Cannabis edibles: Behaviours, attitudes, and reasons for use

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Abstract: Legalization of cannabis may correspond with increased prevalence of use of cannabis-infused edibles. The purpose of this literature review was to search the literature and summarize edible-related behaviours, perceptions and reasons for use. The main findings indicate that edibles are potentially being used more frequently and that there is a general lack of understanding on how to safely use them. The information from this review can be used to help direct future areas of research and to inform future health promotion initiatives on safe edible use.

Key words: Edibles; cannabis; cannabis-infused; behaviours; attitudes.

Introduction

Cannabis is a drug with psychoactive effects that is used both medicinally and recreationally. Legalization of cannabis for recreational use is becoming more common, with Canada having legalized cannabis in mid-October of 2018. The legalization of cannabis may enable the introduction of new products and potentially higher potencies of products (Hopfer, 2014). After legalization in Colorado, the use of cannabis-infused foods and edibles has surged (Krauss et al., 2017b) with edibles making up 45% of total cannabis sales in the year it was legalized (Barrus et al., 2016). However, after legalization Colorado also experienced a spike in cannabis-related emergency department visits, the majority of which were related to edibles (Barrus et al., 2016).

There are many different modes of consumption of cannabis, and each comes with its own risks and benefits. The method of administration can affect the initiation of effects, the duration of psychoactive effects, and the intensity of the high (Borodovsky et al., 2016). Ingestion of cannabis in edible form results in a different pharmacokinetic profile than smoking. When taken orally, delta-9-tetrahydrocannabinol (THC) undergoes a first-pass effect in the liver to a more potent compound, 11-hydroxytetrahydrocannabinol (11-OH-THC), which is then able to cross the blood–brain barrier and exert effects (Barrus et al., 2016). Because of this physiological process, there is a variable delay in the onset of effects, which may result in users consuming more than intended after not feeling the effects initially (Parnes et al., 2018). In Denver, a man jumped off of a balcony after consuming an entire edible cookie after not feeling the initial effects of the one-sixth he was only supposed to consume (Hancock-Allen et al., 2015). This demonstrates one of the potential risks of edible use by edible-naïve individuals. Additional concerns related to the consumption of edibles include the potential

for interaction with other drugs in the body (Frieze et al., 2016), dosage titration within the product, the variable onset of effects, as well as different rates of absorption (Parnes et al., 2018). There are also concerns surrounding the packaging and inaccurate labelling of edible products. Edibles are often packaged to mimic regular sweets and candy, with bright and appealing labels, which may increase their appeal to children and lead to accidental ingestion. Labelling of edible products was found to be very inaccurate, with one study finding that only 17% of retail products contained the labelled dose of THC, whereas 23% of retail products contained at least 10% more than the labelled dose (Parnes et al., 2018).

With the above stated concerns, it is relevant to examine what the general behaviours and attitudes towards and experiences with edible cannabis are, given the recent recreational legalization of cannabis in Canada. The purpose of this literature review is to synthesize existing research to explore the general behaviours and attitudes towards edible cannabis. The methods for this literature review were modelled after those of a scoping review. A structured protocol was followed to address a broad research question (Arksey and O'Malley, 2005). The literature was identified and characterized in a reproducible and updateable way to summarize what is known currently and to help identify gaps in the literature for further research (Arksey and O'Malley, 2005).

Methods

The methodology used for this literature review was modelled after that proposed by Arksey and O'Malley (2005). This method consists of a five-stage process including identifying the research question, identifying relevant studies, study selection, charting the data, and collating, summarizing and reporting the results (Arksey and O'Malley, 2005).

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Research question

This literature review attempts to answer the research question: what are the behaviours, attitudes, and reasons for use of cannabis-infused edibles?

Data sources and search strategy

Two electronic database aggregators were accessed through the University of Guelph Library. These include PUBMED (1950–present) and Web of Science (all databases). The initial search was conducted on 27 October 2018. A consistent search query was used: (cannabis OR marijuana OR marihuana OR ganja OR pot OR hashish OR weed) AND (edible* OR infuse* OR “space cake” OR “marijuana infused” OR “cannabis infused”) AND (attitude OR perc* OR aware* OR behavior OR factor OR correlates OR intent* OR knowledge). No time parameters were included. Google Scholar and Google were also used during the initial search. The only additional parameter included was that the literature must be in English.

Citation management

The desktop and web-based reference manager Mendeley was used to import and manage all citations. Duplicate citations were deleted after importing.

Eligibility criteria

The screening process was completed by one reviewer and was comprised of three stages. This included a title screen, abstract screen, and a full-article screen. The title had to appear applicable to the research question to be included past the initial title screen. The abstract and full article screening identified articles that addressed use and behaviours of edible cannabis, attitudes toward it, or reasons for use of edibles.

Data characterization

A table was created in Excel 2016 to characterize each article using items such as author, date of publication, publication type, study design, and legality of cannabis in the study location. There were no further exclusions based on this step.

Results

Search and selection of articles

The initial search produced 386 citations. These citations were uploaded into the reference manager, Mendeley, at which point duplicates were removed. After duplicates were removed, 211 citations remained. Three-stage screening of the remaining citations included a title, abstract, and full-article screen and resulted in 21 articles available for synthesis. An additional five articles were identified through snowballing and a web search. The flow of information through the literature review process is depicted in Figure 1 (Moher et al., 2009).

General characteristics of included articles

All of the literature included was produced between 2014 and 2018. Surveys were used as the main method of data collection in 54% (14/26) of the literature. Other methods included interviews, reports, analysis of social media content, and literature reviews. The United States accounted for 73% (19/26) of the included literature, with Canada accounting for the remainder. Other general characteristics such as author and sample size are shown in Table 1.

General edible use and related behaviours

Prevalence of use

There are a relatively small number of studies that address cannabis-infused edibles specifically; therefore, a limited amount of information is available on the prevalence of edible use in the context of legalization. It does, however, appear that legalization of recreational cannabis corresponds with increased prevalence of edible use in adults. Across the United States, there are varying cannabis laws including: recreational cannabis laws, medicinal cannabis laws, and the complete prohibition of cannabis use. In a nationally representative survey of the United States, 29.8% of adults who have ever used cannabis and 16.1% of current adult cannabis users reported having ingested an edible (Schauer et al., 2016). Contrary to this, in just the first year of legalization of recreational use in Colorado, significantly more cannabis users had used an edible. In this first year, 53.6% of adult current cannabis users reported having consumed an edible (Allen et al., 2017). In Canada, the prevalence of edible use among cannabis users has been increasing, even prior to recreational legalization. In 2017, 32% of cannabis-using respondents to the Canadian Cannabis Survey reported using an edible in the last 12 months (Government of Canada, 2017). This increased to 41% in the 2018 report, prior to recreational legalization (Government of Canada, 2018).

Prevalence of edible use in youth cannabis users also appeared to vary depending on legality. In California, where recreational use is legal, Friese et al. (2017) analyzed data from the California Healthy Kids Survey and found that 82% of past-month cannabis users and 72% of lifetime cannabis users had ingested edibles at some point. Lower levels of edible use were noted in a study of university students in the southwestern United States where there are only medicinal cannabis laws; Jones et al. (2018) found approximately 62% of Bachelor and Masters student cannabis users had consumed edibles in the last year, roughly 10%–20% lower than in California.

Heavier cannabis use

Edible users were found to have heavier overall cannabis use compared to cannabis users who did not consume edibles. Across the United States, adolescent and young adult edible users were more likely to use cannabis multiple times per day and to be high for longer (Krauss et al., 2017a). Similarly, in California, adolescent edible users reported more frequent overall cannabis use in their lifetime than nonedible users (Friese et al., 2017). These respondents had used cannabis more

Figure 1: PRISMA flow diagram of literature review selection process.

frequently in the past 30 days and had used it more frequently on school property than nonedible users (Frieze et al., 2017).

Initiation of use

Several studies examined the age of initiation of edible use as well as edible use in relation to initiation of cannabis use. Adolescent edible users in California, which has recreational cannabis laws, started using cannabis at a younger age than cannabis users not reporting edible consumption (Frieze et al., 2017). Whether edibles were the initial or subsequent mode of cannabis use was examined in another study.

Approximately 3% of adolescent cannabis users across the United States reported edible use as their first method of cannabis administration, whereas 65% reported it as the second (Knapp et al., 2018). Of those who initiated edible use after smoking cannabis, 65% did so within a week to a year after first smoking (Knapp et al., 2018). The impact of medical cannabis laws on initiation of edible use was examined by Borodovsky et al., (2016) who found no significant difference in the age of onset of edible use between medical cannabis law states and non-medical cannabis law states in the United States. No study examined the age of onset of edible use in relation to recreational cannabis law states.

Table 1: General characteristics of the 26 included publications

Author (year)	Study design	Location	Legal status of cannabis at time of study	Sample size	Use of cannabis by participants
Allen et al., 2017	Quantitative	Colorado	Legal for recreational use	634	Cannabis users
Barrus et al., 2016	Review	N/A	N/A	N/A	N/A
Borodovsky et al., 2016	Quantitative	United States	Varied	2838	Cannabis users
Borodovsky et al., 2017	Quantitative	United States	Varied	2630	Cannabis users
Cavazos-Rehg et al., 2018	Cross-sectional	United States	Varied	4166 tweets	Presumed cannabis users (analysis of posts)
Charlebois et al., 2018	Quantitative	Canada	Legal for medicinal use	1087	Cannabis and noncannabis users
Friese et al., 2016	Qualitative	California	Legal for recreational use	39	Cannabis and noncannabis users
Friese et al., 2017	Quantitative	California	Legal for recreational use	5390	Cannabis and noncannabis users
Giombi et al., 2018	Qualitative	Denver, Colorado and Seattle, Washington	Legal for recreational use	68	Cannabis users (specifically edibles)
Government of Canada, 2017	Quantitative	Canada	Legal for medicinal use	9215	Cannabis users
Government of Canada, 2018	Quantitative	Canada	Legal for medicinal use	7743	Cannabis users
Hancock-Allen et al., 2015	Report	Colorado	Legal for recreational use	N/A	N/A
Hopfer, 2014	Review	N/A	N/A	N/A	N/A
Johnson et al., 2016	Quantitative	Colorado	Legal for medicinal use	12,536	Cannabis users and noncannabis users
Jones et al., 2018	Cross-sectional	Southwestern US	Legal for medicinal use	357	Cannabis users
Kepple and Freisthler, 2017	Quantitative	Los Angeles, California	Legal for recreational use	524	Cannabis users
Knapp et al., 2018	Quantitative	USA	Varied	2630	Cannabis users
Krauss et al., 2017a	Quantitative	United States	Varied across country	2444	Cannabis users
Krauss et al., 2017b	Quantitative	N/A	N/A	51 videos	Cannabis users
Lamy et al., 2016	Quantitative	United States	Varied	1653 tweets	Presumed cannabis users (analysis of posts)
Lau et al., 2015	Qualitative	San Francisco, California	Legal for recreational use	97	Cannabis users
Meacham et al., 2018	Quantitative	Online	N/A	N/A	Presumed cannabis users (analysis of posts)
Murphy et al., 2015	Qualitative	San Francisco, California	Legal for medicinal use	97	Cannabis users
Parnes et al., 2018	Review	Colorado	Legal for recreational use	N/A	N/A
Popova et al., 2017	Qualitative	Denver, Colorado	Legal for recreational use	32	Tobacco or cannabis or vaporizer users
Schauer et al., 2016	Quantitative	United States	Varied	4269	Cannabis users and nonusers

Driving high

Given the inconspicuousness and ease of consumption of edibles, there is concern that one edible-related behaviour that will rise is the use of edibles in cars to avoid detection, and will therefore contribute to instances of driving high. In a survey of university students in the southwestern United States, cannabis users who reported edible use were actually not more likely to use an edible over smoking in a car (Jones et al., 2018). However, more frequent edible use was associated with driving while high after accounting for age, sex, and socioeconomic status (Jones et al., 2018). This did not remain statistically significant after controlling for overall frequency of cannabis use (Jones et al., 2018). Increased frequency of overall cannabis use remains a relevant concern with respect to driving, but at least Jones et al. (2018) found edibles do not appear to be used over smoking cannabis in a car.

Effect of dispensaries

Financial and geographic access to dispensaries appear to have an impact on the purchase of edibles, according to Kepple and Freisthler (2017) who surveyed people leaving cannabis dispensaries. In Los Angeles, California (a recreational cannabis law state), consumers were more likely to have purchased edibles from dispensaries in higher median income census tracts (Kepple and Freisthler, 2017). This may be explained by financial access; those in higher median income census tracts have higher disposable incomes and therefore a greater ability to buy speciality cannabis products such as edibles (Kepple and Freisthler, 2017). Geographic access to dispensaries also influenced the purchase of edibles, with consumers being more likely to purchase edibles when in closer proximity to a greater number of dispensaries (Kepple and Freisthler, 2017). Additionally, dispensary density was found to be positively correlated with percentage of ever edible use in a nationally representative survey (Borodovsky et al., 2016). Overall, approximately 12% of individuals leaving a dispensary had purchased an edible product (Kepple and Freisthler, 2017). Although these findings provide information on purchasing behaviours of edibles, they do not account for users that access their edibles in different ways, such as buying from a friend or making it themselves.

Edibles on social media and the internet

Given the ever-increasing popularity and accessibility of social media, several studies used quantitative analysis of various social media sites to gain insight into edible use and whether edible-related internet activity is increasing. In general, there was greater tweeting activity about edibles in states with recreational and (or) medical cannabis laws (Lamy et al., 2016). Of these, tweeting activity was highest in Colorado, Washington, and Oregon (Lamy et al., 2016). Although this greater activity could be indicative of a more positive perception of edibles or higher prevalence of use in these legalized states, it is important to note that this may also be explained by a fear of legal repercussions as a result of tweeting about edibles in a state where recreational use is not legal (Lamy et al., 2016).

The content of edible-related tweets was examined in two studies, finding a mix of positive and negative tweets. Positive tweets were present in a higher proportion than negative ones, and the proportion appeared to increase over time. Lamy et al. (2016) found that 56.8% of edible-related tweets were positive, whereas Cavazos-Rehg et al. (2018) found that 75% of edible-related tweets were positive and normalized or encouraged edible use. Of these tweets that normalized or encouraged edible use, 48% were about having consumed edibles or wanting to or planning to use edibles (Cavazos-Rehg et al., 2018). Approximately 13.2% of tweets analyzed in 2016 were negative, with many indicating that users had difficulty predicting the duration of the high experienced and its intensity (Lamy et al., 2016). Concerns and difficulties with edibles were also noted by Cavazos-Rehg et al. (2018); a total of 4% of tweets analyzed in this study were about being tricked into consuming edibles or accidental consumption of edibles, indicating some of the risks perceived with edibles.

Quantitative analysis of posts on Reddit showed that volume for edible-related posts has been increasing and at a faster rate (Meacham et al., 2018). "Question" and "Help" were two of the most frequently occurring words in Reddit posts concerning edibles (Meacham et al., 2018), which may indicate difficulty with use similar to the negative tweets mentioned previously.

Sources of information

Young adult cannabis or tobacco users in Denver, Colorado, used two separate sources for information about edibles: external and internal (Popova et al., 2017). External sources included the government, media, friends, and health care providers, whereas internal sources were their own experiences with using edibles and the way their body responded to them (Popova et al., 2017). In this study, many respondents felt there was a contradiction between the internal stream of information and the external stream, and they trusted their body to be the best source of information in determining if something was beneficial or detrimental for them (Popova et al., 2017). For other teens, the media was a source of negative attitudes about edibles. In a qualitative study of teens many of the participants heard from the media about youth dying from edible consumption (Friese et al., 2016), and this contributed to their risk perception.

Edible-related experiences

Significant negative experiences were reported with edible use. Physical dependence, academic and occupational problems, impaired control, self-care problems, and risk behaviours were all statistically significantly associated with more frequent edible use after controlling for demographic variables (Jones et al., 2018). Two studies in states with recreational cannabis laws, found that in adults and older adults, edible use was associated with greater odds of an unexpected high (Allen et al., 2017) or overdose (Lau et al., 2015) compared with other modes of consumption. This remained significant after controlling for age, gender, education, current use, and mean amount of cannabis consumed in the past month (Allen et al., 2017). Negative symptoms participants associated with these unexpected highs included sleepiness, nausea, anxiety, paranoia, and hallucinations (Lau et al., 2015).

Although many participants reported an unexpected high and other associated negative symptoms as a result of edible use, the most common response of adults to an unexpected high was to go to sleep, followed by deciding not to drive (Allen et al., 2017). Analysis of edible-related tweets as well as focus groups revealed that some users were essentially incapacitated from an unexpected high due to edible ingestion. They were completely unable to perform normal tasks afterwards due to difficulty in assessing the duration, intensity, and unpredictability of the high produced by edibles (Lamy et al., 2016; Lau et al., 2015).

These negative experiences were significant enough that certain groups of users, particularly older adults, used a “harm-reduction method” to avoid the negative effects of edibles. These respondents essentially used trial and error with a variety of different edibles to determine the dose and characteristics of an edible necessary for them to obtain the desired effects and avoid the negative ones (Lau et al., 2015). An additional, alternative method for other older adult users was to use their access to medical cannabis dispensaries to manage their edible use, as they felt the labelling helped them determine what would work best for them (Lau et al., 2015).

Perceptions towards edibles

To date, there have not been many studies on the general attitudes and perceptions of both nonusers and users towards edibles; however, in the limited literature respondents associated edibles with many perceived risks. An overall common perception is that edibles are cannabis-containing food products, when in reality the extracts often used to produce edibles can be different than the plants used for smoking, and the extracts produce a different profile of effects and issues (Barrus et al., 2016), something that is often not understood. Overconsumption was a predominant concern associated with edible use (Charlebois et al., 2018; Giombi et al., 2018; Popova et al., 2017). In a study examining the attitudes of Canadians towards cannabis as a food ingredient, approximately 59% of respondents were apprehensive about the possibility of eating too much (Charlebois et al., 2018). Concerns about the potency of edibles were also common (Charlebois et al., 2018; Giombi et al., 2018; Popova et al., 2017), with many participants worrying that the effects of edibles would be too strong or voicing concerns about unknown dosage (Friese et al., 2016; Lamy et al., 2016). In both Twitter analysis and focus groups, the delay in effects after ingestion of edibles was another concern noted (Giombi et al., 2018; Lamy et al., 2016;), with users viewing this aspect of edibles as risky because it leads to the potential for overconsumption.

Unpredictability of the high, the unreliability of edibles, as well as inconsistent distribution of cannabis in the product were additional risks associated with edible use as noted by Friese et al. (2016), Giombi et al. (2018), Lamy et al. (2016), Lau et al. (2015), and Popova et al. (2017). These risks of edible use lead to users being concerned about their ability to titrate or regulate the dosage from edibles (Lau et al., 2015). Not knowing what was in homemade edibles, intense highs, and long-lasting effects were other perceived risks noted in a qualitative study of teen cannabis users and nonusers as well as in a quantitative analysis of edible-related tweets (Friese et al., 2016; Lamy et al., 2016). The negative perceptions and attitudes towards edibles in general actually prevented some from choosing to consume them.

Popova et al. (2017) found young adult tobacco or cannabis users said they would rather smoke cannabis than use an edible because of some of the difficulties they associated with edibles. Additionally, among adolescent users who had smoked, vaped, and used edibles, edibles were the least preferred method of transmission, potentially because of the negative perceptions towards edibles (Knapp et al., 2018).

Due to the unassuming appearance of edibles, the risk of unintentional ingestion was a concern mentioned in three articles. In a qualitative study of edible users, the accidental ingestion of edibles by both children and pets was a concern (Giombi et al., 2018). The packaging of edibles is often very vibrant and appealing, so the risk is that it will also appeal to children. With respect to accidental ingestion, the health of children was more of a concern for those with children than those without (Charlebois et al., 2018). The potential for edibles to be used with malicious intent was also a concern. Adolescent female noncannabis users in particular likened edibles to “spiked drinks” (Friese et al., 2016), and were concerned about being tricked into ingesting them.

Although there is limited information available on the perceptions towards edibles, it appears that the majority of edible users perceived edible use as less risky than nonedible users. In California, female teenage noncannabis users were more concerned about edibles than any other group (Friese et al., 2016). However, both female and male cannabis users and nonusers perceived dosage to be a risk associated with homemade edibles (Friese et al., 2016). Although general cannabis users perceived some risk to be associated with edible use, edible users specifically were less likely to agree with the statement that edible use is very risky (Friese et al., 2017). In this same study, teen noncannabis users showed the most concern about edible use; approximately 54% of these respondents strongly agreed or agreed that edible use is very risky (Friese et al., 2017). Similarly, in focus groups in California, teenage noncannabis users, particularly girls, voiced concern about edible use, whereas edible users were generally not concerned about deaths related to edibles (Friese et al., 2016). In another quantitative study of adolescents in California, only 31% of cannabis users who used edibles agreed or strongly agreed with the statement that edible use is very risky (Friese et al., 2017).

In the context of a school setting, edible-using youth viewed edible use as less risky than smoking cannabis because edible use is less likely to attract unwanted attention (Friese et al., 2016). Nonedible users, youth who perceived school rules clearly, and females all had a higher perceived risk of edible use (Friese et al., 2017). In adolescent cannabis and edible users, there was a positive relationship between parental education and perceived risk of edible use (Friese et al., 2017).

Reasons for use of edibles

Although many of the reported perceptions towards edibles were negative and related to risk, edibles were viewed positively with respect to why they were used. Reasons for edible use included the effect of edibles over other modes of consumption, the benefit of the form of the product itself, and the ease of consumption associated with its form. In one set of focus groups with only edible users, most participants found edible use to be more socially acceptable than other forms of cannabis and used

edibles to avoid the stigma associated with smoking (Giombi et al., 2018). While stigma was mentioned by these edible users, avoiding the harmful effects of smoking as a reason for edible use was not (Giombi et al., 2018). Edible use as a way to avoid harmful effects of smoking was, however, mentioned in multiple other studies with both edible users and nonusers. Older adult cannabis users expressed concerns about the chemicals in rolling papers for joints and the general effects of smoking on their respiratory health, and they used edibles as an alternative to mitigate the health risk from smoking (Lau et al., 2015). Likewise, in quantitative analysis of tweets, some positive tweets portrayed edibles as a healthy alternate to smoking cannabis (Lamy et al., 2016). Both teen cannabis users and nonusers noted that some people use edibles because they have concerns about the harmful effects of smoking (Friese et al., 2016). Youth that perceived the harmfulness of smoking as high were two times more likely to have ingested edibles as their standard method of consumption (Johnson et al., 2016). The use of edibles to mitigate the harms of smoking may in part be due to public health campaigns in the past about the dangers of cigarette smoking (Johnson et al., 2016) that have translated over to cannabis smoking.

Aside from health as a reason to use edibles over smoking, multiple studies found that edibles were used for their innocuous appearance and consumption. Discreetness was a predominant reason for the use of edibles as mentioned by participants in five studies (Barrus et al., 2016; Friese et al., 2016, 2017; Giombi et al., 2018; Lau et al., 2015). They were used to avoid the odor of smoke, and for their easy, inconspicuous consumption. Adolescent female recreational edible users in particular perceived smoking as unattractive for girls and expressed high concern about the odor of cannabis lingering following smoking. They used edibles as a way to avoid this (Friese et al., 2016).

Edibles were also used over other modes of consumption because of their different effects. Respondents of two studies cited longer lasting highs as a reason for using edibles (Giombi et al., 2018; Popova et al., 2017). Better pain relief (Giombi et al., 2018), facilitation of sleep and relaxation (Lamy et al., 2016), convenience (Giombi et al., 2018), and a more efficient way of getting high (Popova et al., 2017) were additional reasons for use of edibles.

Discussion

There was limited literature about edibles available for review, likely due to their relatively recent increase in popularity and relevance. However, several subsequent steps should be explored given the results of this review. Further research is needed to gain a better understanding of the attitudes and behaviours of various groups towards edibles as well as some form of reliable health promotion campaign on edible use. The results of this literature review indicate that legalization of the recreational use of cannabis may impact the prevalence of edible use both in a general population and specifically in youth. States with recreational cannabis laws had greater overall prevalence of edible use compared with nationwide edible use as well as compared with states with just medical cannabis laws. It should be noted, however, that this difference could be due to underreporting prior to recreational legalization, rather than a true increase in prevalence of use.

Given that the Government of Canada has just recently legalized cannabis after having medical cannabis laws for many years, and is planning on legalizing edibles sometime in 2019, it is important to recognize that an increase in edible use is likely. As indicated by the Canadian Cannabis Surveys of 2017 and 2018 (Government of Canada, 2017, 2018), we are already seeing an increase in edible use by cannabis users, so with legalization it is likely this prevalence will be even greater. In addition to increased edible use by cannabis users, we may also see noncannabis users turn to edibles. In a nationwide survey of Canadians, almost 46% of respondents indicated that they would be willing to try a cannabis-infused food product once cannabis was legalized (Charlebois et al., 2018). There may also be greater trends towards edibles due to their discreetness and the perception that they are healthier than smoking cannabis (Murphy et al., 2015) as well as some of the other commonly cited reasons for use of edibles. This interest and increase in edible use is concerning given some of the problems associated with its use.

The results of this literature review revealed that there are issues with edible use, one of these is a general lack of understanding regarding edible use. This is indicated by the high prevalence of users reporting negative experiences when using edibles, some as significant as a total inability to function because of an unexpected high (Lau et al., 2015). Because edibles are different from more conventional modes of cannabis consumption, such as smoking, people often don't know how to safely use them to avoid adverse effects like an unexpected high. This lack of understanding could lead to greater harm, as demonstrated with the increase in edible-related hospital visits after recreational legalization in Colorado (Barrus et al., 2016). With the abovementioned increase in edible use, this is concerning, particularly for individuals who may have absolutely no knowledge about cannabis, edibles, or edible safety.

In addition to the negative experiences of edible users, edibles were also perceived to be associated with a variety of risks. While it was evident that there are concerns about edibles, it was clear that edible users in general are less concerned about their use than nonedible users (Friese et al., 2017). In addition to being less concerned about edible use, edible users were also found to be heavier overall cannabis users (Krauss et al., 2017a). This makes the need for some form of health promotion campaign even greater, as the heavy users who are at greatest risk from edibles are also the least likely to view edible use as risky. Nonedible users would also benefit from an educational campaign, as demonstrated by other rising concerns regarding edibles. One of these is the potential for edibles to be used maliciously, akin to a "spiked drink" (Friese et al., 2016). This is something that both edible and nonedible users need to be made aware of. Other issues such as inconsistent distribution of THC in edibles and delayed highs are additional factors that are specific to edibles that people may be unaware of and should be educated about. Education in the form of a health promotion campaign, or other similar endeavour, may be a valuable tool to mitigate both user and nonuser risk and increase safety and understanding of edible use.

There may be some difficulty in establishing an effective campaign. Young edible users in particular were less likely to believe external sources of information about edibles when compared with their own physical reactions; this was because they felt that

their own experiences contradicted the external messaging (Popova et al., 2017). They then discredited external sources of information (Popova et al., 2017). This is important to note in the positioning of future health promotion campaigns so that the message is not immediately dismissed by the target audience. Social media may be an appropriate channel to explore for the dissemination of edible-related information, especially to youth. As edible-related social media activity increases in areas with legal recreational use (Lamy et al., 2016), this may be a more direct means of communicating with both nonedible and edible users and thus a more effective way to educate them.

More research is needed to gain a better understanding of the current attitudes towards edible cannabis products, particularly in Canada. This was one of multiple gaps in the literature with others including the lack of research on university students and their specific attitudes and behaviours with respect to edibles. Additional factors that the literature did not cover include the locations where edibles are being used, whether smoke-free locations have an impact on edible use, how the process of legalization affects perceived risks towards edibles, and if any of these factors contributes to use. These are all key areas that have personal and public health implications and thus warrant greater examination.

After legalization, Colorado encountered such difficulties with edibles that there was a movement towards banning them completely (Monte et al., 2015). This was met with opposition, and as a result no ban was implemented but regulations were changed (Monte et al., 2015). It is unclear at this point what the exact edible-related policies will be in Canada, so gaining a greater contextual understanding of the current knowledge of edibles, especially in university students, is important to be able to effectively prepare both potential and current edible users. Given the increasing prevalence of edible use and the risks and reasons for use, more research on edibles and how people can be most effectively educated on them is needed.

Limitations

Limitations to this literature review included the databases selected, limited studies on this subject, and the exclusion of literature not published in English. Additionally, the inclusion criteria were developed and applied by one person and not verified by another researcher. Due to these limitations, there is the potential that not all studies relevant to this subject were captured.

Conclusion

Based on the literature found during this review, it is recommended that research efforts be increased to learn more about the perceptions and attitudes towards edibles in Canada, particularly in the context of legalization. While research continues, it is important that these findings be used constructively. With increasing prevalence of edible use, there is a window of opportunity for the implementation of harm reduction methods and health promotion campaigns to educate both potential and current edible users on the risks of edible use and how to safely consume them. Given the use of social media by young people, this may be one potential avenue of effective public dissemination that needs to be explored.

It is important that future research examines the most effective mode of communication for this audience and that health promotion campaigns are implemented accordingly. The results of this literature review have provided a foundational overview of the current attitudes towards edibles and where the gaps in the research are. These findings demonstrate that education on safe edible use is necessary to mitigate user risk and enhance understanding. Along with subsequent research findings, the results of this literature review can be used to create and implement effective health campaigns to educate people on the risks associated with edibles and their safe use.

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