.887, p = .001.

Differences based on Attitudes towards Marijuana Use and Legalization and Typical Voting Behaviors and Intention to Vote

Results of the study indicated that students who ever used edible marijuana were more likely to want marijuana to be legal (M = 3.97, SD = .979) than those who never used edibles (M= 2.97, SD= 1.209) (see Table 3). Moreover, students who ever used edibles were more likely to want medical marijuana to be legal (M = 4.36, SD = .860) than those who never used (M = 3.75, SD = .961). Significant differences were found based on attitudes

Table 3. Ever Used Edible Marijuana based on Attitudes towards Legalization

Item	Have Not Used in Lifetime	Have Used in Lifetime		
	M (*SD*)	*M* (*SD*)	*F*	*p*
Marijuana Should be Legal in Ohio	2.97 (1.209)	3.97 (.979)	42.507	<.001
Medical Marijuana Should be Legal in Ohio	3.75 (.961)	4.36 (.860)	23.337	<.001

Note. $N = 291$.

Table 4. Ever Used Edible Marijuana based on Intention to Vote

Item	Have Not Used in Lifetime	Have Used in Lifetime		
	M (*SD*)	*M* (*SD*)	*F*	*p*
I usually vote in elections	2.96 (1.136)	3.05 (1.118)	.399	.528
I intend to vote in November	3.49 (1.123)	3.62 (1.243)	.709	.400
I intend to vote because marijuana is on the ballot	2.56 (.999)	2.96 (1.238)	7.856	.005

Note. $N = 291$.

towards marijuana becoming legal in Ohio, $F(1, 291) = 42.507$, $p < .001$ as well as medical marijuana becoming legal in Ohio, $F(1, 291) = 23.337$, $p < .001$.

Students who ever used edibles were slightly more likely ($M = 3.05$; $SD = 1.118$) to usually vote than their peer counterparts ($M = 2.96$; $SD = 1.136$) (see Table 4). No significant differences in students' use based on voting behaviors were found, $F(1, 291) = .399$, $p = .528$. Students who used were also slightly more likely to intend to vote in November ($M = 3.62$; $SD = 1.243$) than non-users ($M = 3.49$; $SD = 1.123$). No significant differences in students' use based on intention to vote were found, $F(1, 291) = .709$, $p = .400$. In line with these results, student who have used this substance were slightly more likely ($M = 2.96$; $SD = 1.238$) to plan to vote due to marijuana being on the ballot as opposed to students who have not used this substance ($M = 2.56$; $SD = .999$). Significant differences in students' use based on intention to vote due to marijuana being on the ballot were found, $F(1, 291) = 7.856$, $p = .005$.

DISCUSSION

Study findings revealed greater than one in four college students ever used edible marijuana. Regarding past year, approximately 15% used whereas approximately 5% used in the past 30 days. In comparison, previous research found 5% of Colorado youth had used edible marijuana products in their lifetime (Johnson, et al., 2016). Such high rates of edible marijuana use in this sample are cause for concern as limited research exists on the determinants and consequences of use. Few studies have examined the extent of edible marijuana use; therefore, the present study has identified high rates of use and provides insight into this behavior. It is apparent intervention is needed to educate this population on edible marijuana use, increasing awareness and enabling students to make informed decisions regarding use of marijuana edibles.

The present study found no differences in edible marijuana use based on sex, grade, or race/ethnicity. It appears edible marijuana use may be popular among college students across varying demographics and backgrounds. This is contrary to previous research, which indicates male college students are more likely than female college students to use marijuana (Johnston, O'Malley, Bachman, Schulenberg, & Miech, 2015). Similarly, a qualitative study of teen edible marijuana use found females were more likely to use edibles (Friese, Slater, Annechino, & Battle, 2016). There is a lack of research specifically on edible marijuana use. It is clear additional research on characteristics of edible marijuana users are needed.

Similar to other drugs, family and friends use of drugs was found to place students at risk for edible use. Students were more likely to use edible marijuana if a family member used marijuana. Regarding friends, students were almost 5 times as likely to use edibles if friends used marijuana. Additional research suggests that parent behavior has an impact on friend

choice among adolescents and emerging adults (Loke & Wong, 2010). Additionally, adolescents and emerging adults tend to choose peer groups based on common attitudes and beliefs (Alexander et al., 2001; Andrews et al., 2002; Simons-Morton, 2007). Thus, it is not surprising that parent and peer use is associated with increased odds of use.

Concerningly, students who ever used marijuana and drove in a car were 10 times more likely to use edibles than students who did not ever use and drive a car. Students who rode with a driver who used marijuana were over 4 times more likely than their counterparts to use edible marijuana. It is possible that students in this group may feel as if marijuana use is not a risky behavior. Conversely, it is also possible this group is also simply at high risk and engages in risky behaviors. Additional research is warranted to investigate student perceptions of marijuana use and driving. Similarly, edible users' perceived harm of marijuana use should also be investigated.

In the present study, edible users were less likely than non-users to feel marijuana is harmful. It is possible edible users may be sensation-seekers or willing to experiment with a variety of behaviors. Perhaps, as a group, these users perceive behaviors as less likely to be risky or harmful. Based on study findings, additional research is warranted to investigate psychosocial factors that may be associated with edible marijuana use. In the present study, edible marijuana users were less likely than non-users to feel marijuana is harmful. Perceived harm of marijuana use is decreasing among young adults (Johnston et al., 2015). Long-term studies of the health effects of edible marijuana use are needed. If consequences are found, then harm reduction approaches and educational campaigns educating the public on harmful effects can be utilized.

Students familiar with Responsible Ohio were 3 times more likely to have used edible marijuana than their counterparts who were not familiar with that organization. It may be possible that Responsible Ohio was successful in targeting current marijuana users with their initiatives yet failed to target non-users. It may be interesting to assess future campaigns and successes in directing campaign materials and events to marijuana and non-marijuana users.

Not surprisingly, edible users were more likely than non-users to believe marijuana should be legal for both medicinal and recreational purposes. Interestingly, study findings also revealed that edible marijuana users were slightly more likely than non-users, to vote, vote in the upcoming election, and to vote because marijuana was on the ballot. Research on voting behaviors indicates that prominent issues and events may effect voting behavior (South University, 2016). It may be that edible users were more interested in the election due to marijuana legalization appearing on the ballot. Previous research of college students found that holding a positive attitude regarding marijuana use increased the odds of voting for marijuana legalization (Moreno et al., 2016). The present study found that use contributed to intention to vote as well as intention to vote specifically due to a marijuana initiative being on the ballot.

Limitations

The following are study limitations. In this study, participants included students enrolled in one Midwestern, urban university in Ohio, and therefore it may not be possible to generalize these findings to other populations. Second, study findings are limited by the honesty and self-reporting accuracy of the participants. Third, as this was a cross-sectional study, cause and effect cannot be determined. Next, this study only examined marijuana users who reported consuming edible marijuana. No comparisons were made between marijuana users who consume via smoking versus marijuana users who consume edibles. Future studies should seek to examine differences based on marijuana route of administration.

Conclusions

Marijuana use is commonly reported among college students; however, limited information is available specifically on edible marijuana use. The present study found 26.3% of students ever used edible marijuana in their lifetime. With greater than one in four students reporting using edible marijuana, attention is needed to this behavior on college campuses. Additionally, potential negative consequences for college students should be explored.

Future research on edible marijuana should compare students who smoke marijuana with

those who use edible products. Perhaps, there are differences in these two populations. Additionally, identifying the types and quantity of edible marijuana consumed may be an important step. Edible marijuana may be increasing in popularity and research is necessary to explore this health behavior among college students.

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