# Practice and attitude of pet owners feeding raw based pet diets compared to non-raw based diets.

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## Abstract

**Background:** New trends in raw based diets are putting people at a higher risk for becoming ill from pathogens. An outbreak investigation of pig ears containing Salmonella found over 50% of the tested pig ears were positive for the bacteria and 38% of pet treats contained Salmonella. At the time of the outbreak, pet owners became ill with Salmonella which was believed to be from handling the pig ears or from their ill pets that were carrying the bacteria. An outbreak in Italy involving kibble demonstrates there is a risk when feeding raw and non-raw diets.

**Methods:** An online survey was conducted through Reddit and QR codes to assess some of the pet owner's hygiene practices and attitudes. Participants self -identified as feeding either raw or non-raw based diets. Statistical analysis was conducted through NCSS software to perform Chi-Square Tests.

**Results:** The raw group statistically washed their pet's bowl once a day or more compared to the non-raw group ($p \geq 0.0000$). There was an association ($p \geq 0.0000$) between how often people washed their hands before and after feeding their pet compared to which diet they fed their pet. Majority (90%) of the raw group washed their hands every time or most times after feeding their pet, compared to 63% of the non-raw group. Additionally, 15% of the non-raw group said they hardly ever washed their hands after feeding their pet. Many of the raw group (82%) experienced gastrointestinal illness 2 times or less in the last 2 years compared to 59% of the non-raw group experienced it more than 2 times in the last 2 years.

**Conclusion:** To protect pet owners from becoming ill, proper hand and dish hygiene is important. Pet owners should be educated on the risks each diet has and where proper hygiene is most important.

**Keywords:** Pet food, raw meat-based diet, non-raw meat-based diet, survey, hygiene

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## Introduction

Pets are an important component of people's lives. There are an estimated 471 million dogs and 373 million cats kept as pets around the world (Bedford, 2020). Pet owners have many options to choose from when it comes to feeding their pet. Pet cats and dogs can be fed raw diets, wet food (cans or stews), kibble/dry food, or freeze dried (Woo, 2015). People believe that feeding raw food to their pet is healthier for the animal (Lenz et al., 2009). There is little published research done to show what the risk of people becoming sick from their pets. Research focuses on the level of contamination in pet foods, but it can be difficult to know how often people become sick from handling the pet food (Anturaniemi et al., 2019). If it is unclear how often transmission from pets to their owners happens then the best way to minimize the risk is by preventing it. This study focused on seeing if there was an association with what people's hygienic habits and attitudes are compared to if they feed a raw based or non-raw based diet.

## Statement of the Problem

Many pet owners are choosing to feed their pet a RMBD for the health of their pet but may be putting their own health at risk. This literature review focuses on looking at the incidence of contaminated pet food, and the study looks at what people's hygienic habits are.

## Purpose of the Study

This study is assessing the attitude and practices of pet owners compared to the type of diet they offer their pet, raw based or non-raw based. Raw based was considered at least 50% of the diet and included freeze dried, frozen, or fresh meat that was not cooked. Non-raw based diet was 50% of their diet that was cooked fresh meat, kibble, or canned wet food and stews.

## Literature Review

### Known Contaminants

Many studies have assessed the level of pathogenic contamination in both RMBDs and nRMBDs. The most common pathogens studied are *Salmonella*, Campylobacter, *Escherichia coli*, and *Listeria monocytogenes*, all of which can infect both animals and humans. Risk of transmission to the public is high especially with young, old, pregnant women, or immunocompromised (YOPI) in the same household as pets on RMBDs (Clark et al., 2001; Lenz et al., 2009). Many studies have analyzed samples from food, fecal matter, and the environment that the dogs lived in. Studies have found anywhere from 5% to 80% of food samples were positive for Salmonella (Hellgren et al., 2019; Joffe & Schlesinger, 2002; Lenz et al., 2009; Nemser et al., 2014; van Bree et al., 2018).

Differences in positive food samples could be related to where the study was performed and the regulations for the product manufacturer. The two lowest results containing *Salmonella* in the diet at 5% and 7% both came

from studies conducted in the United States, the next highest at 8% and 20% came from Sweden and the Netherlands, respectively, and the highest at 80% was conducted in Canada (Hellgren et al., 2019; Joffe & Schlesinger, 2002; Lenz et al., 2009; Nemser et al., 2014; van Bree et al., 2018). Both the United States and the European Union have regulations and standards for the production of animal feed including equipment hygiene which can reduce the risk of contamination to foods (Genge, 2019). In Canada, pet foods are not regulated by any federal body. This could be a reason why there was a significant increase in the percentage of *Salmonella* found in the study by Joffe & Schlesinger (2002). However, in the study there was a small sample size which could give misleading results. In all the studies above, none of the dogs that were tested displayed any symptoms of illness or diarrhea (Amadi et al., 2018; Hellgren et al., 2019; Joffe & Schlesinger, 2002; Lenz et al., 2009; Nemser et al., 2014; van Bree et al., 2018). *Salmonella* is able to shed intermittently for weeks in the feces after any symptoms have resolved (Amadi et al., 2018) which could lead to inaccurate results if they were only taken at times when the bacterium was not being excreted in the feces. RMBDs are not the only potential sources of *Salmonella* for pets. In Tuscany, a dog kennel had an outbreak of *Salmonella* from dry dog food and 61% of dog's fecal samples and the dry food fed to the dogs came back positive for the bacterium including one microbial resistant strain (Selmi et al., 2011). This is a concern for the public that are feeding their dogs dry food that can be contaminated. Finding extended-spectrum beta-lactamases (ESBL) producing *E. coli* and antimicrobial resistant strains of *Salmonella* in pet food and their feces will make it more difficult to help the public when someone contracts one of these bacteria and is a risk to people regardless of which diet their pet is fed.



**Risk of Transmission**

Surveys have found people are hesitant to believe that their pet or they have become sick as a result of feeding RMBDs with only 0.04% of survey respondents having confirmed or suspected pathogen contributions (Anturaniemi et al., 2019). A study by Anturaniemi et al (2019), found the highest number of confirmed pathogen transmission from their pet was with people that prepared their pets food in the same location with the same utensils as human food. Overall, the majority of respondents believed they have never become sick from transmission between human and a pet, although the study hypothesized that people never suspected their pet's food as a cause (Anturaniemi et al., 2019). Preparing RMBD with the same utensils that are used for human consumption creates a higher risk of cross contamination. During a *Salmonella* outbreak involving pigs ear treats in Canada, human stool samples collected contained 6 of the isolated strains that were found in pig ears (Clark et al., 2001). The investigation did find some isolates from human stool samples that are only found in chickens, so the exact rate of disease linked to the contaminated pig ears was not discovered (Clark et al., 2001).

### Canadian Context

Currently, pet food in Canada is only regulated by international bodies if they export to other countries. Generally, food manufacturers are regulated under the Canadian Food Inspection Agency (CFIA) but currently, they do not inspect facilities manufacturing pet food (Genge, 2019). This can lead to a higher risk for contamination of pet foods especially in small producers that do not sell internationally. Any recalls in Canada are documented by Health Canada but they are not enforced, it is done voluntarily by the company in Canada (Canadian Food Inspection Agency, 2018). There is a higher risk for both RMBDs and nRMBDs produced in Canada, and as discussed above there have been outbreaks related to pig ears in Canada (Clark et al., 2001) as well as others related to dry food and treats (Health Canada, 2020).

### Purpose of this Study

In the outbreak in a dog kennel in Tuscany, dry dog food is not guaranteed to be free of contamination, but people may not have as good of hygiene practices because they do not believe feeding their dog dry dog food is a risk (Selmi et al., 2011). Feeding nRMBDs may mean that people are less likely to wash their hands before and after feeding their pet and may not wash their food and water bowels as frequently. Higher numbers of small outbreaks may become more prevalent in the future and it could become more difficult to treat as more antibiotic resistant strains emerge. The true rate of transmission is most likely underreported especially since most people may not think that the food they have been feeding their pets for long periods of time could be the cause of illness or they do not get tested to see what made them sick. Evaluating the publics current knowledge on safe pet ownership, food handling and finding where further improvement and education can be done to prevent zoonotic transmission is important. The study will use a survey to assess pet owner's food and hygienic attitude, knowledge, and practices in relation to which type of food they give their pet.

## Materials and Methods

### Materials

The purpose of this study was to look at what the general population's hygiene habits (washing hands, how often they wash their pets' dish, etc.) and attitudes are in relation to which food they feed their pet. To obtain the information, data was collected through an online survey. The survey was conducted through Survey Monkey (http://www.surveymonkey.com), an online platform that allows the survey link to be distributed and shared through social media, email, or scanned on quick response (QR) codes. The data was analyzed using Microsoft Excel and NCSS data analysis tool pack (NCSS 2020 Statistical Software, 2020). NCSS is a statistical analysis program that can perform many different evaluations and is user friendly (NCSS 2020 Statistical Software, 2020).

**Standard Methods**

The survey was distributed online through Reddit, a social media platform and as a flyer with a QR code. The survey was posted in the Canadian pet cats and dogs subreddit. Reddit was chosen because it does not have any bias towards collecting data from people that the author personally knows as would be the case in social media platforms such as Facebook or Instagram. Reddit accounts are free and easy to make. The main ways to collect surveys are in person using forms, telephone surveys, and online surveys. Online surveys are the most effective way to reach a large population group and allowing participants do the survey on their own time. Conducting online surveys can also save time for the researcher because they do not need to be out in the field trying to obtain responses from people in person or over the phone (Howard, 2019). A pilot study was conducted before the survey was posted on Reddit to ensure the survey made sense and was valid. The link was sent out to people that agreed to participate in the pilot study, which assessed the validity and ensure the survey questions were easy to understand for participants. After the pilot study, comments for improvements were taken and necessary changes were made such as grammatical errors or clarification on questions. In addition to posting the survey on Reddit, the survey was distributed through flyers with QR codes. The flyers were placed in 1 pet store from the Lower Mainland that agreed to post it and one dog obedience group based out of Kelowna, BC. The flyers were up from January 17, 2021 to February 05, 2021. The survey was open from January 07, 2021 to February 08, 2021 and self-completed online.

The survey was split into 5 main sections, first splitting the respondents into groups of RMBDs and nRMBDs. This was based on what 50% or more of their diet consisted of, not including treats. Then followed by looking at people's practice, knowledge, and attitude towards pet foods as it relates to hygiene, lastly with a few questions about what is important to them in choosing their pet's food. These included questions about how often they washed their hands after feeding their pet, where they fed their pet in relation to human food and other questions. The full survey questions are listed in Appendix C.

**Inclusion and Exclusion Criteria**

Anyone that has a pet cat or dog was allowed to voluntarily complete the survey. Participants that answered "Neither" to having a pet cat or dog, answered "do not wish to participate", or did not fill in which diet they fed their pet (raw or non-raw based) were not included in the analysis. Demographic information was not collected so there were possible international respondents. This was not a large concern since questions about the pet food manufacturing origin was asked to find out what regulations the pet food was manufactured under. Where the pet food was manufactured was important because regulations are different depending on where the pet food was produced. When analyzing how often pets became ill in the

last 2 years, it can also be compared to the amount that are prepared in countries with less strict regulations.

**Ethical Considerations**

There were no demographics or personal information collected on participants which aided in keeping the data confidential and anonymous. Surveys begun with an invitation letter and consent form to inform participants of the study and ensure they know inclusion is voluntary. They were given the option to accept or reject the consent form as the first question of the survey.

Prior to the study, survey questions were reviewed and approved by BCIT research instructor and by the BCIT Research Ethics Board to ensure there was no ethical harm to participants during the survey.

## Statistical Analysis of Data

The data from Survey Monkey was extrapolated and exported into Excel. The data was moved into NCSS for analysis using Chi-Squared test to see whether the data is statistically significant or not. Descriptive statistics done in Excel will include bar charts and tables to neatly show results. These will include comparisons of the percentage of responses for related questions.

## Results

In total there was 163 respondents, on average 142 respondents answered each survey questions. Non-raw based averaged 85 responses per question and raw based had 57. The majority of respondents owned dogs (94), 33 owned cats, and 22 owned both. The three options for where people feed their pet in relation to human food included in the same area with the same utensils, in the same area with different utensils, and in a separate area with different utensils. A statistically significant ($p=0.003$) amount of the raw group feed their pet in the same area with the same utensils used for human food (62%) compared to the non-raw group that was even split between answers. In the raw group 83% wash their pet's water and food bowl one time a day or more compared to the non-raw group where 56% washed their pet's bowls less than once a day or hardly ever. The $P \geq 0.0000$, therefore, reject the null hypothesis and conclude that there is an association between people that feed raw compared to non-raw diets and how frequently they wash their pet's bowl. Unlike owners washing their hands after feeding, there was no association ($p=0.1694$) between how often people washed their hands after playing and which diet they fed their pet.

Owners that fed their dog a raw diet were more likely to also feed raw based treats, 78% once a month or more, compared to non-raw diets, 41% never feeding raw based treats. With a p value of 0.0213 there was an association between which diet pet owners fed and how many times their dog had developed gastrointestinal (GI) illness in the last two years. 82% of owners feeding a raw diet reported their pet having a GI illness 2 times or less compared to 60% of owners feeding non-raw diets. There was no association ($p=0.4027$) between people

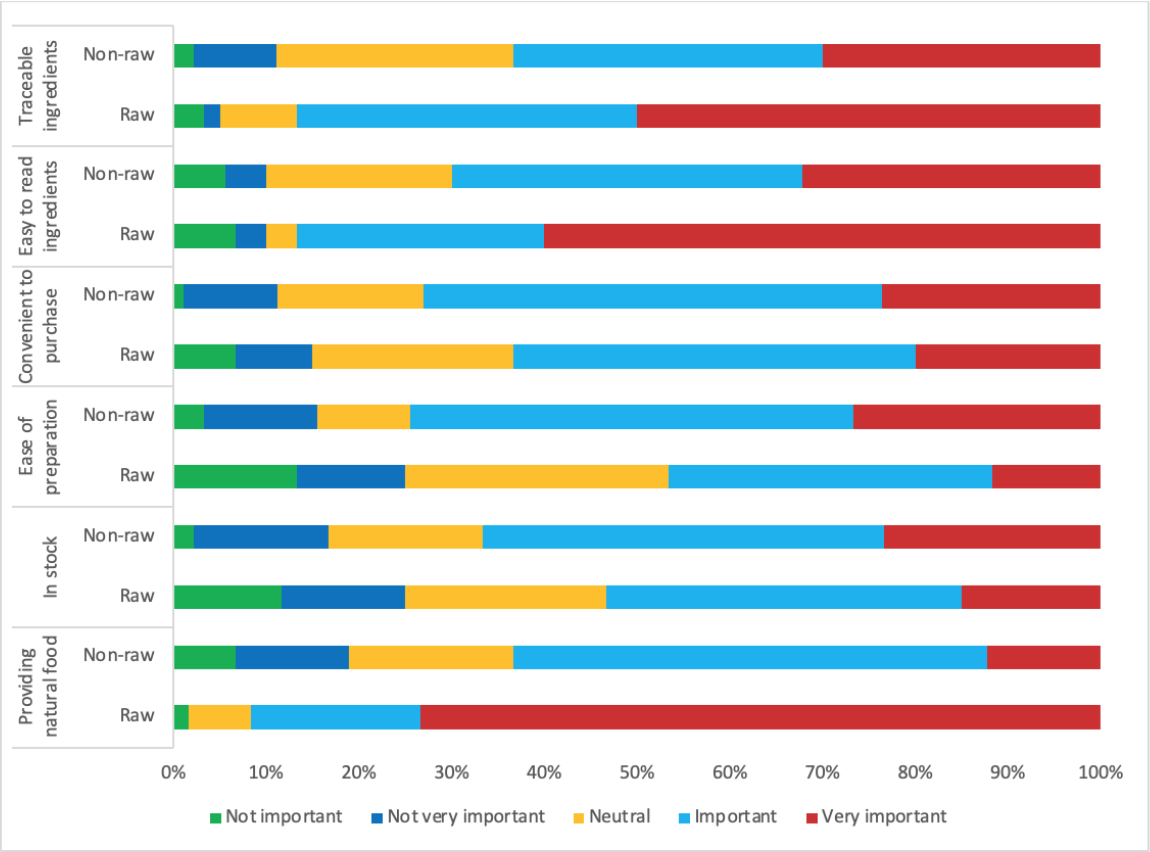


Figure 1: Comparison of Raw and Non-raw groups with respect to what is important to them when they pick a food for their pet.

that fed raw or non-raw diets and if they believed their pets food had caused GI illness. There was a statistically significant (p=0.0000) association between people that fed a raw based diet and agreed with the statement “raw based food is healthier for my pet” (93% agree or strongly agree). The raw group was less likely to agree with the statement “non-raw is healthier for my pet” (p=0.0000). Figure 1 depicts the importance of varying aspects to raw and non-raw based groups. There is no association (p>0.05) between answers for “in stock” and “convenient to purchase”. There is an association between groups for “providing a natural food for my pet” (p=0.0000), “ease of preparation” (p=0.0022), “easy to read ingredients” (p=0.0039), and “traceable ingredients” (p=0.0117).

The last question of the survey asked how feasible some actions related to previous questions are. Figure 2 compares the feasibility of preparing their pets food in a separate area from human food, washing hands after feeding or playing, and washing their pets bowl at least once a day. Both raw and non-raw groups did not think that preparing their pet’s food in a separate area from human food was very feasible. P=0.1411, therefore, do not reject the null hypothesis and conclude that there is no

association between raw and non-raw diets and if owners believe it is feasible to feed their pet in a separate area. Both the raw and non-raw group thought it was feasible or very feasible to wash their hands after feeding and play but there was no association (p=0.3837). The raw group was more likely to answer it was very feasible to wash their pets bowl at least once a day compared to the non-raw group. The was an association (p=0.0021) between the two diets

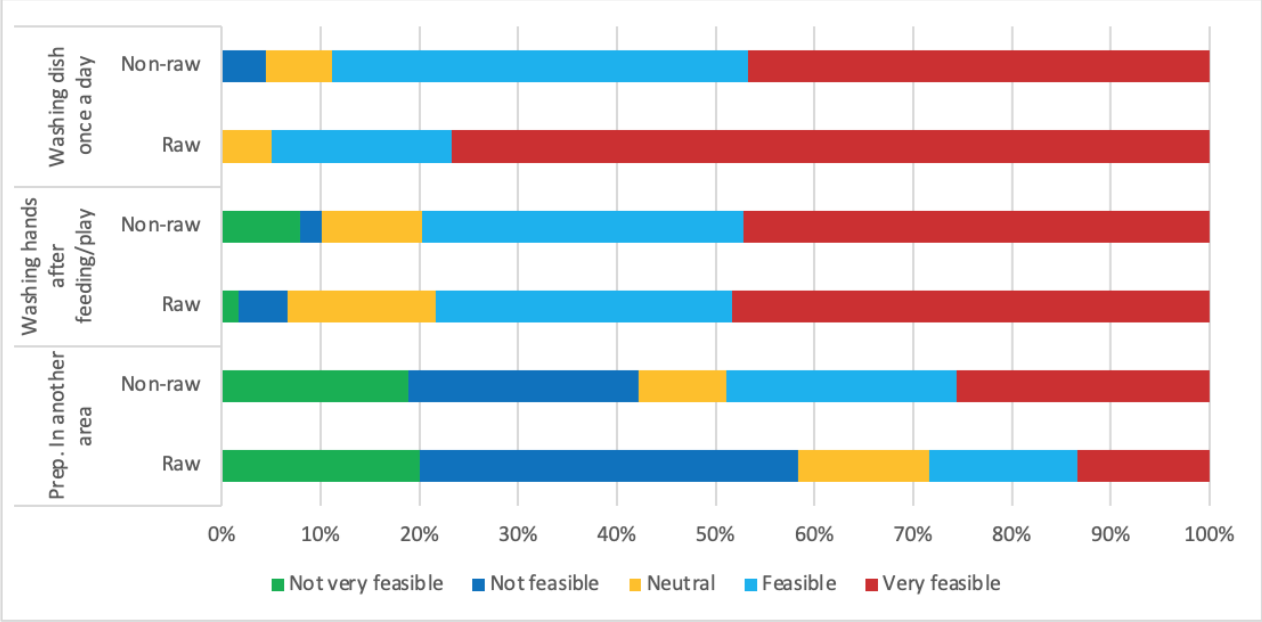


Figure 2: Comparison of raw and non-raw based diets and how feasible owner's believe certain everyday tasks are.

and how feasible they believed washing their pets bowl at least once a day.

## Discussion

In this study, the RMBD group fed statistically more raw based treats than the nRMBD group but did not report a higher frequency of GI illness in the last two years. In a controlled environment, with no other sources of pathogens (treats, consuming dirt, etc.) it is expected to see higher amounts of GI illness in RMBD groups. In many papers sampling raw pet foods, they found pathogens in over 50% of the samples (Baede et al., 2017; Hellgren et al., 2019; Joffe & Schlesinger, 2002; Selmi et al., 2011; van Bree et al., 2018). Raw based treats such as pig ears, bone marrows, and freeze-dried meat can be a possible source of pathogens for both the RMBD and nRMBD group. The outbreak investigation in Canada of pig ears (Clark et al., 2001) found 51% of pig ears and 38% of other pet's treats sampled to be contaminated with Salmonella. Studies done by van Bree et al (2018) and Joffe & Schlesinger (2002) found highly contaminated RMBDs which would also suggest that higher cases of GI

illness in the RMBD group would be expected. Over 90% of all respondent's pet food was made in North America, with 96% of the RMBD was made in North America. Minimal enforcement and regulations for pet food in North America potentially could lead to a greater chance of contaminated products. Therefore, you would expect more of the RMBD group to have reported GI illness than the nRMBD. Some potential reasons for the difference from what was expected to the results in the study could be because of beta error due to not enough respondents. Another reason for the difference could be bias in respondents if they did not believe their dog had a GI illness or a 2-year period could have been too long for accurate recollection of past events.

The majority of RMBD group fed their dogs in the same area with the same utensils as human food preparation. From a public health perspective, it is preferred to prepare raw-based foods in a separate area from human food because of the risk of cross-contamination (Anturaniemi et al., 2019; Nilsson, 2015). It is the more feasible and convenient for the RMBD to feed in the same area as human food since raw food requires refrigeration or freezing and it is likely that people do not have multiple fridge/freezers (Long, 2016). If raw food is prepared with the same utensils as human food, it is important to ensure proper washing and sanitation before the utensil is used again (FoodSafety.gov, 2020). However, residential dishwashers would rely on high temperatures or chemicals to sanitize (Adams, n.d.). Since residential dishwashers do not have a chemical sanitizer added, they would rely on high temperatures to sanitize (Adams, n.d.) and may not be effective at sanitizing the utensils used between raw pet food and human foods. As discussed previously, the rate of GI illness in pets and in humans is most likely underreported. This could be due to relying on participants recall and/or what each person considered GI illness since it is an objective question without laboratory confirmation.

The RMBD group washed their hands more frequently than the nRMBD group, 90% to 63% respectively. Improper hand hygiene puts people at a higher risk of becoming ill (Centre for Disease Control and Prevention, 2016). Majority (95%) of the respondents thought it was feasible or very feasible to wash their pet's food and water dish once a day or more. In addition, 83% of the RMBD group already wash their pet's food or water bowl once a day or more. This agrees with the idea that people understand raw food is contaminated and are more likely to regularly clean after feeding their pet compared to the nRMBD group. Lenz et al (2009) sampled around homes, 15% were positive for salmonella in the homes for both RMBD and nRMBD. This suggests that no matter which diet is fed to a pet, the home is still a potential risk for people to become ill. Therefore, no matter which diet is fed it is important to frequently wash pet's dishes, wash hands after feeding and playing, and trying to minimize the risk for cross contamination by preparing the pet's food in a different area or having designated utensils for a pet's food to help minimize this risk.

Regulating pet food in Canada on a federal level may not be an issue because many large Canadian pet food companies sell internationally and are therefore regulated by other countries such as the FDA in the USA (Pet Food Association of Canada, 2015). The higher risk is small companies such as butchers that only make pet foods. They are not regulated by local government if there are no products sold for public consumption (Dangerfield, 2018). Unregulated small companies may not be as sanitary or test their products for pathogens which could potentially lead to pets becoming ill and their owners who are caring for them. Therefore, to minimize the risk of people becoming ill from handling their pet's food, hygiene practices such as washing hands and washing their pet's dishes are essential.

## Limitations

Throughout the research project, COVID-19 limited how studies can effectively be done and what type of study was the most practical (online survey). Strengths of the study including having a large number of respondents in the beginning to indicate problems or wording issues. Some weaknesses of the study were adapting the study to be online only. An ideal addition to the study would have been to swab homes to see if there are pathogens in people's homes as well.

Questions inquiring about how often pet owners believed their pet became ill relied on their recall which may not have been accurate. It was also dependant on what a person determined as GI illness. For example, an owner may not believe their pet had a GI illness if their pet had diarrhea once and a fever, but the owner never took the pet's temperature.

Answers obtained from local people through QR codes may have had different habits compared to getting a broader response through social media platforms. Responses obtained from a broad range of people may give a better idea of people's habits but it would be difficult to know without comparing the responses.

## Knowledge Translation

Evidence from the literature review suggests that there is a risk for the public becoming ill from their pet (Hoelzer et al., 2011; Lenz et al., 2009). Raw and non-raw pet foods as well as pet treats have shown many can be contaminated with pathogens (Clark et al., 2001; Damborg et al., 2016; Hellgren et al., 2019; Schmidt et al., 2018; Selmi et al., 2011). Once a pet has been exposed to pathogens such as Salmonella they can continue to shed the pathogens in their feces without having any symptoms (Amadi et al., 2018; Jones et al., 2019). Therefore, regulations and guidelines to make pet food safer for pets and their owners is a crucial step. As discussed previously, pet food in Canada is not regulated but even regulated countries such as in the EU can still find high pathogen loads in pet foods (Baede et al., 2017; Selmi et al., 2011). An assessment needs to be done to find out whether it is worth the effort to regulate pet food in Canada if it is still prone to containing pathogens even with legislation in

place. Efforts may be better spent educating the public on the risks and how to maintain a hygienic home.

## Conclusion

The literature review found many pet foods, especially RMBD are contaminated with pathogens that have the ability to make pets and their owners sick. The survey found pets on RMBD to be more likely to wash their hands and pet's bowl every day compared to the nRMBD group. Having good hand hygiene and washing pet's dishes are important steps to minimize the chances of pets or pet food transmitting pathogens to people. Future studies should try to assess the true rate of disease to further understand the public health risk.

## Recommendations for Future Studies

- Looking at the risk of pathogens from pets transferring to humans through fecal-oral routes or cross contamination
- Sampling for pathogenic bacteria common in pet areas around the home
- Swabbing people's hands before and after handling pet food
- Swab used pet toys for pathogens
- Survey looking at what pet owners know about pet food recalls and regulations in Canada
- Testing if an educational tool looking at improving pet owner's hygiene will make a difference in the amount bacterial load around the home


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## Competing Interest

The author declares that they have no competing interest.

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