So you think you can cook pot? - Evaluating knowledge of food safety and edible safety between users and non-users of cannabis edibles in British Columbia

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Abstract

Background: With regulations on additional cannabis products including edibles being in the works, Canada is faced with a new layer of food safety challenges as the public becomes increasingly curious about adding cannabis into their diets. Knowledge in both food safety and edible safety is essential to prevent health hazards associated with edible cannabis products.

Methods: An online self-administered survey was conducted on a British Columbia population. In addition to demographic data which also included cannabis usage, participants answered two knowledge tests on food safety and edible safety, respectively. The surveys were analyzed for differences in test scores between demographic groups.

Results: Users of cannabis edibles have significantly higher knowledge in edible safety than non-users. This was not affected by the purpose or frequency of edible use. A slight positive correlation (0.18) between food safety knowledge and edible safety knowledge suggested the two topic areas to be mutually beneficial. In contrary, knowledge in food safety was not significantly different across all demographic groups.

Conclusions: Non-users of cannabis edibles are more at risk of health hazards related to ingestion of cannabis edibles due to lower knowledge in this subject matter and eagerness to experience cannabis products after their legalization. Therefore, there is a need for education programs to help familiarize the public with these products. It is also recommended for the public to strengthen general food safety knowledge because all of it also applies when making edibles.

Keywords: cannabis, edibles, food safety, knowledge, THC, legalization

Introduction

With the new legalization of recreational cannabis in Canada, many people will be curious to try it for the first time, and especially in the form of edibles. Although recreational edibles are not sold in stores at present, preparation at home for personal use is allowed. This project aims to understand whether current users of cannabis edibles have the same degree of food safety knowledge as non-users, because improper preparation of certain cannabis edibles can have serious health consequences such as foodborne illnesses and overdoses (Warriner, n.d.). Specific knowledge related to cannabis such as dosage and active ingredients will also be surveyed. Having this knowledge on hand can also potentially impact one's decision to buy certain edible products. Therefore, results from the survey will illustrate the inherent risk of edible-related illnesses within the population and provide direction for future health promotion

programs related to edibles. Interest in the legalization process of cannabis in Canada was the main driving factor for this project, along with inspiration and support from the project supervisor. Many Environmental Health Officers (EHO) are curious about the health effects of cannabis and safety issues around edibles. This study hopes to contribute to the field of public health inspection as edibles could fall under the jurisdictions of an EHO soon.

Literature Review

Recreational cannabis was legalized in Canada on October 17th, 2018. This has serious implications on the demand for recreational cannabis across the country. The national cannabis survey released in April 2018 showed that once cannabis becomes legalized, 21% of the population would be more likely to try or increase consumption of cannabis. In the same survey, 28% of the surveyed cannabis users reported to have consumed edibles in the past 3 months, making it the 2nd most popular choice of cannabis consumption after dried flower or leaf joints (Statistics Canada, 2018a). Another Canada-wide survey reported 45.8% of respondents were willing to try a cannabis-infused food product after legalization (Charlebois, Somogyi, & Sterling, 2018). Despite the strong public interest in cannabis edibles, the Canadian government has decided to delay the legalization of the sales of edibles for recreational use, allowing only preparation of edibles at home for personal use (Tasker, 2018). There are no regulations on edibles in Canada or BC at the time of this study, nor is there any detail on edibles in the BC provincial Cannabis Control and Licensing Act (2018). However, cannabis edibles are far from scarce on the market. Consumers can purchase edibles via dispensaries and online shops for medicinal purposes. Some researchers are advising the government to include edibles in the legalization procedure, so regulations can be put in place. However, the challenge for the Canadian government, specifically Health Canada, is to develop a regulatory framework for cannabis edibles, taking the complex food industry into consideration. Health Canada promised that it will be ready a year after the first legalization. Proposed regulations for additional cannabis products including edibles were released in December of 2018 but how robust these regulations will be when enacted remains unknown (Government of Canada, 2018). The rushed legalization of cannabis edibles in several states in the U.S. illustrated potential problems surrounding food safety. As a result, experts warned that Canada should not follow the footsteps of the U.S. (Vermes, 2018).

The word "edibles" itself was born due to the poorly planned legislations on cannabis in the United States. In the U.S. Food and Drug Administration (FDA) regulations, marijuana is categorized as a "Schedule 1 drug", and any food is considered as "adulterated" if it contains a nonnutritive ingredient such as marijuana. As a solution, a new category named "edibles" was created by the Colorado Department of Public Health and Environment (CDPHE) to allow for its administration (Calonge, 2018). Since then, other states and the rest of the world have followed suit. By classifying edibles as neither food nor drug, they cannot be bound by food regulations (Diplock, Leatherdale, & Majowicz, 2017). Since legalization, many states have not been able to

develop a regulatory framework to control the production of edibles. Few consumers, however, are aware of this when purchasing edibles. Consequently, public health departments in many states lacked the power and tools to mitigate the possible health hazards. For example, in Colorado, the authority to conduct sanitary inspections lies with the Department of Revenue, not with CDPHE, and only as an emergency response measure (Calonge, 2018). In Arizona, the state has developed guidelines regarding safe production of edibles. However, the guidelines were not enforceable, and its public health department had to rely on another department's power to initiate a recall (Gaither, Peoples, Phillips, Lees, Corrigan, & Bohn, 2018). Without regulations, many facilities operate without the necessary monitoring procedures to prevent contamination. For example, Arizona Department of Health Services inspected a dispensary kitchen producing cannabis-infused marinara sauce without consulting a process authority, without a hazard analysis and critical control point (HACCP) plan, and without any testing of the food product (Gaither et al., 2018). Some other food safety issues that have been exhibited include unapproved ingredients, harmful levels of cannabis active ingredients (THC and CBD), cross-contamination, and poor sanitation and hygiene (Shaw, 2018). In retrospect of these cases, if Canada follows a similar regulatory system for edibles, consumers will be at risk for foodborne illnesses when purchasing cannabis-infused food products.

In the event of an unregulated Canadian edibles market, consumers should equip themselves with the knowledge on both food safety and cannabis to apply them appropriately when purchasing edibles and cooking with marijuana at home. Research has shown that in fact less than 20% of Canadians feel knowledgeable enough to use marijuana in cooking (Charlebois et al., 2018). However, no specific study has assessed the degree of edibles knowledge in Canadians, nor its association with food safety knowledge. As legalization of edibles draws near, more people could be researching about them. However, popular sources of information such as YouTube often fail to describe basic effects and risks of edibles (Ouellette, Cearley, Judge, Riley, & Jones, 2018). Therefore, this study would like to assess not only the existence of knowledge, but also the accuracy of information received by the consumers in the form of an online questionnaire. The following section explains key cannabis concepts as well as food safety fundamentals that the survey will be based upon.

The main active ingredients in cannabis are the cannabinoids, which are chemical compounds secreted by cannabis flowers. Of all cannabinoids, Tetrahydrocannabinol (THC) and Cannabidiol (CBD) are the most well known for their effects on the human body. THC is responsible for the psychoactive effect in cannabis, which can be described as a euphoric or "high" effect (Rahn, 2014). At a dose as low as 1-2.5 mg of THC, users may experience relief of pain, stress, anxiety, and nausea. It can also improve sleep and decrease appetite. Other beneficial effects include enhanced focus and creativity (Sulak, 2018). However, as the dose of THC increases, therapeutic effects also decrease, but euphoria and side effects intensify. At 50-100 mg, THC can cause increased heart rate, anxiety, pain, impaired coordination, hallucinations, and

other overdose symptoms depending on the individual (Sulak, 2018). Table 1 shows the various symptoms users can expect as dose of THC increases in edibles.

Table 1: Edibles Dosing Chart published by Healer and Leafly illustrating symptoms and suitable users for different doses of THC (Sulak, 2018)

THC Content Per Dose	What to Expect	Who is It For?
1-2.5 mg THC	• Mild relief of pain, stress, anxiety, and other symptoms • Improved focus and creativity	• First-time consumers • Microdosers
2.5-15 mg THC	• Stronger symptom relief • Euphoria • May impair coordination and alter perception	• Patients with persistent problems • Restless sleepers • Social butterflies
15-30 mg THC	• Strong euphoria or unwanted effects in unaccustomed consumers • May impair coordination and alter perception	• Well-seasoned consumers • Medical patients with developed tolerances • Experienced consumers seeking to sustain sleep
30-50 mg THC	• Very strong euphoria in unaccustomed consumers • Likely to impair coordination and alter perception	• Consumers who have poor GI absorption of cannabinoids • People with significant tolerance to THC
50-100 mg THC	• Can cause extreme side effects such as rapid heart rate, nausea, and pain • Highly likely to impair coordination and alter perception	• For experienced THC individuals only • Patients with cancer, inflammatory disorders, or conditions that necessitate high doses

CBD, on the other hand, is non-psychoactive, and has been shown to have higher therapeutic effects than THC. Not only can it alleviate pain, stress, and inflammation, CBD has also been proven effective in dealing with Multiple Sclerosis and epilepsy (Rahn, 2014). CBD produces a calming effect that can reduce the psychoactivity of THC, making it more beneficial for patients undergoing cannabis treatment (Sulak, 2018). Therefore, understanding the dosage and balance between THC and CBD is crucial for consumers in preventing unwanted symptoms. In fact, edibles are more likely to produce unpleasant effects than any other forms of cannabis (Sulak, 2018). Although marijuana may cause symptoms of overdose, it does not affect the body in ways like other illicit drugs such as opioids or cocaine. Most illegal drugs affect the central nervous system and when overdosed may cause a person to stop breathing or have a heart attack (Desert Hope, n.d.). Cannabinoids do not bind to receptors that control these essential functions and will not have the same detrimental effects as illicit drugs (Desert Hope, n.d.). Nonetheless, dosage remains extremely important for cannabis edibles and especially for new users whom are more likely to feel unpleasant symptoms at lower doses. Therefore, half of the "standard dose" of 10 mg or "microdosing" of around 3-7 mg of THC is recommended for new users (Leafly, 2018). Depending on the type of edibles and individual metabolism, the effect of edibles may take up to two hours to appear. Keeping this in mind, users should not consume more before experiencing the effects of the first dose (Leafly, 2018). Consuming edibles on an empty stomach or in combination with alcohol can speed up the effect and increase THC concentration in the blood, respectively (Leafly, 2018). By understanding the above concepts, an educated user should be able to anticipate the effects and adjust dosage accordingly. If the consumer is cooking with cannabis, he/she should know how many milligrams of THC and/or CBD is in each serving to prevent accidental overdose.

Aside from cannabis knowledge, general food safety knowledge is required for consumers to recognize potential hazardous foods on the market and correctly prepare cannabis-infused foods to reduce risks of foodborne illnesses. The national cannabis survey in April 2018 revealed that Canadians from 15-34 years of age have the highest percentage of cannabis users (Statistics Canada, 2018b). Concurrently, research has shown that young Canadians aged between 19-29 years old have low food safety knowledge, where only 38% of respondents correctly identified the safe final cooking temperature of chicken (74°C) (Burke, Young, & Papadopoulos, 2016). Without the necessary food safety knowledge, increased interest in cannabis cookery amongst young Canadians might increase the rate of foodborne illnesses within this age group. A Californian study on youths aged 15-17 showed that teens chose edibles over smokes to avoid getting caught in school, and many home-made edibles were reportedly sold by students to their classmates (Friese, Slater, Annechino, & Battle, 2016). Gender also plays a role in food safety knowledge where women tend to have a stronger knowledge and better practices than men (Murray et al, 2017). On the flip side, multiple studies indicated that females prefer edibles over smoking when compared to males, which increases their risk of edible-induced illnesses (Friese et al., 2016; Statistics Canada, 2018c). Therefore, age and gender are factors that are important to consider when assessing knowledge in the context of this study.

Cannabis edibles have become increasingly diverse in form in the recent years due to its rising popularity. Beside the iconic pot cookies and brownies, there are candies, infused oils, canned products, and many more. A study has shown that the top 3 items prospective users would like to try after the Canadian legalization are bakery product (46.1%), other ready-to-eat products such as candy (26%), and simple oils (24%) (Charlebois et al., 2018). The focus turns to high-risk items that have the same characteristics as high-risk conventional foods: high pH (>4.6), high water activity (>0.85), and ready-to-eat (Diplock et al, 2017). Particularly, there is interest on infused oils and butters due to their universality in cooking. They pose a major concern for *Clostridium botulinum*, a potentially deadly bacteria common in foodborne illnesses that grows in anaerobic conditions (Warriner, n.d.). In addition, many cannabis enthusiasts make infused oils at home which, depending on the level of food safety knowledge of the individual, might have elevated food safety risks compared to a commercial producer. Other hazardous agents within the scope of cannabis edibles include organic solvents, heavy metals, pesticides, and microbes such as *Salmonella*, *E. coli*, and moulds (Warriner, n.d.). These agents often originate from the growth conditions similar to how E. coli was found on spinach. There had been numerous recalls of cannabis edibles throughout history in North America, with more in the recent years due to the rise in popularity of edibles (Warriner, n.d.). Many recalls were due to the same reasons as outbreaks in other food products, which again raises the question as to whether edibles should be regulated as food in Canada.

Knowledge Translation

The findings from this study can give rise to the development of professional education programs for all types of stakeholders in the

edible cannabis industry, similar to FoodSafe for the food industry. The program will teach people how to prepare cannabis-infused food products safely in terms of dosage control of cannabinoids, proper food handling practices, sanitation, emergency responses, and any other topics related to protecting the public from illnesses caused by cannabis edibles. There can be a version for commercial operators and one for home users. Like FoodSafe, this program can also be made a mandatory requirement in the provincial regulations for all commercial operators involving edible cannabis products.

Purpose of the Study

Reviewing the literature revealed that edibles are potentially hazardous and consumer knowledge of both cannabis and food safety is necessary to enjoy edibles safely. In this period of uncertainty where upcoming regulations on edibles may not protect the public, consumers can only rely on their own knowledge to make safe choices. The purpose of this study is to accurately determine if consumers have the capabilities to make those safe choices, through analyzing differences in food safety and cannabis knowledge between those who consume edibles and those who do not. In addition, the study seeks an association between levels of food safety knowledge and cannabis knowledge.

Materials and Methods

The material for this project included a computer which was used for survey design and statistical analyses. The standard method was an online survey through a BCIT server of SurveyMonkey, an online survey platform (SurveyMonkey, 2018). The survey was open for 2 weeks from January 19th to February 2nd of 2019. The survey was distributed publicly via Reddit. Due to ethical reasons, Reddit was chosen because the link that directed the viewer to the survey was visible without the need for an account. The survey consisted of three parts, which included demographic information, food safety knowledge, and edibles knowledge. All questions were close-ended since they are based on factual information for which there is a right or wrong answer. This study is only interested in whether people can answer the questions correctly, not their perception of a certain issue. Closed ended questions are also easier to analyze with statistical analysis software, which for this study was done on NCSS 12 (NCSS, 2018). The down side was that the questions might not be entirely representative of someone's knowledge in this area. One could have answered all questions correctly by coincidence without knowing much about food safety or cannabis edibles. As a safety measure, every question had an "I don't know" option to eliminate random guessing as much as possible. The questions were also designed in a manner that could be easily understood by the general public, had a smooth flow, and were relevant to the purpose of the study (Statistics Canada, 2015). The survey took around 5-10 minutes to complete, and responses were received automatically in real-time via SurveyMonkey.

Inclusion and Exclusion Criteria

Participant must be a B.C. resident of 19 years of age or older and have lived in B.C. for at least 12 months. This was to exclude anybody living in B.C. temporarily for school or work purposes. This study was only interested in the knowledge of B.C. residents.

Ethical Considerations

All survey studies involving human participants needed to have ethics approval according to the BCIT Research and Ethics Board (British Columbia Institute of Technology (BCIT), 2018). The survey results were kept confidential and all participants anonymous. No personal information was collected in the survey. A consent form was shown at the start of the online questionnaire, followed by the cover letter to give a brief introduction to the study and its purpose. The participant must give consent to move on to the survey questions or be directed to the end of the survey. A cover letter was also posted on Reddit posts to inform readers before they click into the survey link.

The survey platform was carefully selected due to privacy issues with information being stored on U.S. servers. The BCIT SurveyMonkey server is based in Canada and is not under the surveillance of the U.S. government.

Results

Data was collected as both nominal and numerical data. The demographic section included multichotomous and dichotomous, nominal and ordinal data. The two knowledge sections included True and False, and multiple-choice questions, in which numerical data was collected as the test scores out of six per section. Demographic statistics were displayed in bar graphs to indicate the distribution of responses by group. Means, medians, modes, ranges, and standard deviations of test scores on the knowledge assessment were also displayed. All descriptive statistics were done using the export function of SurveyMonkey. They can be found in the appendix of this report.

In terms of demographics of the response population, around 200 respondents filled out the survey. For gender, 61% were males, 34% were females, 3% considered themselves as others. Most respondents were 19-28 years of age (52%) and 29-38 years of age (32%). For education, it is relatively even across all groups, with the most respondents having an university undergraduate degree (29%). Over 70% of the respondents reported having consumed or is consuming edibles, 21% reported never having used any cannabis product, and only 7% used non-edible cannabis products only. Around 65% of the respondents used edibles for recreational purposes and 9% for medicinal purposes, with the rest being non-users of edibles. In terms of frequency of use for edibles, non-users of edibles and people who use once every few months tied for the highest percentage groups (25%). About 5.5% reported using edibles everyday. Only 14% reported to be working in the food industry, only 11% reported to be working in the public health field, and only 2.5% reported to be working in the cannabis industry.

For the food safety section of the knowledge test, all demographic groups had an average score between three to four out of six in total. For the edible safety section of the knowledge test, groups identified as edible users scored on average four to four and a half out of six, while those identified as non-users scored on average below two to three out of six. Other demographic groups scored on average three to four across the board. Table 2 and 3 show summaries of results collected.

Table 2: Food Safety Knowledge Test Summary Results

Question with Correct Answer	Percent Correct	Answered "I don't know"
1. You can tell if a food may cause food-borne illness by its look, smell or taste. (FALSE)	58%	5%
2. What is the minimum safe internal cooking temperature for a piece of chicken breast? (74°C/ 165°F)	49%	23%
3. Freezing food is an approved method to destroy parasites but not bacteria. (TRUE)	46%	25%
4. Which one of the following foods is most associated with Listeria (Listeriosis) outbreaks in Canada? (Deli Meats)	49%	36%
5. Handling raw meats and ready-to-eat vegetables using the same cutting board is an example of cross-contamination. (TRUE)	98%	2%
6. What is the temperature range in which microbiological pathogens grow best in foods, better known as the "danger zone"? (4°C - 60°C/ 40°F - 140°F)	63%	18%

Table 3: Edible Safety Knowledge Test Summary Results

Question with Correct Answer	Percent Correct	Answered "I don't know"
1. The degree of "high" a person experiences from consuming edibles is determined by the amount of CBD in the product. (FALSE)	77%	12%
2. Which one of the following is considered a standard dose of THC in edibles? (10 mg THC)	49%	30%
3. It can take up to two hours after consumption of edibles for the user to feel the effects of cannabinoids. (TRUE)	89%	25%
4. Which one of the following is the top safety concern of THC and CBD infused oils? (Botulism)	15%	63%
5. Currently in Canada, sales of edibles for recreational use is illegal but making edibles at home for personal use is allowed. (TRUE)	63%	21%
6. Research has shown that over-consuming THC-infused edibles is potentially lethal. (FALSE)	71%	18%

Inferential Statistics

Mean test scores between demographic groups were compared using ANOVA. Correlation between food safety knowledge and edible safety knowledge was analyzed as well. Seven independent variables were analyzed, including age, gender, education level, type of cannabis usage, purpose of edible usage, frequency of edible usage, and occupation. All analyses were performed using NCSS 12 (NCSS, 2018).

No significant differences were found in food safety knowledge scores between any of the variables mentioned ($p>0.05$). The mean test scores on food safety for all groups were between three to four out of a total of six, which translated to 50% to 67%.

Three out of the seven null hypotheses tested for edible safety knowledge were rejected with an alpha error of 0.00. The first compared the test scores between edible users and users who do not use any form of cannabis. The second compared non-users of edibles with recreational users and medicinal users. The third compared the frequencies of edible use. From these three results, it could be concluded that edible-users have significantly higher edible safety knowledge than people who do not use cannabis at all, which is not affected by purpose of use or frequency.

Additionally, a significant positive correlation (0.1819) between food safety knowledge and edible safety knowledge was found using Spearman Rank Correlation Analysis (Figure 1).

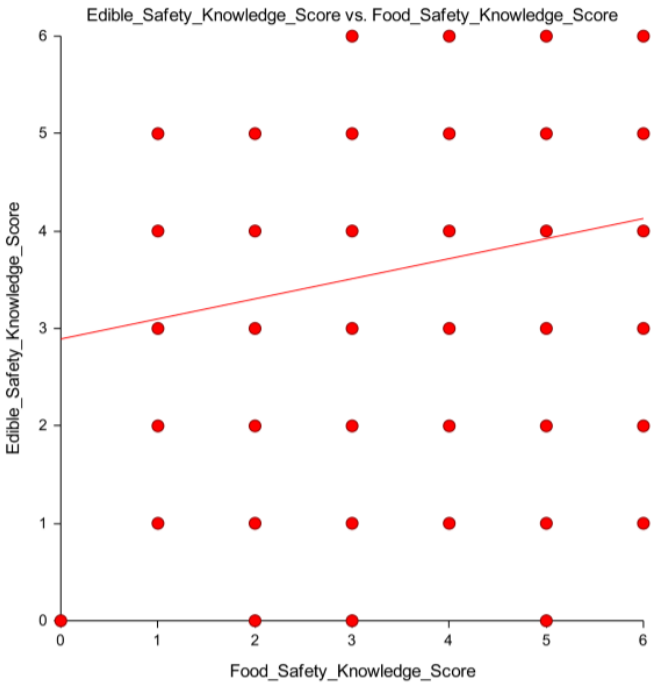

Figure 1: Linear regression plot for correlation analysis with food safety knowledge score as x variable and edible safety knowledge score as y variable.

Discussion

Food Safety Knowledge

No significant differences could mean the knowledge is equally low or high across all groups. Studies on food safety knowledge of Canadians suggested that the average response scores fall within the 81 – 93 % range. This was higher than the results obtained from this study. However, certain questions were being scored significantly lower by specific demographic groups (Murray et al, 2017). Specifically, younger age groups (19-29) were less aware of cross-contamination risks, and older populations (60+) were less aware of risks of consuming raw eggs, sprouts, and unpasteurized juice (Murray et al, 2017). In contrast to that study, most people (98%) were able to correctly answer the cross-contamination question in the survey conducted. The same study also showed stronger food safety knowledge in women than men (Murray et al, 2017). Other studies on the same population also showed younger people having lower food safety knowledge (Burke et al, 2016). Therefore, results for this study generally disagree with previous research. Possible reasons may be that there were only six questions asked and demographic groups were not equally distributed. For example, over 60% of the respondents were males, and over 80% were 19-38 years of age. However, it is worth mentioning that cannabis usage of any type does not seem to affect food safety knowledge. Therefore, there would be equal level of risks in eating non-edible-infused food prepared by a cannabis user and a non-user. In terms of validity, the questions were confirmed in the pilot study to test what it is meant to test. However, the limitation of an online survey is reliability because there was no knowledge of how the respondent answered the question. Besides the occasional "I don't know for everything" respondent, most respondents seem to be truthful when answering the questions as the selections did not seem to be based on convenience, such as selecting the first answer for each question. The results will only be able to be extrapolated to younger populations due to the imbalance in age groups. Also, the results for food safety knowledge in relation to type of work is not valid since over 70% of the respondents were not in any of the professions of interest.

Edible Safety Knowledge

The results suggested that both medicinal and recreational users, even if they have only tried edibles once, have more knowledge in edibles than those who have never tried. It might seem obvious that edible users have more knowledge in edibles than non-users, but this finding can lead to several possible scenarios. It could mean that either people are seeking out information

before trying it for the first time, or they started researching on edibles after a bad experience. In the latter case, there can be significant public health impacts due to the Canadian population's surging interest in edibles, especially when a portion of the less knowledgeable non-users also have the intent to try edibles. As mentioned in the literature review, some 45% of the Canadian population are willing to try an edible product after legalization (Charlebois et al, 2018). This percentage could likely increase over time. Therefore, it is important that non-users should be educated on edibles even if there is no immediate intent to use. It will also help them avoid accidental ingestion of edibles. Another interesting finding was that only 15% of the respondents correctly answered the top safety concern of THC and CBD infused oils, while 63% did not know the answer (Figure 2). This is very alarming because infused oils are the most common way to introduce cannabis into cooking and carries high health hazards. This finding conforms to previous research which found that less than 20% of Canadians feel knowledgeable enough to cook with cannabis (Charlebois et al, 2018)., which means having a strong background in food safety is important for edible users to a certain degree. For example, preventing contaminations of pathogens in regular food items and edibles are equally important and the principles behind it are the same.

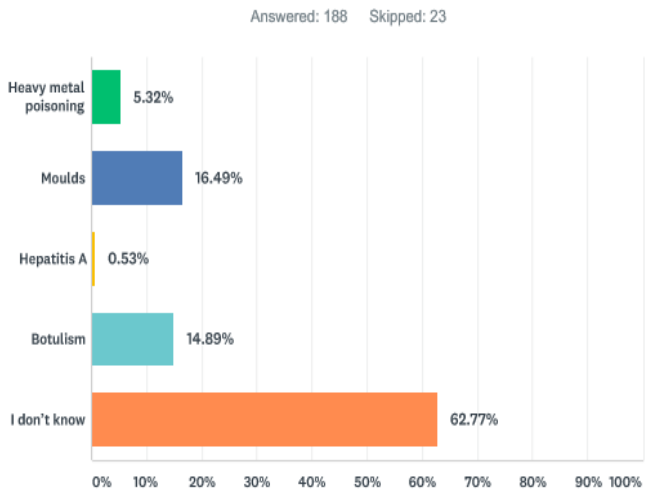

Figure 2: Total survey results for Question 18: Which one of the following is the top safety concern of THC and CBD infused oils?

Knowledge Translation

Results from this survey identified some of the knowledge gaps within the BC population in areas of food safety and edible safety. This information can be used to develop policies and legislation for governments to better control the public's exposures to edible cannabis products and reduce the risks associated. At the time of writing, the federal government of Canada is in the process of developing legislation for edible cannabis, extracts, and topicals, and have asked the public's opinions through consultation (Health Canada, 2019). Results from this research can be combined with the consultation results to correlate public knowledge and opinions on edible cannabis to understand if the public's concerns are valid or not. In many cases, the public requires education to alleviate their outrage. The information gathered in this research can help pinpoint key knowledge deficiencies to aid in developments of programs. For example, the BC FoodSafe program can focus more on areas of food safety the public lacks and incorporate edibles into the existing lesson plan to help food handlers recognize health hazards associated

with cannabis if edibles become more common in commercial food establishments. Additionally, the results also help identify new business opportunities, such as education and consultation programs focused on cannabis edibles, and cannabis cooking lessons for people who are interested in adding cannabis to their diets but are unsure about the risks involved. This information will also be published and be available to the public and fellow researchers, which would evoke more research on cannabis edibles.

Limitations

The main limitations of conducting an online self-administered survey are survey fraud and the sampling population. Survey fraud is when respondents give fake answers to survey questions (Howard, 2018). This can be due to the way the survey is worded or structured. If the questions are difficult to understand for the respondents, they might just click on random answers. Since there is no control over how the respondents answer the questions, it is possible for them to not choose "I don't know" even if that was the case. There was also the possibility of respondents guessing the answer correctly which are false-positives, especially in this survey where half of the questions were True or False questions, and respondents have the internet at their disposal to search the answer. Demographic information could also be falsely inputted, although the chance of someone sabotaging the results is low. The second limitation is the uneven distribution of the sampling population. There was potential bias in results because there were significantly more young males than other age groups. Also, although this survey sampled for BC populations via subreddits of major regions within BC, there was no way of identifying where in BC the respondents were from and making sure there was an even distribution. The same goes for other demographic groups where there were too little respondents to compare means.

One way to deal with these limitations is to identify and eliminate confounding factors to increase internal validity (McLeod, 2013). For example, respondents can be invited into a setting with no internet access or any other form of external communication, so they do not cheat. Issues with sampling population can be dealt with by using random sampling to select respondents (McLeod, 2013). However, this method will be resource-intensive as it will require access to personal information of the entire BC population and actively sending out invitations. The time and money that would be required would only be feasible for a government-sanctioned survey. Results could also be improved with a longer time frame to conduct the survey, which would have given a more balanced and representative sample population.

Future Research

Some ideas for future student research projects are as follows:

- Survey on public's perception regarding likelihood of experiencing overdose symptoms for different edible cannabis products
- Survey on public's perception of the new edible legislation when it comes into effect

- Analysis of the effects of poor food handling practices on edible cannabis products (synergistic effects of foodborne pathogens and cannabinoids)
- Metanalysis on the effects of edible cannabis legislation on public health outcomes by comparing edible-related illness cases from regions with legislation and regions without
- Repeat this exact study after legalization of edibles to compare results

Conclusions

From this survey study, it was revealed that for populations in BC, any amount of usage, for whatever purposes, of cannabis edibles is associated with higher knowledge on edibles. Those who have no previous usage have significantly lower knowledge in edibles than those who have. In conjunction with previous research on likelihood of new users after Canada's legalization of cannabis edibles, this study signals the urgent need for public education on cannabis to prevent negative health impacts associated with these products. Food safety has also been shown in this study to be an important factor in edibles and should be reinforced through education as well. Practically, this study will serve as a supporting document for policy-making, program development, and resource allocation for the public and private sectors when dealing with issues on cannabis edibles.

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Competing Interests

The authors declare that they have no competing interests.

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