Perceptions and attitudes towards human and companion animal nutrition, nutrition education and nutrition guidance received from healthcare professionals

by

May Kamleh

A Thesis
presented to
The University of Guelph

In partial fulfilment of requirements
for the degree of
Doctor of Philosophy
in
Population Medicine

Guelph, Ontario, Canada
© May Kamleh, September 2019
ABSTRACT

PERCEPTIONS AND ATTITUDES TOWARDS HUMAN AND COMPANION ANIMAL NUTRITION, NUTRITION EDUCATION AND NUTRITION GUIDANCE RECEIVED FROM HEALTHCARE PROFESSIONALS

May Kamleh

Advisor: Dr. Deep K. Khosa

Co-Advisor: Dr. Elizabeth A. Stone

Attitudes and beliefs of pet owners strongly influence their decision-making surrounding their pets’ diet. Thus, guidance in nutrition choices is an essential component of clinical practice. Despite the increasing emphasis on changing dietary practices to improve health, graduates of many healthcare programs, including veterinary medicine, do not feel they receive sufficient nutrition education to prepare them to consult on nutrition. As a result, nutrition counselling rates and compliance to nutrition recommendations in medical and veterinary clinics historically and presently remain low.

This research had two primary studies. The first study investigated the attitudes of incoming veterinary students of their own nutrition, pet nutrition and importance of nutrition education. The second study explored pet owners’ perceptions towards nutrition information received at veterinary clinics and the extent that their health beliefs influence their intention to comply with medical and veterinary nutrition recommendations. Through a mixed-methods approach, in-depth thematic analysis of qualitative data informed design of two online questionnaire tools, analyzed using descriptive statistics and multivariable modelling.
Incoming students reported low accessibility of and low confidence in seeking pet nutrition information. Students relied on and trusted the veterinarian for pet nutrition advice but expressed mistrust of pet food companies’ motivations. Despite considering nutrition education important, students perceived overall low emphasis on nutrition in the veterinary curriculum. Factors positively associated with students’ perceived confidence in their nutrition education included academic self-efficacy (OR=2.20) and presence of board-certified veterinary nutrition faculty (OR=2.43).

The determinants of pet owners’ perceived effectiveness of veterinary nutrition recommendations were: education level (OR=3.96), suburban living (OR=1.51), being a cat versus a dog owner (OR=1.75), feeding commercial dry diets (OR=2.16), visiting the veterinarian more than once a year (OR=3.68) and trusting the veterinarian (OR=1.45). In the context of using the Health Belief Model as a theoretical framework, perceived benefits of nutrition guidance and self-efficacy were the strongest predictors of intention to comply with medical and veterinary nutrition recommendations.

Outcomes of this research have health promotion and educational implications and shed light on the importance of incoming students’ own perceptions on nutrition and pet owners’ perspectives on nutrition information received from medical and veterinary professionals.
DEDICATION

To my loving AJT, my inspiring parents and supportive siblings. For their advice, their love and their faith.
ACKNOWLEDGEMENTS

First and foremost, I would like to express my most sincere gratitude to Dr. Deep Khosa. Deep, thank you for all your support and advice over the years, both within and outside the capacity of this academic program. You not only patiently guided my development as an independent researcher, but also supported my growth as a person. I will truly miss our inspiring discussions, revolving around all aspects of research, professionalism and life. Thank you for your unending curiosity that constantly reminded me of the value of public health research and drove me to overcome numerous challenges. I will forever respect your knowledge and complete devotion throughout this journey and will always appreciate learning from you as a role model. I have benefitted tremendously from, and am extremely grateful for, your kindness, mentorship, friendship and genuine concern for my professional and personal well-being.

I would also like to sincerely thank my co-advisor, Dr. Elizabeth Stone. Elizabeth, your wealth of knowledge, helpful suggestions and refreshing, unique perspectives were at many times my driving force forward. I am grateful for your valuable and detailed advice, your continuous consideration of my interests and career goals and for openly sharing your experiences, especially when things were sometimes challenging. I thank my advisory committee members, Dr. Cate Dewey and Dr. Adronie Verbrugghe - for their feedback, words of encouragement and for making time in their busy academic schedules to guide my professional and personal development.

Research in this thesis was made possible through the generous financial support of the Pet Trust McRae Research Fund and OVC graduate scholarships. Thank
you for believing in me throughout the years. I am grateful to all willing participants in this research. Without their commitment, time and eagerness, data collection would not have been possible.

To my fellow Pop Med students and faculty, I feel fortunate to have been surrounded by wonderful, supportive people over the years. I’m particularly thankful to my fellow team members for their willingness to chat about research and “real life”. Alisha, thank you for all the laughs in the good times and support in the down times. You have been a colleague and true friend from the very beginning – we did it!

I have deep gratitude for my family’s unwavering support and love: mom, dad, Hamoodi, Shimo, my brothers and my yoyo. Thank you for your unconditional support, enthusiasm in my work and for emphasizing the importance of working hard toward your dreams. Each one of you set me up for success in a whole range of countless ways. Talking to you about my work was one of the most enjoyable aspects of my degree. Thank you for listening to my half-an-hour long answers to your questions. Having a family like ours by my side has given me the confidence to accomplish far more than I ever imagined I could.

Finally, to Miassar and Rayan – your presence in my life is a source of immense happiness. Mia - you were the one who believed in me at the start of our friendship over two decades ago. Regardless of the physical distance separating us, you will always be closest to my heart.
STATEMENT OF WORK

STUDY DESIGN:

The initial research idea was conceived by Dr. Deep Khosa and the research proposal prepared by Drs. Deep Khosa and Elizabeth Stone. This work was supported by funding from the McRae Fund and OVC Pet Trust. I led the specific study details and conceptual thinking around the topics and themes within these Chapters with input from committee members. Qualitative and quantitative tools were developed or adapted with assistance from Dr. Deep Khosa and committee members. Some quantitative methods were adapted from existing validated tools. Specifically, the pet owner questionnaire was developed based on the Health Belief Model constructs, however we adapted the questions to pertain to perceptions on both human and animal nutrition. Dr. Jennifer McWhirter’s advice on this study design was greatly appreciated.

DATA COLLECTION:

Qualitative data (March 2016 – May 2016; February 2018 – June 2018)

I spearheaded snowball and convenience sampling methods for qualitative data (presented in Chapters 2 and 4). I designed the semi-structured questioning guide with feedback from committee members and subsequently, ran and moderated all focus groups, took notes and conducted validation methods. Verbatim transcription was conducted by a professional transcriber.

Quantitative data (September 2016 – January 2019)
I carried out quantitative questionnaire design and distribution with direct advice from Dr. Deep Khosa. Further input was sought from Drs. Elizabeth Stone, Cate Dewey and Adronie Verbrugghe. I organized the systematic random sampling process for recruiting both veterinary students (presented in Chapters 2 and 3) and oversaw the administration of all quantitative questionnaires and collection of data. Similarly, I distributed the quantitative data questionnaire to pet owners across Canada and the USA by utilizing social media groups and contacting professional associations (presented in Chapters 4 and 5).

DATA ANALYSIS:

I conducted all data entry and data cleaning activities. I organized and analyzed all qualitative data in NVivo 10 (QSR International 2012) with support from Dr. Deep Khosa. I analyzed all quantitative data in STATA 14.0 (StataCorp 2015) and SAS 9.2 (SAS Institute, Cary, North Carolina, USA) with input from Drs. Deep Khosa, and David Pearl.

PRESENTATION OF RESULTS:

I was responsible for preparing all chapters presented in this thesis, prior to receiving edits and feedback from Dr. Khosa. Following this editing process, each chapter was sent to Drs. Elizabeth Stone, Cate Dewey and Adronie Verbrugghe for additional feedback. I completed any subsequent editing prior to submission of manuscripts for publication.

Results from this research were presented in poster format at the Qualitative Health Conference in October 2016, the American Academy of Veterinary Nutrition’s
Symposium in June 2017 and the International Conference on Communication in Veterinary Medicine in March 2018. Results were presented in oral format at the Joint Veterinary Educator Collaborative and Primary Care Veterinary Educators Symposium in June 2018 and the Association of Medical Education in Europe’s Conference in August 2018.
TABLE OF CONTENTS

ABSTRACT ...........................................................................................................................................II
DEDICATION ........................................................................................................................................ IV
ACKNOWLEDGEMENTS .......................................................................................................................V
STATEMENT OF WORK ........................................................................................................................ VII
LIST OF FIGURES ..................................................................................................................................XIII
LIST OF TABLES ...................................................................................................................................... XV
LIST OF APPENDICES ........................................................................................................................ XVII
PREFACE ................................................................................................................................................ XVIII

CHAPTER ONE: INTRODUCTION AND LITERATURE REVIEW .......................................................1
  1.1 Importance of Nutrition Education ...............................................................................................1
    1.1.1 Importance of Client Nutrition Counselling and Communication .........................................1
    1.1.2 Status of Nutrition Education in Medical Schools ...............................................................5
    1.1.3 Status of Nutrition Education in Veterinary Schools ............................................................7
  1.2 Importance of Investigating Attitudes, Perceptions and Beliefs ....................................................9
    1.2.1 Nutrition Attitudes and Beliefs ...............................................................................................10
    1.2.2 Pet Owners’ Attitudes and Beliefs ...........................................................................................11
  1.3 The Human Animal Bond .............................................................................................................18
    1.3.1 Definition of the Human Animal Bond .................................................................................18
    1.3.2 Human Animal Bond and Health Outcomes .......................................................................19
    1.3.3 Analogy Between Owner-Pet and Parent-Child Relationship .............................................20
    1.3.4 Human Animal Bond and Nutrition Behaviour ..................................................................21
  1.4 The Health Belief Model ...............................................................................................................23
    1.4.1 Health Belief Model Constructs .............................................................................................23
    1.4.2 The Health Belief Model in Health and Nutrition Research ..............................................25
    1.4.3 The Health Belief Model in Veterinary Medicine .................................................................26
  1.5 Positionality Statement for Qualitative Data Collection .............................................................27
    1.5.1 Acknowledging Emerging Feelings .......................................................................................28
    1.5.2 Situating Myself Within the Work .......................................................................................28
  1.6 Overall Thesis Structure .............................................................................................................30
References .............................................................................................................................................31

CHAPTER TWO: RESEARCH AIMS AND STRUCTURE ...................................................................42
  2.1 Statement of the Problem ..............................................................................................................42
  2.2 Research Aims ..............................................................................................................................43

CHAPTER THREE: Perceptions of companion animal nutrition and their own nutrition by first year veterinary students at the Ontario Veterinary College: implications for a veterinary nutrition curriculum .........................................................47
Abstract .............................................................................................................................................47
<table>
<thead>
<tr>
<th>Chapter</th>
<th>Title</th>
<th>Pages</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Introduction</td>
<td>48</td>
</tr>
<tr>
<td>Methods</td>
<td></td>
<td>51</td>
</tr>
<tr>
<td>Results</td>
<td></td>
<td>55</td>
</tr>
<tr>
<td>Discussion</td>
<td></td>
<td>67</td>
</tr>
<tr>
<td>References</td>
<td></td>
<td>74</td>
</tr>
<tr>
<td>Figures</td>
<td></td>
<td>77</td>
</tr>
<tr>
<td>Tables</td>
<td></td>
<td>80</td>
</tr>
</tbody>
</table>

CHAPTER FOUR: The perceived importance, emphasis and confidence in veterinary nutrition education of first-year Canadian and USA veterinary students. 86
Abstract                                                                                             86
Introduction                                                                                       87
Methods                                                                                             89
Results                                                                                             94
Discussion                                                                                         97
Conclusion                                                                                         101
References                                                                                         103
Figures                                                                                           106
Tables                                                                                             107

CHAPTER FIVE: A cross-sectional study of pet owners’ diet motives and attitudes towards nutrition guidance received from veterinarians. 111
Abstract                                                                                           111
Introduction                                                                                       112
Methods                                                                                           114
Results                                                                                           117
Discussion                                                                                         121
References                                                                                         128
Figures                                                                                           131
Tables                                                                                             134

CHAPTER SIX: What factors influence pet owners’ intention to comply with nutrition recommendations by medical and veterinary health professionals? An application of the Health Belief Model. 139
Abstract                                                                                           139
Introduction                                                                                       140
Methods                                                                                           144
Results                                                                                           148
Discussion                                                                                         152
References                                                                                         159
Figures                                                                                           164
Tables                                                                                             166

CHAPTER SEVEN: DISCUSSION, FUTURE DIRECTIONS, AND CONCLUSION. 171
7.1 Overview of Findings.............................................................................................................171
7.2 Discussion and Implications of Key Findings........................................................................172
   7.2.1 Study 1.........................................................................................................................172
   7.2.2 Study 2.........................................................................................................................183
7.3 Limitations...........................................................................................................................192
7.4 Future Research.....................................................................................................................196
7.5 Concluding Remarks.............................................................................................................199
References.................................................................................................................................202

APPENDICES.................................................................................................................................209
LIST OF FIGURES

Figure 2.1. A flow diagram representing an overview of this research..................45

Figure 3.1. Schematic flowchart showing the sequential steps of participant recruitment and data collection. A mixed methods exploratory design in which qualitative data informed the design of an online questionnaire tool distributed to incoming first-year veterinary students (n=84).........................................................................................................................77

Figure 3.2. Sources of information used by incoming veterinary students to learn about their own nutrition and their pet’s nutrition (n=84). Respondents could select more than one response in answering these questions.................................................................78

Figure 3.3. Incoming veterinary students’ opinions regarding the motivations of pet food companies (n=84). In this case, students were responding to questions about beliefs related to their pet’s nutrition.................................................................78

Figure 3.4. Incoming first year veterinary students’ responses (n=84) to question asking about what factors influenced their trust towards pet nutrition companies’ motivations.................................................................79

Figure 3.5. Incoming veterinary students’ responses to questions regarding the level of trust towards the regulatory standards set for the human and pet food industries (n=84)........................................................................................................79

Figure 4.1. Comparison of nutrition instruction versus other subject areas of veterinary medicine expressed as % who agree that veterinary instruction will provide adequate education in each area. Responses represent data from all schools surveyed........106

Figure 5.1. Most common reasons reported by dog and cat owners (n=1402) for feeding home-made and raw diets.................................................................131

Figure 5.2. Most common reasons reported by dog and cat owners (n=1402) that influence their decision when purchasing food for their pet (*represents p<0.05 between dog and cat owner responses)........................................................................131

Figure 5.3. Self-reported body condition score (BCS) of pet by dog and cat owners (n=1402) in survey regarding nutrition information-seeking attitudes and beliefs........132

Figure 5.4. Dog and cat owner’ responses (n=1402) to question about what factors affect their decision on what to feed their pet. Respondents could select more than one choice. (*represents p<0.05 between dog and cat owner responses).........................132

Figure 5.5. Dog and cat owner’ responses (n=1402) to question about what factors affect their decision on how much to feed their pet. Respondents could select more than one choice. (*represents p<0.05 between dog and cat owner responses).........................133
**Figure 6.1.** Schematic of the Health Belief Model adapted for the population in this study. The model was used as a theoretical framework to explain and predict pet owners’ intention to comply with nutrition recommendations from health care professionals for their own nutrition and their pet’s nutrition.

**Figure 6.2.** Pet owners’ (n=1402) self-reported general health status for own health and their pet’s health on questionnaire that assessed nutrition attitudes and behaviours.

**Figure 6.3.** Pet owners’ (n=1402) responses to how healthy they perceive their current diet and their pet’s diet to be on questionnaire that assessed nutrition attitudes and behaviours.
**LIST OF TABLES**

**Table 3.1.** Themes, subthemes and representative example quotes for qualitative thematic analysis of four focus group discussions conducted with pre-veterinary (n=9) and first-year veterinary students (n=10) on nutrition beliefs and perceptions...........80

**Table 3.2.** Age, gender, residence, and career plans upon graduation for incoming student veterinarians at the Ontario Veterinary College who completed the questionnaire (n=84)..................................................................................................................81

**Table 3.3.** Factors influencing the decisions of incoming veterinary students on what to feed their pets (n=111). Respondents could select more than one source of information in responding to this question..............................................................................................................82

**Table 3.4.** Incoming veterinary students’ responses to a question about where pet food was purchased (n=111). Respondents could select more than one response option for the question.................................................................................................................................83

**Table 3.5.** Incoming veterinary students’ responses (n=111) about motivators and barriers to changing their pet’s current diet. Respondents could select more than one response option for each question.........................................................................................................................84

**Table 3.6.** Response to questionnaire statements relating to attitudes of incoming veterinary students (n=84) regarding nutrition information-seeking.........................................................85

**Table 4.1.** Incoming first-year veterinary students (n=326) demographic data, including career plans upon graduation by school of attendance...................................................................................................................107

**Table 4.2.** ANOVA associations of students’ age, gender and school’s presence of board-certified faculty with perceived importance of, emphasis on and academic self-efficacy for nutrition education in veterinary school.................................................................................................108

**Table 4.3.** Multilevel logistic regression reduced model* of perceived confidence** in nutrition education among incoming first year veterinary students (n=326).....................109

**Table 4.4.** Student veterinarians’ preferred learning formats for nutrition education across schools.........................................................................................................................110

**Table 5.1.** Demographic data of pet owners (n=1402) participating in survey regarding pet nutrition information-seeking attitudes and beliefs..................................................................................................................134

**Table 5.2.** Demographic data of pets (n=1402) represented in survey regarding pet nutrition information-seeking attitudes and beliefs................................................................................................................135

**Table 5.3.** Comparison of feeding behaviours of dog and cat owners (n=1402) represented in survey regarding pet nutrition information-seeking attitudes and beliefs................................................................................................................136
Table 5.4. Frequency of seeking veterinary care for cat owners versus dog owners (n=1402) represented in survey regarding pet nutrition information-seeking attitudes and beliefs……………………………………………………………………………..137

Table 5.5. Multivariable reduced logistic regression results of associations of dog and cat owner (n=1402) attitudes with perceived effectiveness of nutrition care received at veterinary clinics………………………………………………………………………………………………………..138

Table 6.1. Demographic characteristics of pet owners (n=1402) responding to questionnaire on attitudes towards recommendations from health care professionals for their own nutrition and their pet’s nutrition………………………………………………………………………………………………………………166

Table 6.2. Comparison of attitudes of seeking nutrition information among pet owners (n=1402) for their own nutrition versus for their pet’s nutrition………………………………167

Table 6.3. Mean score of Health Belief Model (HBM) components for owners’ own nutrition and their pet’s nutrition……………………………………………………………………………………………………168

Table 6.4. Correlations between Health Belief Model (HBM) model constructs. Pearson correlation coefficient (r) for each construct by respondents’ beliefs about their own nutrition and about their pet’s nutrition……………………………………………………………………………………………………………………169

Table 6.5. Multivariable linear regression models predicting pet owners’ (n=1402) intention to follow health care professionals’ nutrition advice for their own nutrition and their pet’s nutrition, showing coefficients, significance values, and 95% CI for each model………………………………………………………………………………………………………………170
LIST OF APPENDICES

Appendix A. Semi-structured interview guide for pre-veterinary and first-year veterinary students at the OVC, sampled via class email lists.................................209

Appendix B. Semi-structured interview guide for pet owners across Ontario, sampled via snowball sampling methods.................................................................216

Appendix C. Online Questionnaire Tool Developed to Capture Incoming Veterinary Students’ Nutrition Attitudes and Beliefs.....................................................223

Appendix D. Online Questionnaire Tool Developed to Capture Pet Owners’ Nutrition Attitudes, Beliefs and Nutrition Information-Seeking Behaviours........247
Preface

Over the past few years, I have had the chance to develop both personally and professionally as a mixed-methods researcher. Through my own engagement in this work, and through my experiences as a PhD student, I have come to know more about the factors that influence an individual’s personal and private perceptions in terms of their well-being. Those beliefs play a role not only in their sense of identity but also in the way they interact with others.

Education and health are often said to be inextricably linked: a familiar axiom declares that students must be healthy in order to be educated, and they must be educated in order to remain healthy. In this era of interest in educational standards and concern for the social and health problems confronting humans and animals, the pivotal role of healthcare professionals in educating people is receiving increased attention. I have always been passionate about pedagogy, while trying to provide the best possible learning experience for students. In my third year of my undergraduate education, I worked as an instructor at the University of Toronto’s Medical Youth Summer Program. I led a class of over thirty high school students from all over the world and was responsible for providing an enriching educational experience that provides students with insight on higher education learning in the university setting. As an undergraduate student myself at the time, this task was both challenging and immensely rewarding in equal measures.

Upon completion of the program, I was then hired by the Department of Teaching Labs at the Faculty of Medicine to conduct a research project that investigated the
impact of the program on student learning and engagement with scientific research. Using survey methodology that compared students’ pre- and post-program perceptions and attitudes, I realized that because students enrolled into the program from different parts of the world, their perceptions varied greatly based on their prior exposures.

My experiences and observations led me to start to understand the value in capturing students’ own perceptions and beliefs and the way that it may influence their learning outcomes. At the time, I was focused on the transition from high school into undergraduate programs. However, I was also interested in the way that learning experiences play a role in population health outcomes, particularly in medical students, whose learning experiences ultimately affect their future clinical practice. For this reason, I decided to focus more on education in the realm of public health. Education and health promotion are core practices in public and population health efforts. Yet, despite this, many public health concerns (e.g. obesity, vaccination rates) remain despite education campaigns. Ultimately, a key player in improving health and well-being (via education) is the healthcare professional. A year after my undergraduate education, based on my interests in public health education and promotion and a desire to make a contribution to improve the barriers that healthcare professionals may face in educating the public, I decided to continue my studies in education, with a focus on veterinary nutrition.

The following literature review describes the importance of nutrition education and counselling, the rationale behind investigating attitudes, perceptions and beliefs, the
human-animal bond, the health belief model and a positionality statement. This chapter concludes with an overview of the thesis structure.
1.1 Importance of Nutrition Education

1.1.1 Importance of Client Nutrition Counselling and Communication

Healthcare professionals, such as physicians and veterinarians, have the primary responsibility for patients’ health and safety, including treatment and prevention of disease. A fundamental component to living a healthy, active life is sound nutrition. In humans, poor nutrition is associated with a variety of negative health outcomes, including obesity, malnutrition, diabetes, hypertension, cardiovascular disease (CVD), and even respiratory problems (Bancej et al. 2015). Poor nutrition in companion animals can also result in comorbidities, including orthopedic problems and arthritis, respiratory problems, diabetes and urinary tract disorders (German 2006; Molina et al. 2018). The ultimate consequence of these negative health outcomes is a decreased lifespan (Kipperman and German 2018). There is ample evidence that nutrition interventions can decrease morbidity, mortality, poor quality of life and medical costs (Ammerman et al. 1993; Van Eys 1998; Dalziel and Segal 2007; Churchill and Ward 2016; Sharma et al. 2018). Thus, it may be argued, a core skill for today’s medical and veterinary practitioners is to counsel patients/clients on nutrition behaviours and management (Kolasa et al. 2014; Churchill and Ward 2016).

Many physicians recognize the importance of nutrition counselling in their clinical practice. In a study of physicians in Canada, 80% reported that nutrition education is important and 60% reported that their patients would benefit from nutrition counselling
(Wynn et al. 2010). Furthermore, over 70% of surveyed physicians stated that they believed nutrition intervention changes behaviour. Kushner (2003) showed that over 75% of USA physicians agreed that nutrition education is a primary responsibility of the primary care provider. Similarly, in the context of veterinary medicine, many veterinarians recognize the importance of discussing nutrition with clients (Becvarora et al. 2016). The American Animal Hospital Association (AAHA) and the World Small Animal Veterinary Association (WSAVA) adopted nutrition as the “fifth vital sign” in 2010 and 2011, respectively. According to the AAHA’s Guidelines for Dogs and Cats, “incorporating nutritional assessment into regular animal care is critical for maintaining pets’ health, as well as their response to disease and injury” (Baldwin et al. 2010).

Inherent in these guidelines is that each companion animal patient should be evaluated for nutritional risk factors during each physical exam. The guidelines especially highlight the value of a nutritional assessment when a patient presents with specific risk factors, such as an abnormal body condition score (underweight or overweight), presence of disease conditions, specific life stages or alternative diets.

Effective interaction and communication between patients and doctors or clients and veterinarian has been suggested to improve the success of nutritional counselling in influencing behavioural change (Endevelt and Gesser-Edelsburg 2014; Churchill and Ward 2016; Phillips et al. 2017). The value of effective communication within the veterinarian–client–patient relationship is well discussed within the veterinary literature (Shaw et al. 2004; Kanji et al. 2012; Phillips et al. 2017). Compliance to veterinary nutrition recommendations remains low (Churchill and Ward 2016; Kipperman and German 2018). Clients have been reported to have greater compliance with veterinary
recommendations when there is strong veterinary-client communication (Lue et al. 2008). Veterinarians often experience barriers in delivering nutritional advice to clients and feel unconfident in communicating nutrition to clients (Morrisey and Voiland 2007; Becvarora et al. 2016; Churchill and Ward 2016). Time pressures within a clinical interaction, client misinformation, and client resistance are communication barriers that have been identified to exist during interactions between veterinarians and their clients (Churchill and Ward 2016; Coe et al. 2008). Nutrition communication, in particular between veterinarians and owners/clients is influenced by owners’ pre-existing attitudes and perceptions regarding the role of nutrition in their pet's health (Churchill and Ward 2016). Thus, a key factor in client perceptions of the quality of communication is the ability of veterinarians to provide thorough and tailored recommendations to the owner in addition to the pet (Lue et al. 2008). For instance, the manner in which veterinarians pose questions in obtaining a diet history from clients has been found to impact the completeness and accuracy of the information obtained (MacMartin et al. 2018). In addition, research suggests that, when a client has a pre-established viewpoint regarding a problem that is not congruent with the veterinarian’s viewpoint, the client is likely to reject the veterinarian’s viewpoint in favor of their own (Coe 2013). In this same research, when veterinarians followed up with clients to understand their perspective on why a change was not appropriate or adjusted the recommendation to better suit the client, it was found that clients were more likely to verbally indicate an intention to follow through with the veterinarian’s long-term diet recommendation.

Research on the role of physician-patient communication in compliance outcomes is extensive and well reported in the human medical field (King and Hoppe
2013). The literature suggests that nutrition counselling attitudes among physicians affects patients' compliance to medical recommendations (Martin et al. 2005). In general, patient-tailored care have resulted in greater satisfaction and adherence to medical recommendations (King and Hoppe 2013). In veterinary medicine, nutrition counselling that focuses on behavioural attitudes along with lifestyle interventions have been shown to be beneficial in weight management strategies for both owners and their pets (Bartges et al. 2017; Coe et al. 2008).

Shared decision-making processes between veterinarians and owners has also been suggested as a counselling technique to improve compliance to nutrition recommendations. Shared decision-making involves the input of the patient or the client in the medical recommendations being proposed and actively involving them in the treatment plan (Wilson et al. 2010). In human medical settings, shared decision-making has been shown to improve compliance to medical recommendations, including nutrition guidance (Vaillancourt et al. 2015). The implications of shared decision-making in veterinary medicine has been previously explored (Kanji et al. 2012; Küper and Merle 2019); albeit in a limited capacity. Several studies involving focus groups and in-depth interviews revealed that pet owners want to be involved in the decision-making process, appreciate sharing their personal perspective and have a desire to be given multiple options for care (Coe et al. 2008; Küper and Merle 2019). Relationship-centered care, which incorporates shared decision-making with owners, was shown to improve adherence to dentistry and surgical veterinary recommendations (Kanji et al. 2012). Thus, an important aspect of nutrition training for veterinarians is to prepare graduating
veterinarians to communicate on nutrition topics with clients in a personalized manner while effectively involving the owner in their pet’s nutritional management.

1.1.2 Status of Nutrition Education in Medical Schools

Since the 1980s, nutrition education for physicians-in-training has been acknowledged as crucial (Howard and Bigaouette 1983; Adams et al. 2006; Adams et al. 2010; Gramlich et al. 2010; Mogre et al. 2018). The Academy of Nutrition and Dietetics has specified that nutrition education is an essential component of medical curricula and should include enough training for the physician to provide comprehensive nutrition services for patients (Kris-Etherton et al. 2014). Yet, the lack of nutrition training in medical school is well documented in the literature (Danek et al. 2017; Mogre et al. 2017). Adams et al. (2006) reported that most medical school instructors believed that the amount of nutrition education in the curriculum was insufficient. For example, although the National Academy of Sciences recommends a minimum of 25 hours of nutrition education for medical students (Adams et al. 2010), many schools fail to meet the minimum requirement and devote limited time to nutrition education (Devries et al. 2019). In a recent study of USA medical schools, the average time dedicated to nutrition instruction was 19 hours over 4 years and was largely focused on biochemical and molecular nutrition processes rather than clinical training (Devries et al. 2019). It has been suggested that this lack of nutrition education translates into low nutrition counselling rates in medical settings (Schoendorfer et al. 2017). For instance, in one study, only 22.2% of graduating physicians felt adequately prepared by their nutrition education to provide nutrition care in the general practice setting (Mogre et al. 2018). In
another study of practicing physicians, 48% reported the inability to adequately counsel patients on common obesity treatment options (Waring et al. 2014).

Studies amongst medical students have also highlighted students’ dissatisfaction with their medical nutrition training, frequently describing the emphasis on their nutrition education as “inadequate” (Gramlich et al. 2010; Mogre et al. 2018). In a 2018 survey of 342 Canadian medical students, authors concluded that 79% of students reported that more nutrition instruction is needed (Hanninen and Rashid 2018). In addition, when asked to evaluate their curricula, medical students consistently requested more teaching hours be devoted to practical aspects of nutrition. Furthermore, the literature suggests that student satisfaction with nutrition education is not improving, despite some curricular changes (Gramlich et al. 2010).

Support for nutrition education in medical school is lacking. Experts have recommended that medical school faculty and students need more nutrition training. For example, in one study preceptors expected medical students to counsel patients on nutrition, but were unable to provide feedback or suggest strategies (Wong et al. 2004). Several barriers have been reported as a basis for inadequate nutrition education in medical curricula. Through the literature, the most common barrier to nutrition education is time in the curriculum (Newcome 2012). Others include limited curricular materials, lack of advocacy and lack of engagement at senior levels in medical schools (St Jeor et al. 2006). Nutrition is also a field in which the public is exposed to an increasing array of information, largely through the use of the Internet (Walker 2003) and thus, the physician must be aware of these sources of information and be able to adequately
interpret and evaluate their credibility and efficacy in promoting health and treating disease. A number of strategies to improving nutrition education in the medical curriculum have also been discussed by some of these studies (Walker 2003; Kris-Etherton et al. 2014). Suggested strategies focused on integrating formal classroom learning in nutrition with practical, experiential, inquiry-driven, interprofessional, and population health management activities and assessments. In another study, investigating the nutrition knowledge of pre-medical students was suggested as an important consideration for designing nutrition curricula (Newcome 2012).

1.1.3 Status of Nutrition Education in Veterinary Schools

Given that recommendations and guidelines for veterinary practice stress the importance of incorporating nutrition assessments and the fact that veterinarians are considered a primary source of nutrition information by pet owners (Kogan et al. 2012), veterinarians are expected to be a credible source of nutrition information. The American College of Veterinary Nutrition (ACVN) has developed a list of nutrition-related competencies for veterinarians as a foundation for designing veterinary nutrition curricula (Abood 2008). Yet, previous research reports practicing veterinarians feel inadequately trained in nutrition subjects prior to graduating (German 2006). Although not as extensively studied as nutrition education in medical schools, studies reveal that over a third of veterinary students are not satisfied with the nutrition education they receive (Ikuta et al. 2006).

In the past decade, there have been increased efforts to improve and develop nutrition curricula in veterinary programs (Abood 2008). Still, a recent report among
deans and faculty members from 63 European veterinary schools emphasized that the nutrition skills and performance of new graduates were not fully satisfactory (Becvarora et al. 2016). Nutrition for companion animals is taught in most veterinary schools to some capacity, yet the number of hours and method of instruction varies (Becvarora et al. 2016). Veterinary educators recognize the need to develop the nutrition curriculum to better prepare graduates to discuss these topics with clients. Nonetheless, similar barriers to those reported in medical schools exist, such as limited curriculum time, perceived lack of interest from students and shortage of veterinary nutrition specialists (Becvarora et al. 2016). There is also a reported need to better identify how to tailor veterinary nutrition education in a way that highlights the importance of nutrition for clinical practice and improves counselling confidence (Towell et al. 2010; Rösch et al. 2014). In the context of human nursing and medical education, when students considered their nutrition education to be relevant to future clinical practice, they reported higher clinical confidence, achievement and satisfaction with their nutrition training (Brashers et al. 2016). Similar investigations are yet to be conducted amongst veterinary students.

A lack of nutrition training has been associated with low nutrition counselling rates in veterinary clinics (Kipperman and German 2018). In a survey of USA dog and cat owners, while 90% of them expressed interest in obtaining a dietary recommendation from their veterinary health team, only 15% perceived they had received one (Buckholder and Toll 2010). Similarly, in a 12-month retrospective study of primary care veterinary records of over 148 dogs in the UK, only 70% of the medical record entries documented the patient’s body weight, with less than a third reporting a
qualitative body condition assessment (German and Morgan 2008). Nutrition is considered a sensitive health topic, particularly if the owner has strong opinions about how to feed their pet or displays signs of inadequate nutrition themselves. This can add a complicating factor to the veterinarian and instills a fear that they will offend, upset, anger or even lose a client, leading to professional anxiety, apprehension, and avoidance (Churchill and Ward 2016). The results of another report substantiate that veterinarians may believe that compliance to their nutrition guidance will be low, regardless of professional concern (Eastland-Jones et al. 2014).

The status of nutrition education in veterinary schools cannot be fully presented without acknowledging the role of the pet food industry in veterinary nutrition training. It is widely recognized that pet food companies have historically played a role in guiding nutrition education and conducting research in companion animal nutrition. It is also acknowledged that pet food companies presently also continue to play a role in education and research as it relates to companion animal nutrition.

In summary, although research has shown the importance of nutrition for human and animal health and well-being and the recognized importance of nutrition amongst veterinarians and physicians, there remains a gap in the way that nutrition curricula is taught in veterinary and medical schools. Moreover, nutrition instruction in veterinary school has not been as extensively studied as in human medical literature. Research that does exist suggests interprofessional and experiential learning processes may be more effective in preparing medical and veterinary graduates to apply nutrition concepts to clinical practice. Students’ attitudes and satisfaction with their nutrition education may
potentially be correlated with their counselling attitudes and practice and thus, examining their attitudes may be an important consideration for nutrition curricular design.

1.2 Importance of Investigating Attitudes, Perceptions and Beliefs

1.2.1 Nutrition Attitudes and Beliefs

An attitude is defined as a way of thinking or feeling about something and is a way that one expresses or applies their belief and thus, influences one’s behaviour (Chaiklin 2011). Research has found that some of our attitudes are inherited (Olson et al. 2001), while others are learned through direct and indirect experiences (De Houwer et al. 2001). For example, we may develop attitudes via the media (Hargreaves and Tiggemann, 2003; Levina et al. 2000) or through our interactions with friends (Poteat 2007). Social psychologists are particularly interested in the behavioural aspects of attitudes. Psychological principles support the fact that attitudes are likely to guide behaviour and thus, an exploration of one’s attitudes and beliefs on a subject may predict their behavioural decisions on that topic (Albarracín and Wyer 2000).

Exploring the correlation of nutrition-related attitudes and beliefs with various health outcomes is well-established in the literature. Nutrition beliefs, attitudes and practices have been investigated among a wide range of populations, such as students (Cason and Wenrich 2002; Barzegari et al. 2011), adolescents (Haidar et al. 2017), parents (Vollmer and Mobley 2013; El-Nmer et al. 2014) and the elderly (Jeruszka-Bielak et al. 2018). Furthermore, extensive research exists on attitudes that influence dietary behaviours such as fat intake, fruit and vegetable consumption, beverage
selection and dietary restriction (Hollis et al. 1986; Blake and Melton 1992; Lin and Lee 2005; Halloran et al. 2018). Attitudes and beliefs have also been positively correlated with purchasing decisions (Drichoutis et al. 2006; Benson et al. 2018) and information-seeking behaviours (Knight-Agarwal et al. 2019).

Attitudes and beliefs are important in health research because they vary among individuals and have implications for clinical practice, education and policy since they are potentially modifiable through specific interventions (Quicke et al. 2017). Altering specific behavioural risk factors, for example, may lead to reduced morbidity and mortality (McTigue et al. 2003). Lifestyle intervention programs typically focus on altering beliefs, attitudes and practices to promote successful behavioural change and enhance positive health outcomes (Dunn et al. 1998; Fleming and Godwin 2008). For example, among studies that assessed the efficacy of diet and physical activity interventions, those that focused on understanding patients' barriers were more effective in promoting healthy behaviour than interventions that did not examine participants’ attitudes and beliefs (Kardakis et al. 2013; Vlaar et al. 2017).

1.2.2 Pet Owners’ Attitudes and Beliefs

1.2.2.1 Pet Owners’ Nutrition-Related Attitudes

It is now well recognized that along with animal-related factors, owner-related beliefs, attitudes and practices play a major role in pets’ health and well-being. The nutritional choices of pet owners are likely influenced by numerous factors, including their knowledge of their pet’s nutritional needs, where they seek nutrition information, their thoughts about the pet food industry, and their perceptions towards the nutritional
value and safety of ingredients in different diets (Michel et al. 2008). Educating pet owners about nutrition and dietary management is an essential component of veterinary medicine and can play an important role in addressing any misconceptions that may influence their feeding habits (Michel et al. 2008). Understanding how and what people choose to feed their pets, as well as behaviours and attitudes that may influence these choices, could facilitate better communication with clients regarding dietary choices for their pets.

Previous surveys have examined the role that pet owners’ attitudes play in their feeding decisions (Willoughby et al. 2005; Laflamme et al. 2008; Michel et al. 2008; Parr and Remillard 2014; Morgan et al. 2017). Type of diet fed to pets is influenced by pet owner beliefs of what is ideal for pet health and wellbeing. For example, although most dog and cat owners in Canada, the US and Australia feed their pets commercial dry diets (Robertson 1999; Laflamme et al. 2008), feeding of raw and home-made diets is more prevalent in owners who express greater mistrust of commercial pet foods and the pet food industry (Laflamme et al. 2008). Previous studies have reported that pet owners that do not feed commercially processed diets have less trust in veterinarians, as a source of information on pet nutrition, than those that do feed commercially processed diets (Connolly, Heinze and Freeman, 2014; Rajagopaul et al. 2016). Concern about safety and quality control of commercially processed diets is also a commonly cited reason for choosing to feed their pet raw food (Morgan et al. 2017). Despite professional concerns that home-made and raw diets may be nutritionally imbalanced as primary feeding regimens (Freeman et al. 2013; Oliveira et al. 2014) and professional veterinary and health associations (e.g. the American Veterinary Medical
Association, Canadian Veterinary Medical Association, Center for Disease Control) discouraging the feeding of raw diets to pets, studies amongst pet owners have reported beliefs that home-made and raw diets are more natural and healthier for the pet (Freeman et al. 2013). These findings highlight the importance that the attitudes held by pet owners regarding their pet’s nutrition play in their feeding decisions, regardless of scientific or professional recommendations.

In a qualitative investigation of Irish pet owners’ perceptions towards cat and dog feeding and exercise needs, authors concluded that feeding decisions “draw on specific beliefs and perceived levels of control regarding pet-specific behaviours, what is needed for pet health and wellbeing, and how pet owners perceive tangible health signs” (Downes et al. 2017). Owners also reported that feeding pet treats was often a way of expressing emotional attachment to the pet. Studies have also suggested that owners’ attitudes towards pet nutrition is influenced by the implications of the chosen diet on the owner (e.g. convenience, time management, cost) (White et al. 2016; Downes et al. 2017).

Research has also demonstrated a difference between cat owners and dog owners’ attitudes towards feeding decisions (Willoughby et al. 2005; Laflamme et al. 2008). In a study by Laflamme et al. (2008), more dogs (30.4%) than cats (13.1%) were fed table scraps, home-made and raw diets. Dogs were also more likely to receive treats.

Dodd et al. (2019) also investigated pet owners’ beliefs and reasons for feeding their pets a plant-based diet. Owners who consumed a vegan diet for their own nutrition
were more likely to express interest in feeding a plant-based diet to their pet; yet, most respondents expressed concern with the nutritional adequacy of plant-based exclusive diet for cats and dogs. Dog owners were twice more likely than cat owners to feed plant-based foods. Results of this study demonstrate the possible relationship between owners’ own nutrition habits and their attitudes towards their pet’s dietary management.

Owner attitudes and perceptions may also influence the likelihood of pets becoming overweight. Indeed, overweight pets tend to have overweight owners (Holmes et al. 2007; Nijland et al. 2010). Misperception of pets’ body weights among owners is commonly reported in the literature. Multiple studies have found a disconnect between owners’ perception of body condition score (BCS) of their pet and the veterinarian’s assessment of the pet’s body condition (Courcier et al. 2011; Krasuska and Webb 2018). Owners tend to underestimate their dog’s BCS, for example. In one study, experts classified 79% of pet dogs to be overweight or to have obesity, while only 28% of the owners estimated their dog to be above an ideal body weight (Kipperman and German 2018). In two surveys conducted with dog- and cat-owning households in Australia, owner dietary management factors were positively correlated with risk of overweight in pets (McGreevy et al. 2005; McGreevy et al. 2008). For instance, dogs who were fed snacks or fed once a day were 1.5 and 1.4 times more likely to be overweight, respectively than those who were not fed snacks. Attitudes surrounding physical activity also differed between owners of obese pets and those of pets that are ideal weight. Owners of overweight dogs are significantly less likely to consider physical activity important and are less likely to walk their dogs daily, with walks lasting less periods of time than those of healthy weight dogs (Muñoz-Prieto et al. 2018). Among cat
owners, those who own overweight cats were less likely to play with them than owners of ideal weight cats (Kienzle and Bergler 2006).

1.2.2.2 Pet Owners’ Information-Seeking Attitudes

In order to effectively educate pet owners on how to manage their pet’s diet and health, a careful examination of where owners seek their nutrition information from is required. Several studies have indicated that veterinarians are considered the primary source of nutrition information for both dog and cat owners (Michel et al. 2008, Kogan; Schoenfeld-Tacher et al. 2012; Churchill and Ward 2016). In a study of 852 pet owners in 6 countries, 45% relied on their veterinarian for assistance with their pet’s nutrition and dietary choices (Freeman et al. 2013). However, there is a gap in the literature on owners’ attitudes towards nutrition information received from veterinary clinics. One study reported that trust of nutrition information from a veterinarian is rated high, yet trust of the pet food industry is considerably lower (Michel et al. 2008). For instance, dog owners were significantly less likely than cat owners to trust that pet food manufacturers provide nutritionally sound, quality products. In other studies, pet owners acknowledged that the media may increase their mistrust of the pet food industry, particularly when conflicting information and recommendations exist, leading to confusion and frustration (Rajagopaul et al. 2016). However, studies that examine owners’ intention to comply with nutrition recommendations are lacking.

Studies show that at least 15% of pet owners cite the Internet as their primary source of nutrition information (Laflamme et al. 2008; Michel et al. 2008). The Internet has provided increased access to large amounts of often unreliable or unverified
information (Michel et al. 2008), potentially creating greater risk of inconsistency in veterinary nutrition recommendations and causing confusion among pet owners. Directing owners to resources of sound nutritional quality and correcting any misperceptions is an important role of the veterinarian when consulting on nutrition.

1.2.2.3 Pet Ownership Styles and Attitudes

Ownership styles might also be important, whereby different styles of ownership might mean different feeding beliefs, food types and rewards, predisposing some pets to weight gain and undesirable food-related behaviour. Limited information exists in the veterinary literature regarding styles of pet ownership. One study suggested that owners typically display one of ‘dominionistic’, ‘humanistic’ or ‘protectionist’ views towards their pets (Blouin 2013). Dominionistic owners value pets in terms of their functional value (e.g. protection); humanistic owners view their pets as surrogate human beings and have a close attachment; and protectionist owners have a general high regard for animals, and all pets, viewing them as valuable companions and creatures with free-thought and feelings. Few studies have examined how pet ownership styles may influence dietary habits and behaviours (German 2015; Pretlow and Corbee 2016). In a study by Rohlf et al. (2010) respondents who believed they have control over feeding their dogs appropriately were more likely to intend to do so (p<0.001). These findings may help to explain why owners of obese dogs are more likely to give in to begging behavior from their dogs (Kienzle et al. 1998); it is likely that owners who give in to begging have lower perceived control over their pet’s diet (Downes et al. 2017). Here, a parallel can be drawn with parenting and childhood obesity.
In this respect, different parenting styles have been identified which reflect differences in the degree of control the parent places over their child's behaviour and the responsiveness of the parent to their child's wishes (Hughes et al. 2005). The children of parents who display either an indulgent style (i.e. displaying warmth and respect for their child's needs but only limited monitoring of their behaviour) or an authoritarian style (i.e. making high demands on their children whilst showing little responsiveness to their opinions or wishes) are more likely to be overweight than those who show other styles (Hughes et al. 2005; Vollmer and Mobley 2013). There are many parallels between how parents care for children and how owners care for their pet, and a recent review considered how pet ownership styles could be mapped to parenting styles (German 2015). For instance, in the indulgent style, pet owners would alter the diet to suit pet's preferences, offer treats and table scraps and determine the timing of food by the pet's needs. Another study that applied the Parenting Styles and Dimensions Questionnaire to a group of 518 dog owners found that parenting styles apply to the way that owners interact with and direct their dogs (Herwijnen et al. 2018). If pet ownership styles exist that are similar to parent styles, then similar predispositions might exist for nutrition-related behaviours that may be targeted in veterinary medicine and public health initiatives. Most current weight management strategies require the owner to exert control over both the amount and type of food fed, akin to the authoritarian style. Veterinary clients with different ownership strategies might find it difficult to adjust their behaviours, predisposing them to fail. A question that warrants further investigation by researchers and veterinarians is to what extent can pet ownership styles be changed by education.
1.3 The Human Animal Bond

1.3.1 Definition of Human Animal Bond

The Human-Animal Bond (HAB) is defined as “the dynamic relationship between people and animals such that each influences the psychological and physiological state of the other” (Takashima and Day 2014). The HAB has been widely investigated and related research extensively reported. Decades of research have lent scientific support to the bond that a companion animal and the owner share (Purewal et al. 2017). The study of human-animal relationships has become a new and respected field of research, anthrozoology (Takashima and Day 2014).

Pet owner surveys have reported that most pet owners consider their pet as a member of the family, even referring to themselves as “mom” or “dad” to their pets (Ainsworth 1989; Freiwald et al. 2014; Hawkins; et al. 2017). The most commonly cited theoretical paradigm for understanding the human animal bond is attachment theory. Originally proposed by Bowlby (1969), attachment theory suggests that maintaining close proximity to animals helps humans to better cope with the world. Attachment appears to be an important component of the relationship between people and their pets (Mueller et al. 2018) and has been shown to positively predict attitudes to animals and is associated with greater concern for animal health (Hawkins et al. 2017). A survey by the American Veterinary Medical Association (2007) revealed that 94 percent of respondents said they provide regular veterinary checkups to assure a good quality of life for their pets, and 58 percent said they visit the veterinarian more often than the family physician.
1.3.2 Human Animal Bond and Health Outcomes

Numerous studies have repeatedly demonstrated a strong correlation between animal companionship and better health outcomes. The studies that are relevant to the research in this thesis are presented in this literature review. Interacting with a dog for as little as five minutes can lead to a reduction in the stress hormone cortisol, suggesting that owning an animal may be an effective anti-stress treatment (Odendaal 2000; Barker & Wolen 2008). Several case control studies demonstrate the relationship between owning a pet and cardiovascular health. The first study that examined this association showed that among heart attack patients, pet ownership was associated with better survival outcomes (Friedmann et al. 1980). Since then, results of this study were replicated in larger sample sizes (Rajack 1997; Friedmann, Thomas and Son 2011). Similarly, pet ownership was associated with improved survival and lower risk of fatal cardiovascular events in a sample of hypertensive older adults (Chowhurdy et al. 2017). A review of the current literature suggests that pet ownership or positive interactions with an animal can reduce risk factors in some people such as stress, depression, physical inactivity and obesity, which are all associated with cardiovascular disease. Pet ownership is also correlated with lower rates of hypertension among some owners. For example, in a randomized control trial by Allen et al. (2001) where one group of hypertensive people adopted pet dogs, there was a marked reduction in systolic blood pressure among those in the treatment group than the controls (p<0.001). Multiple studies, with sample sizes up to 5741 participants, all reported lower cholesterol and/or triglyceride levels linked to dog and cat ownership (Anderson et al. 1992; Dembicki and Anderson 1996; Lentino et al. 2012).
In contrast, several studies demonstrate mixed or null effects of pet ownership on cardiovascular and physical health. In one survey of 2,551 older adults comparing sociodemographic attributes, mental and physical health measures, and personality traits of pet owners and non-owners, caring for a pet was associated with lower physical health (Parslow et al. 2005). The direction of findings also varied by species: Enmarker et al. (2012) and Pruchno et al. (2018) found positive associations between health outcomes and dog ownership, but negative associations between health outcomes and cat ownership. Despite the mixed findings, the overall body of research on pet ownership and physical health instigated the American Heart Association to issue a scientific statement in 2013 suggesting that owning a pet may reduce risk for CVD (Levine et al. 2013). Future study designs that include factors such as age and species of pet, length of ownership, strength of bond may be useful in further understanding the complex relationship between pet ownership and physical health.

1.3.3 Analogy Between Owner-Pet and Parent-Child Relationship

For many pet owners, an animal companion is “a faithful, intimate, noncompetitive and non-judgmental friend” (Hawkins et al. 2017). Several studies have also suggested that the attachment between a pet owner and their cat or dog can be regarded as functionally similar to that seen between a parent and a child (Ainsworth 1989). For instance, studies have shown that the owner-pet relationship shows behavioural and neuroendocrine similarities to that in mothers and infants (Odendaal and Meintjes 2003; Nagasawa et al. 2009). The neurohormone oxytocin, which is known for influencing bonding and attachment, is produced in the paraventricular and
supraoptic nuclei in the hypothalamus and is known to stimulate milk ejection during breastfeeding and uterine contractions during labor (Uvnäs-Moberg 1998). However, oxytocin is not only released during labor and breastfeeding, but may also be released by non-noxious sensory stimulation such as gentle touch. Both animals and humans respond to this type of stimulation, which induces, for example, anti-stress effects (e.g., decreased cortisol levels and blood pressure) (Uvnäs-Moberg 1998) and facilitates friendly social interactions (Domes et al. 2007b), such as pair bonding and maternal behavior and attachment (Uvnäs-Moberg et al. 2005). Higher oxytocin levels have been recorded in studies that explore owner-pet interactions (Nagasawa et al. 2009), although the robustness of this effect was called into question due to factors like limited sample sizes and poor experimental controls (Beetz et al. 2012; Miller et al. 2009). In an effort to better understand the neurochemical processes involved in the synergy between owner-pet and parent-child relationship, Stoechel et al. (2014) used functional Magnetic Resonance Imaging (fMRI) to study brain activation patterns when mothers view pictures of their child and their dogs. Neural responses have been investigated by using fMRI when humans view the faces of their romantic partner or child compared with other faces (Bartels and Zeki 2000). The authors reported significant overlap in fMRI patterns in regions involved in reward, emotion and affiliation when comparing mothers’ reactions to images of their child and their dog.

1.3.4 Human Animal Bond and Nutrition Behaviour

A link between feeding behaviours and the human-animal bond has also been documented. Kienzle et al. (1998) reported that obese dogs slept more often in the
owner’s bed and that owners of obese dogs spoke more and on a greater variety of subjects to their dogs and were less afraid of contracting diseases from their dogs than were owners of healthy weight dogs. In another report by German et al. (2016), owners of overweight dogs were more likely to see them as a “baby” (p<0.0001) and allow them to sleep in their bed (p<0.001). The interpretation of these studies is that those owners tend to disregard warnings on possible health risks of poor nutrition and instead argue that they express their love through food. Additionally, these owners may have a tendency to translate every need to a request for food.

Similarly, owners of overweight cats indicate that they have a closer relationship with their cats than those of healthy weight cats (Roudebush et al. 2008). Owners of overweight and obese dogs and cats in particular use food as a pivotal means of interaction, communication, and bonding with their animal companions (White et al. 2016). Strategies to utilize the human-animal bond in motivation and adherence to a dietary regime are also being developed (Churchill and Ward 2016). One example of this strategy is the People and Pets Exercising Together (PPET) study, a one-year prospective study that examined the effectiveness of a combined weight loss program in people and their pets (Kushner et al. 2006). Using counselling on controlling caloric intake and increasing physical activity, the PPET study compared the results of the program in reducing weight among the group with dogs versus those without dogs. Although there were no significant differences in mean weight loss between the two groups, the combined group (consisting of owners and their dogs) resulted in successful weight loss for both the owner and their dog. Thus, the results show that incorporating household pets in a weight loss program may offer a potentially practical approach to
both human and pet obesity that builds on the human-animal bond. In another report of ways to address low compliance to veterinary weight-management recommendations, the author suggested employing social workers to help veterinarians understand the social aspect of the human-animal bond and how it impacts the pet’s care in both veterinary schools and hospitals (Linder 2017).

1.4 The Health Belief Model

1.4.1 Health Belief Model Constructs

The Health Belief Model (HBM) was among the first models that adapted theory from the behavioral sciences directly to explain and predict health problems; it remains one of the most widely recognized conceptual frameworks of health behavior (Glanz et al. 2015). The major focus of the model is on the attitudes and health beliefs of individuals. The Health Belief Model was developed initially in the 1950s by a group of social psychologists in the U.S. Public Health Service to explain the widespread failure of people to participate in programs to prevent and detect disease (Rosenstock 1988), such as the tuberculosis health screening program. Later, the model was extended to include people’s responses to symptoms (Kirsch 1974) and to their behaviors in response to diagnosed illness, particularly related to adherence to medical regimens (Becker 1974).

The original Health Belief Model consisted of five constructs (Rosenstock et al. 1988):

- Perceived Susceptibility relates to a person’s perception of contracting an illness. This dimension includes one’s acceptance of the diagnosis, personal estimates of getting a disease, and susceptibility to illness in general.
• Perceived Severity is one’s belief of how serious a condition is; it specifies physical, emotional and social consequences of having a condition.

Perceived Threat is the combination of a person’s perceived severity of an illness and their perceived susceptibility to that condition. A person’s acceptance of personal risk and susceptibility is an important factor leading to health-promoting behavior. Nonetheless, an individual’s course of action often depends on that person’s perceptions of the benefits and barriers related to adopting a protective health behaviour.

• Perceived Benefits are one’s beliefs in the efficacy of a particular action to reduce the risk or seriousness of disease; such perceptions often define the action to be taken and clarify the positive effects that may be expected.

• Perceived Barriers are one’s beliefs about the tangible and psychological costs of a particular action (e.g., expense, danger, and pain). A non-conscious cost-benefit analysis occurs; individuals weigh the benefits minus the barriers to action.

• Cues to Action are strategies that activate one’s readiness to make a behavioural health change; they provide information, promote awareness, and employ a system of reminders for those interested in changing behavior. A diverse set of demographic, socio-psychological, and structural variables may affect a person’s perceptions, thereby potentially influencing health-related behavior. Cues to action are personalized and often vary based on the study group and outcome in question (Carpenter 2010).

Modified versions of the Health Belief Model have been developed and contain additional measures. Most notable is the addition of the Self Efficacy construct (Rosenstock et al. 1988), or one’s personal confidence in his/her ability to successfully perform an action. The addition of this constructs allows the HBM to better fit the challenges of changing habitual unhealthy behaviors, such as being sedentary,
smoking, or overeating (Glanz et al. 2015). The HBM is also important in research that examines adherence to medical or public health recommendations, since it establishes the beliefs behind the ability to apply the information, not just their beliefs on the value in the information provided (Carpenter 2010).

1.4.2 Application of the Health Belief Model in Health and Nutrition Research

Since its development, the HBM has been adapted to explore a variety of long-term and short-term health behaviours, including sexual risk behaviours (Zhao et al. 2012), vaccination promotion programs (Smith et al. 2011) and cancer screening (Darvishpour et al. 2018; Almadi and Alghamdi 2019). The HBM has also become a guiding framework for health behaviour interventions (Glanz et al. 2015), such as public health education programs. In particular, nutrition education programs aimed at improving understanding of lifestyle choices and improving dietary decisions have been based on the HBM (Park 2011; Iranagh et al. 2016; Araban et al. 2017). For example, James et al. (2012) conducted seven focus groups with 50 overweight and obese participants based on the HBM to design culturally appropriate weight management programs for African-American women. The model has also been applied to understand the dietary habits among different population groups. For instance, several studies have been conducted by applying the model to investigate university students’ health and dietary behaviours (Kim et al. 2012; Rahmati-Najarkolaei et al. 2015; Arash et al. 2016; Tavakoli et al. 2016). In a study by Kim et al. (2012) of the factors influencing college students’ nutrition behaviours, applying the HBM showed that nutrition confidence influences students’ nutrition health beliefs and behavioural intention to eat healthy and
exercise. Furthermore, the findings supported the importance of understanding students' nutrition knowledge, which had a direct correlation with nutrition confidence and behavioural intention.

1.4.3 Application of the Health Belief Model in Veterinary Medicine

The application of the HBM in veterinary medicine has been limited. The model has been used to explain a range of farmer attitudes and perceptions, including those related to risk management strategies to diseases of pigs (Valeeva et al. 2011); preventive behaviours against sunlight (Jeihooni and Rakhshani 2019; Moradhaseli et al. 2019); and pesticide use (Khan 2010).

In the context of pet owner attitudes, few studies exist that demonstrate the model's efficacy in predicting knowledge and intentions. Wheeler (2011) applied the HBM as a theoretical framework to understand pet owners' knowledge and perceptions of zoonotic disease threat and to measure factors that influence their protective behaviours against Salmonellosis and methicillin-resistant Staphylococcus aureus infections. The findings concluded that adopting protective behaviours is best predicted by participants' perceived benefits towards the behaviours and receiving more cues to action. The model was also applied in the context of exploring pet owners' beliefs and compliance towards veterinary vaccine recommendations. For instance, Haines et al. (2008) used the HBM to explain cat owners' knowledge and decision-making about vaccinations and concluded that further owner education about the health consequences of vaccine-preventable disease may lead to improved vaccine uptake. Similarly, using the HBM to understand dog owners' intention to vaccinate against
rabies revealed several factors that played a role in owners’ understanding of the benefits of vaccinations and identified barriers (e.g. distance from vaccination center, transporting dog) that prevent owners from vaccinating their dogs (Beyene et al. 2018).

In summary, the HBM is a widely used theoretical framework that is useful in understanding individuals’ health beliefs and predicting the likelihood that they will engage in preventive health behaviours. The utility of the model has especially been highlighted within the fields of human health outcomes and nutrition intervention programs, with demonstrated success of various nutrition education programs based on the model. Although the use of the model is less common in veterinary medicine, it is a useful framework to explore pet owners’ attitudes and decision-making processes.

1.5 Positionality Statement for Qualitative Data Collection

1.5.1 Acknowledging Emerging Feelings

Graduate students in Population Health must navigate a challenging research landscape that requires a balance of academic requirements, career ambitions and research. Often involving data collection from multiple settings for the mutual benefit of the academic and local communities. This ‘research experience’ requires students to address issues of power and positionality as a researcher in order to collect meaningful data. In my case, I knew that my research would involve interviewing pet owners, a subpopulation that is known to express strong bonds with their companion animals and thus, hold very strong views about animal care. Because one goal of the research was to capture pet owners’ nutrition perceptions and attitudes on why/how they seek nutrition information for their own health and their pet’s health, it was important to recruit
representative participants of the general public. This meant that recruitment efforts targeted pet owners of varying education levels, socioeconomic status, health status and ethnicities. I came into this research wondering whether all my participants could relate to me as a young Middle-Eastern female. I was cognizant of the contrast that may occur between other participants’ social positions and my privileged stance as a professional woman with economic and social resources and opportunities. Further, my values are engrained through my cultural upbringing in Dubai; and I feared that my own perceptions and beliefs surrounding health and nutrition may prevent me from doing justice to the participants’ narratives in my analysis.

As I began my focus groups with my first cohort – veterinary students, I wondered whether they would regard me as an outsider who might have difficulty understanding their educational experiences and stresses and whether they would perceive what I was trying to explore as worthwhile. I recognized that my background is in human medicine and I did not pursue veterinary medicine prior to my graduate degree. I was also aware that due to family allergies, I did not previously own a dog or cat and thus, internally feared this would be make me seem as unqualified for this research. Recognizing this reality is unsettling, as it should be (Tuck and Yang, 2012). I knew that it was crucial to engage participants from the beginning and develop rapport (Shaffir, 1991). Still, I felt apprehension about how students would cooperate in the research process.

1.5.2 Situating Myself Within the Work
I tried to use a number of strategies to feel and portray myself as more relatable to the students. I dressed very informally for the focus groups and initiated casual conversation on meeting each participant. I stressed the fact that I am in no way involved in their evaluation and that, while I come from a human medical background, I am inherently interested in One Health approach to health promotion and disease prevention. As the focus groups began, I felt that students were more open to discussing their perceptions and beliefs with a student who may also be struggling with balancing priorities. At the end of the focus groups, I began to disclose more of myself as a graduate student who had experienced the confusion of balancing academic duties with my own well-being. Reciprocity of shared experiences lessened the hierarchal nature of the focus groups in my mind, yet I was aware of my inescapable position of power in my role as researcher.

How I came to this work is different than how I will leave this work. I leave this work changed, humbled, and with an immense sense of gratitude. When I first listened to the focus groups audiotapes, I wondered whether I could do justice to the students’ and pet owners’ narratives in my analysis. Regardless of their nutrition perceptions, all my participants felt an overwhelming feeling of responsibility, love and bond to their pet. I did not want to give a false account of the meanings of my participants experiences and struggles with wanting to provide their pet with the best nutrition despite their perceived barriers. As noted by Daly (1997), the challenge for the researcher is to preserve participants’ meanings while being aware of personal and professional meanings that permeate analysis. I was cognizant of the fact that my professional background and familiarity with the literature and, to a lesser extent, my personal experiences were
influences on my interpretation of data. They not only gave me a priori familiarity with relevant issues but also enhanced my ability to make sense of the data and immerse myself into the context of the themes that were emerging. For instance, while the original nature of my research was to identify barriers with seeking human and pet nutrition information, I realized once I started analyzing the initial focus group data that participants also talked about facilitative influencers. This apparent shift in my research was imperative in my motivation to design and conduct focus groups with pet owners from the public based on a theoretical framework that examines health beliefs from all angles.

Although my self was an inherent influence on the interpretative process, the meaning I brought to the data was supported by text. Moreover, the integration of existing theories, revision of data analysis procedures by a secondary researcher and comparison of this research with other studies were used to enhance theoretical adequacy. However, this is not to say my interpretation is the only legitimate explanation of the data. My role in this project was to find channels for communicating the stories and experiences that people have trust me with - channels to which I have unique access, given my position in academia—to share the importance, the imperatives of this work with those who implement nutrition curricula and relay nutrition information. It is an honour and a privilege to share their voices, stories, and wisdom with you.

1.6 Overall Thesis Structure
The aims and overall structure of this research is presented in Chapter 2. Chapters 3 and 4 describe empirical papers from studies involving veterinary students, while Chapters 5 and 6 describe empirical papers from studies involving pet owners. Chapter 7 presents and discusses main findings, implications of the research, limitations and future directions.

References


Newcome, J. (2012). Nutrition Knowledge of Pre-Medical Students. Undergraduate Honors University of Arkansas.


2.1 Statement of the problem

Veterinarians play a critical role in providing nutrition consultation and supporting clients to adopt healthy dietary habits for their pets. Thus, applicable and informative nutrition education in veterinary schools is essential. Despite recent efforts to develop veterinary nutrition curricula, research shows that graduating veterinarians do not feel they were adequately prepared in nutrition. The same perspective is echoed by veterinary school faculty and deans. This may result in lower counselling rates on nutrition and lower compliance by clients on veterinary nutrition guidance. The overall goal of the research presented in this thesis was to gain an insight into the ways that nutrition perceptions and information-seeking attitudes can play a role for veterinary students in their nutrition education and for pet owners in their feeding decisions.

Specifically, we aimed to elicit incoming veterinary students' nutrition perceptions and nutrition information-seeking behaviors at the time of incoming veterinary school. The goal was to capture the influence of students' experiences and prior knowledge of their own nutrition habits and their pets' nutrition on their attitudes towards companion animal nutrition. Additionally, we sought to explore incoming veterinary students' perceptions and attitudes towards the veterinary nutrition education that they will receive.

Based on existing evidence, an important consideration for veterinary nutrition curricula and practicing veterinarians’ approach to nutrition counselling is to recognize
the role that pet owners' nutrition attitudes and beliefs play in their feeding decisions towards their pet. Research on effective veterinary communicative strategies to educate clients on nutrition-related topics has previously been conducted. Minimal research has been directed towards determining the views of the pet owners themselves about the nutritional advice they receive from veterinarians. Research from both the human and veterinary medical fields have shown that a positive attitude toward medical recommendations can promote a change in health behaviours and encourage adherence to a healthcare professional's recommendations.

2.2 Research Aims

The specific aims of this research were as follows:

1. Understand how prior perceived knowledge, nutrition-related perceptions and nutrition information-seeking behaviours influence veterinary students' beliefs towards companion animal nutrition at the time of entering veterinary school (Chapter Three)

2. Investigate US and Canadian incoming first-year veterinary students perceived importance of and emphasis on nutrition training in veterinary school and highlight their preferred learning methods for nutrition instruction (Chapter Four)

3. Determine attitudes/beliefs of incoming veterinary students toward nutrition in clinical practice and how they anticipate their veterinary nutrition education will prepare them to confidently discuss nutrition upon graduating (Chapter Four)

4. Characterize US and Canadian pet owners’ diet motives and motivations for seeking nutrition information (Chapter Five)
5. Understand pet owners’ perceived confidence, trust and perceived effectiveness of nutrition recommendations from their veterinarian (Chapter Five)

6. Examine to what extent pet owners’ health beliefs about their own nutrition align with their beliefs about their pet’s nutrition using the Health Belief Model as a theoretical framework (Chapter Six)

7. Assess how well the constructs of the Health Belief Model predict pet owners’ intention to comply with human and veterinary medical nutrition recommendations (Chapter Six)

The aims above were addressed in two interrelated studies designated Study 1 and Study 2.

Study 1 addressed the first three aims of this research and involved data collection from incoming veterinary students across all five Canadian and five randomly selected USA veterinary schools. It involved a mixed-methods research approach aimed at capturing and exploring incoming veterinary students’ nutrition-related perceptions and attitudes towards veterinary nutrition education. Results from Study 1 are reported in Papers 1 and 2 (which are presented in Chapters 3 and 4). Paper 1 focused on results most relevant to veterinary educators and Paper 2 focused on results useful for a general medical science education readership.

Study 2 addressed the remaining four aims of this research and involved data collection from pet owners across Canada and the USA. Using a mixed-methods research approach, the overall goal of Study 2 was to investigate how pet owners’ health and
nutrition-related beliefs influence their pet feeding decisions and attitudes towards human and veterinary medical nutrition recommendations. This work, reported in Papers 3 and 4 (presented in Chapters 5 and 6), targeted practicing veterinarians, veterinary educators and health promotion professionals.

Figure 2.1 represents an overview of the research undertaken for this thesis. The links between the studies, the research aims and the four papers reporting the results are highlighted.
**STUDY 1 – Veterinary Students**
- Qualitative focus group discussions with first year veterinary students
- Online questionnaire tool to capture incoming veterinary students’ nutrition-related perceptions and attitudes

**AIM 1**
Elicit veterinary students’ baseline nutrition-related perceptions and nutrition information-seeking behaviors at the time of entering veterinary school

**AIM 2**
Evaluate incoming veterinary students’ perceived importance of and emphasis on veterinary nutrition education & their preferred learning methods for nutrition instruction

**AIM 3**
Describe students’ beliefs on nutrition counseling and reported confidence in how their veterinary nutrition education will prepare them to discuss nutrition upon graduating

**STUDY 2 – Pet Owners**
- Qualitative focus group discussions with pet owners
- Online questionnaire tool to capture pet owners’ health beliefs and attitudes of veterinary nutrition guidance

**AIM 4**
Characterize US and Canadian pet owners’ diet motives and motivations for seeking nutrition information

**AIM 5**
Understand pet owners’ trust and perceived effectiveness of nutrition recommendations from their veterinarian

**AIM 6**
Examine to what extent pet owners’ health beliefs about their own nutrition align with their beliefs about their pet’s nutrition

**AIM 7**
Assess how well the HBM predicts pet owners’ intention to comply with human and veterinary clinical nutrition recommendations

**PAPER 1 – in press**
Title: Perceptions of companion animal nutrition and their own nutrition by first year veterinary students at the Ontario Veterinary College: implications for a veterinary nutrition curriculum
Journal: Journal of Veterinary Medical Education
Readership: Educators

**PAPER 2**
Title: The Perceived Importance, Emphasis and Confidence in Veterinary Nutrition Education of First-year Canadian and US Veterinary Students.
Submitted for publication: Medical Science Education
Readership: All medical and health science educators

**PAPER 3**
Title: A survey of diet motives and attitudes towards nutrition guidance received from veterinarians
Submitted for publication: Veterinary Record
Readership: Practicing veterinarians and veterinary educators

**PAPER 4**
Title: Understanding intention to comply with nutrition recommendations by medical and veterinary health professionals: an application of the Health Belief Model
Submitted for publication: BMC Public Health
Readership: Practitioners and health promotion professionals

---

**Figure 2.1.** A flow diagram representing an overview of this research
CHAPTER THREE

Perceptions of companion animal nutrition and their own nutrition by first year veterinary students at the Ontario Veterinary College: implications for a veterinary nutrition curriculum.

3.1 Abstract

Extant research shows veterinarians face increasing challenges in discussing nutrition with clients despite receiving professional nutrition education in the veterinary medical curriculum. The aim of this study was to elicit student veterinarians’ baseline nutrition-related perceptions and nutrition information-seeking behaviors at the time of entering veterinary school. Participants were newly enrolled veterinary students at the Ontario Veterinary College (n=84). Focus group discussions (n=19) informed the design of an online questionnaire tool capturing students’ demographics, and perceptions of their own and their pets’ nutrition. Students reported to be influenced by individual factors (e.g. time), their social networks (e.g. family), and surrounding environment (e.g. cost/contradictory messages in the media). Overall, 58% of students considered themselves knowledgeable about pet nutrition at the time of commencing veterinary school with 71% prioritizing their pet’s diet as much as their own. Students’ confidence in finding pet nutrition information was correlated with perceived accessibility (r=0.76, p=0.001) and perceived quantity of information available on pet nutrition (r=0.83, p=0.001), but not quality of information (r=0.13, p=0.03). In general, students relied on and trusted the veterinarian for nutrition advice. However, 94% of students expressed
mistrust of pet food companies’ motivations. Our data supports that students entering veterinary school have their own perceptions on pet nutrition that may impact nutrition education and suggests this as an important consideration in the design and delivery of a veterinary nutrition curriculum. Veterinary medical faculty should be encouraged to discuss baseline nutrition information and address any misconceptions to help students prepare for future consultations with clients.

3.2 Introduction

The importance of nutrition for the health and well-being of companion animals is well recognized (German 2006). Evaluating the nutritional status of a companion animal patient, and making nutritional recommendations are minimum standards of veterinary care. The American Animal Hospital Association (AAHA) and the World Small Animal Veterinary Association (WSAVA) adopted nutrition as the “fifth vital sign” in 2010 and 2011, respectively. The AAHA’s Guidelines for Dogs and Cats were developed on the basis that “incorporating nutritional assessment into regular animal care is critical for maintaining pets’ health, as well as their response to disease and injury” (Baldwin et al. 2010). Given these recommendations and guidelines for practice, veterinary students are expected to be trained and prepared to address nutrition topics confidently and professionally with clients (Walsh et al. 2001).

Previous research reports practicing veterinarians feel inadequately trained in nutrition subjects prior to graduating (Buffington and LaFlamme 1996; Laflamme et al. 2008). Moreover, studies reveal over a third of veterinary students are not satisfied with the nutrition education they receive (Moore et al. 2002; Ikuta et al. 2006). Consistent
reports among deans and faculty members from 63 European veterinary schools emphasized that while nutrition was considered integral to veterinary education, the skills and performance of new graduates were not fully satisfactory (Becvarora et al. 2016). Over the past decade, there has been an increasing recognition and effort by veterinary faculty to enhance students’ competency and ability to apply nutritional principles clinically (Abood 2008). It is also recognized that the integration of nutrition into veterinary training is vital for effective communication around all topics of nutrition with clients for graduating veterinarians (Morrisey and Voiland 2007).

In veterinary medicine, nutrition training was seen to be inadequate in equipping students to confidently discuss nutrition, with the call for a more rigorous nutrition component in veterinary education (Becvarora et al. 2016). Furthermore, research demonstrates that nutrition communication between veterinarians and owners is influenced by owners’ pre-existing attitudes and perceptions regarding the role of nutrition in their pet's health (Bland et al. 2009; Bland et al. 2010). Coupled with pre-existing perceptions, the Internet has provided increased access to large amounts of often unsubstantiated information (Abood 2008; Delaney 2011), potentially creating greater risk of inconsistency in the recommendations that the pet owning public receive from their veterinarians versus other sources (Jehn et al. 2003). Considering that many veterinary students have owned or cared for at least one companion animal (Shanan 2011), it is therefore reasonable to expect that students enter veterinary school with pre-existing nutrition perceptions and perceived nutrition knowledge, much like the pet owning public, that may influence uptake of their veterinary nutrition education.
The diversity of student learning styles, and prior personal experiences and knowledge, may make it problematic for faculty to design appropriate applied situations for instruction that pertain to all students, particularly in the context of nutrition education. A learner’s “prior knowledge” – a term used to define one’s procedural knowledge on a subject prior to receiving a respective curriculum (Thompson and Zamboanga 2003; Hailikari et al. 2007; Hailikari et al. 2008) plays a primary role in learning retention and achievement (Brod et al. 2013). Perceived prior knowledge, along with existing perceptions, are important considerations as both may have an impact on students’ uptake and assimilation of information in a learning setting.

In the context of human medical education, research amongst first-year students demonstrates that they enter medical school feeling more knowledgeable about nutrition than they actually are (Connor et al. 2015). Since prior knowledge and existing perceptions may arise from exposure to nutrition information from a variety of educational, consumer and personal contexts, it is not known how accurate or reliable the prior knowledge may be. Interestingly, Connor et al. (2015) found that medical students who used non-peer reviewed resources were equally as likely to report feeling competent about their nutrition information at the time of entering medical school as those who utilized peer-reviewed resources.

Little is known about the effect that students’ personal behaviors, attitudes and perceptions have on their overall veterinary educational experience. More specifically, lack of knowledge about veterinary students’ understanding and perceptions of nutrition at the time they enter veterinary school may hamper efforts to improve the nutrition curriculum. Veterinary students’ selections of information sources and how they
interpret and assimilate nutrition information may have direct implications for how they educate future clients about their pets’ nutrition.

The objectives of this study were to: (1) explore nutrition practices, attitudes and perceptions held by veterinary students prior to beginning the veterinary nutrition curriculum; (2) To highlight incoming veterinary students’ level of perceived nutrition knowledge that may influence students’ learning of nutrition information; and (3) identify the sources of information that students used to learn about companion animal nutrition prior to entering veterinary school.

3.3 Methods

3.3.1 Study Design

This was a single-center cross-sectional study using a mixed-methods approach (Creswell, Tariq and Woodman 2013). This approach was chosen as it combines and integrates the use of both qualitative and quantitative methodologies (Figure 3.1) to better understand both the depth and breadth of a previously under-explored research topic. The study was conducted at the Ontario Veterinary College (OVC), University of Guelph between March 2016 and October 2016. The first part of the study used focus groups of pre-veterinary and veterinary students to qualitatively explore discussion topics surrounding their perceptions of companion animal nutrition and their own nutrition. The results from the qualitative data were used to inform and help in the question design for an online quantitative questionnaire tool, distributed only to incoming first-year Doctor of Veterinary Medicine (DVM) students in the first week of their program in September 2016. University of Guelph’s Research Ethics Board approval (REB # 16JA039) was obtained for all aspects of the study.
3.3.2 Focus Group Interviews

The focus group interviews were conducted in order to generate key topics relating to students’ experiences and perceptions towards pet nutrition to inform development of the questionnaire tool. All focus group discussions took place at the Ontario Veterinary College and followed a semi-structured question guide. A moderator (first author) was responsible for running the focus group discussions, taking notes of non-verbal behaviors and analyzing the data.

The focus group question guide comprised five overall sections: a short demographic questionnaire; students’ perceptions of their own nutrition; students’ perceptions of their pet(s)’ nutrition; students’ sources of nutrition information; and students’ expectations of their nutrition education during veterinary school. Two groups of students were invited to participate in the focus groups. The first group consisted of undergraduate students from the university’s Future Vets Club (a student-organized group n=400 of students with interest in attending veterinary school). The second group was first-year veterinary students who were enrolled at the OVC at the time of focus group recruitment. An open email invitation to participate was sent to both groups; inclusion criteria included students who owned at least one cat or dog. The rationale for inviting both pre-veterinary students and enrolled first-year veterinary students was to ensure an in-depth exploration of nutrition perceptions and beliefs held both prior to starting and within the first year of veterinary school.

3.3.3 Qualitative Data Analysis

All focus group interviews were audio recorded, transcribed verbatim and de-identified to ensure that transcribed material could not be linked to student data. A
letter-number system with unique numbers (##) assigned to each participant was
developed, where “V##” indicates the participant was a veterinary student and “PV##”
indicates the participant was a pre-veterinary student. Qualitative data analysis software
(NVivo 10©, 2014, QSR International Pty Ltd.) was used to assist in data organization
and retrieval. Transcripts were systematically checked against the audio-recordings for
accuracy of representation and coded by the first author. An inductive thematic content
analysis approach, which provides “rich and detailed, yet complex account of data”
(Braun and Clarke 2006), was used to analyze the data by the first author. In brief, each
transcript was read multiple times and open codes were applied to sections of text
illustrating common ideas across different student focus groups. A codebook was
developed in which common codes occurring across groups were then organized into
subthemes and overarching themes. Naming and definition of themes and subthemes
were reviewed, and cross checked with codes by the second author for consistency and
accuracy of representation.

3.3.4 Questionnaire Survey

Upon analysis of focus group transcripts, a questionnaire was developed based
on the key categories, subthemes and themes from the focus group interviews. The
final questionnaire included the following sections: participant and pet demographics;
students’ perceptions and perceived knowledge of their own and their pets’ nutrition;
students’ sources of information; and students’ expectations of nutrition education within
the veterinary curriculum. The survey was initially piloted with graduate students (n=6)
from OVC, who possess a DVM degree, to assess survey length, clarity of language,
organization and flow of questions, as well as completeness. Feedback from the piloting
process was used to further refine and establish content validity. The final question design consisted of multiple-choice questions where students may select more than one response; and structured question statements capturing perceptions with response rating on 5-point Likert scale (1=strongly disagree, 5=Strongly agree) as well as statements capturing trust of students (1=strongly agree, 5=strongly disagree).

The finalized questionnaire was disseminated via Qualtrics © (2017, Provo, Utah) during the first week of veterinary school (September 2016). Non-probability sampling; in this case, convenience purposive sampling (Marshall 1996; Palinkas et al. 2015), was used. All incoming first-year veterinary students (referred hence forth as “incoming veterinary students”) at the Ontario Veterinary College (n=120) received an email invitation within their first week of veterinary school and were eligible to participate if they were the owner of at least one cat or one dog. If respondents owned two or more cats or two or more dogs, they were asked to choose only one of the cats or dogs to be the subject of the questionnaire and answer all further questions specific for that animal alone. For participants who owned both dogs and cats, they were given the option to complete separate questionnaires for one dog and one cat. If students chose to complete separate questionnaires for their dog and their cat, they still only answered questions about their own personal nutrition once. Participation in the questionnaire was voluntary and not linked to courses or grades in any way, with the option of also including themselves in a prize draw at the end of the survey.

3.3.5 Questionnaire Data Analysis

Answers provided by respondents in the questionnaires were numerically coded and entered onto a spreadsheet for quantitative statistical analysis using STATA14©
(2015, College Station, Texas). Since questionnaire responses comprised categorical data, non-parametric methods were chosen. The analyses included frequency tests on the numerical data to provide descriptive statistics relating to prevalence of held views. Spearman and Mann-Whitney Rank Sum test were used to detect correlations and differences between comments about human and pet nutrition, respectively. The Kruskal–Wallis one-way analysis of variance on ranks was used to evaluate differences among student pet owners based on type of pet (cat versus dog) since responses were on a limited noncontinuous scale of 1 to 5. Data were reported as mean ± SD. Statistical significance was set at p<0.05.

3.4 Results

3.4.1 Qualitative Focus Group Results

Four focus group discussions with a total of 19 students (9 pre-veterinary students and 10 first-year veterinary students) were conducted. Sessions lasted between 90 to 120 minutes each (average length of 102 minutes). Data saturation (the point at which no new information is gained) was not reached. Nonetheless, students’ responses from focus groups discussions provided the research team with an in depth, rich insight into perceptions, thoughts and ideas about the topic at hand. Table 3.1 presents the themes, subthemes and example representative quotes derived from the qualitative content analysis. The three prevailing themes related to students’ discussions around perceptions of companion animal nutrition were: accessibility of pet nutrition information, time and money constraints, and trust in pet food industry.

3.4.1.1 Theme 1: Accessibility of pet nutrition information
Subtheme: *Credibility of nutrition information from sources accessed*

This theme was defined as the availability of information sources and the ability or knowledge of students to find that information. Both the veterinary and pre-veterinary students expressed the opinion that information for pet nutrition is generally less accessible and more “scattered” than that available for their own nutrition, indicating “they just don’t know where to find it [nutrition information]” (V03). Participants acknowledged that pet owners often seek information from various sources, some of which may lead to confusion and frustration. Still, while respondents acknowledged that there might be abundant information on pet nutrition existing on the Internet, participants were skeptical of its content and thus, wished to have more sound information just as easily accessible, suggesting that: “[it’s] hard to trust anything online though. You could just be reading something that’s completely wrong. We need more information that we can find, read, trust and apply” (V06).

Yet interestingly, some students said that while part of the reason owners seek nutrition information from sources other than their veterinarian is to find the cheapest alternative with the lowest acceptable risk to the well-being of their pet, these pet owners may not always question the rigor of the source. As expressed in the words of one participant: the general public is misinformed, and absorbent of whatever information is presented without really fact checking, which can be a problem, because like you said, [referring to another focus group participant] it’s cheaper and it sounds okay, we’ll just go with that” (V07).

Subtheme: *Veterinary-client communication about nutrition information*
With reflection, participants suggested that the information provided in veterinary clinics could be perceived by clients as biased towards selling particular products. Several students stressed the importance of clients being informed about recommended resources so that they can seek trustworthy information for their pets’ nutrition. If owners do not have access to sound nutrition information from the veterinarian, students were in consensus that owners turn to online sources, including pet food websites, blogs, and social media platforms. Specifically, they reported that they were less likely to rely on a resource, even from their veterinarian, when conflicting information was seen to exist. This prevented them from feeling confident enough to make judgements regarding their pet’s current diet. Put very succinctly, “I’d like to make changes but…I don’t know where to go for more information that I can rely on because every time I go to a more reliable source, whether it be a site or another vet, I seem to get conflicting information” (V02).

To that end, many participants recognized the importance of providing options to clients and tailoring recommendations to meet not just the pets’ needs but also clients’ needs and budget. Students especially believed that because the client usually must be the one to seek that information (even during consultations), it becomes more convenient to access information online. One participant explained, “I think it’s just easier for people to go online…maybe veterinarians can educate them, but…you’re going to see your vet once a year and it’s hard in a 20-minute appointment to like make an impact…if the client doesn’t ask, I think a lot of doctors don’t say anything” (PV08).

3.4.1.2 Theme 2: Time and monetary considerations
Subtheme: Cost of veterinary care

Nearly all students discussed the role that financial constraints play in various aspects of pet ownership, including how owners decide to feed their pets. Several participants stressed that while they recognized pet ownership is a commitment, the reality is that most owners want to provide the best care for their pet within their financial ability. In describing how cost plays a role in owners’ feeding decisions, one participant described, “why would you second guess it…a lot of things come down to money” (V02). As a result, several students expressed the need for veterinary professionals to address clients’ financial limitations when providing diet recommendations, “I think cost is the number one thing that people look at and then, and then maybe the ingredients afterwards” (V09). One idea discussed by students was presenting owners with costs upfront and then proceeding to explain the benefits of each option could be more valuable than recommending a diet that they cannot afford. For many students however, emotional attachment and concern for their pet was a more integral factor in what they decide to feed their pet than monetary considerations were, for instance, one student relayed what they had heard a pet owner say “cost is no longer an issue for me because it just doesn’t matter to me. The good stuff is what she likes and it's good for her and it's working, so that's what we're going to do” (PV02).

Subtheme: Managing priorities

In discussing the way students viewed time as a factor of consideration for their own nutrition and their pet’s nutrition, it became apparent that participants approached this from different contexts. For instance, across all focus groups, students recognized
and admitted being overwhelmed with priorities for school, that they often do not have enough time to focus on their nutrition. Simply put by one participant, “it’s just the way it’s going to be until I have something that is more like a career that I can go home and have time and not have to focus on school or stuff. It’s just not feasible for me right now” (V07). However, while time was addressed as a constraint when deciding what to feed their pets, students felt that owners were less likely to be aware of it, with one participant indicating that “like when we’re talking about human food, we’re talking about the two main things were cost and time, and cost is one for this one [feeding your pets] too but time is also a thing people don’t admit. Not everyone has the time to prepare food…it’s just easy to take a scoop of kibble and put it in the bowl and feed your dog” (V08).

3.4.1.3 Theme 3: Trust in the pet food industry

Subtheme: The role of profit in pet food industry

Feeling suspicious towards the motivations of the commercial pet food industry was a common theme among most participants. The most consistent suspicion arose from the notion that “they’re [pet food companies] only motivated by profits” (PV04). Specifically, these concerns were predominantly raised with reference to marketing campaigns used by pet food companies. Recognizing that the Internet and the media have become highly effective tools in educating owners about commercial diet options, students worried that the claims made by the pet food industry are scientifically unsound. A few participants also explained that skepticism towards the nutritional value of commercial pet foods in the context of their pets’ health and wellbeing could be a
direct result of advertisement campaigns. One participant described this confusion as “we don’t know for sure that all the commercial diets are bad, it’s just a mistrust of the media” (V01). Some even went on to explain that conflicting information provided by the media coupled with persuasive advertising that targets owners’ emotional attachment to their pets is what makes them particularly wary of companies’ motives.

Still, participants felt that these feelings of suspicion and frustration were compounded by the way clients were overwhelmed when presented with pet food brand options. Particularly, students were curious about how emerging human food trends are influencing the pet food industry. For example, “they [pet food companies] think what’s healthy for you is healthy for your [pet] … so that’s frustrating” (V02). In contrast, some students commented that having a variety of brand options were important for them as pet owners so that they can make the right decision about a diet.

Feeling conflicted about the motives behind veterinarians’ recommendations was a challenge expressed by several students. While not as unanimously agreed upon as suspicion towards pet food companies, there were several students who thought information from veterinarians may also be perceived as biased. Several participants in both the pre-veterinary and veterinary student cohorts thought that veterinarians have profit incentives for recommending and selling certain pet food brands in their clinic. One stated, “a lot of the time they’re just trying to sell food that they’re getting a profit off, so I don’t know if I necessary (sic) trust them… and each one [vet] has a different [recommendation] – you should try this food because it’s the one they’re selling at the front of their store” (PV03). One participant voiced that this perception also existed
amongst pet owners, describing it as “sometimes they’ll [pet owners] think that the vets are recommending those diets to increase their profits” (PV10).

Subtheme: *Regulatory bodies responsible for overseeing pet food industry*

Students were also cognizant of the apprehension around regulations in place to monitor pet food production. In contrast to their own nutrition, students were concerned that regulatory measures within the pet food industry are not as well-known by pet owners, leading to the assumption that the pet food industry is not as rigorously regulated as that of human food production. For instance, one participant explained that “people just develop that general mistrust of commercial dog foods because they don’t think they can trust what’s in it, and they don’t realize how regulated those companies are” (V08).

### 3.4.2 Questionnaire Quantitative Data

#### 3.4.2.1 Response Rate and Demographics

Of the 120 students who received the questionnaire, 84 (70%) students fully completed it. Ninety-eight percent (82/84) of respondents were female, which is representative of class gender distribution of that first year OVC class. Half of the respondents were between 20-22 years old, and approximately 90% (76/84) of students were from Ontario, with 33% planning on entering companion animal primary care practice after graduation, with another 20% planning on rural practice with multiple species (Table 3.2).

Since some students owned both cats and dogs, 31 students completed two independent pet questionnaires, one for a dog and one for a cat. The final sample
included 59 dogs and 52 cats (111 pets). Mean age for dogs was 6.6 years and mean age for cats was 6.5 years. Among dogs and cats represented in this survey, 75% (83/111) were considered by their student owners to be generally healthy. Among the activities most commonly shared by students and their pets (where students could select more than one activity), petting (109/111, 98.2%) and talking (92/111, 82.9%) to the animal topped the list for both dog and cat owners, followed by grooming (79/111, 71.2%) and playing with toys together (78/111, 70.3%). Less common were sleeping together (22/111, 19.8%), watching TV together (20/111, 18%) and eating together (20/111, 18%).

3.4.2.2 Students’ current pet feeding habits

Eighty-two percent (91/111) of pets were fed a dry commercial diet; only 2.7% (3/111) pets were fed a homemade cooked diet; and none were fed a raw diet. The most common method of dispensing food to pets (with most respondents indicating the use of more than one method) was using measuring cups (60/111, 57%), followed by free-feeding (35/111, 32%), scheduled, portion-controlled feeding (28/111, 25%), and weighing the food with a scale (5/111, 4.5%).

More than half of the respondents (54/84, 64%) admitted they worry about filler ingredients in their pets’ diet. Fifty percent of respondents (42/84) reported feeding commercial treats daily and over a third of respondents (29/84, 35%) acknowledged that they considered treats as a form of communicating affection to their pets.

3.4.2.3 Factors that influence perceptions of current feeding routine
When asked to select from a list of all factors that apply with respect to how they decided on their pet’s current diet, most respondents said they fed their pets (94/111, 85%) based on a recommendation from a veterinarian or veterinary technician (Table 3.3). How healthy the companion animal was also perceived an important factor when deciding which food to buy for over 50% (56/111) of pets. Only 6 pets’ (6/111, 5%) diet was based on nutrition information the owners read about online (Table 3.3). Almost half of the pets’ food (52/111, 47%) was purchased from a veterinary clinic (Table 3.4).

Despite relying on a veterinarian recommendation for their pet’s diet, when asked how often nutrition came up after a diet recommendation was made, only 38% (42/111) of student pet owners indicated they discussed nutrition with their veterinarian during each visit, with 27% (30/111) only doing so if prompted by their veterinarian and 19% (21/111) explaining it is discussed only if they ask about it specifically. The rest of the students (18/111, 16%) only felt the need to discuss nutrition if there’s a specific health concern for their pet. The decision of bringing up nutrition with their veterinarian was dependent on both their own experiences with their veterinarian (74/111, 67%) and their family members’ experiences (47/111, 42%).

The most frequently reported difficulty in changing diets of cats and dogs was cost (72/111, 65%) (Table 3.5). For the majority of pets (97/111, 87%) owned, students reported they were satisfied with their current brand of pet food. However, when asked to specify factors (students could select more than one factor) that influence how students manage their pets’ diet, 23% (26/111) responses were based on the fact that students felt they did not know enough about pet nutrition (Table 3.5). The number one motivator for a respondent to change their pet’s diet, would be a change in the health
status of the pet. In fact, 95% (80/84) of students admitted their goal is to provide their pet with the best nutrition possible.

When comparisons were made to students’ responses of their own nutrition habits, the two major determinants of healthy behavior for their own diet included cost (70/84, 83%) and time (61/84, 73%) (data not shown). Barriers influencing their own eating choices included cooking skills (41/84, 49%), not knowing enough about nutrition (17/84, 20%) and conflicting information (9/84, 11%).

3.4.2.4 Factors influencing perceived importance of their pet’s diet

The extent to which students gave thought to their pet’s diet correlated with how knowledgeable they considered themselves to be about pet nutrition (r=0.89, p<0.001). Those who thought they were more knowledgeable about pet nutrition were also more likely to consider their pet to be healthy (r = 0.81, p=0.007). The majority of pets had student owners who agreed that nutrition decision-making for their pet is of equal importance to their own nutrition (79/111, 71%). Very few respondents described nutrition for themselves to be more important than that for their pet (3/111, 3%).

3.4.2.5 Attitudes towards relationship with pet

More than half of pets were described as “family member” (63/111, 57%). Since participants could choose more than category about their bond with their pet, other categories selected were “pet parent” (46/111, 42%), “owner” (23/111, 21%), “caregiver” (36/111, 32%), “companion” (40/111, 36%) and “friend” (29/111, 26%). Those who described their pet as a family member were more likely to prioritize their pet’s diet over their own rather than consider it of equal importance (r=0.76, p=0.041). It became
evident that the emotional attachment that respondents shared with their pet was an integral factor in their feeding behavior. Seventy percent (59/84, 70%) of respondents described their relationship with the family pet that they grew up with as a vital contributor to their relationship with their current pet.

3.4.2.6 Perceived nutrition knowledge and nutrition confidence

Overall, 58% (49/84) of students perceived themselves to be knowledgeable about pet nutrition at the time of commencing veterinary school. However, a significant perception amongst students was that there is more information about human nutrition than pet nutrition in the wider literature (p<0.001). Students confidence in finding information about their pet’s nutrition was correlated with their perception of accessibility of pet nutrition information (r=0.76, p=0.001) and the perceived quantity of information available on pet nutrition (r=0.83, p=0.001). Respondents’ perceived confidence in nutrition information was however not associated with the perceived quality of information that existed on pet nutrition (r=0.13, p=0.03). Significantly more students perceived themselves to be confident in knowing what to change for their own diet than for their pet’s diet (p=0.0023).

3.4.2.7 Sources of information utilized

There was no significant difference between cat and dog responses with respect to perceived level of nutrition knowledge or sources of information utilized to learn about their pet’s nutrition. The top sources for pet nutrition are shown in Figure 3.2. For their own nutrition they relied on online resources (35/84, 42%), university lectures (38/84, 45%) and family members (28/84, 33%).
3.4.2.8 Perceptions of trust of nutrition information

Using a series of subscale question statements, students were asked to rate their level of trust with respect to the human food industry, the pet food industry, regulatory standards, health care professionals’ recommendations and online sources of information. In general, trust was rated high for a diet recommendation from a veterinarian (Table 3.5), with a high degree of reliance on the veterinarian for nutrition advice (2.14 ± 0.06). However, only 14% of respondents (12/84) rated that they would strongly trust advice from a veterinarian who is employed or funded by a pet food company (mean value = 3.32 ± 0.09). This agreed with their level of trust of a health professional for their own nutrition who is employed by a human food company. Further, 94% (79/84) of students perceived profit as the number one priority of pet food companies (Figure 3.3).

Only a minority of respondents agreed that pet food companies are willing to educate pet owners about pet nutrition and <20% believed they sought ethical production of products. Along with their own experiences with pet food companies (70/84, 83%), more than half of students considered the media as an influential element in their mistrust towards the pet food industry (44/84, 53%) (Figure 3.4). Interestingly, respondents were more likely to distrust both the media (e.g. TV, radio, print, advertising, social media) and the Internet (e.g. online blogs, online articles) as source for their pet’s nutrition than for their own nutrition (Table 3.6). When responses to trust statements from cat owners were compared to those from dog owners, significant differences were found for 2 of 6 statements. Cat owners were more likely to question recommendations if conflicting opinions were seen to exist amongst veterinarians (p =
0.028) yet were more trusting than dog owners towards veterinarians affiliated with food companies (p<0.001). Mean level of trust for regulatory standards set for the human food industry in comparison to that of the pet food industry is shown in Figure 3.5, with most students expressing similar attitudes of trust for the regulatory standards for both industries.

3.5 Discussion

The overall aim of this study was to gain a better understanding of how prior perceived knowledge and perceptions of nutrition influence the beliefs of pre-veterinary and veterinary students towards companion animal nutrition at the time of entering veterinary school. The inclusion of open-ended, focus group questions via the mixed-methods study design made it possible to capture students’ in-depth views of nutrition, reasons for their perceptions and how these views may impact their education. This information then helped in the design of the quantitative questionnaire provided to incoming veterinary students. Of note were students’ roles in this study, in all cases, respondents assumed the dual role of veterinary student and pet owner.

Incoming veterinary students’ behaviors and beliefs toward pet nutrition paralleled those reported amongst pet owners in the general population. Prior studies have reported that clients consider veterinarians to be their principle and most trustworthy source of information regarding pet nutrition (Connolly et al. ; Freeman et al. 2013; Parr et al. 2016), which was consistent with our results for incoming veterinary students. In our study, students who were cat owners were more likely to question conflicting information between veterinarians and other sources of information. This is in
line with an investigation of factors for feeding raw diets (Morgan et al. 2017), where cat owners were more likely than dog owners to question veterinarians’ advice. Commercial dry and canned foods are fed by 85% to 90% of pet owners in industrialized countries (Robertson 1999; Laflamme et al. 2008). A similar prevalence (82%) was demonstrated among students in this study. Treats were also fed by 50% of students in this study, consistent with the report by Michel et al. (2008) of USA and Australian pet owners’ feeding practices. The most reported barrier to students changing their pets’ diet was cost (71%). It was noteworthy in the focus group data that most students mentioned cost as a determinant when considering how to feed their pet. These findings are consistent with the study of Suarez et al. (2012) who investigated the preferences of general population pet owners when buying commercial pet food, and cost was indeed an important factor. Of note, the majority (84%) of students in this study would consider health status before cost as the primary motivator if they had to change their pet’s diet. One reason for not primarily considering cost above health could be that the cost of the current diet is manageable and thus, students do not feel the need to change it unless there a health issue arises. Alternatively, students may be willing to pay what it costs to have a healthy pet, especially since they are entering the veterinary profession, and share a close bond with their pets. This is likely as 95% of students in this study also reported that they want to provide their pet with the best nutrition possible. Similarly, Michel et al. (2008) in their study of pet owners in the general population found that regardless of what owners fed their pet, they were nonetheless also striving to provide their pet with what they considered to be optimal care. Interestingly, both cost and time were also cited by students in this study as determinants of choices in their own diet.
and where they choose to seek information about their own nutrition. Overall, students’ perceptions of pet nutrition positively correlated with those of their own nutrition, suggesting the level of importance they placed on pet nutrition at the time of entering veterinary school.

In the context of medical students, it has been suggested that one reason for students’ lack of confidence in their nutrition education is their confusion in knowing where to access reliable nutrition information outside the classroom (Connor et al. 2015). In this study, incoming student veterinarians reported difficulty finding information on pet nutrition. Multiple factors played into this perception for the students in this study. Pre-veterinary and veterinary students perceived more information existing on human nutrition than pet nutrition, referring in the focus groups to veterinary nutrition information as “scattered”. More striking however, is the perception of veterinary students that there is insufficient accurate and reliable information on pet nutrition. Furthermore, students’ perceptions of not being knowledgeable about pet nutrition was regarded as one of the difficulties of changing their current pet’s diet. Our data suggest that feelings of mistrust towards the pet food industry could contribute to the incoming students’ uncertainty on where to access reliable pet nutrition information. Only 9% of students sought pet nutrition information from pet food companies, qualitatively describing it as “called into question”.

Interestingly and consistent with our findings, the same sentiment appears to exist in the general population of pet owners (Morrisey and Voiland 2007), where most respondents felt that pet food companies did a poor job at educating their customers about pet nutrition. Of particular note, and somewhat concerning, was the finding that
incoming veterinary students’ level of trust towards veterinarians affiliated with pet nutrition companies was modest. This may be of consideration in the instances where veterinary nutrition faculty use resources by pet food companies for educational purposes. We speculate this mistrust towards pet food companies may also play a role in students’ level of comfort when communicating nutrition advice to future clients. In 2008, Zicker explained that while veterinarians are considered important nutritional advisors for pet owners, they often may not be confident when recommending commercial pet diets. One reason proposed by Zicker (2008) is that veterinarians are perhaps unsure of all the quality control systems that ensure safety and adequacy of pet foods. This was reconfirmed in our study where less than 20% of incoming veterinary students believed “ensuring ethical production of products” was a priority for pet food manufacturers. We thus speculate that the preconceived beliefs that students carry into the program may persist even after graduation if not specifically addressed in the curriculum and influence their confidence in discussing nutrition, as cited by Zicker (2008). Students were aware that the media played a role in their doubts towards pet food companies’ motivations and were cognizant that this may have influenced their decisions on what to feed their pet. Unsurprisingly, this belief correlates with that of pet owners (Kienzle et al. 1998; Rajagopaul et al. 2016), furthermore, owners who feed noncommercial (Michel et al. 2008) and raw diets (Morgan et al. 2017) express even greater mistrust. In the current study, 95% of incoming students reported the top reason for mistrust of the pet food industry was the perceived motivation of profit of companies. Profit was also mentioned in the pre-veterinary focus groups as a reason behind veterinarians’ recommendations, although responses from the questionnaire data did
not support this. Future research may aim to survey graduating students to evaluate whether veterinary faculty have addressed such beliefs with students, and whether fourth year students’ opinions towards pet food companies change or evolve with time.

Incoming veterinary students in this study and pet owners exhibited very similar information behaviors. Approximately 15–17% of pet owners use online resources as a primary source of information for obtaining information on pet nutrition (Laflamme et al. 2008; Freeman et al. 2013), very similar to the 13% of incoming student veterinarians who use online resources as their primary source of information for pet nutrition. Incoming veterinary students are likely to be exposed to a wide range of companion animal nutrition information, similar to other consumers, some of which may be accurate and verified, and some may be less accurate, or opinion based. Practically, this highlights the importance of incorporating discussions between veterinary educators and students early in the curriculum surrounding beliefs and perceptions they may have about pet nutrition. Firstly, to understand and appreciate the varying levels of perceived knowledge and understanding that students bring with them, and secondly, to address any misperceptions prior to entering professional practice. Since pet owners are likely to check validity of online information by consulting their veterinarians (Kogan et al. 2012), it is important that student veterinarians are confident to communicate complete and accurate nutrition information.

The perceived knowledge that incoming students gather from prior exposure to companion animal care may influence their understanding and retention of nutrition education within the veterinary curriculum. Educators should consider that most incoming veterinary students have their own perceptions, knowledge and beliefs
towards pet nutrition and care. Prior knowledge from both undergraduate courses as well as external influences have been shown to interplay with self-regulation and motivation in human medical training, especially when faced with a learning task, where learners attempt to connect new information to existing schemas or knowledge constructs (van Gog et al. 2005). Exposing veterinary students to an anatomy course, for instance, prior to commencing the veterinary program was shown to positively influence student learning outcomes in their first year (McNulty et al. 2016). Veterinary faculty should be encouraged to discuss and perhaps assess, rather than assume, the baseline nutrition information that student veterinarians bring with them.

Results from this study provide useful insights but it is acknowledged that a convenience, single-center sample of one class in one Canadian veterinary school was obtained for this study. Thus, the results from these focus groups and questionnaire may be less generalizable than those derived from a broader sample. There was also a distinct gender bias with over 95% of the incoming class and the students sampled being female; yet, this is representative of the distribution of most graduating veterinary classes in the USA and Canada (Lofstedt 2003). Despite these limitations, the results from this study yield important insights into the wide range of views and behaviors of these incoming student veterinarians. Future studies could analyze a larger sample size and students from more than one veterinary school to increase the robustness of the results and minimize selection and information bias.

Our results have illustrated pre-professional attitudes and perceptions about pet nutrition that will require understanding and explicating to optimize the veterinary nutrition curriculum, and to better serve the needs of students, with a view to improve
uptake and retention of knowledge. This may help ensure veterinary graduates have a sound nutritional knowledge base to use in veterinary practice.
REFERENCES


Delaney SJ. Focus on nutrition: how a diplomate of the American College of Veterinary Nutrition can help your practice and patients. Compend Contin Educ Vet 2011;33(6).


Invited participants from two groups for focus group (FG) discussions:
- Undergraduate students with interest in attending veterinary school (n=400) - denoted as “PV”
- First-year veterinary students at the time of data collection (class of 2019) enrolled at OVC (n=120) - denoted as “V”

Four FG group discussions with students from PV and V groups (n=19) were conducted.

Data from FGs analyzed using thematic analysis resulting in themes and sub-themes.

Students’ responses from FGs informed and helped in the design of survey items for the quantitative questionnaire.

Quantitative questionnaire developed and pilot-tested with DVM graduate students (n=6) at OVC.

Finalized quantitative questionnaire sent to incoming first-year veterinary student (class of 2020) enrolled at OVC (n=120) with an invitation to respond.

Statistical analyses conducted on completed surveys n=84 (70% response rate to the questionnaire invitation).

**Figure 3.1.** Schematic flowchart showing the sequential steps of participant recruitment and data collection. A mixed methods exploratory design in which qualitative data informed the design of an online questionnaire tool distributed to incoming first-year veterinary students (n=84).
Figure 3.2. Sources of information used by incoming veterinary students to learn about their own nutrition and their pet’s nutrition (n=84). Respondents could select more than one response in answering these questions.

Figure 3.3. Incoming veterinary students’ opinions regarding the motivations of pet food companies (n=84). In this case, students were responding to questions about beliefs related to their pet’s nutrition.
**Figure 3.4.** Incoming first year veterinary students’ responses (n=84) to question asking about what factors influenced their trust towards pet nutrition companies’ motivations.

**Figure 3.5.** Incoming veterinary students’ responses to questions regarding the level of trust towards the regulatory standards set for the human and pet food industries (n=84).
Table 3.1. Themes, subthemes and representative example quotes for qualitative thematic analysis of four focus group discussions conducted with pre-veterinary (n=9) and first-year veterinary students (n=10) on nutrition beliefs and perceptions.

<table>
<thead>
<tr>
<th>Theme</th>
<th>Subthemes</th>
<th>Example student quotes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Theme 1: Accessibility of pet nutrition information</strong></td>
<td>Credibility of nutrition information from sources accessed</td>
<td>“I don’t know where to go for more information that I can rely on”</td>
</tr>
<tr>
<td></td>
<td></td>
<td>“Information is scattered”</td>
</tr>
<tr>
<td></td>
<td>Veterinary-client communication about nutrition information</td>
<td>“Vets should…be giving out information or advertising certain diseases that can arise, based on a poor-quality diet”</td>
</tr>
<tr>
<td></td>
<td></td>
<td>“If the client doesn’t ask, I think a lot of doctors don’t say anything”</td>
</tr>
<tr>
<td><strong>Theme 2: Time and monetary factors</strong></td>
<td>Cost of veterinary care</td>
<td>“Cost is the number one thing that people look at and then, and then maybe the ingredients afterwards”</td>
</tr>
<tr>
<td></td>
<td>Managing priorities</td>
<td>“It’s just not feasible for me right now”</td>
</tr>
<tr>
<td></td>
<td></td>
<td>“Time is also a thing people don’t admit”</td>
</tr>
<tr>
<td><strong>Theme 3: Trust in pet food industry</strong></td>
<td>The role of profit in pet food industry</td>
<td>“They’re looking more to make the money, that’s why they have it advertised a lot”</td>
</tr>
<tr>
<td></td>
<td></td>
<td>“They’re [pet food companies] only motivated by profits”</td>
</tr>
<tr>
<td></td>
<td>Regulatory bodies responsible for overseeing pet food industry</td>
<td>“People just develop that general mistrust of commercial dog foods because they don’t think they can trust what’s in it, and they don’t realize how regulated those companies are”</td>
</tr>
</tbody>
</table>
Table 3.2. Age, gender, residence, and career plans upon graduation for incoming student veterinarians at the Ontario Veterinary College who completed the questionnaire (n=84).

<table>
<thead>
<tr>
<th>Demographic Variable</th>
<th>N (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total</strong></td>
<td>84</td>
</tr>
<tr>
<td><strong>Age (years)</strong></td>
<td></td>
</tr>
<tr>
<td>&lt;20</td>
<td>0</td>
</tr>
<tr>
<td>20-22</td>
<td>42 (50)</td>
</tr>
<tr>
<td>23-25</td>
<td>32 (38)</td>
</tr>
<tr>
<td>25-27</td>
<td>6 (7.2)</td>
</tr>
<tr>
<td>28-30</td>
<td>2 (2.4)</td>
</tr>
<tr>
<td>&gt;30</td>
<td>2 (2.4)</td>
</tr>
<tr>
<td><strong>Gender</strong></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>82 (97.6)</td>
</tr>
<tr>
<td>Male</td>
<td>2 (2.4)</td>
</tr>
<tr>
<td><strong>Residence</strong></td>
<td></td>
</tr>
<tr>
<td>Ontario Resident</td>
<td>75 (89.3)</td>
</tr>
<tr>
<td>US Resident</td>
<td>7 (8.3)</td>
</tr>
<tr>
<td>International Resident (neither US or Canada)</td>
<td>2 (2.4)</td>
</tr>
<tr>
<td><strong>Career Plans Upon Graduation</strong></td>
<td></td>
</tr>
<tr>
<td>Companion animal exclusive practice</td>
<td>28 (33.3)</td>
</tr>
<tr>
<td>Food animal exclusive practice</td>
<td>2 (2.4)</td>
</tr>
<tr>
<td>Equine exclusive practice</td>
<td>6 (7.1)</td>
</tr>
<tr>
<td>Rural community practice (companion animal, equine, food animal)</td>
<td>17 (20.2)</td>
</tr>
<tr>
<td>Public health</td>
<td>3 (3.6)</td>
</tr>
<tr>
<td>Research</td>
<td>5 (6)</td>
</tr>
<tr>
<td>Industry</td>
<td>3 (3.6)</td>
</tr>
<tr>
<td>Other</td>
<td>18 (21.4)</td>
</tr>
<tr>
<td>Prefer not to answer</td>
<td>2 (2.4)</td>
</tr>
</tbody>
</table>
Table 3.3. Factors influencing the decisions of incoming veterinary students on what to feed their pets (n=111). Respondents could select more than one source of information in responding to this question.

<table>
<thead>
<tr>
<th>Basis for buying food</th>
<th>No.</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Veterinarian's or veterinary technician's recommendation</td>
<td>85</td>
<td>76.58</td>
</tr>
<tr>
<td>Current health status of my pet</td>
<td>56</td>
<td>50.45</td>
</tr>
<tr>
<td>Cost</td>
<td>35</td>
<td>31.53</td>
</tr>
<tr>
<td>Ingredients of pet food</td>
<td>33</td>
<td>29.73</td>
</tr>
<tr>
<td>Activity levels of my pet</td>
<td>31</td>
<td>27.93</td>
</tr>
<tr>
<td>Feeding my pet what I think it should eat</td>
<td>23</td>
<td>20.72</td>
</tr>
<tr>
<td>Feeding my pet what I think it enjoys eating</td>
<td>19</td>
<td>17.1</td>
</tr>
<tr>
<td>Veterinary Nutritionist's recommendation</td>
<td>13</td>
<td>11.71</td>
</tr>
<tr>
<td>Convenience</td>
<td>11</td>
<td>9.91</td>
</tr>
<tr>
<td>Loyalty to certain brand(s)</td>
<td>10</td>
<td>9.01</td>
</tr>
<tr>
<td>Packaging of pet food</td>
<td>7</td>
<td>6.31</td>
</tr>
<tr>
<td>Feeding what my family/friends have been feeding their pet(s)</td>
<td>7</td>
<td>6.3</td>
</tr>
<tr>
<td>What's on sale</td>
<td>6</td>
<td>5.41</td>
</tr>
<tr>
<td>Reading about diets online</td>
<td>6</td>
<td>5.41</td>
</tr>
</tbody>
</table>
Table 3.4. Incoming veterinary students’ responses to a question about where pet food was purchased (n=111). Respondents could select more than one response option for the question.

<table>
<thead>
<tr>
<th>Where was food purchased?</th>
<th>No.</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Veterinary clinic/ hospital</td>
<td>52</td>
<td>46.8</td>
</tr>
<tr>
<td>Pet store</td>
<td>38</td>
<td>34.2</td>
</tr>
<tr>
<td>Supermarket/ Grocery Store</td>
<td>25</td>
<td>22.5</td>
</tr>
<tr>
<td>Big-box stores (e.g. Walmart, Costco)</td>
<td>4</td>
<td>3.6</td>
</tr>
<tr>
<td>Purchase the raw products and make my own food</td>
<td>3</td>
<td>2.7</td>
</tr>
<tr>
<td>Online</td>
<td>0</td>
<td>0.0</td>
</tr>
</tbody>
</table>
Table 3.5. Incoming veterinary students’ responses (n=111) about motivators and barriers to changing their pet’s current diet. Respondents could select more than one response option for each question.

<table>
<thead>
<tr>
<th>Motivators</th>
<th>Barriers</th>
</tr>
</thead>
<tbody>
<tr>
<td>My pet’s health (84%)</td>
<td>Too costly (65%)</td>
</tr>
<tr>
<td>Veterinarians’ recommendation (58%)</td>
<td>My dog might not like it (61%)</td>
</tr>
<tr>
<td>Cost (32%)</td>
<td>I don’t know enough about nutrition (23%)</td>
</tr>
<tr>
<td>Reading about a diet online (2.7%)</td>
<td>Change of diet causes health problems (23%)</td>
</tr>
<tr>
<td>Family/friends’ encouragement (1.2%)</td>
<td>Experts give conflicting information (6%)</td>
</tr>
</tbody>
</table>
Table 3.6. Response to questionnaire Likert statements relating to attitudes of incoming veterinary students (n=84) towards nutrition information-seeking.

<table>
<thead>
<tr>
<th>Statement</th>
<th>Responses Pertain to Own Nutrition (n=84)</th>
<th>Pet’s Nutrition (n=111)</th>
<th>Species of pet</th>
<th>P-value**</th>
</tr>
</thead>
<tbody>
<tr>
<td>I trust the messages that the media portrays regarding nutrition</td>
<td>4.11 ± 0.16*</td>
<td>4.12 ± 0.01</td>
<td>4.19 ± 0.05</td>
<td>4.24 ± 0.05</td>
</tr>
<tr>
<td>I rely on my physician/vet for nutrition information</td>
<td>2.82 ± 0.12</td>
<td>2.14 ± 0.06</td>
<td>2.23 ± 0.03</td>
<td>2.07 ± 0.05</td>
</tr>
<tr>
<td>I trust the advice I receive from my physician/ vet for nutrition</td>
<td>2.18 ± 0.01</td>
<td>1.92 ± 0.03</td>
<td>1.89 ± 0.01</td>
<td>1.96 ± 0.02</td>
</tr>
<tr>
<td>I trust advice from a physician or vet who are employed for or funded by</td>
<td>4.07 ± 0.04</td>
<td>3.32 ± 0.09</td>
<td>2.87 ± 0.01</td>
<td>3.70 ± 0.01</td>
</tr>
<tr>
<td>a food company</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I trust the Internet as a source for nutrition information</td>
<td>3.5 ± 0.03</td>
<td>3.68 ± 0.06</td>
<td>3.65 ± 0.01</td>
<td>3.71 ± 0.03</td>
</tr>
<tr>
<td>Conflicting information from physicians/vets makes me question their</td>
<td>2.42 ± 0.15</td>
<td>2.83 ± 0.04</td>
<td>2.12 ± 0.11</td>
<td>3.01 ± 0.07</td>
</tr>
<tr>
<td>recommendations</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Respondents had the following options: 1= strongly agree, 2= agree, 3=neutral, 4= disagree, 5= strongly disagree. *Mean ± SD scores **P-value for cat vs. dog owner significant at p<0.05.
4.1 Abstract

Veterinarians play a critical role in providing nutrition consultation and supporting clients to adopt healthy dietary habits for their pets, thus applicable, informative nutrition education in veterinary schools is essential. The aim of this study was to explore incoming veterinary students’ perceived importance, emphasis and confidence in the veterinary nutrition education they will receive. First-year veterinary students at all five Canadian and five randomly selected US veterinary schools were invited to complete a 31-item questionnaire. Response rate was 34.6% (n=326). Descriptive statistics and multivariate logistic regression were performed. While most students (92%) considered nutrition education to be an important component of veterinary training, 64% felt it will not be a subject of great emphasis. Veterinary students at schools with a board-certified veterinary nutrition faculty were more likely to perceive higher emphasis on nutrition education (p<0.001). In the multivariable analysis, academic self-efficacy was a positive predictor of students’ perceived confidence in how well they anticipate their nutrition education will prepare them for their clinical roles (p=0.003). An interaction was observed between perceived emphasis and presence of a board-certified nutritionist (p=0.021). Examining the perceptions of veterinary students entering veterinary school
are important aspects to consider in the design and delivery of a veterinary nutrition curriculum, and maybe equally important for students entering other professional health programs.

4.2 Introduction

In the past decade, greater efforts and attention have been paid to teaching nutrition in veterinary schools [1, 2]. The acquisition of nutrition competency is a fundamental objective in veterinary medicine to promote and maintain companion animals' health [3]. In 2010 and 2011, respectively, the American Animal Hospital Association (AAHA) and the World Small Animal Veterinary Association (WSAVA) adopted nutrition as the “fifth vital sign”, indicating a health measure that should be assessed every time a pet is presented to a veterinarian [1]. The AAHA’s “Guidelines for Dogs and Cats” were developed on the basis that “incorporating nutritional assessment into regular animal care is critical for maintaining pets’ health, as well as their response to disease and injury” [4, 5].

Pet owners often consider veterinarians to be their primary source of information for nutritional advice [6, 7]. Of 852 pet owners surveyed in 6 countries, 45% relied on their veterinarian for assistance with pet nutrition [8]. Thus, it is reasonable to expect that veterinarians should be able to provide objective and accurate nutrition information. However, a survey of dog and cat owners in the US revealed that although 90% of owners wished to obtain dietary recommendations from their veterinary health care team, only 15% perceived that they had received this information [5]. Similarly, in a
German study, 57% of pet owners visiting 18 veterinary clinics felt a nutritional recommendation to be important but 77% of them did not receive one [9].

Veterinary school graduates may not attain adequate skills in nutrition, leading to dissatisfaction with the nutrition education they receive in veterinary school [10]. In a 1996 survey of veterinarians in the US, 70% indicated they felt that their nutrition education was inadequate [11]. Practicing companion animal veterinarians in the US also reported attitudes of low confidence in their nutrition knowledge [3]. Nutrition for companion animals is taught in most veterinary schools to some capacity, although not all schools employ board-certified faculty in veterinary nutrition. In the US and Canada, 14 out of 30 and 3 out of 5 veterinary schools, respectively, have board-certified faculty teaching the nutrition curriculum [12].

Veterinary faculty recognize the need to address the under-representation of nutrition in veterinary medical curricula and tackle the lack of confidence of upper-year students with respect to nutrition counselling [2, 1, 13]. Yet, there remain potential barriers to integrating nutrition education [1, 14] in veterinary curricula, including limited curriculum time and lack of interest or advocacy. Additionally, nutrition is a curricular field in which there is potentially conflicting literature and changing recommendations [15]. Thus, veterinary faculty are challenged to deliver nutrition content that is perceived relevant by students, taking into consideration the students’ prior exposure to nutrition information and personal beliefs. In the context of human nursing and medicine, when students considered their nutrition education to be relevant to future clinical practice, they reported higher clinical confidence, achievement and satisfaction with their nutrition
training [16, 17]. Similar investigations are yet to be conducted amongst veterinary students.

It is important to assess incoming veterinary students’ perceived importance and relevance of nutrition education to their future roles as veterinarians since prior knowledge and attitudes on learning and instructional design [18] have been shown to influence student achievement and self-efficacy beliefs. With the Internet serving as a well-utilized learning resource [19], access to biased nutrition information may predispose students to negative attitudes towards veterinary nutrition education. Assessing this information will assist in the identification of any gaps in current veterinary curricula and highlight teaching methodologies that are optimal to improve student learning outcomes. Our aim is to investigate students’ attitudes and perceptions toward nutrition education at the start of their veterinary education prior to receiving nutrition instruction as part of their veterinary curricula.

The objectives of this study were to survey incoming first-year veterinary students at veterinary schools in the US and Canada to:

(1) evaluate the perceived importance of nutrition education

(2) describe how they perceive emphasis on, reported confidence in, and reported academic self-efficacy in nutrition education they will receive; and

(3) highlight their preferred learning methods for nutrition instruction.

4.3 Methods

4.3.1 Study Design
A multi-center cross-sectional study was carried out among incoming first-year veterinary students at all five Canadian veterinary schools and five randomly selected US veterinary schools. The study was conducted between September 2016 and November 2016 via an online questionnaire tool, distributed to a total of 942 incoming Doctor of Veterinary Medicine (DVM) students (incoming students are defined as those commencing first year of veterinary studies). This study received ethics approval from all participating institutions.

4.3.2 Questionnaire Design

A 31-item questionnaire was developed based on a review of the existing literature, focus group discussions with veterinary students at the research team’s home institution and amongst the research team. Using a series of multiple-choice questions and structured question statements capturing perceptions on 5-point Likert scale, questions were designed to collect data on veterinary students’ self-reported nutrition attitudes and behaviors which compromised sections on: students’ perceptions and perceived knowledge of their own and their pets’ nutrition; and students’ expectations of nutrition education within the veterinary curriculum. The intention of this study was to focus on perceptions of nutrition education. This compromised 4 sections: student perceived importance of and emphasis on nutrition education; academic self-efficacy; perceived confidence in discussing nutrition; and preferred learning format for nutrition education. Students’ were also asked to rate their own general health status, extent of thinking about diet, barriers to healthy eating and their nutrition priorities. Demographic data collected included age, gender, number and types of pets owned, degrees completed and career plans after veterinary school.
4.3.2.1 Perceived Importance and Emphasis on Nutrition Education

Perceived emphasis on nutrition education in veterinary school and perceived importance of receiving nutrition education were each measured on a similar 5-point Likert scale (1=not at all important, 5=extremely important). Students were also asked to rate to what extent they thought their veterinary training would prepare them in each of seven subjects of veterinary medicine (1=yes, 2=unsure, 3=no).

4.3.2.2 Academic Self-Efficacy

A 4-item measure was developed to assess nutrition academic self-efficacy. This score was defined as students' strength of belief in their own ability to achieve educational duties at expected levels [20]. Participants were asked to rate, on a 5-point Likert scale, their level of confidence in their ability to apply nutrition education (e.g. I am confident that I can apply the veterinary nutrition education that I will receive to my current companion animal). The response scale ranged from 1 (completely disagree) to 5 (completely agree) and was adapted from a previously validated survey [21]. A total self-efficacy score, ranging from 5 to 20, was then calculated by adding the scores for each item. Higher scores reflect stronger self-efficacy beliefs.

4.3.2.3 Perceived Confidence in Discussing Nutrition

Using a 5-point Likert scale (1= not at all confident, 5= completely confident), students were asked to rate their perceived level of confidence to discuss nutrition with clients that they will achieve by the time they graduate.

4.3.2.4 Preferred Learning Format for Nutrition Education
Students were asked to select from a list their preferred methods for learning nutrition in veterinary school (students could select more than one response). Data on whether each school employed board-certified faculty in veterinary nutrition and whether nutrition credit(s) were required as an admission requirement were also recorded.

4.3.3 Questionnaire Distribution

Pilot testing for length, question clarity and comprehensiveness was completed by six first-year veterinary students at the research team’s home institution. Feedback from the piloting process was used to further refine question wording and establish content validity. Question item reliability was calculated at Cronbach’s alpha =0.86, yielding satisfactory internal consistency for the questionnaire instrument. The final questionnaire was disseminated via Qualtrics© (2017, Provo, Utah) via email invitation from each school’s student affairs office. The anonymous, confidential questionnaire was distributed in both English and French to one institution.

Inclusion criteria included incoming veterinary students in their first two months of veterinary school who own at least one cat or one dog. Responses to the questionnaire were not linked to any personal identifiers. Via a separate survey link, students were given the option to enter a prize draw for an iPad upon submission of the questionnaire. The presence of a board-certified nutrition faculty at each participating school was verified by the authors.

4.3.4 Data Analysis
Data was exported into STATA14© (2015, College Station, Texas) and tabulated. Discreet variables are presented as percentages. Agreement with statements were indicated by a response of 4 or 5 on a 5-point Likert scale (1=strongly disagree, 5=strongly agree); disagreement was indicated by a response of 3 or less. Likert data were reported as mean ± SD. Univariate Analysis of Variance (ANOVA) was used to compare scale mean scores by demographic data and perceived emphasis by subjects. Data from Canadian versus USA veterinary schools was compared using chi-square analyses. Statistical significance was set at p<0.05.

Multilevel logistic regression analysis [22] was conducted using the dichotomized dependent variable perceived confidence – reported as how well students thought their veterinary nutrition education will prepare them to confidently discuss nutrition with future clients. Students who reported a confidence score of 4 or higher on a 5-point scale (1=not at all confident, 5=completely confident) were scored as confident (1) and those reported confidence score of 3 or less were considered unconfident (0). Perceived knowledge and perceived emphasis were similarly dichotomized. The following independent variables were considered as “putative predictors” in the models: age, gender, academic self-efficacy (total score), perceived level of nutrition knowledge (high/low), perceived emphasis on nutrition training (high/low), board-certified nutrition faculty (yes/no), and self-rated general health status of students (excellent, good, poor). Backward elimination approaches were conducted. Confounding was evaluated by determining whether the Odds Ratio changed by more than 20% as each variable was removed from the model. School and country were included as random effects in all models to compare variance at each cluster level. Interaction terms were generated and
tested based on the strategy of creating two-way interactions among all predictors that were significant in the final effects model. The interaction terms were then assessed for significance (p-value ≤ 0.05); if nonsignificant, it was removed from the reduced model. Variance partition components using were calculated at each of the student-, school-, and country-level using the latent variable method.

4.4 Results

A total of 326 of the 942 veterinary students invited completed the questionnaire (response, 34.6%). Student characteristics are presented in Table 4.1. Student respondents were primarily female (85.3%) within the age ranges of 20-22 years (45.7%) or 23-25 years (34.4%), which is representative of first year enrollees in US and Canadian veterinary schools (82% female; mean age 23.5 years) [23]. Almost half of respondents (161/326, 49.4%) indicated they are interested in companion animal practice upon graduation.

4.4.1 Perceived Importance and Emphasis on Nutrition Education

Most respondents (92%) indicated it was important that veterinary graduates receive nutrition training, with 79% indicating graduates should possess adequate skills to provide a nutritional assessment at each client visit. Approximately 13% of students reported that nutrition should only be discussed when a client asks a veterinarian or when there’s a specific health concern for the pet (8%). The four most highly rated consultation skills that veterinary students felt they needed to develop in relation to their veterinary nutrition education were: ability to communicate effectively with owners (83%), confidence to correct client’s nutrition misinformation (67%), ability to
personalize nutrition recommendation to both clients’ and pets’ needs (63%), and use of language that clients can understand and implement (63%).

Perceived importance of nutrition education did not differ significantly by age, gender or presence of nutrition faculty (Table 4.2). Further, no difference was found among students intending to enter companion-animal practice and those intending to practice in other areas (p=0.30). Students, however, were more likely to find nutrition education “extremely” important if they viewed themselves as “healthy” (p<0.01) and gave more thought to their own diet (p=0.02). When asked to report whether they considered themselves knowledgeable about nutrition in the context of their own pets, 66% of students perceived that they were.

More than half of all 326 students (64%) perceived emphasis on nutrition education to be low in their school’s veterinary curriculum. When asked to compare how much education students anticipate their veterinary training will deliver in each of the 7 specified areas of veterinary medicine, students thought they would be least educated in nutrition (Figure 4.1). Only 20% of students felt that they will have enough nutrition training upon graduating. This was significantly lower than how much education students felt they would receive in each of “Medicine” (p<0.001) and “Anatomy” (p=0.0234) subject categories. ANOVA results on whether perceived emphasis of veterinary students differed significantly by demographic variables are presented in Table 4.2. Veterinary students at schools with a board-certified veterinary nutrition faculty were more likely to perceive higher emphasis on nutrition education (F=7.62, p<0.001).
4.4.2 Perceived Confidence in Discussing Nutrition

Less than 50% of students believed their veterinary education will prepare them to confidently discuss nutrition upon graduation. Results of multilevel binary logistic regression analysis are shown in Table 4.3. Eight independent variables entered the model, including age, gender, academic self-efficacy score, perceived level of nutrition knowledge (high/low), perceived level of emphasis on nutrition education (high/low), board-certified nutritionist faculty (yes/no) and student self-rated health status (excellent, good, poor). Since the effect of gender, age, health status and perceived knowledge were not significant (p>0.05) in the model, they were dropped in the reduced model.

Self-efficacy score was the most important predictor for students’ perceived confidence. Students with higher reported self-efficacy with the nutrition education they will receive had higher odds of perceiving they will be confident in discussing nutrition with future clients (OR=2.20, p=0.003). A significant interaction was observed between perceived emphasis and presence of board-certified veterinary nutrition faculty (OR=2.43, p=0.021). For those who attended a school with a board-certified nutritionist faculty, perceived emphasis had a more dramatic effect on perceived confidence; however, for students who did not attended a school with a board-certified nutritionist, perceived emphasis had a minimal effect on perceived confidence.

Most of the variation in perceived confidence was explained at the student-level, while the school- and country- levels explained 28% and 11% of variation in confidence, respectively.
4.4.3 Students’ Preferred Learning Format for Nutrition Education

As shown in Table 4.4, incoming student veterinarians reported that they wished to receive nutrition instruction through a mixture of lectures, hands-on learning and external resources. Case-based learning was the preferred format of learning nutrition (64.5%), with no overall differences between Canadian versus US veterinary students (p=0.669).

4.5 Discussion

The goal of this study was to investigate US and Canadian incoming first-year veterinary students’ views on the perceived importance of and emphasis on nutrition training in veterinary school, as well as how well they anticipate it will prepare them to confidently discuss nutrition upon graduating.

While research on veterinary students’ perceptions of nutrition education is limited, given the importance of nutrition to animal health and welfare, it is not surprising that most respondents in our study considered it to be an important part of their veterinary education. Our finding is in agreement with reported attitudes of both medical students [16, 24] and practicing veterinarians [3]. However, despite the high value incoming veterinary students place on nutrition topics within the veterinary curricula, still 21% of incoming veterinary students did not believe nutrition should be assessed at every client visit, a result that warrants further investigation by veterinary educators. While this perception could change during veterinary school, other authors have noted similar nutrition counselling attitudes among practicing veterinarians, in which nutrition was only discussed in light of a specific diagnosis or when requested by a client
(Roberts and Murray 2013). Thus, this finding may be a reason why frequency of nutrition counselling within veterinary clinics remains inconsistent [9]. Furthermore, students were more likely to find nutrition education “extremely” important if they viewed themselves as “healthy” and gave more thought to their own diet. We hypothesize that emphasizing the importance of nutrition as part the wellness campaigns being developed in veterinary schools could benefit both the students and their future clients and patients. This has been especially true amongst medical students, where freshman students were more likely to consider nutrition counselling relevant than students in their senior year [16]. Spencer et al. (2006) further suggested that this decline in perceived nutrition counseling relevance may be attributed to students placing less emphasis on their own dietary habits throughout medical school. Practically, this suggests that while most incoming health care professional students recognize that it is important to receive nutrition training as part of their education, their perceived relevance on its application to their future roles varied.

Despite students’ overall low perceived emphasis on nutrition training in the curriculum, we found that the presence of a board-certified veterinary nutritionist amongst faculty resulted in higher perceived emphasis on nutrition education. The benefits in the presence of nutrition faculty may have begun to be more recently recognized; in European veterinary schools, it was noted by deans that a majority of schools indicated a need for at least one faculty member teaching small-animal nutrition [1]. Perhaps the presence of a board-certified veterinary nutritionist may counter the belief noted by our study’s respondents that they expect to receive more instruction in other areas of veterinary medicine compared to nutrition. While it is unclear why
surveyed veterinary students perceive they will be least trained in nutrition, Adams et al. [25] suggested that one reason medical students report low perceived satisfaction with their nutrition education is the belief that the nutrition curriculum will be presented in an integrated format rather than as its own course. Therefore, our data suggests that veterinary faculty discuss incoming students’ preconceptions about the veterinary nutrition curriculum. Whether the nutrition education is integrated throughout the curriculum or in a separate course, addressing these perceptions before delivering a veterinary nutrition curriculum is delivered may help to minimize confusion and dissatisfaction, while enhancing confidence in their nutrition education.

Less than half of incoming veterinary students anticipated that their veterinary nutrition education will prepare them to confidently discuss nutrition with future clients. This perceived lack of confidence was significantly associated with students’ beliefs on the relative low emphasis on nutrition education, especially in instances where they attend a school with a board-certified veterinary nutrition faculty member. Interestingly, how knowledgeable students considered themselves to currently be about animal nutrition was not associated with how confident they perceived they will be to discuss nutrition upon graduation. In accordance with widely accepted behavioral theories [26], an important predictor in our model was academic self-efficacy. In our study, students with high academic self-efficacy with respect to their nutrition education were more likely to perceive they will be confident in discussing nutrition topics with clients. Indeed, research evidence has shown that students with high self-efficacy in various academic domains exhibit greater effort to engage in tasks that foster the development of their knowledge, skills and abilities in those areas; and persist longer at challenging tasks.
Furthermore, the positive impact of academic self-efficacy affects quality of effort, where students high in academic efficacy use more deep cognitive processing strategies than their counterparts with weaker efficacy beliefs [29].

In fact, research amongst professional health students suggests that self-efficacy beliefs may accurately predict their motivation and future clinical confidence, regardless of their actual competence [30]. For example, academic self-efficacy is associated with higher rates of nutrition counselling amongst medical students [31] and the amount of effort developing strategies to improve students’ beliefs that they can apply their nutrition education may be important in improving their preparedness to provide nutrition care. Bandura and others have suggested implementing instructional practices that not only foster knowledge and skill attainment, but also bolster the necessary accompanying confidence [32, 33]. Based on incoming veterinary students’ responses in our study regarding their preferred learning format, we propose case-based and experiential learning be incorporated from the start of their nutrition education.

A limitation of our study is that the students who elected to complete the survey may have a greater interest in nutrition. As such, the generalizability of the findings to all incoming veterinary students may not be accurate. In addition, the way that nutrition is taught at each school or number of hours was not assessed; however, surveys were distributed to students in the first two months of their program to avoid much variability in amount of nutrition training received. One strength of our study was that we collected data from a sample of 10 schools across two countries. Limited research to date exists on nutrition education amongst veterinary students from more than one school.
Our findings suggest that students perceive nutrition as highly important to veterinary education and further recognize the importance of being able to relay nutrition information in lay terms and correct future clients’ misconceptions. At the same time, not all students believed nutrition should be discussed at regular animal assessments. The relevance of clinical nutrition, beyond diagnosing nutrition diseases, should be emphasized to students early in their degree. Further, students did not perceive nutrition education in veterinary school to be emphasized as much as other subjects. Students’ perceptions of low emphasis towards nutrition may influence how important they view nutrition throughout their program. Students also felt that their nutrition training will not prepare them to confidently discuss nutrition topics in clinical practice. This lack of perceived confidence may have important consequences. According to findings reported by Mihalyqnuk et al. [34], medical students who perceived a higher quality of nutrition education during their medical training reported higher nutrition proficiency. By targeting incoming veterinary students’ attitudes of veterinary nutrition instruction as well as their academic self-efficacy, educators will be better positioned to inform and implement a veterinary nutrition curriculum that develops both the “skill and will” to consult on nutrition upon graduation.

4.6 Conclusion

Education aimed at improving nutrition competencies is vital for health care practitioners. Little is known about veterinary students’ perceptions of nutrition education. While most students had favourable attitudes towards nutrition education in the veterinary curriculum, they perceived low emphasis on nutrition education in
comparison to other areas of veterinary medicine. Less than half of incoming veterinary students anticipated that their veterinary nutrition education will prepare them to confidently discuss nutrition with future clients. Perceived confidence was significantly associated with students’ perceived emphasis, presence of board-certified veterinary nutrition faculty member and their academic self-efficacy. Experiential nutrition training interventions targeted at students from the start of their veterinary education could be beneficial in boosting their confidence and self-efficacy.
REFERENCES


Bandura A. Social learning through imitation. Lincoln: University of Nebraska Press; 1962.


German AJ. The growing problem of obesity in dogs and cats. J Nutr. 2006;136(7 Suppl):1940S-6S.


Lombardi K. Self-efficacy and nutrition knowledge of parents in Western Australia [thesis]. Perth, Australia: Edith Cowan University; 2013.


Figure 4.1. Comparison of nutrition instruction versus other subject areas of veterinary medicine expressed as % who agree that veterinary instruction will provide adequate education in each area. Responses represent data from all schools surveyed.
TABLES

Table 4.1. Incoming first-year veterinary students (n=326) demographic data, including career plans upon graduation by school of attendance.

<table>
<thead>
<tr>
<th>School</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9a</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20-22</td>
<td>42</td>
<td>13</td>
<td>8</td>
<td>8</td>
<td>12</td>
<td>6</td>
<td>13</td>
<td>21</td>
<td>18</td>
<td>8</td>
</tr>
<tr>
<td>23-25</td>
<td>32</td>
<td>7</td>
<td>2</td>
<td>11</td>
<td>13</td>
<td>4</td>
<td>17</td>
<td>8</td>
<td>11</td>
<td>7</td>
</tr>
<tr>
<td>25-27</td>
<td>6</td>
<td>2</td>
<td>1</td>
<td>7</td>
<td>3</td>
<td>2</td>
<td>5</td>
<td>3</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>28-30</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>3</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>&gt;30</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>3</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>82</td>
<td>22</td>
<td>10</td>
<td>27</td>
<td>17</td>
<td>11</td>
<td>31</td>
<td>28</td>
<td>28</td>
<td>22</td>
</tr>
<tr>
<td>Male</td>
<td>2</td>
<td>4</td>
<td>1</td>
<td>3</td>
<td>8</td>
<td>2</td>
<td>6</td>
<td>7</td>
<td>7</td>
<td>2</td>
</tr>
<tr>
<td>Career Plans Upon Graduation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Companion animal</td>
<td>46</td>
<td>2</td>
<td>6</td>
<td>15</td>
<td>16</td>
<td>10</td>
<td>17</td>
<td>19</td>
<td>18</td>
<td>12</td>
</tr>
<tr>
<td>Food animal</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Equine</td>
<td>6</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>0</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Rural community</td>
<td>17</td>
<td>13</td>
<td>2</td>
<td>13</td>
<td>11</td>
<td>1</td>
<td>8</td>
<td>6</td>
<td>11</td>
<td>7</td>
</tr>
<tr>
<td>Public health</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>5</td>
<td>5</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Research</td>
<td>5</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Industry</td>
<td>5</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

*a School 9 requires nutrition credit as an admission requirement into veterinary school.

*School 1 (n=84), School 2 (n=26), School 3 (n=11), School 4 (n=30), School 5 (n=31), School 6 (n=13), School 7 (n=37), School 8 (n=35), School 9 (n=35), School 10 (n=24).
Table 4.2. ANOVA associations of students’ age, gender and school’s presence of board-certified faculty with perceived importance of and emphasis on for nutrition education in veterinary school.

<table>
<thead>
<tr>
<th>Scale Variables</th>
<th>By age</th>
<th></th>
<th>By gender</th>
<th></th>
<th>By veterinary nutrition board-certified faculty</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>F</td>
<td>Sig.</td>
<td>F</td>
<td>Sig.</td>
<td>F</td>
<td>Sig.</td>
</tr>
<tr>
<td>Nutrition education importance</td>
<td>2.43</td>
<td>0.622</td>
<td>1.35</td>
<td>0.259</td>
<td>3.59</td>
<td>0.077</td>
</tr>
<tr>
<td>Perceived nutrition emphasis</td>
<td>3.93</td>
<td>0.762</td>
<td>0.081</td>
<td>0.779</td>
<td>7.62</td>
<td>0.001*</td>
</tr>
</tbody>
</table>

*p<0.05.
Table 4.3. Multilevel logistic regression reduced model* of perceived confidence** in nutrition education among incoming first year veterinary students (n=326).

<table>
<thead>
<tr>
<th>Variable</th>
<th>Odds Ratio(^a) (OR)</th>
<th>95% Confidence Interval (Lower, Upper)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self-efficacy score</td>
<td>2.20</td>
<td>1.8, 2.4</td>
<td>0.003</td>
</tr>
<tr>
<td>Perceived emphasis on nutrition education (base=low)</td>
<td>1.61</td>
<td>0.95, 1.96</td>
<td>0.161</td>
</tr>
<tr>
<td>High</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Board-certified faculty (RG=no)</td>
<td>1.88</td>
<td>1.35, 2.61</td>
<td>0.014</td>
</tr>
<tr>
<td>Yes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interaction</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Board-certified status with perceived emphasis</td>
<td>2.43</td>
<td>1.91, 3.10</td>
<td>0.021</td>
</tr>
</tbody>
</table>

Note: RG means reference group.
\(^a\) The odds of perceiving nutrition education in veterinary school would prepare students to confidently discuss nutrition upon graduation.
* Multilevel model includes random intercepts for school and country. Predictors entered into full model but insignificant: age, gender, perceived general health and perceived knowledge.
** Outcome variable 0=unconfident (1, 2 or 3 on 5-point Likert scale), 1= confident (4 or 5 on 5-point Likert scale); (Likert scale: 1=not at all confident, 5=completely confident)
Table 4.4. Student veterinarians’ preferred learning formats for nutrition education across schools.

<table>
<thead>
<tr>
<th>Learning format</th>
<th>N (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Case-based learning</td>
<td>64.5</td>
</tr>
<tr>
<td>Experiential learning in clinic setting</td>
<td>56.1</td>
</tr>
<tr>
<td>Detailed lecture in classroom setting</td>
<td>55.4</td>
</tr>
<tr>
<td>Presentations/field trips to industry</td>
<td>54.8</td>
</tr>
<tr>
<td>Accessible resources</td>
<td>41.7</td>
</tr>
<tr>
<td>Online discussions</td>
<td>9.3</td>
</tr>
</tbody>
</table>
CHAPTER FIVE

A cross-sectional study of pet owners’ diet motives and attitudes towards nutrition guidance received from veterinarians.

5.1 Abstract

Attitudes and beliefs of pet owners strongly influence their decision-making surrounding their pets’ diet. Thus, nutrition guidance is an essential component of veterinary practice and integral to managing rising pet obesity rates. This study examined pet owners’ diet motives and the way these motives influence their perceptions towards perceived effectiveness of nutrition guidance received from their veterinarian in managing their pet’s diet. A cross-sectional study of 1402 dog and cat owners in the United States and Canada was conducted using an online questionnaire tool. Data was analyzed using descriptive statistics and logistic regression modelling. Dog and cat owners’ dietary practices were influenced by distinct motivations. Our results suggest that clients are concerned about the effectiveness of veterinary nutrition recommendations. Cat owners were more likely than dog owners to consider the nutritional guidance they receive from veterinarians effective for their pet’s diet (OR=1.75, p=0.04). Length of pet ownership, feeding dry diets and frequency of veterinary visits were all positively associated with owners considering veterinary nutrition guidance to be effective in managing pet’s diet. Identifying these perspectives can aid in developing strategies to provide nutrition support to pet owners to improve their perceptions of, self-efficacy with, and compliance with veterinary nutrition recommendations.
5.2 Introduction

Counselling on nutrition is a vital component of veterinary care and well recognized in its importance for the health and well-being of companion animals. The American Animal Hospital Association (AAHA) and the World Small Animal Veterinary Association (WSAVA) adopted nutrition as the “fifth vital sign”, ideally assessed at every appointment, in 2010 and 2011, respectively. Poor nutrition poses a major risk to long-term animal health. Also obesity, a result of poor dietary management, is associated with the onset of a number of diseases (e.g. diabetes mellitus, urinary tract disease, orthopedic disease) leading to poor quality of life and reduced life expectancy (German 2006). The AAHA Guidelines for Dogs and Cats specify that an extended evaluation and design of a dietary management plan is required when a patient presents with specific risk factors, such as an abnormal body condition score, presence of health conditions, specific life stages or alternative diets (AAHA 2003).

Veterinary practitioners are central to managing the health and well-being of companion animals; and are often considered the primary source of nutrition information by pet owners (Michel et al. 2008; Kogan et al. 2010). Despite this, owners often discontinue treatment or fail to comply with all the recommendations (Laflamme 2006; Rohlf et al. 2010). One reason suggested for this lack of follow through is the apparent disparity between the viewpoints of the veterinarian and the client on their pet’s nutrition. For example in one survey, although 32% of 1,104 dog or cat owners reported having an overweight or obese pet, only 0.3% (n = 3) perceived obesity as a health concern (Freeman et al. 2006). To address this disparity, previous researchers suggest
that along with animal factors, consultations in nutrition must address owners’ motives and attitudes behind feeding their pets (Burkholder and Toll 2000; German 2006; Krasuska and Webb 2018), especially given the owner has complete control over food intake and selection. However, these studies did not investigate the information-seeking beliefs behind owners’ attitudes, which most likely would greatly influence any steps to change their behaviours.

According to behavioural theory models, information alone does not produce or change behaviours unless there are consequent changes in attitudes (Ajzen 1991). The more positive the attitude towards the change, the stronger will be a person’s intention to perform the behaviour. For example, improved uptake and adherence to dental and surgery recommendations by clients are linked to how much the veterinarian tailored their recommendation to the client (Kanji et al. 2012). Therefore, clients’ perceptions of the nutrition advice they receive from their veterinarian may influence the likelihood that they will change their feeding behaviour. In a study of pet owners in the United Kingdom (n=74), approximately two-thirds of respondents who agreed with their veterinarian’s assessment that their dog was overweight were motivated to take action to reduce weight (Cairns-Haylor and Fordyce 2017). The strength of that motivation appeared to correlate with the information provided during the consultation.

Minimal research has been directed towards determining the views of the pet owners about the nutritional advice they receive from veterinarians. Veterinarians and veterinary educators recognize the need to better train veterinarians on the provision of nutritional care and ensuring client compliance (Roberts and Murray 2013). In order to
do this, it is important to develop an understanding of nutrition-related attitudes of the client, particularly their experiences, perceptions and expectations towards the nutrition guidance they receive at veterinary clinics. This knowledge could inform counselling practices and training of veterinarians, as well as plans for weight management interventions in primary care. Our aim in this study was to characterize pet owners’ diet motives, motivations for seeking nutrition information and further understand their trust and perceived effectiveness of nutrition recommendations from their veterinarian.

5.3 Methods

5.3.1 Questionnaire

A 47-question web-based questionnaire to assess pet owners’ beliefs toward feeding behaviours as well nutrition recommendations was developed using information gained from a literature review, focus groups and discussion amongst authors. After the initial drafting, the questionnaire was piloted on a sample of 17 pet-owning participants, who were asked to answer the questionnaire and give their direct feedback to authors, thus enabling testing for question flow, ambiguity, and potentially missing or inappropriate response options. The questionnaire was adjusted accordingly for clarity of questions and length of survey. The study was approved by the University’s Research Ethics Board (REB#16JA039).

The final version of the questionnaire consisted of informed consent followed by four main sections compromised of questions relating to information about (1) the pet’s age, weight, sex, body condition score (BCS), diet behaviours; (2) the owner demographics age, gender, family structure, employment status, place of residence,
education status; (3) the owner-pet relationship including questions about length of ownership, level of attachment to the pet, time spent with the animal, and attitudes toward feeding behaviour; (4) nutrition information-seeking attitudes including questions about perceived nutrition knowledge, sources of information utilized, confidence and trust in nutrition information from veterinary clinics. Respondents were also asked to indicate if they or any household member were a veterinarian, veterinary technician, breeder or health care professional.

### 5.3.2 Covariates

Multiple choice and close-ended questions wherein respondents were provided with a number of choices to select from were used to identify demographic variables for owner and pet and to quantify feeding behaviours. Free-text boxes were provided for participants to enter alternative answers when none of the listed options applied to them. Feeding behaviours consisted of diet fed, purchasing factors and frequency of veterinary visits. Self-reported BCS of pet was assessed in both word and picture format using a 5-point scale (1: emaciated, 2: lean, 3: ideal, 4: overweight, 5: obese). Five-point BCSs have been used in previous studies and produced reliable results. For example, McGreevy et al. (2005) used a similar 5-point BCS to investigate the prevalence of obesity in dogs in Australian veterinary practices. Questions asking the respondent to identify his or her level of agreement with the statement (i.e. 1=strongly disagree, 5= strongly agree) were used to capture reasons for seeking nutrition information from the veterinarian, trust in veterinary nutrition information, and perceived
effectiveness when applying it to their pet’s diet and health. Perceived attachment to pet was measured on a 5-point Likert scale (1=not at all attached, 5=extremely attached).

5.3.3 Participants and Procedure

Inclusion criteria were: being over 18 years of age; living with and taking care of at least one dog or one cat; residing within the United States or Canada; and is not a veterinary or medical doctor. Respondents were invited to participate via an online link to a survey on Qualtrics © (2017, Provo, Utah) via social media platforms (e.g. pet-centric groups), pet owner blogs, and the university’s communication bulletin. Access was made available from October 2018 – January 2019. All responses remained anonymous and respondents were given the option to enter a gift card prize draw upon completion via a separate questionnaire. For participants who owned both dogs and cats and/or more than one dog or one cat, the owner was asked to identify one pet to for which they answered all survey questions. The survey was only made available in English.

5.3.4 Analysis

Descriptive statistics were calculated for each survey item including frequency distribution, mean and median responses. Owner and pet age were collected on a continuous scale in years. Differences between responses from cat and dog owners were compared using the z test of proportions. Multivariable binary logistic regression modeling was used to assess the relationship between demographic, feeding and veterinary visit variables and perceived effectiveness of veterinary nutrition recommendations on pets’ diet and health. The dependent variable was a dichotomous variable that is equal to one if an individual perceived effectiveness of nutrition
recommendations to be “definitely effective” or somewhat effective” and to zero for a response of “not effective”. Explanatory variables were owner and pet demographic variables as well as nutrition and health attitudes and beliefs. Skewness and kurtosis were examined with histograms. Backward stepwise regression was employed. All possible 2-way interaction terms were examined but only interactions with a p<0.05 were retained in the final model. Confounding and multicollinearity among the variable were assessed using a comparison of Odds Ratios and Variance Inflation Factor, respectively. Statistical significance was set at P < 0.05. All analyses were performed, and all figures created with STATA14© (2015, College Station, Texas).

5.4 Results

The survey was completed by 1402 adults from Canada and the USA. General participant demographics are presented in Table 5.1. Most respondents were female (1178; 84%) and mean age of respondents was 39.2 years (range 19-87). The majority lived in either urban (645; 46%) or suburban (533; 38%) areas, although some resided in rural communities (224; 16%).

Mean age of pet in this sample was 6.1 years (range 0.2-23), as shown in Table 5.2. Fifty-six percent of respondents owned more than one type of pet (785), with a mean of 2 pets per household (range, 1-8). The final sample represented more responses pertaining to dogs (897; 64%) than cats (505; 36%). Average length of pet ownership of the represented pets in the questionnaire was 5.3 years (range 0.2 – 23). Reported level of attachment to pet did not differ between dogs and cats, with most
(1356, 96.7%) respondents reporting they consider themselves “extremely attached” to their pets.

5.4.1 Self-Reported Feeding Behaviours

Table 5.3 shows feeding behaviours by type of pet. Most respondents fed dry food (1051; 75.0%) and feeding of treats was common; yet species differences were noted. For example, dog owners were significantly more likely to feed home-made cooked diets (p<0.001) and raw diets (P<0.001) than cat owners. However, no significant differences were detected in dog and cat owners’ reasoning behind feeding homemade or raw diets. Among the 277 pet owners who fed home-cooked diets, the biggest motivator for doing so was the belief that it is healthier for their pet (31%) followed by concern about safety/quality control of commercial pet foods (22.1%) (Figure 5.1). As shown in Figure 5.1, most common reason for feeding raw diet, which may be purchased commercially, among 355 dog and cat owners was that it “is healthier” (45%) but they also took into consideration the preference of pet (16%). Vitamins/supplements were more likely to be fed daily by owners who fed raw (p<0.001) and home-cooked diets (p=0.004) and owners who visited their veterinarian more than once a year (p=0.01). There were no differences in vitamin/supplement feeding amongst owners who fed vegetarian diets (p=0.12) or table scraps (p=0.30).

Dog owners were significantly more likely to consider regular exercise important for their pet's health than cat owners (p<0.001). In response to the question about what reasons were most important in influencing owners’ decisions when choosing pet food, responses from dog owners differed significantly from cat owners as shown in Figure
5.2. Dog owners were less likely to consider price (p=0.01) and a veterinarian's opinion (p<0.001) but more likely to look for what they deemed to be natural ingredients (p<0.001). Consequently, there was also observed differences between cat and dog owners about where pet food was purchased (Table 5.3).

5.4.2 Beliefs Regarding General Pet Health

There was also a difference in the way cat and dog owners perceived their pet’s current diet; more dog owners regarded their pet’s diet to be healthy than cat owners did (p<0.001). In response to perceived knowledge about pet nutrition, approximately half the respondents (56.0%) considered themselves “moderately” knowledgeable. However, in general, dog owners perceived themselves to be more knowledgeable about pet nutrition than cat owners (OR 1.23, p=0.03) and were 1.31 times more likely (p=0.01) to report thinking about their pet’s nutrition “always”.

Cat owners were less aware how much their current pet weighs than dog owners (p<0.001). Figure 5.3 shows results of self-reported BCS. Dog owners were 1.56 times more likely to perceive their pet to be of ideal weight (p=0.004). Among owners that considered their pet to be overweight (n=209), the most commonly reported reason was not enough exercise (48.8%), followed by overfeeding (42.5%) and medical condition (8.7%). Conversely, most owners (n=73) attributed their pet being underweight to medical conditions (72.7%), with underfeeding (22.7%) and too much exercising (4.6%) not as commonly reported.

5.4.3 Nutrition-Information Seeking Attitudes
Overall, as shown in Table 5.4, dog owners were more likely to take their dogs to a veterinarian more than once a year than cat owners (p<0.001). When respondents were asked about factors that affected their decision on what to feed their pet (Figure 5.4), the two most commonly cited were information from veterinarian (618; 44.1%) and information read online (544; 38.8%). Species differences were also noted. While cat owners more frequently relied on veterinarian instructions (p=0.01), dog owners were more likely to cite information from breeder or rescue center (p=0.03). Next, respondents were asked about factors that affected their decision on how much to feed their pet (Figure 5.5). In this case, only 34.2% (480) of dog and cat owners relied on veterinarians’ instructions. Instead, it was more common for respondents to assess the pet’s BCS themselves and adjust feeding amount accordingly (904; 64.5%), especially among dog owners (p<0.001). Cat owners were more likely to seek veterinarian instructions (p=0.01) or free-feed (p<0.001). Instructions on pet food packaging among both cat and dog owners was more important when deciding how much to feed than what to feed their pet (p<0.001).

5.4.4 Attitudes Towards Nutrition Information Received from Veterinarians

General trust in veterinary advice was rated high by both dog and cat owners, with 68.1% (955) of cat owners and 62.7% (879) of dog owners strongly agreeing that they trust their veterinarian for nutrition advice. There were differences in the frequency of nutrition discussions with veterinarians among cat and dog owners (Table 5.4). Although dog owners were more likely to visit their veterinarian more than once a year, more cat owners reported discussing nutrition with their veterinary each visit than dog
owners. A clear discrepancy was also identified between respondents’ preference for nutrition care, and nutrition care practices reported being received from a veterinarian. Eighty-four per cent of respondents stated that receiving nutrition care would be beneficial to the management of their pet’s diet, however, only 43% of respondents perceived they have received this advice from their veterinarian in the past year.

Binary logistic regression was employed to determine what factors are associated with perceived effectiveness of nutrition advice received from veterinarians, the results of which are shown in Table 5.5. Having college or university degree (OR 3.96, p=0.009) or completing professional schooling (OR 2.12, p=0.01) was associated with greater odds of perceiving nutrition care to be effective for a pet’s diet. Working in the healthcare field was associated with a 2.94-fold (p=0.020) higher odds of perceived effectiveness of veterinary nutrition care compared to not working in the healthcare field. While living in a suburban community increased odds of perceiving nutrition care to be effective (OR 1.51, p=0.034), compared to those in the highest income category, the lowest income category was inversely associated with perceived effectiveness of nutrition care (OR 0.55, p=0.001).

Cat owners were significantly more likely than dog owners to consider veterinary nutrition care effective for their cat’s diet and health (OR 1.75, p=0.044). Length of pet ownership, self-rated importance of exercise and frequency of veterinary visits were all positively associated with owners considering nutrition guidance received from veterinarians to be effective in managing pet’s diet. Owners who classified their pets as
overweight using BCS were also less likely to perceive nutrition care received to be effective (OR 0.46, p=0.005).

5.5 Discussion

Most studies of pet owner perceptions towards feeding management of companion animals have focused on how the pet is currently fed (Laflamme et al. 2008; Michel et al. 2008). Our results help to broaden our understanding of the factors associated with dog and cat owners’ nutrition decisions to seek nutrition information and how they perceive nutrition guidance at veterinary settings. The respondent population had a greater proportion of females and dog owners than cat owners. This high proportion of females is consistent with previous human-companion animal interaction research (Ley et al. 2008). Previous nutrition companion animal research has also shown higher participant response rates from dog owners (Michel et al. 2008; Freiwald et al. 2014; Dodd et al. 2019).

Feeding practices of pet owners in this study are similar to previous reports of pet feeding practices in Canada, the US and Europe (Kienzle et al. 1998; Laflamme et al. 2008), which suggests that extrapolation of these data to the general pet population is possible. Commercial dry diets were prevalent and treats were fed by almost half of pet owners. This is consistent with results from other reports (McHarg et al. 1995; Robertson 1999; Laflamme et al. 2008). However, results of this study suggest that dog and cat owners differ in their attitudes towards nutrition management of their pet and their perceptions of nutrition care received in veterinary settings. Consistent with previous studies, dogs represented in this study were more likely to be fed raw diets
and home-made diets. Concern about safety of commercial pet foods was a common motivation behind feeding those diets, a finding that had been previously associated with feeding both home-made diets (Remillard 2008) and raw diets (Morgan et al. 2017). Interestingly, more pet owners in this study fed vitamins/supplements than previous studies in the USA and Australia, which report figures of less than 10% (Freeman et al. 2006; Laflamme et al. 2008). This could be due to the increased feeding of home-made and raw diets in recent years (Oliveira et al. 2014; Seneviratne et al. 2016) and recognition that these diets have a greater likelihood of being nutritionally imbalanced. Indeed, in our study, owners who fed raw and home-cooked diets were more likely to feed vitamins/supplements daily than those who did not. This was not the case for owners who fed vegetarian or table scraps though, despite veterinary recommendations for supplementing these diets.

The frequency of veterinary visits for the dogs and cats in our study was similar to that reported by others (Wise et al. 2003; Laflamme et al. 2008). Overall, a higher proportion of pet owners (28.2%) reported buying their pet food from veterinary clinics in our study than existing reports of pet owners (5.4%) in New Zealand (Surie 2014). This may be explained by the high level of trust in veterinarians rated by dog and cat owner respondents in this study with respect to nutrition advice. Still, dog owners were less likely than cat owners to purchase pet food from veterinary clinics. This may help to explain dog owners' inclination to look for "natural ingredients" when purchasing dog food. Those beliefs may be a factor in the fact that dog owners were more likely to view their pet as healthy and rate themselves as more knowledgeable about pet nutrition than cat owners. Consequently, dog owners were also more likely to report their dog's
BCS as “ideal”. This is potentially concerning however as when respondents were asked about factors that influenced their decision on how much to feed their pet, the most common response was adjusting feeding amount based on a self-assessment of their pet’s BCS. Previous research demonstrates the tendency of pet owners to underestimate their pet’s body condition scoring, particularly in dogs (Eastland-Jones et al. 2014). This means that underestimation of BCS by pet owners can exacerbate the problem of overfeeding pets when owners misperceive how much food to provide. It also highlights the need for veterinarians to discuss with clients how much to feed their pets, as it appeared that dog and cat owners were more likely to consult their veterinarian when deciding on what to feed their pet and less likely to do so when deciding on amount. Providing owners with information on the importance of knowing what to feed and how much to feed may help to reduce owners’ beliefs that making dietary adjustments according to their perception of their pet’s weight is a replacement for veterinary advice.

Our results propose an insight into why it is important that veterinarians routinely consult on nutrition in a specific and detailed manner, particularly since this and previous research shows that owners want and expect nutritional advice from their veterinarian but do not always receive it or know how to apply it (Linder and Mueller 2014). Considering that the veterinarian is commonly reported as the primary source of nutrition information amongst pet owners (Michel et al. 2008) and yet, pet obesity rates remain substantial, this may potentially help to highlight a communication gap between veterinarians and owners when addressing owners’ feeding practices. Clients have been reported to have greater compliance with veterinary recommendations when there
is strong veterinary-client communication (Lue et al. 2008). A key factor in client perceptions of the quality of communication is the ability of veterinarians to provide thorough recommendations (Lue et al. 2008). For instance, the manner in which veterinarians pose questions in obtaining a diet history from clients has been found to impact the completeness and accuracy of the information obtained (MacMartin et al. 2018). These findings may also help to explain why most respondents in this study expressed a desire to receive nutrition recommendations from their veterinarians, yet less than half perceived they had received nutrition advice in the past year. Careful consideration of this finding is essential. It is unclear whether owners have this perception due to a lack of veterinary nutrition advice by veterinarians or a communicative gap such that the owner does not perceive to have received advice when the veterinarian offers it. Misalignment between veterinarian and owner perception has been previously described with reference to pet obesity management, with authors suggesting that veterinarians need to provide more in-depth nutrition and dietary management discussions to meet clients’ needs (White et al. 2011; Phillips et al. 2017).

Analogous to results from studies investigating human patients’ perceptions of nutrition care provided by their general physicians (Ball et al. 2012), this study suggests that pet owners do not necessarily perceive the nutrition guidance received from veterinarians as effective in managing their pet’s diet. In the context of patient care provided by physicians, for example, patients’ attitudes and beliefs regarding the care they receive were shown to influence adherence to treatments (Goff et al. 2008). The aim of veterinary nutrition care is to improve the health outcomes of patients via
improvements to owners’ understanding and feeding practices. Therefore, perceived effectiveness of guidance is an important indicator of owners’ nutrition behaviours for their pets. Frequency of veterinary visits was a significant indicator of perceived effectiveness of nutrition care when the owner visited their veterinarian more than once per year. Perhaps visiting the veterinarian more often may increase the chance of discussing nutrition and result in higher perceived effectiveness of nutrition recommendations. Another interesting factor that influenced the way owners perceived nutrition care was where they purchased their pet food from. Those who acquired it from pet stores had significantly lower odds of perceived effectiveness compared to those purchasing their pet food from veterinary clinics. This is unexpected as pet store employees are not considered primary sources of nutrition information by previously surveyed pet owners (Laflamme et al. 2008; Morgan et al. 2017) and thus, it is unlikely that information obtained from employees may reduce pet owners’ likelihood to seek nutrition information from their veterinarian. A plausible explanation is the fact that pet store staff may offer conflicting nutrition recommendations to that obtained from veterinary settings. In fact, in a study of 84 veterinary students who were pet owners (Kamleh et al. in-press), conflicting nutrition recommendations from different sources was shown to negatively influence students’ trust of nutrition information from veterinarians. Since greater trust of veterinary nutrition advice is associated with higher perceived effectiveness of veterinary nutrition care, this may help to explain why the place of acquiring pet food may play a role in pet owners’ attitudes towards effectiveness.
There are some limitations to this study. First, it is important to note that clients' perceptions of experiences with veterinarians do not necessarily reflect true occurrences. The cross-sectional study design and statistical analysis precludes assessment of causality. Non-response bias may also be a concern in this study. Since few studies have been conducted with this focus, it would be difficult to assess what changes might be made to encourage non-respondents to participate, or to determine what difference of opinion they represent. Another limitation of our study may be that the questionnaire was self-response from multiple sources, including social media platforms, and thus, owners who responded may be more interested in nutrition or have stronger opinions towards their veterinarian's advice.

Veterinarians should take a more proactive role in understanding the way that pet owners’ feeding practices and beliefs influence their perceptions of veterinary nutrition recommendations. In the context of managing pet obesity and overall health, where a fundamental goal is to assist clients to improve their pet’s dietary habits, perceptions of consultations from the perspectives of clients are important considerations. Identifying these perspectives can aid in developing nutrition support strategies provided to pet owners to improve perceptions of, self-efficacy with, and compliance with veterinary nutrition recommendations.
REFERENCES


veterinary students at the Ontario Veterinary College: implications for a veterinary nutrition curriculum." J Vet Med Educ.


FIGURES

Figure 5.1. Most common reasons reported by dog and cat owners (n=1402) for feeding home-made and raw diets.

Figure 5.2. Most common reasons reported by dog and cat owners (n=1402) that influence their decision when purchasing food for their pet (*represents p<0.05 between dog and cat owner responses).
Figure 5.3. Self-reported body condition score (BCS) of pet by dog and cat owners (n=1402) in survey regarding nutrition information-seeking attitudes and beliefs.

Figure 5.4. Dog and cat owner’ responses (n=1402) to question about what factors affect their decision on what to feed their pet. Respondents could select more than one choice. (*represents p<0.05 between dog and cat owner responses).
**Figure 5.5.** Dog and cat owner' responses (n=1402) to question about what factors affect their decision on *how much to* feed their pet. Respondents could select more than one choice. (*represents p<0.05 between dog and cat owner responses).
### Table 5.1. Demographic data of pet owners (n=1402) participating in survey regarding pet nutrition information-seeking attitudes and beliefs.

<table>
<thead>
<tr>
<th>Variable</th>
<th>N</th>
<th>%</th>
<th>Mean</th>
<th>Median</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>1402</td>
<td>39.2</td>
<td>34</td>
<td></td>
<td>19-87</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>1178</td>
<td>84.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>224</td>
<td>16.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Highest Education</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High school/GED or Associates</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Degree</td>
<td>60</td>
<td>28.2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bachelor’s Degree</td>
<td>88</td>
<td>41.3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Graduate Degree</td>
<td>65</td>
<td>30.5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Country</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>USA</td>
<td>522</td>
<td>37.2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Canada</td>
<td>880</td>
<td>62.8</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Place of residence</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Urban</td>
<td>645</td>
<td>46.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Suburban</td>
<td>533</td>
<td>38.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rural</td>
<td>224</td>
<td>16.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Work in healthcare field</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>262</td>
<td>18.7</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>1140</td>
<td>81.3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Household income</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;$19,000</td>
<td>144</td>
<td>10.3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$20,000 - $39,999</td>
<td>182</td>
<td>13.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$40,000 - $59,999</td>
<td>102</td>
<td>7.3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$60,000 - $79,999</td>
<td>397</td>
<td>28.3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$80,000 - $99,999</td>
<td>257</td>
<td>18.3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$100,000+</td>
<td>320</td>
<td>22.8</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 5.2. Demographic data of pets (n=1402) represented in survey regarding pet nutrition information-seeking attitudes and beliefs.

<table>
<thead>
<tr>
<th>Variable</th>
<th>N</th>
<th>%</th>
<th>Mean</th>
<th>Median</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>1402</td>
<td></td>
<td>6.1</td>
<td>6</td>
<td>0.2-23</td>
</tr>
<tr>
<td>Number of pets owned</td>
<td>1402</td>
<td></td>
<td>2</td>
<td></td>
<td>1-8</td>
</tr>
<tr>
<td>Type of pet in survey</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dog</td>
<td>897</td>
<td>64.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cat</td>
<td>505</td>
<td>36.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Length of pet ownership (years)</td>
<td>1402</td>
<td></td>
<td>5.3</td>
<td></td>
<td>0.2-23</td>
</tr>
<tr>
<td>Indoor pet</td>
<td>987</td>
<td></td>
<td>70.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Outdoor pet</td>
<td>25</td>
<td></td>
<td>1.78</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Indoor and outdoor pet</td>
<td>390</td>
<td></td>
<td>27.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Place of acquiring pet</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rescue/Adopted/Shelter</td>
<td>548</td>
<td></td>
<td>39.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Breeder</td>
<td>419</td>
<td></td>
<td>29.9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pet Store</td>
<td>125</td>
<td></td>
<td>8.88</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Home-bred</td>
<td>124</td>
<td></td>
<td>8.86</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Friend/family</td>
<td>99</td>
<td></td>
<td>7.09</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Online</td>
<td>87</td>
<td></td>
<td>6.17</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 5.3. Comparison of feeding behaviours\(^a\) of dog and cat owners (n=1402) represented in survey regarding pet nutrition information-seeking attitudes and beliefs.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Cats (n=505)</th>
<th>Dogs (n=897)</th>
<th>P-Value*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>%</td>
<td>n</td>
</tr>
<tr>
<td>Type of diet fed</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dry</td>
<td>319</td>
<td>82.4</td>
<td>647</td>
</tr>
<tr>
<td>Wet</td>
<td>3455</td>
<td>68.2</td>
<td>153</td>
</tr>
<tr>
<td>Home-made</td>
<td>36</td>
<td>7.1</td>
<td>219</td>
</tr>
<tr>
<td>Raw</td>
<td>106</td>
<td>11.8</td>
<td>153</td>
</tr>
<tr>
<td>Table scraps</td>
<td>65</td>
<td>12.9</td>
<td>179</td>
</tr>
<tr>
<td>Vegetarian</td>
<td>15</td>
<td>2.9</td>
<td>16</td>
</tr>
<tr>
<td>Prescription</td>
<td>128</td>
<td>25.3</td>
<td>134</td>
</tr>
<tr>
<td>Treats fed</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Homemade treats</td>
<td>24</td>
<td>4.7</td>
<td>213</td>
</tr>
<tr>
<td>Commercial treats</td>
<td>229</td>
<td>45.3</td>
<td>408</td>
</tr>
<tr>
<td>Place of pet food purchase</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Veterinary clinics/hospitals</td>
<td>190</td>
<td>37.6</td>
<td>205</td>
</tr>
<tr>
<td>Supermarket</td>
<td>99</td>
<td>19.6</td>
<td>159</td>
</tr>
<tr>
<td>Online</td>
<td>47</td>
<td>9.4</td>
<td>70</td>
</tr>
<tr>
<td>Pet store</td>
<td>336</td>
<td>66.5</td>
<td>524</td>
</tr>
<tr>
<td>Purchase raw products and make food</td>
<td>33</td>
<td>6.5</td>
<td>163</td>
</tr>
</tbody>
</table>

\(^a\) Owners could select more than one response from list.

*Represents the comparison between dog owners and cat owners using the \( z \) test of proportions; responses were considered significant at \( p<0.05 \).
Table 5.4. Frequency of seeking veterinary care for cat owners versus dog owners (n=1402) represented in survey regarding pet nutrition information-seeking attitudes and beliefs.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Cats (n=505)</th>
<th>Dogs (n=897)</th>
<th>OR (95% CIs)</th>
<th>P-Value*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency of veterinary visits</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Never</td>
<td>9</td>
<td>0</td>
<td>1.00</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>&lt;1 per year</td>
<td>95</td>
<td>47</td>
<td>4.19</td>
<td>(2.91 – 6.09)</td>
</tr>
<tr>
<td>1 per year</td>
<td>24</td>
<td>320</td>
<td>1.67</td>
<td>(1.34 – 2.09)</td>
</tr>
<tr>
<td>&gt; 1 per year</td>
<td>15</td>
<td>530</td>
<td>0.32</td>
<td>(0.25 – 0.40)</td>
</tr>
<tr>
<td>Frequency of nutrition discussions with veterinarian</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Only when my veterinarian brings it up</td>
<td>12</td>
<td>238</td>
<td>1.00</td>
<td>0.003</td>
</tr>
<tr>
<td>Each visit</td>
<td>19</td>
<td>278</td>
<td>1.37</td>
<td>(1.09 – 1.72)</td>
</tr>
<tr>
<td>Only when I have a specific question</td>
<td>99</td>
<td>163</td>
<td>1.10</td>
<td>(0.83 – 1.45)</td>
</tr>
<tr>
<td>Only when my pet presents with a health condition</td>
<td>86</td>
<td>227</td>
<td>0.61</td>
<td>(0.46 – 0.80)</td>
</tr>
</tbody>
</table>

*Responses were considered significant at p<0.05. OR: Odds Ratio (95% CIs) calculated by using multivariable logistic regression.
Table 5.5. Multivariable reduced logistic regression results of associations of dog and cat owner (n=1402) attitudes with perceived effectiveness of nutrition care received at veterinary clinics.

<table>
<thead>
<tr>
<th>Explanatory Variable</th>
<th>OR</th>
<th>95% CI</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Owner Characteristics</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Income (ref=100,000+)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;40,000</td>
<td>0.55</td>
<td>0.34 – 0.89</td>
<td>0.001*</td>
</tr>
<tr>
<td>Education level (ref=high school or less)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>College or university degree</td>
<td>3.96</td>
<td>3.01 – 4.16</td>
<td>0.009*</td>
</tr>
<tr>
<td>Graduate or professional school</td>
<td>2.12</td>
<td>1.98 – 2.44</td>
<td>0.014*</td>
</tr>
<tr>
<td>Place of residence (ref=urban)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Suburban</td>
<td>1.51</td>
<td>1.38 – 2.09</td>
<td>0.034*</td>
</tr>
<tr>
<td>Healthcare field (ref=no)</td>
<td>2.94</td>
<td>2.28 – 3.21</td>
<td>0.020*</td>
</tr>
<tr>
<td><strong>Feeding Variables</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pet Type (ref=dog)</td>
<td>1.75</td>
<td>1.52 – 1.89</td>
<td>0.044*</td>
</tr>
<tr>
<td>Length of ownership, yrs</td>
<td>0.69</td>
<td>0.24 – 0.88</td>
<td>0.001*</td>
</tr>
<tr>
<td>Diet (ref=prescription)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dry</td>
<td>2.16</td>
<td>1.27 – 2.39</td>
<td>0.009*</td>
</tr>
<tr>
<td>Place of purchasing diet (ref=veterinary clinic)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pet Store</td>
<td>0.60</td>
<td>0.42 – 0.87</td>
<td>0.042*</td>
</tr>
<tr>
<td>Tried to change (ref=no)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Decrease it</td>
<td>1.50</td>
<td>1.38 – 2.04</td>
<td>0.004*</td>
</tr>
<tr>
<td>Increase it</td>
<td>0.65</td>
<td>0.42 – 0.97</td>
<td>0.025*</td>
</tr>
<tr>
<td><strong>Health Variables</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Importance of exercise (ref=no)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>General health (ref=poor)</td>
<td>3.43</td>
<td>2.40 – 4.51</td>
<td>0.024*</td>
</tr>
<tr>
<td>Excellent</td>
<td>1.75</td>
<td>1.51 – 2.12</td>
<td>0.019*</td>
</tr>
<tr>
<td>BCS (ref=ideal)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overweight</td>
<td>0.46</td>
<td>0.33 – 0.64</td>
<td>0.005*</td>
</tr>
<tr>
<td>Veterinary visits (ref=never)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt; 1 per year</td>
<td>3.68</td>
<td>2.82 – 5.67</td>
<td>0.004*</td>
</tr>
<tr>
<td>Trust (ref=no)</td>
<td>1.45</td>
<td>1.20 – 2.3</td>
<td>0.019*</td>
</tr>
</tbody>
</table>

*p<0.05. OR: Odds Ratio. Variables entered into full model: gender, age (years), income: <$40,000, $40,000 - $59,999; $60,000 - $99,000, $100,000+; place of residence: rural, suburban, urban; pet age (years), knowledge of pet’s weight (yes/no), diet: dry, wet; homemade; raw; table scraps, prescription; place of purchasing diet: pet store, veterinary clinic, online; make own diet, pet exercise (hours), general health: poor, average, excellent; BCS: underweight, ideal, overweight; perceived pet nutrition knowledge (none, a little, a lot), veterinary visits (never, <1 per year, 1 per year, > 1 per year).
CHAPTER SIX

What factors influence pet owners’ intention to comply with nutrition recommendations by medical and veterinary health professionals? An application of the Health Belief Model

A version of this article is submitted as: Kamleh, M., Khosa, D., Dewey, C., Verbrugghe, A., & Stone, E. What factors influence pet owners’ intention to comply with nutrition recommendations by medical and veterinary health professionals? An application of the Health Belief Model. BMC Public Health.

6.1 Abstract

Nutrition-related disorders (e.g. obesity, underweight) are increasing in prevalence and affect both humans and animals adversely. Although most people are aware of nutrition recommendations for their own health, compliance remains low. The decisions that people make about nutrition for themselves and their pets are influenced by the lifestyle and environmental risk factors they share with their pets and by how they make decisions. Thus, the aim of this paper was to evaluate the intention of people who own pets to comply with medical and veterinary medical nutrition recommendations using the Health Belief Model (HBM) as a theoretical framework. Pet owners in Canada and the United States completed an online questionnaire assessing nutritional beliefs and the HBM constructs. The paired t-test, spearman's correlation and linear regression modelling were used to analyze the data. Results showed that for both owners’ own nutrition and their pet’s nutrition, perceived benefits and self-efficacy were the strongest predictors of intention to comply with nutrition recommendations from healthcare professionals. However, only in the pet nutrition model was higher intention to comply associated with lower perceived barriers to achieving better nutrition. The study suggests that participants may be motivated by different factors when deciding on
whether to comply with nutrition recommendations from their physician versus their pet’s veterinarian and are more influenced by the perceived benefits of recommendations than the perceived barriers. Outcomes of this study have health promotion and educational implications when attempting to reduce rates of nutrition-related diseases in both humans and companion animals.

6.2 Introduction

In the past decade, human and animal health professionals have increased their focus on patient-centered nutrition counselling strategies to promote healthy eating (Churchill and Ward 2016; Maximova et al. 2016). Psychological, physical, cultural, and normative barriers can be obstacles to behavioral changes, especially nutritional ones (Martin et al. 2005; Churchill and Ward 2016). Effective interaction and communication between patients and doctors (or clients and veterinarians) are crucial for the success of nutritional counselling in influencing behavioural change (Endevelt and Gesser-Edelsburg 2014; Churchill and Ward 2016; Phillips et al. 2017). Decision-making interactions between providers and patients – or, as in veterinary medicine, between providers and clients – are often occurring along a continuum. At one end, the patient or owner is fully responsible for the decision and at the other, the provider helps to guide these decisions. Nutrition counselling, including weight management, should be a part of health examinations and preventive care (Ball et al. 2012). Despite this, compliance with nutrition recommendations from health care professionals remains low (Goff et al. 2008; Ball et al. 2012; Ball et al. 2013). A suggested reason for this low compliance is individuals' common misperception of their body weight and nutritional status (Duncan
et al. 2011; Akindele et al. 2017). For example, individuals do not always believe they are overweight (Akindele et al. 2017) or underweight (Kienzle et al. 1998). This denial often causes unease and is a complicating factor during discussions on nutritional management. In fact, health care professionals may be reluctant to discuss nutrition with patients or clients because they believe that their dietary and lifestyle recommendations would not be followed, regardless of the concern and guidance they provide (Kipperman and German 2018).

The human-animal bond is strong with most pet owners viewing their pet as a family member or even like a child (Horowitz 2008). Analogous to how parents often misperceive the body shape of their children (Remmers et al. 2014), owners may believe their pets are of ideal weight when in fact they are overweight (Courcier et al. 2011). For instance, multiple studies have found disagreement between owners’ perception of body condition scoring (BCS) of their pet and the veterinarian’s assessment of the pet’s BCS (Eastland-Jones et al. 2014; Muñoz-Prieto et al. 2018). In addition, given that a parent’s role when making decisions for their child influences treatment preferences (Zikmund-Fisher et al. 2006), it may be appropriate to apply the findings from research among decisions in pediatrics to that of veterinary medicine. In a review of studies describing parents’ treatment decisions, Lipstein et al. (2012) described the complexity and diversity of influences on parent decision making. For instance, parents are influenced in their decision making by changes in their child's health status, other community members, prior knowledge, and personal factors, such as emotion. In addition, most parents were interested in sharing their decision-making process with their provider.
In veterinary medicine, previous literature has discussed factors that influence pet owners’ attitudes towards feeding management of their pets (e.g. why they feed specific diets) (Laflamme et al. 2008; Seneviratne et al. 2016; White et al. 2016; Morgan et al. 2017; Dodd et al. 2019). Veterinarians are frequently cited as the primary source of nutrition information for pet owners (Michel et al. 2008), yet there is a lack of research on the decision-making process in the veterinary setting. Although research on how to develop effective communication strategies for veterinarians has been conducted (Linder and Mueller 2014; Phillips et al. 2017), pet owners’ attitudes towards the nutrition information that they receive from their veterinarian has not been extensively addressed (MacMartin et al. 2018). In human medicine, studies have explored the psychosocial factors that might influence effective adherence to medical recommendations (Martin et al. 2005; Jaworski et al. 2018). The patient’s attitude toward their own health and nutrition recommendations is of particular significance in this context. In patients with a specific disease or condition, their attitude toward a disease can be defined in three dimensions: cognitive (the patient’s knowledge about the disease and treatment process), emotional (emotions the patient experiences regarding the disease), and behavioural (actions taken by the patient with respect to the disease and treatment process) (Petersen et al. 2011). A positive attitude toward treatment and health can promote more effective adherence to medical and dietary recommendations for both owners’ own health management and towards their pet’s health (Kanji et al. 2012; Jaworski et al. 2018).

The Health Belief Model (HBM) is a widely accepted conceptual frameworks in human health promotion research for explaining, predicting, and influencing health-
related behaviour (Rosenstock et al. 1988). The underlying concept of the model is that the personal beliefs or perceptions about a health condition influence individuals’ willingness to engage in preventive health behaviour. According to the HBM, a patient is most likely to comply with healthcare recommendations if they feel that they are vulnerable to developing adverse health outcomes (perceived susceptibility), believe that those problems will have a highly undesirable impact (perceived severity), perceive that healthcare professionals’ recommendations will be effective in reducing the risk of these outcomes (perceived benefits), can easily seek a healthcare professional’s advice (perceived barriers), and feel confident that they will be able to utilize the advice (perceived self-efficacy).

Several papers have applied this theory to explain health behaviours in the human medical context. Park (2011), for example, studied factors affecting female adolescents’ intention to control their weight as measured by the elements of the HBM. The HBM has also been directly used to understand caregiver factors influencing decision-making of various child health outcomes, including vaccination rates and eating behaviours (Jacobson Vann et al. 2011, Smith et al. 2011; Salari and Filus 2016).

Although the HBM was used in veterinary medicine to assess intention of owners to vaccinate their pets, (Beyene et al. 2018). it has not been used to evaluate potential compliance with nutrition recommendations. Given the utility and applicability of the HBM in explaining beliefs and perceptions underlying decision-making, it may be a useful framework to explore pet owners’ nutrition-related habits. Despite shared lifestyle, decision-making and environmental risk factors for nutrition in people and their animals, the link between the beliefs that influence owners’ compliance with nutrition
advice for their own health and those that affect their compliance towards veterinary nutrition recommendations remains unexplored. Therefore, the aim of this study was to (1) examine pet owners’ beliefs about their own nutrition versus their pet’s nutrition and (2) to assess how well the constructs of the HBM predict the factors affecting pet owners’ behavioural intention to comply with medical or veterinary nutrition recommendations.

6.3 Methods

6.3.1 Research Participants

Participants were pet owners who own and care for at least one dog and/or cat. Inclusion criteria included being at least 18 years of age and residing in the US or Canada. All subjects gave their informed consent for inclusion before they participated in the study. The study was approved by the University’s Research Ethics Board (REB#16JA039).

6.3.2 Study Procedures

This cross-sectional study consisted of a questionnaire tool that is consistent with the one used in Chapter 5. The aim of the part of the questionnaire presented in this chapter was to assess pet owners’ general beliefs toward nutrition and exercise behaviours for themselves and their pet, as well as attitudes towards nutrition recommendations received from health care professionals. After a pilot test with a convenience sample of 17 pet owners, the initial version of the questionnaire was edited and refined for question flow and clarity. Individuals who performed the pilot testing were not included in the final data analysis. The final Qualtrics © (2017, Provo, Utah) survey was distributed via social media platforms, online blogs and the university’s
communication bulletin. Access was made available from October 2018 – January 2019. Each respondent was asked to complete two analogous sections in the questionnaire: one for their own nutrition beliefs and one for their beliefs about their pet’s nutrition. Respondents who owned more than one dog and/or cat were asked to choose one pet for which they answered all survey questions. Responses from owners pertaining to pets other than dogs and/or cats were excluded. All responses remained anonymous and respondents were given the option to enter a gift card prize draw upon completion via a separate questionnaire.

6.3.3 Variables

Development of the questionnaire instrument followed the procedure outlined by Rosenstock (1988) for the construction of an instrument consistent with the HBM. The final 47-item questionnaire included three sections: demographics, general health beliefs and weight reduction behaviours, and the HBM constructs. All variables were self-reported. Multiple choice and close-ended questions were used to record demographic variables and measure dietary and exercise behaviours. Owner demographic variables included age (years), gender, educational level (categorical), marital status, number of children, employment status, household income and urban/rural living. Pet demographic variables included type of pet (cat or dog), age (years), length of ownership and place of acquiring pet. Health and exercise variables were related to nutrition habits, exercise behaviours, level of perceived nutrition knowledge, information-seeking and general health self-rating and were all measured on 5-point Likert scales (e.g. 1=not at all healthy, 5=extremely healthy). Health Belief Model constructs were also measured using five-point Likert scales (1=strongly
A final score was calculated for each construct by summing respondents’ responses to five-point Likert statements pertaining to the construct. The lower range indicated a lower construct score (i.e. respondents answered on the lower end of the Likert scale for the statements within the construct). For example, the outcome variable – intention to follow nutrition recommendations (behavioural intention) – was measured by summing responses to six Likert statements surrounding likelihood of following specific nutrition recommendations provided by their health care professionals (range 5-30). A higher score indicates higher intention to follow nutrition recommendations. Reliability was assessed using Cronbach’s alpha for each of the six constructs.

Using Janz and Becker’s (1984) schematic, Figure 6.1 represents the context and population of this study as it applies to the HBM. The perceived threat construct consisted of the susceptibility construct (range: 5-25), with a higher score reflecting higher perceived risk developing nutrition-related illness, and perceived severity construct (range: 5-25) measured similarly, with a higher score representing greater perceived seriousness of such outcomes. The perceived benefits construct (range: 5-25) consisted of five statements, with a higher score reflecting more perceived advantages complying with nutrition recommendations from veterinarian or physician for their pet’s or own health, respectively. The perceived barriers construct (range: 5-25), measured in the same manner, with a higher score indicating greater perceived barriers to following nutrition recommendations. A higher score of the self-efficacy construct (range: 5-25) represented greater confidence in one’s ability to know how to apply nutrition recommendations from a healthcare professional. The cues to action (internal
or external factors that trigger health actions (Rosenstock et al. 1988) were each measured as yes/no questions (range: 0-15).

6.3.4 Statistical Analysis

Sample size was determined a-priori using a conservative alpha estimate of 0.5, margin of error of 5% and a 95% Confidence Interval. Based on these parameters, a minimum sample size of 348 was required. Statistical analysis was performed using SAS (SAS Institute, Cary, North Carolina, USA). Descriptive statistics including frequencies and measures of central tendencies and dispersion (range and standard deviation) were used to describe demographic variables and general health beliefs. Paired sample t-tests were applied as appropriate to compare HBM construct means between responses for own nutrition and pet responses. Pearson’s r was used to determine the relationship among HBM constructs. Chi-square tests were used for univariable associations among categorical demographic variables and general health beliefs and attitudes.

Two multivariable linear regression models were used to identify the best predictor for intention to follow nutrition recommendations based on the HBM for their own nutrition and their pet’s nutrition. The dependent variable was the sum of responses to six statements as mentioned above. Independent variables include each of the HBM constructs (perceived susceptibility, perceived severity, perceived benefits, perceived barriers, self-efficacy), cues to action variables (sources of nutrition information, number of visits to healthcare professional/year, frequency of nutrition discussion with healthcare professional, factors influencing decision to discuss nutrition with veterinarian), having a relative/healthcare professional that’s a doctor/veterinarian
and demographic variables (age (years), gender, children (yes/no), type of pet (cat/dog) and education level). The following strategy was used to build the final models: (1) screening variables (using liberal \( p<0.2 \)) and estimating correlation among HBM construct variables (variables with correlation coefficients greater than \(|0.7|\) were removed); (2) building multivariable model; (3) creating and evaluating all possible 2-way interaction terms significant in the final model; (4) checking for presence of confounding; and (5) the variance inflation factor (VIF) was used to examining the multicollinearity among the variables where VIF>10 were assumed to indicate collinearity. Standardized residuals were used to assess goodness-of-fit of the models and presences of outliers was checked. \( R^2 \) was calculated to assess the variance explained by the model. Statistical significance was set at \( p<0.05 \).

6.4 Results

6.4.1 Sample Characteristics

In total, 1402 adults completed the questionnaire (Table 6.1). Most respondents were female (1178; 84%) and mean age of respondents was 39.2 years (range 19-87). Over half of respondents (880; 63%) resided in Canada and the remaining (37%) resided in the USA at the time of questionnaire completion. The majority lived in either urban (645; 46%) or suburban (533; 38%) areas, although some resided in rural communities (224; 16%).

Mean age of pet in this sample was 6.1 years (range 0.2-23). Fifty-six percent of respondents owned more than one type of pet (785), with a mean of 2 pets per household (range, 1-8). The final sample represented more responses pertaining to
dogs (897; 64%) than cats (505; 36%). Average length of pet ownership was 5.3 years (range 0.2 – 23).

6.4.2 General Health Beliefs and Nutrition Attitudes

Respondents' self-reported general health status for themselves and their pets is shown in Figure 6.2. They were significantly (p<0.001) more likely to rate their pet’s health as excellent compared to their own. In turn, respondents also rated their pet's current diet as significantly healthier than their own diet (p<0.001) (Figure 6.3).

Respondents were 1.64 times (p<0.001) more likely to report thinking about their pet’s nutrition more often than their own. A higher proportion of owners (p<0.001) reported trying to reduce their own weight in the past year (1129, 80.5%) than their pet’s weight (645, 46.0%). On the other hand, 32.0 % (449) of owners reported never trying to alter their pet’s weight.

Owners reported a mean level of exercise 12.4 hours/week for their pets and 13.3 hours/week for themselves. Overall, respondents considered exercise to be equally important for their own health and their pet’s health. The most common barriers to exercising were not enough time (831, 59.3%), lack of motivation (440, 31.4%) and health issues (306, 21.8%).

Table 6.2 shows a summary of respondents' nutrition information-seeking behaviours. In general, respondents were more likely to take their pet to the veterinarian more often than visiting their doctor for their own health (p<0.001). In addition, discussions with the veterinarian surrounding nutrition were more frequent than nutrition discussions with their doctor. When asked about the top sources that respondents seek nutrition
information from, differences between their own nutrition and their pet nutrition responses were observed, as shown in Table 6.2.

6.4.3 Health Belief Model Constructs

Cronbach's $\alpha$ of the perceived threat scale was 0.841, 0.990 for the perceived benefits scale, 0.905 for the perceived barriers scale, 0.913 for the cues to action scale and 0.867 for the perceived nutrition self-efficacy scale all reflecting good internal consistency. As the level of internal consistency for all constructs was greater than 0.7, we summed the Likert scale responses for each construct.

The mean and standard deviation (SD) of the Health Belief Model constructs subscales are shown in Table 6.3. The paired t-test indicated that there were significant differences in the perceived threat constructs between respondents' beliefs for their own nutrition and their pet's nutrition. While respondents perceived themselves to be more susceptible to nutrition-related illnesses in comparison to their pet ($p=0.016$), they reported a higher mean score of perceived severity of nutrition-related illness in their pet compared to their own health ($p=0.012$). Results also showed that self-efficacy was higher for respondents' own nutrition versus their pet, indicating they may feel they are more confident in applying nutrition recommendations from a doctor for their own dietary habits ($p=0.0003$).

There were observed differences between respondents who had children and those who did not. Respondents who had and cared for children were more likely to report a higher mean score of perceived susceptibility for their pet ($p=0.002$) and higher mean score of cues to action ($p=0.001$).
Table 6.4 shows the correlation coefficients between all HBM constructs and perceived knowledge. Except for the correlation between self-efficacy and cues to action, all other HBM constructs showed significant correlation (p<0.001) to cues to action for both respondents’ health beliefs about their own nutrition and their pet’s nutrition. Perceived barriers were the only construct that was not significantly correlated with respondents’ perceived knowledge for their own nutrition (p=0.221) and their pet’s nutrition (p=0.291). Perceived knowledge was most highly correlated with perceived severity of nutrition-related diseases, indicating that those who considered themselves more knowledgeable about their own nutrition (r=0.624, p<0.001) and their pet’s nutrition (r=0.712, p<0.001) were significantly more likely to perceive nutrition-related diseases as serious health outcomes.

6.4.4 Intention to Follow Nutrition Recommendations from Health Care Professional

A number of significant relationships were found among behavioural beliefs and motivation to comply with nutrition recommendations. The variables that remained significant in the final models are shown in Table 6.5. Analyses omitted the cues to action construct since most cues did not significantly affect intention to follow recommendations. The strongest predictors for the intention to comply with nutrition recommendations from both a doctor and the veterinarian were perceived self-efficacy and perceived benefits. While perceived susceptibility was significant, perceived severity was not a predictor of respondents’ intention to follow a healthcare professionals’ recommendation and was thus removed from the final model.
The intention to follow nutrition advice from a veterinarian was positively associated with perceived benefits while negatively associated with perceived barriers. Respondents’ self-reported health status was also significant; those who perceived themselves to be healthier reported lower intention to follow their physician’s nutrition advice. Similarly, those who perceived their pet to be healthier are less likely to follow veterinary nutrition recommendations. In the model pertaining to responses about pet nutrition, cat owners were more likely to follow their veterinarians’ advice on nutrition than dog owners.

The adjusted $R^2$ value was .613 for the model pertaining to respondents’ own nutrition, indicating that 61 percent of the variance in intention to follow a physician’s nutrition advice can be explained by the model. Similarly, 72% of the variance in the pet nutrition model is explained by model predictors.

6.5 Discussion

This study demonstrates the value in applying the HBM to predict and understand the intention of pet owners to follow nutrition recommendations. Perceived self-efficacy and perceived benefits were the strongest predictors of pet owners’ intention to comply with the advice provided by their doctors and veterinarians for their own nutrition and their pet’s nutrition, respectively.

In this study, gender and age of the owner or the pet were not significant predictors of self-reported compliance with nutrition advice. This is in line with previous studies examining factors that influence medical adherence in adults. For example, in examining compliance with antihypertensive therapy, Monane et al. (1996) found no
relationship between compliance and gender. While some studies reported an association between advanced age and higher compliance to medical recommendations (Chan et al. 2010), others reported no associations (Rolnick et al. 2013). We found higher intention to follow nutrition recommendations from both human and veterinary doctors with higher educational status, yet perceived knowledge of nutrition was not associated with intention to follow recommendations. In fact, several studies have found that knowledge of a specific disease is not associated with educational level (Mehrotra et al. 2000; Beyene et al. 2018).

Respondents rated their own health and their own diet more negatively than how they rated their pet’s health and diet. The actual health status of the people and their pets was not determined, but misperception of a pet’s body weight and health status has been previously reported (Courcier et al. 2011; Eastland-Jones et al. 2014). Respondents were also significantly more likely to think about their pet’s nutrition compared to their own. Giving more thought to their pet’s diet may help to explain why respondents perceived that their pet was less susceptible to nutrition-related health consequences. Another possible explanation is that owners were more likely to consult and discuss nutrition with their veterinarian, thus, developing a greater sense of satisfaction with their pet’s health than their own. In contrast, only 27.3% of respondents cited their physician as their primary source of nutrition information, with more than 60% utilizing online websites and blogs. The level of satisfaction with one’s health based on information-seeking behaviours is a topic that has been explored by previous research (Tustin 2010; Simou et al. 2015). For example, patients who rated the Internet as a
better source of information than their doctor were significantly more likely to be
dissatisfied with their health status (Tustin 2010).

Our findings are consistent with reports that indicate perceived benefits is one of
the most powerful predictors of protective intentions (Heininger 2009; Chen 2015). In
the context of our study, this indicates that respondents are more likely to follow medical
and veterinary nutrition recommendations if they believe that this advice will be
beneficial to their own or their pet’s overall health. In the multivariable model, it was also
clear that having a relative or close friend that is a doctor or veterinarian was positively
associated with respondents’ intention to follow nutrition advice. Similarly, in a study of
factors influencing dog owners’ intention to vaccinate against rabies, Beyene et al.
(2018) found that those who had a close relationship with a healthcare professional
were more likely to vaccinate their dogs. One reason for this may be that respondents
who interact with healthcare professionals (doctors or veterinarians) are more likely to
trust their advice and thus, perceive higher benefits in following their recommendations.
The perceived barriers construct however, in our study, was a significant influence on
their compliance with recommendations for their pet’s nutrition but not for their own
nutrition. There are several possible explanations for this. Respondents were less likely
to seek nutrition advice from their physician and thus, the examples of barriers
presented in the survey (e.g. no time, conflicting recommendations) might not be
encountered with a physician. In contrast, respondents reported visiting their
veterinarian more often than their physician and thus, may experience more barriers in
seeking and following nutrition recommendations. Indeed, the cost of veterinary care is
one such barrier that has been extensively documented in the literature (Bland et al.)
Other barriers include conflicting recommendations from different veterinarians and feelings of unease with discussing their pet’s nutrition, especially if the owner is overweight (Kipperman and German 2018). These results may help to inform veterinarians and other healthcare professionals on the importance of addressing tailoring nutrition recommendations to address any barriers, which may potentially improve compliance to nutrition recommendations.

Nutrition counselling that focuses on behavioural attitudes along with lifestyle interventions have been shown to be beneficial in weight management strategies for both owners and their pets (Bartges et al. 2017). This is reinforced by the results of the model in our study, which showed that self-efficacy was highly associated with intention to follow recommendations. Pet owners who feel confident in applying the veterinary nutrition advice to their pet’s diet were more likely to follow recommendations. The notion of a personalized veterinary-client relationship and patient-centered counselling has been previously addressed in client adherence research (Lue et al. 2008). When a veterinarian tailors nutrition recommendation to the owner’s beliefs and situation in addition to the pet’s condition, it may help the owner apply those recommendations to the pet’s diet and overcome any misconceptions they may have (Bland et al. 2010). Researchers have linked the presence or absence of a client-tailored recommendation to a range of outcomes, including satisfaction and adherence to medical recommendations (Frankel 2006). This relationship was also documented for owners’ own health and is similar to other reports that established the role of self-efficacy in predicting health behaviours, including healthy eating and intention to follow medical recommendations (Salahshoori et al. 2014; Oshotse et al. 2018).
It is worth noting that although respondents perceived their pet’s health as better than their own and consulted their veterinarian more often, they were more confident with applying nutrition recommendations from their doctor than applying those from their veterinarian. Our data does not provide an explanation for this finding. It is possible that respondents may have rated their pet’s health better than it actually is. In fact, research shows that caregivers tend to misperceive their dependent’s health and diet status (Heitzinger et al. 2014), for example as is the case among parents and their children (Duncan et al. 2011). Considering that pet owners play the primary role in their pet’s health and nutrition, much like parents do with their children (German 2015), it is possible that they misperceive their pet’s health and diet. Furthermore, research in the medical literature demonstrates that when individuals make medical decisions for themselves, they consider different factors than when making decisions for others (Zikmund-Fisher et al. 2006; Batteux et al. 2019). This concept of “accountability” (i.e. when a caregiver feels responsible for a child or pet) results in caregivers taking more risk-averse decisions for others than for themselves in the same situation (Stone et al. 2013); which may explain why respondents in our study felt more confident in applying nutrition recommendations for themselves than their pet.

In human medicine, many public health campaigns aim to improve awareness of nutrition through nutrition courses or intervention programs by emphasizing the severity of adverse outcomes resulting of poor nutrition. However, our study results showed that perceived severity of nutrition-related diseases was not a predictor of the respondent’s intention to follow nutrition advice from their doctor or veterinarian. Their current health status (and their pet’s current health status) along with the perceived susceptibility
construct were stronger predictors. Therefore, individuals are more likely to apply nutrition advice if they felt that they themselves or their pet were at immediate risk of an adverse health outcome, rather than if they perceived themselves to be at low risk, regardless of how severe the outcome would potentially be. Perceived susceptibility and severity were also significantly correlated with self-efficacy, a finding that is unique and interesting. For both their own nutrition and their pet’s nutrition, owners who perceived a higher threat of nutrition-related diseases were more likely to perceive higher self-efficacy. This may be due to psychological determinants that play a role in medical compliance (Petersen et al. 2011). In this case, if respondents felt they are at immediate threat for nutrition-related conditions, they might exert greater effort and have higher incentive to understand and apply nutrition recommendations and in turn, feel more confident about it.

A limitation of our study is that respondents were self-selected and all responses were self-reported and thus, we did not assess actual health status or nutrition knowledge of the owner or pet. Nonetheless, applying the Health Belief Model as a theoretical framework allowed us to evaluate factors that may affect the likelihood of that pet owners intend to follow nutrition recommendations from their healthcare professional. Unquestionably there is great potential in employing a One Health framework to provide novel solutions for the prevention and treatment of nutrition-related health consequences (Bartges et al. 2017). Our findings indicate that for people who own pets, their intention to follow their physician’s recommendations for their own nutrition is strongly influenced by their educational level, perceived susceptibility to adverse nutrition-related health consequences, self-efficacy and the perceived benefits
of nutrition recommendations. These predictors were also significant in explaining their intention to follow pet nutrition recommendations from their veterinarian. In addition, perceived barriers to receiving nutrition advise also affected the intentions of pet owners to follow nutrition recommendations.

The results of this study have policy and educational implications when attempting to reduce rates of nutrition-related diseases in both humans and companion animals. Specifically, prevention efforts aimed at improving uptake of nutrition recommendations may be more effective if they focus on the benefits of seeking professional nutrition advice and improving individuals' self-efficacy rather than only on nutrition-related health consequences. This may aid in increasing compliance to nutrition recommendations. Improving shared decision making in veterinary medicine can only be accomplished when there is an understanding of how owners perceive, make, and wish to make, medical decisions for their pets.
REFERENCES


Figure 6.1. Schematic of the Health Belief Model adapted for the population in this study. The model was used as a theoretical framework to explain and predict pet owners’ intention to comply with nutrition recommendations from health care professionals for their own nutrition and their pet’s nutrition.

Figure 6.2. Pet owners’ (n=1402) self-reported general health status for own health and their pet’s health on questionnaire that assessed nutrition attitudes and behaviours.
**Figure 6.3.** Pet owners’ (n=1402) responses to how healthy they perceive their current diet and their pet’s diet to be on questionnaire that assessed nutrition attitudes and behaviours.
### Table 6.1
Demographic characteristics of pet owners (n=1402) responding to questionnaire on attitudes towards recommendations from health care professionals for their own nutrition and their pet’s nutrition.

<table>
<thead>
<tr>
<th>Demographic variable (N=1402)</th>
<th>N (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>1178 (84.0)</td>
</tr>
<tr>
<td>Male</td>
<td>224 (16.0)</td>
</tr>
<tr>
<td>Academic Degree</td>
<td></td>
</tr>
<tr>
<td>High school/GED</td>
<td>395 (28.2)</td>
</tr>
<tr>
<td>Bachelor's Degree</td>
<td>579 (41.3)</td>
</tr>
<tr>
<td>Graduate Degree</td>
<td>428 (30.5)</td>
</tr>
<tr>
<td>Country</td>
<td></td>
</tr>
<tr>
<td>USA</td>
<td>522 (37.2)</td>
</tr>
<tr>
<td>Canada</td>
<td>880 (62.8)</td>
</tr>
<tr>
<td>Children</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>359 (25.6)</td>
</tr>
<tr>
<td>No</td>
<td>1043 (74.4)</td>
</tr>
<tr>
<td>Place of residence</td>
<td></td>
</tr>
<tr>
<td>Urban</td>
<td>645 (46.0)</td>
</tr>
<tr>
<td>Suburban</td>
<td>533 (38.0)</td>
</tr>
<tr>
<td>Rural</td>
<td>224 (16.0)</td>
</tr>
<tr>
<td>Employment status</td>
<td></td>
</tr>
<tr>
<td>Employed</td>
<td>986 (70.3)</td>
</tr>
<tr>
<td>Unemployed</td>
<td>416 (29.7)</td>
</tr>
<tr>
<td>Household income*</td>
<td></td>
</tr>
<tr>
<td>&lt;$19,000</td>
<td>144 (10.3)</td>
</tr>
<tr>
<td>$20,000 - $39,999</td>
<td>182 (13.0)</td>
</tr>
<tr>
<td>$40,000 - $59,999</td>
<td>102 (7.3)</td>
</tr>
<tr>
<td>$60,000 - $79,999</td>
<td>397 (28.3)</td>
</tr>
<tr>
<td>$80,000 - $99,999</td>
<td>157 (11.2)</td>
</tr>
<tr>
<td>$100,000+</td>
<td>320 (22.8)</td>
</tr>
<tr>
<td>Have health professional or veterinarian relative</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>407 (29.0)</td>
</tr>
<tr>
<td>No</td>
<td>995 (71.0)</td>
</tr>
<tr>
<td>Pet Type</td>
<td></td>
</tr>
<tr>
<td>Dog</td>
<td>897 (64.0)</td>
</tr>
<tr>
<td>Cat</td>
<td>505 (36.0)</td>
</tr>
</tbody>
</table>
Table 6.2. Comparison of attitudes of seeking nutrition information among pet owners (n=1402) for their own nutrition versus for their pet’s nutrition.

<table>
<thead>
<tr>
<th>Variable</th>
<th>For Own (n=1402)</th>
<th>For Pet (n=1402)</th>
<th>p-value*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency of regular doctor/veterinarian visit</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Only in case of emergencies</td>
<td>254 18.1</td>
<td>7 0.5</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>&lt;1 per year</td>
<td>255 18.2</td>
<td>123 8.8</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>1 per year</td>
<td>579 41.3</td>
<td>544 38.8</td>
<td>0.1770</td>
</tr>
<tr>
<td>&gt; 1 per year</td>
<td>314 22.4</td>
<td>718 51.2</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Frequency of nutrition discussions with doctor/veterinarian</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Each visit</td>
<td>251 17.9</td>
<td>534 38.1</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Only when my doctor/veterinarian brings it up</td>
<td>332 23.7</td>
<td>353 25.2</td>
<td>0.358</td>
</tr>
<tr>
<td>Only when I have a specific question</td>
<td>380 27.1</td>
<td>276 19.7</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Only when I/ my pet present with a health condition</td>
<td>439 31.3</td>
<td>238 17.0</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Sources of nutrition information**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Doctor/veterinarian</td>
<td>383 27.3</td>
<td>876 62.5</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Online websites</td>
<td>498 35.5</td>
<td>590 42.1</td>
<td>0.0003</td>
</tr>
<tr>
<td>Blogs</td>
<td>447 31.9</td>
<td>101 7.2</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Grocery/pet store</td>
<td>74 5.3</td>
<td>240 17.1</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

*Significance is at p<0.05. Assessed using paired t-tests. **Respondents could select more than one source of information.
Table 6.3. Mean score of Health Belief Model (HBM) components for owners’ own nutrition and their pet’s nutrition.

<table>
<thead>
<tr>
<th>Variable name</th>
<th>Own Nutrition</th>
<th>Pet Nutrition</th>
<th>p-value*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
</tr>
<tr>
<td>Perceived susceptibility</td>
<td>12.5</td>
<td>0.82</td>
<td>8.8</td>
</tr>
<tr>
<td>Perceived severity</td>
<td>16.2</td>
<td>1.02</td>
<td>21.4</td>
</tr>
<tr>
<td>Perceived benefits</td>
<td>14.7</td>
<td>1.28</td>
<td>15.1</td>
</tr>
<tr>
<td>Perceived barriers</td>
<td>20.1</td>
<td>2.02</td>
<td>23.9</td>
</tr>
<tr>
<td>Self-efficacy</td>
<td>11.4</td>
<td>0.69</td>
<td>7.2</td>
</tr>
<tr>
<td>Cues to action</td>
<td>14.3</td>
<td>1.73</td>
<td>15.1</td>
</tr>
</tbody>
</table>

SD=standard deviation, HBM = health belief model. * Derived from paired t-test. Significance is at p<0.05.
Table 6.4. Correlations between Health Belief Model (HBM) model constructs. Pearson correlation coefficient (r) for each construct by respondents’ beliefs about their own nutrition and about their pet’s nutrition.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Perceived susceptibility</th>
<th>Perceived severity</th>
<th>Perceived benefits</th>
<th>Perceived barriers</th>
<th>Self-efficacy</th>
<th>Cues to action</th>
<th>Perceived nutritional knowledge</th>
<th>Knowledge</th>
</tr>
</thead>
<tbody>
<tr>
<td>Own Nutrition (n=1402)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cues to action</td>
<td>0.688 P &lt; 0.001</td>
<td>0.608 P &lt; 0.001</td>
<td>0.342 P &lt; 0.001</td>
<td>-0.412 P &lt; 0.001</td>
<td>0.253 P=0.45</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perceived nutritional knowledge</td>
<td>0.427 P &lt; 0.001</td>
<td>0.624 P &lt; 0.001</td>
<td>0.214 P &lt; 0.001</td>
<td>-0.300 P=0.221</td>
<td>0.449 P &lt; 0.001</td>
<td>0.519 P=0.0</td>
<td>36</td>
<td></td>
</tr>
<tr>
<td>Pet Nutrition (n=1402)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cues to action</td>
<td>0.748 P &lt; 0.001</td>
<td>0.608 P &lt; 0.001</td>
<td>0.342 P &lt; 0.001</td>
<td>-0.537 P &lt; 0.001</td>
<td>0.161 P=0.291</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perceived nutritional knowledge</td>
<td>0.514 P &lt; 0.001</td>
<td>0.712 P &lt; 0.001</td>
<td>0.153 P &lt; 0.001</td>
<td>-0.104 P=0.287</td>
<td>0.102 P &lt; 0.001</td>
<td>0.480 P=0.0</td>
<td>18</td>
<td></td>
</tr>
</tbody>
</table>
Table 6.5. Multivariable linear regression models predicting pet owners' (n=1402) intention to follow health care professionals' nutrition advice for their own nutrition and their pet's nutrition, showing coefficients, standard error and significance values.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Own Nutrition</th>
<th>Pet Nutrition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type of pet (cat vs dog)</td>
<td>0.78 (0.008)</td>
<td>1.89 (0.303)*</td>
</tr>
<tr>
<td>Education Level</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Graduate or Professional Degree</td>
<td>3.71 (0.37)*</td>
<td>3.4 (0.87)*</td>
</tr>
<tr>
<td>Health professional relative/ friend (yes)</td>
<td>1.87 (0.361)*</td>
<td>2.14 (0.119)**</td>
</tr>
<tr>
<td>Perceived susceptibility</td>
<td>2.36 (0.962)*</td>
<td>2.12 (1.219)*</td>
</tr>
<tr>
<td>Perceived benefits</td>
<td>3.56 (0.734)*</td>
<td>4.12 (1.321)*</td>
</tr>
<tr>
<td>Perceived barriers</td>
<td>-2.50 (0.889)</td>
<td>-3.562 (0.412)**</td>
</tr>
<tr>
<td>Perceived self-efficacy</td>
<td>3.31 (0.111)**</td>
<td>4.00 (0.146)**</td>
</tr>
<tr>
<td>Positive Health (own/pet)</td>
<td>-1.77 (0.158)*</td>
<td>-2.94 (0.264)*</td>
</tr>
<tr>
<td>Adjusted R²</td>
<td>0.613*</td>
<td>0.725*</td>
</tr>
</tbody>
</table>

*p<0.05.  **p<0.01.
Reference categories: gender – male, type of pet – dog and education level – high school.
Variables entered into full model: age, gender, children (yes/no), perceived severity, cues to action, and perceived knowledge.
7.1 Overview of Findings

The research in this thesis combined data from two separate but interconnected studies. In Study 1, we conducted four qualitative focus group discussions, which were used to familiarize ourselves with the nutrition information and perceptions that veterinary students have as they enter veterinary school. The use of qualitative data allowed us to gain an in-depth overview of a previously unexplored topic in veterinary medicine. After a thematic content analysis, the results of these discussions were then used to develop a quantitative questionnaire tool that was first used to investigate the knowledge and perceptions of veterinary students in their first semester of their Doctor of Veterinary Medicine (DVM) program at the Ontario Veterinary College (OVC) (Chapter 3). Then the same questionnaire tool was distributed to entering students at the other four Canadian veterinary schools and selected USA veterinary schools. The data was analyzed to determine the perceived importance, emphasis and confidence in veterinary nutrition education of these entering students (Chapter 4). In Study 2, we employed a similar mixed-methods approach to identify the perspectives of pet owners with seeking nutrition information for their own health and their pet’s health. Following six focus group discussions and thematic content analysis, we conducted a cross-sectional quantitative study on pet owners in Canada and the US.

There were four main findings of this research. The first two contribute to veterinary medical education by providing evidence that incoming veterinary students
have perceptions about their own nutrition and pet nutrition through their prior experiences and knowledge that may influence their uptake of veterinary nutrition education. These findings also demonstrate that while students considered nutrition education in veterinary school to be important, they did not believe they will receive enough and adequate nutrition preparation to confidently discuss nutrition with clients. The third finding made a contribution to research on nutrition consulting in veterinary and medical settings by explaining pet owners’ diet motives and perceptions of nutrition information provided in veterinary and medical clinics. Using a theory-based contextualized approach, the fourth finding clarified which health beliefs influence intention to comply with human and veterinary medical nutrition recommendations, and contributed to explaining how pet owners’ own health beliefs are aligned with their beliefs for their pet’s health. In this final thesis chapter, these findings are discussed in light of contributions to the existing literature and the implications for veterinary nutrition education and practice, with recommendations for future research and possible extrapolation to human medical contexts and other health sciences disciplines.

7.2 Discussion and Implications of Key Findings

7.2.1 Study 1

7.2.1.1 Chapter 3

Chapter 3 presented results from the first aim of this study, which was to investigate the nutrition-related perceptions and information-seeking behaviours of incoming veterinary students. The results from the qualitative and quantitative methods contributed to a growing body of research on nutrition education in veterinary and medical schools. Students reported nutrition beliefs that paralleled those reported
among pet owners in the general population. This was a novel and unique finding. Research investigating nutrition perceptions of veterinary students is limited, with previous research focused on the perspectives of graduating veterinary students on their satisfaction with their nutrition education and perceived confidence with consulting clients on nutrition (Lewis 1996; Delaney 2011). In our research, we found that the perceptions of incoming students about nutrition were consistent with previous research surrounding pet owners’ nutrition attitudes and feeding decisions for their pets (Laflamme et al. 2008). For example, cost was one of the most commonly reported determinants when considering what to feed their pet. Similar findings have been reported in studies that investigated preferences of pet owners from the general population when buying pet food (Suarez et al. 2012; Freiwald et al. 2014). Students’ feeding habits for their pets also mirrored those reported in the literature for pet owners; for example, over 80% of students fed commercial food, which is a similar prevalence to that reported amongst pet owners in industrialized countries (Robertson 1999; Laflamme et al. 2008; White et al. 2016). Similarly, results for treat feeding among students was similar to that reported among dog owners in the literature (Laflamme et al. 2008); yet, we did not compare treat feeding between student dog and cat owners in our study.

Furthermore, the study highlighted the difficulty that students face in knowing where to access reliable nutrition information. Student narratives uncovered that students feel pet nutrition information is “scattered”, “hard to trust” and “completely wrong”. This is an important consideration that has been previously discussed in the context of medical student education (Connor et al. 2015) as well as for nutrition
behaviours in the general public (Quaidoo et al. 2018). Nutrition is a field that is constantly evolving, with conflicting opinions and recommendations. Therefore, accessing reliable nutrition information remains a struggle when seeking both human and pet nutrition information (Drichoutis, et al. 2006; Kogan et al. 2010). Adequate nutrition knowledge has been described as having an awareness of practices and concepts related to nutrition including appropriate dietary intake and wellbeing, food intake and disease, foods signifying key sources of nutrients and dietary guidelines and references (Miller and Cassady 2015). Some studies have suggested that adequate level of nutrition knowledge is related to optimal nutritional behaviours (Drichoutis et al. 2006). Thus, access to credible nutrition information may serve as the basis for appropriate practices. For instance, an individual with adequate knowledge of nutrition stands a better chance of differentiating nutrition facts from nutrition fads (Miller and Cassady 2015). Information disseminated through traditional (e.g. newspapers, TV commercials) and new (online resources) media play a role in determining nutrition choices as these sources market ideas and products that have the ability to influence behaviours (Perloff 2014). Nutrition information-seeking attitudes of pet owners have been previously explored (Michel et al. 2008; Kogan et al. 2010; Kogan et al. 2012). Yet studies that have reported nutrition information acquisition behaviours of veterinary students are limited.

In our study, both pre-veterinary students and first-year veterinary students perceived more information existing on human nutrition than pet nutrition and generally, described the pet nutrition information that does exist as “unreliable”. Interestingly, studies investigating medical students’ perceptions of nutrition revealed that those
students also perceived low reliability of human nutrition resources. In a survey of medical students' use of nutrition resources, Connor et al. (2015) showed that first-year medical students were significantly less likely to use academic journals of nutrition and significantly more likely to use phone apps and television shows as nutrition resources than were fourth-year medical students. This may suggest that as medical students progress through their medical education, they gain more knowledge about which nutrition resources are reliable. This may be true for veterinary students, but was not investigated in our study.

Another possible reason for the perceived lack of reliability in nutrition information is the low level of trust that incoming veterinary students have towards pet food companies that was expressed in our results. Mistrust in food companies was a major theme in the qualitative data and students' quotes suggest it may be related to information-seeking habits. The media and its use by researchers, their institutions and other stakeholders can play a role in promoting or undermining trust (Garza et al. 2019). The explosion and immediacy of information sources are both a boon and a barrier to the public's understanding of science. Conflicting information was described in the qualitative data as a reason for feelings of suspicion and frustration towards pet food brand options and in some cases, even towards veterinary recommendations. In the case of incoming veterinary students, they are likely to be exposed to a wide range of human and animal nutrition information, all of which may influence how they interpret and absorb the nutrition information presented in the veterinary nutrition curriculum.

7.2.1.2 Chapter 4
In addition to incoming students’ perceptions of their own and companion animal nutrition, we evaluated entering students’ perceived importance of veterinary nutrition education as well as how much emphasis they believed will be placed on nutrition in the veterinary curriculum. A significant finding from Chapter 4 is that students perceived nutrition to be a highly important subject in their veterinary training yet did not believe that nutrition would be emphasized. This is consistent with Mogre et al.’s (2018) research involving medical students’ satisfaction with their nutrition education and perceived preparedness for practice. The authors’ interpretation of their findings was that because students considered nutrition to be highly relevant for their future clinical practice, improving students’ satisfaction with their nutrition education would improve their perceived preparedness to provide nutrition care in the general practice settings. It may be speculated that the veterinary students in our research would respond similarly, that is to say students would feel more confident in clinical practice if they graduated their veterinary education programs satisfied with their nutrition training.

Students who attended a school with a board-certified nutrition faculty member were more likely to perceive a higher emphasis on veterinary nutrition education than those who did not. Similarly, while students overall reported low confidence in how well they anticipated their veterinary nutrition education would prepare them to discuss nutrition with future clients, students at schools with a board-certified veterinary nutritionist indicated greater perceived confidence [OR=1.88]. An interaction was also observed in the multivariable logistic regression model, in which perceived confidence was highest [OR=2.43] among those who attend a school with a board-certified nutrition faculty and perceive higher emphasis. The value in including specialized nutrition faculty
within the veterinary curriculum has been addressed in the literature (Freeman 2004; Delaney 2011; Becvarora et al. 2016). Equally, in the context of medical education, suggestions have been made regarding having registered dietitian nutritionists educate medical students about nutrition in order to help address deficiencies in nutrition education in medical schools and residency programs (Hark and Deen 2017). Previous research has shown that an interprofessional approach to teaching nutrition to medical students improves nutrition counselling confidence and increases their likelihood of counselling patients on nutrition (Caines et al. 2018). Interprofessional education (IPE) has been defined as an intervention where the members of more than one health specialty/profession work interactively together for the purpose of improving education of students and/or the health of patients. In response to new accreditation and licensing standards, medical schools are starting to introduce IPE activities into their curricula (Kolasa et al. 2014). Research on IPE has found it can lead to significant improvements in the interprofessional competencies for medical students (Brashers et al. 2016), including improved satisfaction with learning how to counsel patients on nutrition (Kolasa et al. 2014).

In veterinary medicine, board-certified veterinary nutritionists are veterinarians and thus it is not IPE in the traditional sense. However, within the veterinary curriculum, collaboration and interaction between various disciplines (e.g., dermatology, internal medicine, cardiology, oncology) and the nutrition specialists could boost the students’ ability to apply nutritional concepts after graduation. Our data did not assess actual student outcomes in regards to their confidence in nutrition counselling, nonetheless, the fact that their perceived confidence was significantly associated with the presence of
nutrition faculty highlights the role that these professionals may play in the uptake of nutrition topics by veterinary students. Our data along with analogous results in the medical education literature suggest that presence of nutrition professionals may help improve understanding of nutrition concepts, developing nutrition counseling skills and promoting interdisciplinary interactions.

One other important educational implication arising from this research is the role of academic self-efficacy in students’ perceived confidence with their veterinary nutrition education. In our study, students with high academic self-efficacy with respect to their future nutrition education were more likely to perceive they will be confident when they become veterinarians in discussing nutrition topics with clients [OR=2.20]. This research is unique in the context of veterinary nutrition education but is consistent with existing findings on the role that self-efficacy beliefs play in medical students’ motivation and future clinical confidence (Artino 2012). It is worth noting that an increase in confidence does not necessarily translate to an increase in competence, with some evidence demonstrating that confidence poorly predicts future performance on clinical assessments (Morgan and Cleave-Hogg 2002). Still, measures of self-efficacy may be better at predicting learning outcomes than what one is capable of achieving (Bandura 1995). In topics such as nutritional consultation, the behaviour of the veterinarian, i.e., whether they initiate a nutrition-related conversation, may be as important as their knowledge of nutrition.

To better understand this concept, an important aspect of the definition of self-efficacy warrants further explanation. Self-efficacy is a belief about one’s capability and thus, does not necessarily match one’s actual capability to execute a specific action.
Students with higher academic self-efficacy will expend more effort to learn challenging tasks (Gore 2006) and persist longer in the face of difficulty (Schunk 1991), irrespective of their initial knowledge level. Academic self-efficacy is a key component in theories of motivation and learning (Artino 2012). According to Bandura (1995), it is not enough for individuals to possess the requisite knowledge and skills to perform a task; they must also have the belief that they can successfully perform the required behaviour. Thus, as individuals grow and learn, they need to develop both the skillset and efficacy beliefs to effectively apply their knowledge. Indeed, in the case of academic self-efficacy and nutrition education, it has been shown to be directly associated with higher rates of nutrition counselling among medical students (Mogre et al. 2018). Current veterinary curricula focus on providing students with the necessary skills and knowledge to translate into clinical practice. In the case of nutrition, for example, students are trained on the role of nutrition in disease prevention and health promotion and how to assess dietary intake and develop dietary plans. Communication training has also been incorporated to assist graduating students in discussing topics with future clients (Churchill and Ward 2016; Phillips et al. 2017). Yet, nutrition counselling rates in both the veterinary and medical fields remain low (Kolasa et al. 2014; Phillips et al. 2017; Kipperman and German 2018). The missing component in this link could be the requirement to implement instructional practices that not only foster knowledge and skill attainment, but also bolster students’ beliefs that they can apply their nutrition education.

7.2.1.3 Study 1 Implications
The results from Chapter 3 in conjunction with previous research by others highlight the importance of addressing students’ current knowledge and prior experience when designing curricula and learning opportunities. Students’ preconceptions about their own or their pet’s nutrition may not have originally been considered when designing a veterinary nutrition curriculum.

For the majority of veterinary medical schools, even though the importance of nutrition in veterinary medical education is acknowledged, lack of resources and time within the curriculum pose the greatest challenges for an enhanced nutrition curriculum (Becvarora et al. 2016). Graduating veterinarians often feel unprepared to discuss nutrition with clients and feel that their veterinary nutrition education was inadequate (Lewis 1996; Abood 2008; Becvarora et al. 2016). Proposed solutions have included hiring a nutritionist, outsourcing nutrition education, and/or using online materials (Becvarora et al. 2016). Our study sheds light on other factors that are important to enable veterinarians, and potentially other healthcare professionals, to discuss nutrition upon entering professional practice. First, educators should consider that incoming students have their own prior exposure and awareness of nutrition that may influence their understanding and retention of nutrition education and influence their trust of nutrition resources. Since veterinarians are considered the primary source of nutrition information for pet owners (Kogan et al. 2012), it is important that student veterinarians are confident to communicate complete and accurate nutrition information. Second, lack of confidence by students in nutrition counselling upon graduating may not only be attributable to the number of hours of nutrition in the curriculum. Students’ learning satisfaction and knowledge retention has been associated with prior knowledge
(Thompson and Zamboanga 2003; Hailikari et al. 2008). The use of prior knowledge is one way for students to consolidate large bodies of complex content knowledge. It has been suggested that prior knowledge could be particularly influential for students in the early stages of learning (Dochy et al. 1999), particularly in pre-clinical years of medical education when students are required to learn and make sense of large volumes of complex knowledge. Knowledge recall is crucial in clinical years when students apply what they learned in their initial years of their veterinary or medical programs. We suggest incorporating discussions between veterinary educators and students early in the curriculum surrounding their beliefs and misperceptions and addressing these throughout the program. Our study showed that entering veterinary students resemble pet owners’ beliefs more than veterinarians, although we assume that these perceptions may start to change throughout the program to more closely align with studies capturing veterinarians’ attitudes. Perhaps the early introduction of clinically relevant assignments that address prior knowledge can promote establishing a solid foundation of information that can then facilitate recall of information and confidence when applying it to the clinical setting. For instance, we encourage educators to utilize case-based learning exercises to understand and unpack entering veterinary students’ prior knowledge and perceptions, prior to students’ exposure to a formal veterinary nutrition education curriculum. The information gained from students’ responses in working through these case-based exercises can assist educators in capturing and addressing any misperceptions and therefore help us to tailor the nutrition curriculum accordingly.

Perhaps the most effective way to create a strong sense of self-efficacy and satisfaction with educational curricula is through mastery experiences and performance
accomplishments (Pintrich and De Groot 1990; Pajares 1996). Our research revealed that in the context of veterinary nutrition education, students need to feel that nutrition education is as equally important in the veterinary curriculum as other subjects and that they can apply what they are learning in the clinical setting. Research conducted in nursing and medical students revealed that students perceive a higher emphasis on educational subjects when they are supplemented with learning approaches outside the traditional lecture format (Laschinger and Tresolini 1999; Brashers et al. 2016). In our research, veterinary students reported that their preferred methods for learning nutrition is through case-based and experiential learning. Applied learning environments foster interaction and an opportunity to learn through experience, which enhances students’ self-efficacy beliefs. The more traditional problem-based learning (PBL) has been used in healthcare professions, including veterinary science, medicine, dentistry, nursing and others (Williams 2005). Case-based learning (CBL) is derived from PBL and typically involves cases presenting complex concepts with the opportunity to make connections and construct knowledge in a way that is clinically meaningful. However, one clear distinction between case- and problem-based learning is that unlike PBL, as described by Garvey et al. (2000) “the case-based format requires students to recall previously covered material to solve clinical cases, which are based on clinical practice”.

Considering that students enter professional programs with their own attitudes, applying CBL techniques in the pre-clinical years may then establish a better understanding of what nutrition knowledge students are using to solve these cases. Furthermore, because self-efficacy operates within a broad network of sociocultural influences (Bandura 1995), a key aspect of enhancing students’ academic self-efficacy with their
nutrition education is to understand the context of their existing nutrition beliefs and to address these perceptions, as we aimed to do in the study in Chapter 3. Applying CBL and IPE approaches to nutrition education may help to better address students’ prior attitudes, foster deep learning of nutrition concepts, enhance academic self-efficacy with applying nutrition education and boost satisfaction with nutrition education. Together, these developments will then aid students to feel more confident and more adequately prepared to provide nutrition care in the clinical setting (Rösch et al. 2014).

7.2.2 Study 2

7.2.2.1 Chapter 5

The implications from the results of Study 2 assist in filling the gaps that currently exist in the literature regarding pet owners’ motivations for seeking nutrition information and how their current feeding practices influence their attitudes towards nutrition information. Significant relationships were found between species of pet (dog versus cat) and purchasing behaviour, nutrition information-seeking, and factors affecting feeding decisions. Owners control many parameters in the life of their pet. Two of them are of particular importance and result in the development of nutrition-related diseases when not properly managed: food intake and exercise. Previous studies that focused on the feeding management by pet owners showed that the majority of pet owners prefer processed commercial foods (Robertson 1999; Laflamme et al. 2008; Oliveira et al. 2014), a finding that was confirmed by our study results. However, there is a documented rise in the use of alternative pet foods in recent years (Oliveira et al. 2014; Parr and Remillard 2014). The global trend of “pet parenting” has influenced pet owners to have greater concern for the health and wellbeing of their pets. Studies have shown
that many dog and cat owners see homemade and raw diets (either homemade or commercially produced) as a way of increasing the bond with their pets (Oliveira et al. 2014). Other reasons for seeking alternative pet foods have been cited, including doubting the nutritional value of ingredients used in processed commercial diets, having concerns about the safety of industrial processing, believing that their pet dislikes processed commercial food or wanting to be knowledgeable of the food ingredients that their pet is consuming (Parr and Remillard 2014; Morgan et al. 2017; Dodd et al. 2019).

Many of the studies to date investigating motivations behind feeding behaviour have focused on one type of pet, either dogs or cats (Phillips et al. 2017). In our study, we compared dog owners’ diet motives to that of cat owners. For instance, dog owners were significantly more likely than cat owners to feed home-made cooked and raw diets. Furthermore, our results compared owners’ motivation behind feeding commercial raw versus home-made diets. Those who fed raw diets were more likely to believe that it is healthier for their pet and believe that their pet prefers it over processed food, whereas those who fed home-made diets expressed concern about safety and quality control of commercial pet foods. Although these reasons are in line with those mentioned in the literature as stated above, our study was one of few to compare the responses of both those who fed raw diets and home-made diets in the same study.

One particularly important implication of the study in Chapter 5 is how nutrition-information seeking among pet owners influences the factors behind their decisions on how much to feed their pet versus what to feed their pet. Both dog and cat owners reported that they want and expect more nutrition guidance when visiting their veterinarian, especially that they used external sources for deciding on how much to
feed their pets. However, research has shown that clients do not always perceive that they are given a dietary recommendation from their veterinary health care team, even when one is in fact provided (AAHA 2003). Similar to previous reports (Wise et al. 2003), most pet owners visited their veterinarian once a year, with dog owners more likely to visit their veterinarian more than once a year [OR = 3.13] than cat owners. Our study, however, is novel in quantifying the frequency of nutrition discussions during veterinary visits. Generally, cat owners were more likely than dog owners to discuss nutrition with their veterinarian during each visit [OR = 1.37] and relied on their veterinarians’ recommendations for nutrition. These findings are important considerations for both veterinary educators and practicing veterinarians. One of the reasons often cited by veterinarians for low nutrition counselling rates is the fact that they believe that owners are unlikely to follow recommendations (Churchill and Ward 2016; Bartges et al. 2017). Perhaps providing a more comprehensive and tailored nutrition consultation that addresses what to feed and how much may increase owners’ awareness of and satisfaction with nutrition recommendations provided by their veterinarian, in turn improving compliance rates.

Although many studies have investigated the challenges with weight management in the veterinary setting and among owners (Bland et al. 2010; Churchill and Ward 2016; Phillips et al. 2017; Aldewereld 2018), few have looked at the actual expectations owners have for the veterinarian’s role. In addition, how effective owners perceive veterinary nutrition guidance to be in managing their pet’s overall dietary habits and nutrition has not been explored. Similar to previous research that investigated patients’ perceptions of nutrition care provided by their general physicians for their own
nutrition (Ball et al. 2012) and parents’ perceptions for their child’s nutrition (Lupi et al. 2014), trust of the veterinarian increased odds \( [\text{OR} = 1.45] \) that owners found nutrition advice from their veterinarian to be effective in our study. In a previous study investigating parents’ attitudes of the pediatrician’s role in childhood weight management (Lupi et al. 2014), parents often mentioned a trusted relationship with their pediatrician as the reason they would include them in weight management discussions, which is consistent with our study’s findings and other research findings (Farnesi et al. 2012). In particular, research conducted in the human medical context has shown that physicians must build trust with parents when addressing nutrition behavioural changes for their children’s health (Turner et al. 2011). Researchers suggested that a multidisciplinary approach to dietary management that factors in the parents’ concerns without making them feel they are being judged or blamed is most effective (Turner et al. 2011).

Similarities between the owner-pet relationship and the human-infant relationship have been described within the framework of human attachment theory (Ainsworth 1989). Attachment, in this context, usually refers to the bond formed between a caregiver and a child to ensure safety, security and survival that may also apply to people’s relationships with their pets (Stoeckel et al. 2014). The human-animal bond is unique to each owner-pet relationship, yet there is no doubt that most owners report strong attachment to their pets (Freiwald et al. 2014; Mueller et al. 2018), a finding that is reinforced by our data. There is compelling evidence from clinical and laboratory studies that neurochemical responses to pets among owners are the same as those
activated when parents interact with their children (Odendaal and Meintjes 2003; Nagasawa et al. 2009; Stoeckel et al. 2014).

7.2.2.2 Chapter 6

Considering the role of the human-animal bond in the importance of investigating adherence to veterinary nutrition recommendations, in Chapter 6, we applied the Health Belief Model (HBM) as a theoretical framework to examine how pet owners’ beliefs about their own nutrition align with those of their pet’s nutrition. The HBM is one of the most widely used framework to understand behavioural intentions and medical adherence (Estrela et al. 2017). Results showed overlap between pet owners’ health beliefs for themselves and their pet that influences their decision to comply with nutrition recommendations for their own nutrition and their pet’s nutrition. In both situations, owners were most likely to comply with nutrition recommendations if they perceived the information to be beneficial in reducing their risk \([\text{OR}_{\text{human}} = 3.56, \text{OR}_{\text{pet}} = 4.12]\) for adverse nutrition-related outcomes (perceived benefits construct) and believed that they knew how to apply the recommendations they received (self-efficacy construct) \([\text{OR}_{\text{human}} =3.31, \text{OR}_{\text{pet}} =4.00]\). In previous studies that applied the HBM to predict the likelihood of engaging in a protective health behaviour (e.g. likelihood of getting vaccinated), perceived benefits was also documented as an important factor (Chen 2015). Specifically, studies in the medical literature that evaluated how to increase the likelihood of patients’ adherence to dietary guidelines reported that it is important that patients learn the usefulness of the recommendations that they are following (i.e. perceived benefits construct) (Estrela et al. 2017). The odds of complying with nutrition recommendations were also higher if the respondent had a relative who was in the
medical or veterinary profession. In fact, having a relative who's a healthcare professional has been shown to increase dog owners’ likelihood of vaccinating their dogs (Beyene et al. 2018).

While the perceived barriers construct was a significant predictor of intended compliance to pet nutrition recommendations in our study, it is important to note that we did not measure the outcome of adherence to nutrition recommendations (but rather, intention to comply) and thus, cannot conclude what barriers ultimately play a role in following recommendations. It is reasonable to expect that people are more likely to comply with certain nutrition recommendations and have trouble complying with others and thus, barriers may be advice specific (Estrela et al. 2017). In addition, research investigating adherence to medical guidelines showed that different factors influence the way that individuals make medical decision for themselves than for others (Zikmund-Fisher et al. 2006). Therefore, what owners may perceive as barriers for their pets may not be as important for their own nutrition. In particular, when people make medical decisions for a dependent, they are less likely to take risks than for decisions for their own health (Stone et al. 2013), which helps to explain why owners in our study had higher self-efficacy with nutrition recommendations for their own self than their pet.

Further studies that compare adherence outcomes to nutrition recommendations for individuals’ own health and their pet’s health may be valuable in gaining a better perspective on the different barriers that influence pet owners’ nutrition habits and compliance. In order to create solutions for promoting adherence, it is essential to identify the obstacles impeding adherence and what types of behavior could make it possible to follow recommendations. In addition, this identification may also enable the
recognition of the groups that are most vulnerable to non-adherence, aiding in developing and adopting educational strategies targeting them.

7.2.2.3 Study 2 Implications

Study 2 results emphasize the importance of recognizing the caregiver role that pet owners adopt in their companion animal’s health and well-being. In pediatric medicine, understanding the parental perceptions of the role of health care providers in pediatric weight management is considered of value to increasing the communication between providers and parents about childhood weight management (Lupi et al. 2014; Remmers et al. 2014). Similarly, understanding pet owners’ attitudes and perceptions towards the nutrition information provided by the veterinarian, as well as their role in actually managing their pet’s diet, is beneficial to develop effective interventions that can increase communication and compliance of nutrition recommendations. While these perceptions may not represent the true interactions with the veterinarian, given that pet owners play an important role in addressing their pet’s nutrition, a better understanding of their attitudes and perceived effectiveness of veterinary nutrition guidance may help inform effective training opportunities for veterinary students and practicing veterinarians.

In veterinary medicine, strategies to encourage clients to adhere to nutrition recommendations should aim to focus on shared decision-making between the veterinarian and owner. Constructing a professional-individual link with better communication and guidelines that are easy to understand is a recognized therapeutic technique that favors adherence (Martin et al. 2005). An important initial step towards establishing shared decision-making is to increase awareness of nutrition-related
adverse outcomes (Jaworski et al. 2018). The concept of recognition of disease is based in theoretical models of health behaviour change. For this study, applying the HBM emphasized that an individual must recognize a potential health threat before taking action. In pediatric research, parents who recognize their child as being overweight and see this as a problem, for example, were more ready to make lifestyle changes for their child than parents who do not (Kim et al. 2008). Consequently, a parent who does not recognize nutrition-related threats is unlikely to discuss this with their physician and will also be less likely to follow nutrition recommendations by their pediatrician (Kim et al. 2008). The most common misperception in that case is to overestimate how healthy their children’s diets and physical activity levels are (Adamo et al. 2010; Corder et al. 2010) and underestimate their children’s weight, often failing to recognize when their child is overweight or obese (Doolen et al. 2009; Mathieu et al. 2010; Chen et al. 2014). The same trend is seen in veterinary medicine, where owners tend to underestimate their pet’s body condition score and often fail to recognize nutrition-related problems (Rohlf et al. 2010; Eastland-Jones et al. 2014; Muñoz-Prieto et al. 2018). Our study results indicate that if respondents felt they or their pet were susceptible for nutrition-related diseases, they had higher intention to comply with medical or veterinary nutrition recommendations, respectively. Thus, veterinarians, and other healthcare professionals, are encouraged to highlight the risk that a patient faces in a tailored manner.

Another important take-home message from our study is that respondents’ health beliefs for their own nutrition were closely aligned with those for their pet’s nutrition. The relationship between health beliefs of the owner for their own health and the health of
their pet has been previously shown in companion animal obesity research. For instance, overweight pets tend to have overweight owners (Holmes et al. 2007; Nijland et al. 2010), suggesting similar environmental and behavioural influences on obesity. The concept of “family food environment” has been described in the context of childhood obesity risk and refers to family practices and attitudes about food and nutritional management. Pediatric research surrounding adherence to nutrition recommendations consistently showed greater success when parents focused largely on family changes for healthy living and healthy weight in place of changes directed specifically at a child (Mikhailovich and Morrison 2007; Farnesi et al. 2012). Researchers concluded that when providing guidance in the area of nutritional management, physicians should provide recommendations for the family as a whole. Our study shows that intention to adhere to nutrition recommendations from veterinary professionals are paralleled to the intention to follow nutrition guidance from medical professionals for respondents’ own health. Thus, veterinary professionals may be able to optimize their interactions with clients seeking pet nutrition care by taking a family-centered approach that is individualized and responsive to families’ needs. We highlight the value in stronger communication between physicians and veterinarians to achieve family-centered care. Previous research has also highlighted the value in a tailored approach to veterinary counselling that incorporates clients’ financial and physical circumstances (Coe et al. 2007; Churchill and Ward 2016). While entering veterinary students in our study recognized that clients are often seeking tailored recommendations, studies suggest that compassion may decline after professional school (Neumann et al., 2011). Our study adds to the existing veterinary literature by
proposing a framework for veterinary educators to increase awareness amongst veterinary students and graduating veterinarians in considering clients’ attitudes and perspectives. Drawing from examples implemented in human medical education (e.g. Vijn et al. 2018), veterinary nutrition curricula can be redesigned to help students deliver person-centered healthcare. For example, students may be teamed with clients from the start of their veterinary education. This interaction would be aimed at establishing a relationship with clients and thinking about clients’ personal contexts concurrent to learning nutrition topics and clinical skills. This form of educational practice not only reinforces classroom didactics, it creates new learning opportunities and bridges education to professional practice and life.

7.3 Limitations

All chapters (Chapters 3-6) used questionnaires as a data collection tool. As a result, there are intrinsic limitations which could not be controlled given that questions were close-ended to enable a more user-friendly approach and shorter duration to completion for participants. Pre-testing of both student and pet owner surveys was completed as a means to mitigate this issue by ensuring content validity and refining questions based on feedback to ensure adequate interpretation of responses. Conducting qualitative focus group discussions prior to designing the questionnaires also enabled a more thorough understanding of respondents’ experiences and attitudes that formed the basis of the close-ended questions. However, due to the cross-sectional nature of the study design, we cannot establish a temporal sequence or direction of causation for any of the associations.
The studies presented in this dissertation measured self-reported perceptions towards nutrition education and information presented by veterinary professionals. No objective measures were used to measure actual levels of behaviour, so it cannot be said for certain whether the perceived outcomes described (e.g. confidence in nutrition education, adhering to nutrition recommendations) are in fact accurate representations of decision-making by students and owners. Perceptions of entering students may differ to those of last year and/or graduating students that have received formal nutrition education throughout their program. Repeated measures at the end of each educational year and comparison of perceptions by following up with entering students towards graduation may be necessary to evaluate long-term attitudes and more valuable in addressing gaps in the veterinary nutrition curriculum.

Chapter 3 presents results from a single-center (OVC) and thus, is prone to bias due to convenience sampling. This form of sampling method was used to facilitate data collection on entering veterinary students’ perceptions and attitudes before expanding the project into a multi-center USA and Canadian study. However, because convenience sampling is non-random, it is highly vulnerable to selection bias and the results from these focus groups and questionnaire may be less generalizable than those derived from a broader sample. In Chapter 3, generalizability of results must also be cautioned due to the small sample size which limited statistical analysis. Multivariable regression was not possible, but the results of this study will be useful in informing data collection and analysis for future studies of a similar nature (e.g. exploring how veterinary students’ perceptions of their own nutrition influence their educational outcomes of pet nutrition), from more schools and cohorts. The study design was also
important in informing data collection and analysis of the study in Chapter 4, which was of a similar nature but larger scale.

Another limitation in Chapter 4 is the fact that we did not assess each school’s nutrition curriculum (i.e. the way that nutrition is taught at each school or number of hours); however, surveys were distributed to students in the first two months of their program to avoid much variability in amount of nutrition training received.

In Chapters 5 and 6, participant recruitment was exclusively via the internet, with a focus on social media sites and pet owner blogs. While this may have likely resulted in selection bias, this recruitment method is a common way to recruit to explore the range of opinions and attitudes of veterinary nutrition guidance amongst owners who access these sites. Recruiting at veterinary clinics would have been beneficial to compare attitudes between cohorts and assess the impact of this bias. Social media-based recruitment may also introduce a demographic selection bias by recruiting a younger, more Internet-active population. However, our results show that owners of all age groups participated in the survey. Additionally, because participation was voluntary throughout the research, respondents who chose to participate in the study may be more interested in nutrition or have stronger opinions about veterinary advice. Volunteer or self-selection bias might be present if those who chose to participate differed from those who did not participate. A larger study that compares responses of pet owners recruited from broader settings may help to eliminate this bias. Non-response bias is also a possibility in this study. Since few studies have been conducted with this focus, and with this population, it would be difficult to assess what changes might be made to encourage non-respondents to participate, or to determine what difference of opinion
they represent. Finally, the data gathered exploring perceived health status and dietary beliefs were self-reported; thus, the extent to which participants were inclined to provide socially desirable responses is not fully known, especially in their responses pertaining to their pet. Social desirability bias has been most thoroughly investigated in the social sciences, where it is considered one of the most significant and common threats to validity in behavioural sciences research (King and Bruner 2000). This may result in over- or underreporting of beliefs and behaviours. Efforts to minimize this included emphasizing to potential participants that all responses were anonymous and wording questions in ways that highlighted there is no right or wrong answer.

The utility of the HBM, which was applied as a theoretical framework for questionnaire design in Chapter 6, has been previously challenged. Studies that have been conducted to assess how well the HBM constructs predict behaviour have revealed inconsistent results. For the most part, summary results have provided substantial empirical support for the model. Past studies showed that perceived benefits and barriers are more powerful predictors of preventive health behaviour, with perceived severity being the least powerful predictor (which was analogous in our study’s findings). In a meta-analysis of 18 studies (N = 2,702), Carpenter (2010) found that benefits and barriers were consistently the strongest predictors. The variation in the predictive power of constructs from different studies may be attributable to variability in measuring the HBM constructs for different health outcomes. In order to overcome this limitation, we defined the constructs in accordance with HBM theory as described by Rosenstock (1988) while ensuring measures are specific to the behaviour we are addressing (intention to comply with nutrition recommendations). In addition, we used
multiple statements for each construct, which reduces measurement error and increases the content validity of each construct (Glanz et al. 2015). Furthermore, the model assumes that everyone has access to equal amounts of information on the illness or disease. While we did not measure actual knowledge of nutrition-related diseases among respondents, we did measure their perceived knowledge, which is likely to influence their health beliefs and thus, responses to the constructs. Overall, the HBM is more descriptive than explanatory, and does not suggest a strategy for changing health-related actions. The individual constructs are useful but for the most effective use of the model it should be integrated with other public health interventions that account for the environmental context and suggest strategies for change.

7.4 Future Research

The work presented in this dissertation provides a starting point for the understanding of beliefs and attitudes surrounding veterinary information provided on pet nutrition, and the development of the veterinary nutrition curriculum to prepare practicing veterinarians to address those attitudes. As such, it paves the way for future work in this domain in the following areas:

- **The need to better characterize veterinary students’ perceptions of their nutrition education throughout their veterinary school**: Research currently indicates that practicing veterinarians as well as veterinary deans and faculty do not believe graduating student veterinarians are adequately prepared in nutrition (Becvarora et al. 2016). However, in contrast to the human medical literature, there are no studies comparing the evolving attitudes of veterinary students on
nutrition education during their program. Studies assessing their confidence, knowledge, satisfaction and self-efficacy with the nutrition topics presented during each year may be valuable in tailoring the nutrition curriculum to better prepare students for their clinical roles and assessing whether their level of veterinary training relates to their attitudes towards and self-efficacy in nutrition care.

- **Assess adherence outcomes to veterinary nutrition counselling**: while our study assessed intention to adhere to nutrition recommendations, it is important for future work to measure the outcomes of adherence to veterinary nutrition guidance. In some instances, intention does not necessarily predict behaviour. For example, in Rohlf et al. (2010) investigation of dog owner attitudes, their intention to feed appropriately did not make a significant contribution to the actual feeding behavior. A longitudinal design will be necessary to establish causal relationships between beliefs and intentions and between intentions and behaviors. Even if it is assumed that intentions predict behaviours, it still needs to be shown that modifying beliefs and intentions will lead to subsequent modifications in adherence behaviour and consequent improvements in nutritional management. Measuring adherence results can aid in pinpointing the barriers that are most relevant in the decision-making processes of clients and personal factors that ultimately influence whether clients follow their veterinarians' nutrition recommendations. For instance, it may help to assess whether the types of media they use to receive pet health messages make a difference in their adherence outcomes. Additionally, intervention studies that
compare the outcomes of shared decision-making processes in consultations to those that use other consultation techniques may be beneficial to measure the effects these approaches have on behavioural change, particularly with respect to reducing the obesity epidemic and prevalence of diseases related to poor nutrition in humans and their companion animals.

- **Understanding how a One Health nutrition counselling approach can improve outcomes**: our research shows that the way people think and act for their own nutrition is reflective of what they do for their pet’s nutrition. The One Health perspective encourages coordinated action by healthcare professionals to address nutrition in people and companion animals as a public health concern. We showed that pet owners’ health beliefs and intention to comply with nutrition recommendations were aligned for their own health and their pet’s health. In the medical literature, tailored messages and strategies that are responsive to the beliefs and habits of patients have been studied and appear to be especially promising (Estrela et al. 2017). Similarly, our studies show that a key step in nutrition counselling in veterinary settings is to tailor recommendations to the clients and perhaps, offer a family-based approach that fosters collaboration between human medical doctors and veterinarians when counselling on nutrition.

- **Apply alternative behavioural theory models to understand factors that influence adherence to nutrition recommendations in the veterinary context**: future studies should expand on the work presented in this thesis and continue to explore the reasons owners choose to engage in veterinary nutritional management, the reasons they stay engaged, and their reasons for
discontinuing nutritional recommendations or care. As previously stated, the HBM is a useful method for measuring health behaviours. Yet, utilizing alternative behavioural theory models, such as the Information Motivation Behavioral Skills model of adherence, to explore other dimensions of decision-making when it comes to follow nutrition recommendations will aid in understanding processes and add to the outcomes offered by this research. For instance, exploring the effect that social interactions and subjective norms have on adherence outcomes is an angle we did not investigate and may prove valuable, especially that our results show pet owners do seek nutrition information from their social circle.

7.5 Concluding Remarks

The results of this research contribute to current knowledge of veterinary students and pet owner factors influencing pet nutrition. There remains a need to better educate clients about nutritional management of their pet, especially in light of the current increased attention on canine and feline obesity. The need also exists on the veterinary education end, where nutrition education outcomes presently remain unsatisfactory to graduating veterinarians and educators.

Our results provide a new perspective on addressing these gaps, by first identifying the attitudes of entering veterinary students on companion animal nutrition and their nutrition education. These findings are helpful in developing a veterinary nutrition curriculum that is proactive, whereby educators can address any misconceptions students may have on nutrition, identify the learning methods that students prefer to learn nutrition and focus on improving their academic self-efficacy
and confidence with discussing nutrition topics. Supplementing these core competencies with a curriculum that provides a solid foundation of nutritional concepts may prove more effective in increasing counselling rates on nutrition in veterinary practice. Our research results also suggest that hiring a board-certified veterinary nutritionist to deliver the veterinary nutrition curriculum may increase trust among students and provide them with the necessary critical skills to judge the scientific validity of information from pet food companies.

In Study 2, using an established theoretical model, we tested interactions between beliefs, attitudes and intentions and demonstrated that the relationships are complex. These results have several important implications for veterinarians, veterinary educators and healthcare providers in general. First, simply pointing out that a pet’s body condition score is not ideal and that something needs to be done about it is unlikely to lead to satisfactory results, and neither is the provision of general information and specific diets. Instead, owners need to believe that their pet is at risk of nutrition-related disease and that this has important health implications. Such preventive medicine approaches can then reduce the rates of nutrition-related diseases. Second, owners’ trust of veterinarians is not enough on its own to result in perceived effectiveness of their recommendations. The veterinarian needs to tailor information to the owner, understand any misconceptions or biased information they hold and involve them in a shared decision-making process. Veterinarians need to explain both what to feed and how much to feed, all the while considering each client’s unique barriers that may hinder their recommendations. Finally, a multidimensional and owner-focused
strategy should be developed, drawing on the knowledge of the owner’s own health and ensuing a collaboration between physicians as well as those who work with animals.

In conclusion, the results of this research provide a platform for further exploration of educational efforts in veterinary nutrition as well as opportunities for collaboration within a One Health framework and health promotion theoretical models, including strategies to improve overall animal and human health and well-being.
REFERENCES


Consent to Participate in Research

You were invited today to participate in a research project conducted by May Kamleh, a student from the Department of Population Medicine. The purpose of this project is to learn about your perspectives and opinions companion-animal nutrition based on your experiences and any previous training. I want to hear from you and would like to explore your viewpoints. If you have any questions or concerns, please feel free to contact May Kamleh at mkamleh@uoguelph.ca or Dr. Deep Khosa on 519-824-4120 Ext 54470.

If you agree to participate in this study, we would ask you to participate in a group discussion with 6-10 other students who have agreed to participate. The discussion will include your opinions of companion-animal nutrition and what previous experiences or exposure shaped your views on the topic. The discussion will take about 1.5 to 2 hours and will be audio recorded in order to create a verbatim transcript of the discussion. The sessions will be purposefully led by May Kamleh who is not involved in assessing you in any part of your DVM course and so has no conflict of interest. All participants can therefore feel free to share their thoughts and opinion without concern of consequences. To protect your confidentiality, there will not be any identifying information attached to any part of the transcriptions. May Kamleh who will transcribe the audio recordings will be the only person who have access to this information.

Information gathered during this study may be used for a publication or presentation.

There is a potential risk of self-consciousness or the feeling of embarrassment associated with participating in this form of discussion with your peers. Every effort will be made to ensure the confidentiality of participants in connection with this study, however it should be noted that a focus group methodology such as this is not able to assure participants complete confidentiality.

You will be provided a unique opportunity to express your opinions. Data generated from this study could be useful in tailoring DVM student education to incorporate a nutrition component that prepares students to apply nutritional principles clinically, a need that is becoming increasingly paramount among veterinarians. Participants will receive a meal (lunch or dinner) for completing the session.
Every effort will be made to ensure confidentiality of any identifying information that is obtained in connection with this study, however the focus group methodology cannot assure complete confidentiality. The moderator who will transcribe the recordings will have exclusive access to the audio recordings collected in conjunction with this study in order to produce a verbatim transcript of the focus group discussion. When the audio recording is transcribed all participant identifiers will be removed in order to maintain confidentiality. Faculty researchers will be limited to accessing the verbatim transcripts only in order to protect participant confidentiality.

In signing this consent form you agree to keep everything pertaining to this group strictly confidential, including the identity and comments of other members participating in the group. Any findings released from the outcome of this study will not be directly linked to any of the project participants. In signing this consent you are aware and agreeable to the use of non-identifying verbatim quotes in published materials and presentations. The audio recordings will be stored by the moderator until non-identifying verbatim transcripts are produced and confirmed and potentially published. After the publisher’s specified period of time to store data, the audio-recording will be erased.

It is up to you to choose to be a part of this study. If you volunteer to be in this study, you may withdraw at any time without consequences of any kind. If you choose to withdraw from the study, data gathered up until the time of your departure will be included for analysis as it may not be possible to withdraw one participant’s comments from a focus group transcript. You may also refuse to answer any questions you don’t want to answer and still remain in the study. The investigator may withdraw you from this research if circumstances arise that warrant this action.

I have read the information provided for “A study of students’ learning experiences at the Primary Health Care Centre (PHC)” as described herein. My questions have been answered to my satisfaction and I agree to participate in this study with the assurance that my identity on written materials and audio recordings will remain completely confidential. I agree to the use of verbatim quotes in any published materials and presentations as long as my identity remains protected. I have been given a copy of this form.

___________________________  ___________________________
Name of Participant            Name of Witness

________________________________________
Signature of Participant            Signature of Witness

___________________________  ___________________________
Date                          Date
If you have any questions or concerns during or after your participation in this research project, please contact:
(Turn on recorders)

**Introduction** (5 minutes, begin at xx)

- Hello and welcome

- Thanks for taking the time to join me today for this discussion. I am very interested about your thoughts and experiences in relation to companion-animal nutrition.

- My name is May Kamleh and I will be the moderator for today’s discussion.

- During our discussion today I hope to get your thoughts on your own nutrition, your pet’s nutrition and the bond that you share with your companion-animal.

- I have invited you here today because you are about to start your veterinary education and you all either own and/or care for a pet directly.

- The information collected here today will help us to better understand students’ opinions on pet nutrition. We may also choose to write up some of the findings from this process for publication.

- As you have probably already noticed recorders on the table to record our conversation. The recorders are here to capture everything that is said. I will be the one to transcribe the recordings and so will be the only person who will listen to the recordings. To protect your confidentiality, your names will not be attached to any part of the transcriptions so please feel free to speak freely. Can I request that you speak up please when you are talking so that your valuable comments are captured on the recording.

- As you may have also noticed, aside from your fellow students and myself there is no one else here from the OVC. I am not involved in directly assessing you in any part of your studies or applications so there is no conflict of interest in me being present here today. I can assure you that I will hold everything that is said in the room today in the strictest of confidence.

- While a focus group methodology cannot assure complete confidentiality, I ask that you do not repeat anything that is said here to others outside of the group. This is because I want everyone here to feel safe and comfortable about sharing their thoughts and making comments.
My role here today is to ask questions, listen, keep the conversation moving, ensure everyone gets involved, and be mindful of the time.

I would like to hear from all of you but I respect that everyone will participate in different ways. Some people are more talkative, while others are quieter. I will try to ensure that everyone has a chance to speak today. If at any point I have to interrupt you speaking, it will only be because we are running out of time, it is most definitely not because I am not interested in what you have to say.

To help with this process, I am going to ask that only one person speak at any given time. It is okay to disagree with each other because there are no right or wrong answers here.

Please be aware that you have the option to withdraw from this study at any time. If you need to leave today for any reason please do this quietly.

We have 1.5 hours today and there are a number of topics to discuss. Once we are finished today, we will be having lunch/dinner, and I will provide you with an honorarium as a token of our appreciation.

So that we are not interrupted while we chat, can I please ask that you put any cell phones or electronic devices on silent for the duration of our discussion today? Thank you.

If there are any questions I ask today that are not clear or do not make sense then please ask me to clarify them for you.

Are there any questions? Okay, let’s start.

**Icebreaker** (5 minutes, begin at xx)

- So let’s start by going around the table and introducing ourselves. Tell us your name, your favourite place to holiday in the world if money was no object, and your favourite thing to eat.

**Participants’ guided discussion of their perceptions of nutrition in general** (60 minutes, begin at xx)

As I mentioned you all own a pet or care for one and have thus probably needed to make decisions of what and when to feed these pets. I am interested in what these experiences were, how you felt about them, how this differs from your own nutritional experiences, and your perceptions of these feeding practices. Let’s begin by discussing your own general nutrition. I would like you to take a minute and think about what you consume on a daily basis in general. What are
your feeding practices for yourselves? How do you choose when and what to eat?

(Go around the room for responses if there is no spontaneous response from anyone to begin the discussion. MK to invite responses from people who did not respond)

Probes:
How often do you cook or shop for groceries?
How do you feel about what you’re eating?
Where do you learn your nutritional guidelines/what to eat?
How would you define healthy eating for yourself?
Have you ever visited a nutritionist for your own health?

What about the nutrition of your companion-animal, what and when do they eat?

(Go around the room for responses if there is no spontaneous response from anyone to begin the discussion. MK to invite responses from people who did not respond)

Probes:
Where do you learn how and what to feed your pets?
How do you choose what to feed your pet? What made you choose this particular feeding regimen for the pet?
How would you define healthy eating for your pet?
Where are your pets fed? Who feeds them?
Who would you rely on to feed the pet if you couldn’t?

What are thoughts around what you feed your pets?

(Go around the room for responses if there is no spontaneous response from anyone to begin the discussion. MK to invite responses from people who did not respond)

Probes:
What information were you given in veterinary clinics that was useful for to make decision about what you feed your pets?
How would you say nutritional information from the pet food industry differs from that in clinics? Tell me more about why you think this was the case?

So now I’d like you to take a minute and think about the bond that you have with your pet or the companion animal that you attend to. How would you define it?

(Go around the room for responses if there is no spontaneous response from anyone to begin the discussion. MK to invite responses from people who did not respond)

Probes:
Do you see your pet as a part of your family or do you see your pet as a 'working animal'?
What is the role that your family and/or friends play in caring for your pet?

What are your thoughts around the bond that you share with your pet and the decision that you make about their nutrition?

(Go around the room for responses if there is no spontaneous response from anyone to begin the discussion. MK to invite responses from people who did not respond)

Probes:
How does your bond with your pet influence or effect the decision you make about their nutrition?

Given that you are just about to enter veterinary school, tell me how much of your veterinary education you think will have to do with animal nutrition?

(Go around the room for responses if there is no spontaneous response from anyone to begin the discussion. MK to invite responses from people who did not respond)

Probes:
What experiences with your own pet do you think will aid you in providing consultation to clients?

Participants to write down and rank top three influential sources of nutrition for them and top three influential sources of nutrition for their pets. (5 minutes, begin xx)

I am handing out this paper for you to write down the top 3 influential sources for your own nutrition and top 3 influential sources for your pets/animals that you care for. You may have more than 3 things to write down, but please limit each list to 3 things only. Sources can be anything that influences your eating, including advice from family members. Can I also ask you to please rank these things in order of importance – 1 being the most important, to 3 being the least important.

(MK to collect paper with participants’ responses)

Summary (5 minutes, begin at xx)

We have covered all the topics for discussion today so I will summarize what we have discussed and would like you to let me know if there is anything I have left out.

We began with talking about your own nutrition. Your responses included....
We then went on to discuss nutrition for your companion-animal. Your responses to this included…

Next we discussed the bond that you share with the pets you own or care for and how this affects how and what you feed your pets. Your comments to this included…

Finally we talked about how you much you think nutrition will be a part of your education as veterinary students. Your responses to this included…

Is that a fair summary of what we discussed today?

Is there anything else you would like to add to this summary, have I missed anything?

**Participants to complete a short demographics questionnaire** (1 minute, begin at xx)

*(Hand out demographic questionnaire)*

The very final thing for you to do today is to fill in this questionnaire about yourselves. It should only take you a minute to complete. The information you provide on this questionnaire is important to us to help keep track of who took part in this discussion. We do not need your name on these as all responses are anonymous and will be kept confidential.

**Conclusion** (1 minute)

Thank you very much for coming today to join in this discussion.

Please help yourselves to some food and soft drinks.
Semi-structured interview guide for pet owners across Ontario, sampled via snowball sampling methods.

PET OWNERS’ FOCUS GROUP
AN ASSESSMENT OF STUDENTS’ PERCEPTIONS, BELIEFS AND KNOWLEDGE OF COMPANION-ANIMAL NUTRITION

You are invited today to participate in a research project conducted by May Kamleh, a PhD student from the Department of Population Medicine, studying owners’ perceptions of pet nutrition. The purpose of this project is to learn about your perspectives and opinions about your own and pet’s nutrition based on your experiences. I want to hear from you and would like to explore your viewpoints. If you have any questions or concerns, please feel free to contact May Kamleh at mkamleh@uoguelph.ca or Dr. Deep Khosa, Assistant Professor at the Department of Population Medicine, on 519-824-4120 Ext 54470.

If you agree to participate in this study, we will hold a focus group discussion with 3-6 pet owners. The discussion will include your opinions of your own nutrition, pet nutrition and the bond that you share with your pet. The discussion will take about 1.5 hours and will be audio recorded in order to create a verbatim transcript of the discussion. The sessions will be purposefully led by May Kamleh. All participants can therefore feel free to share their thoughts and opinion without concern of consequences. To protect your confidentiality, there will not be any identifying information attached to any part of the transcriptions. A transcriber who has signed a confidentiality agreement will transcribe the recordings and so along with May, they will be the only two people who will listen to the recordings. Participants will be asked to complete a short demographics questionnaire prior to the start of the discussion. You may refuse to answer any question you do not feel comfortable in answering.

Information gathered during this study may be used for a publication or presentation.

There is a potential risk of self-consciousness or the feeling of embarrassment associated with participating in this form of discussion. It should be noted that a focus group methodology such as this is not able to assure participants complete confidentiality.

Participants will receive a 30-minute meal (lunch or dinner) for completing the session along with a $50 Tim Hortons gift card.

The focus group methodology cannot assure complete confidentiality. Focus groups are a public process and thus, you should not share anything that they do not want to make public. The moderator, May Kamleh, along with the transcriber will have exclusive
access to the audio recordings collected in conjunction with this study in order to produce a verbatim transcript of the focus group discussion. When the audio recording is transcribed all participant identifiers will be removed in order to maintain confidentiality. The team will not release the identities of the participants. Faculty researchers will be limited to accessing the verbatim transcripts only in order to protect participant confidentiality.

In signing this consent form you are asked to keep the identity and comments of other members participating in the group confidential. Any findings released from the outcome of this study will not be directly linked to any of the project participants. In signing this consent you are aware and agreeable to the use of non-identifying verbatim quotes in published materials and presentations. The audio recordings will be stored by the moderator until non-identifying verbatim transcripts are produced and confirmed and potentially published. After the publisher’s specified period of time to store data, the audio-recording will be erased. If the results of the study are published, your name will not be used and no information that discloses your identity will be released or published.

It is up to you to choose to be a part of this study. If you volunteer to be in this study, you may withdraw at any time without consequences of any kind. If you choose to withdraw from the study, data gathered up until the time of your departure will be included for analysis as it may not be possible to withdraw one participant’s comments from a focus group transcript. You may also refuse to answer any questions you don’t want to answer and still remain in the study. The investigator may withdraw you from this research if circumstances arise that warrant this action.

This project has been reviewed by the Research Ethics Board for compliance with federal guidelines for research involving human participants. This project is funded by the MacRae Gift-Graduate Student Support award.

I have read the information provided for “A study of owners’ preconceptions of companion-animal nutrition” as described herein. My questions have been answered to my satisfaction and I agree to participate in this study with the assurance that my identity on written materials and audio recordings will remain completely confidential. I agree to the use of verbatim quotes in any published materials and presentations as long as my identity remains protected. I have been given a copy of this form.

___________________________
___________________________
Name of Participant               Name of Witness

___________________________
___________________________
Signature of Participant           Signature of Witness
(Turn on recorders)

**Introduction** (5 minutes, begin at xx)

- Hello and welcome

- Thanks for taking the time to join me today for this discussion. I am very interested about your thoughts and experiences in relation to companion-animal nutrition.

- My name is May Kamleh and I will be the moderator for today’s discussion.

- During our discussion today I hope to get your thoughts on your own nutrition, your pet’s nutrition and the bond that you share with your companion-animal and your relationship with your veterinarians.

- I have invited you here today because you all either own and/or care for a pet directly.

- The information collected here today will help us to better understand pet owners’ opinions on pet nutrition. We may also choose to write up some of the findings from this process for publication.

- As you have probably already noticed recorders on the table to record our conversation. The recorders are here to capture everything that is said. Only the transcriber who has signed a confidentiality agreement and myself will have access to the recordings. To protect your confidentiality, your names will not be attached to any part of the transcriptions so please feel free to speak freely. Can I request that you speak up please when you are talking so that your valuable comments are captured on the recording.

- Because a focus group is essentially a public process; participants should not share anything that they would not want to make public. While a focus group methodology cannot assure complete confidentiality, I ask that you do not repeat anything that is said here to others outside of the group. This is because I want everyone here to feel safe and comfortable about sharing their thoughts and making comments.

- My role here today is to ask questions, listen, keep the conversation moving, ensure everyone gets involved, and be mindful of the time.
• I would like to hear from all of you but I respect that everyone will participate in different ways. Some people are more talkative, while others are quieter. I will try to ensure that everyone has a chance to speak today. If at any point I have to interrupt you speaking, it will only be because we are running out of time, it is most definitely not because I am not interested in what you have to say.

• To help with this process, I am going to ask that only one person speak at any given time. It is okay to disagree with each other because there are no right or wrong answers here.

• Please be aware that you have the option to withdraw from this study at any time, but you cannot withdraw your contribution from the group recording. If you need to leave today for any reason please do this quietly. Any decision to withdraw or not to answer questions will not impact your ability to continue in the study or receive benefits.

• We have 1.5 hours today and there are a number of topics to discuss. Once we are finished today, we will be having lunch/dinner, and I will provide you with an honorarium as a token of our appreciation.

• So that we are not interrupted while we chat, can I please ask that you put any cell phones or electronic devices on silent for the duration of our discussion today? Thank you.

• If there are any questions I ask today that are not clear or do not make sense then please ask me to clarify them for you.

• Are there any questions? Okay, let’s start.

**Icebreaker** (5 minutes, begin at xx)

• So let’s start by going around the table and introducing ourselves. Tell us your name, your favourite place to holiday in the world if money was no object.

• I will start…

**Participants’ guided discussion of their perceptions of nutrition in general** (60 minutes, begin at xx)

As I mentioned you all own a pet or care for one and have thus probably needed to make decisions of what and when to feed these pets. I am interested in what these experiences were, how you felt about them, how this differs from your own nutritional experiences, and your perceptions of these feeding practices.
Let’s begin by discussing your own general nutrition. I would like you to take a minute and think about what you consume on a daily basis in general. How would you define healthy eating for yourself?

(Go around the room for responses if there is no spontaneous response from anyone to begin the discussion. MK to invite responses from people who did not respond)

Probes:
How do you feel about what you’re eating?
Where do you learn your nutritional guidelines/what to eat?
Have you ever visited a nutritionist for your own health?
Who do you rely on for nutrition information for yourself?

What about the nutrition of your companion-animal, How would you define healthy eating for your pet?
(Go around the room for responses if there is no spontaneous response from anyone to begin the discussion. MK to invite responses from people who did not respond)

Probes:
Where do you learn how and what to feed your pets?
How do you choose what to feed your pet?/ What made you choose this particular feeding regimen for the pet?
Where are your pets fed? Who feeds them?
Who would you rely on to feed the pet if you couldn’t?
What are thoughts around what you feed your pets?

Given that you go to a veterinarian for your pet’s health, how much do you think veterinarians know about pet nutrition?

(Go around the room for responses if there is no spontaneous response from anyone to begin the discussion. MK to invite responses from people who did not respond)

Probes:
What information were you given in veterinary clinics that was useful for to make decision about what you feed your pets?
How would you say nutritional information from the pet food industry differs from that in clinics? Tell me more about why you think this was the case?
What are the biggest issues in pet nutrition currently? Do they apply to your pet?
How often does nutrition discussion come up with your veterinarian?
What experiences with your own pet do you think influenced your view about your vet’s knowledge of nutrition?

So now I’d like you to take a minute and think about the bond that you have with your pet. How would you define it?
(Go around the room for responses if there is no spontaneous response from anyone to begin the discussion. MK to invite responses from people who did not respond)

Probes:
Do you see your pet as a part of your family or do you see your pet as a ‘working animal’?
What is the role that your family and/or friends play in caring for your pet?

What are your thoughts around the bond that you share with your pet and the decision that you make about their nutrition?

(Go around the room for responses if there is no spontaneous response from anyone to begin the discussion. MK to invite responses from people who did not respond)

Probes:
How does your bond with your pet influence or effect the decision you make about their nutrition?

Participants to write down and rank top three influential sources of nutrition for them and top three influential sources of nutrition for their pets. (5 minutes, begin xx)

I am handing out this paper for you to write down the top 3 influential sources for your own nutrition and top 3 influential sources for your pets/animals that you care for. You may have more than 3 things to write down, but please limit each list to 3 things only. Sources can be anything that influences your eating, including advice from family members. Can I also ask you to please rank these things in order of importance – 1 being the most important, to 3 being the least important.

(MK to collect paper with participants’ responses)

Summary (5 minutes, begin at xx)

We have covered all the topics for discussion today so I will summarize what we have discussed and would like you to let me know if there is anything I have left out.

We began with talking about your own nutrition. Your responses included….

We then went on to discuss nutrition for your companion-animal. Your responses to this included…

Next we discussed the bond that you share with the pets you own or care for and how this effects how and what you feed your pets. Your comments to this included…
Finally we talked about how much you think nutrition will be a part of your education as veterinary students. Your responses to this included…

Is that a fair summary of what we discussed today?

Is there anything else you would like to add to this summary, have I missed anything?

**Participants to complete a short demographics questionnaire** (1 minute, begin at xx)

*(Hand out demographic questionnaire)*

The very final thing for you to do today is to fill in this questionnaire about yourselves. It should only take you a minute to complete. The information you provide on this questionnaire is important to us to help keep track of who took part in this discussion. We do not need your name on these as all responses are anonymous and will be kept confidential.

**Conclusion** (1 minute)

Thank you very much for coming today to join in this discussion.

Please help yourselves to some food and soft drinks.
Online Questionnaire Tool Developed to Capture Incoming Veterinary Students’ Nutrition Attitudes and Beliefs.

VETERINARY STUDENTS QUESTIONNAIRE – ONTARIO VETERINARY COLLEGE

**This is a Word version of a Qualtrics online survey, therefore formatting in this document is not the same as it would appear on the online version.

You are invited to participate as a student who is beginning their first-year veterinary school education and who has/currently own or care for a pet. If you agree to participate in this study, we would ask you to complete an online questionnaire that will take approximately 30 minutes to complete. Information collected from the questionnaire will only be analyzed by May Kamleh who is not involved in assessing you in any part of your DVM courses and so has no conflict of interest. All participants can therefore feel free to share their thoughts and opinion without concern of consequences. To protect your confidentiality, no identifying information will be attached to your responses only May Kamleh will have access to identifying information attached to any of your responses. There are no risks associated with completing this questionnaire. Your participation in this research study is voluntary. You may choose not to participate. If you decide to participate in this research survey, you may withdraw at any time. If you decide not to participate or if you withdraw from participating at any time, you will not be penalized. You will be provided a unique opportunity to express your opinions. Data generated from this study could be useful in tailoring DVM student education to incorporate a nutrition component that prepares students to apply nutritional principles clinically, a need that is becoming increasingly paramount among veterinarians.

Upon submission of the questionnaire, you will be asked to enter your name into a separate form in order to be entered into a draw to win an IPad Mini 4 or Apple watch. The winner will be chosen using a random draw generator. You are free to withdraw at any time without penalty by closing your browser. You are also free to skip any question(s) that you do not wish to answer and still submit the questionnaire. If you choose to withdraw prior to submission, you will not be eligible to enter the draw. If you withdraw after your responses have been submitted, you will still be entered into the draw but will not be able to withdraw your data. No identifiers will be linked to your data, however. The winner may be required to provide their Social Insurance Number for Financial Services reporting purposes. After the draw and announcement of winner, your personal identifying data will be erased. Every effort will be made to ensure confidentiality of any identifying information that is obtained in connection with this study. However, because data collection is online, complete confidentiality cannot be guaranteed. All data is stored in a password protected electronic format. If the results of the study are published, your name will not be used and no information that discloses your identity will be released or published. If you
wish to receive a copy of the results, you may contact the research team. You do not waive any legal rights by agreeing to take part in this study. If you have questions regarding your rights and welfare as a research participant in this study (REB#16JA309). This project has been reviewed by the Research Ethics Board for compliance with federal guidelines for research involving human participants. If you have any questions or concerns, please feel free to contact May Kamleh at mkamleh@uoguelph.ca or Dr. Deep Khosa, Assistant Professor in the Department of Population Medicine, at dkhosa@uoguelph.ca. I have read and understand the above information and agree to participate in this study. You may print a copy of this consent page for your records.

☐ Agree
☐ Disagree

Are you a Canadian or International Student?

☐ Ontario resident
☐ Out-of-province Canadian student
☐ US student
☐ International student
☐ Prefer not to answer

I identify my gender as

☐ Male
☐ Female
☐ Other, please specify ____________________
☐ Prefer not to answer

Your age

☐ <20
☐ 20-22
☐ 23-25
☐ 25-27
☐ 28-30
☐ >30
☐ Prefer not to answer

My career plans when I graduate from veterinary school are

☐ Companion animal exclusive practice
☐ Food animal exclusive practice
☐ Equine exclusive practice
☐ Rural community practice (companion animal, equine, food animal)
☐ Public health
☐ Research
☐ Industry
☐ Other, please specify ____________________
☐ Prefer not to answer
Now let's consider your own nutrition. The following set of questions will allow you to offer your personal insight on your own eating habits.

How healthy do you think your diet is?
- Very healthy
- Moderately healthy
- Neither healthy nor unhealthy
- Moderately unhealthy
- Very unhealthy
- Prefer not to answer

To what extent do you think about what you eat?
- Every time I eat
- Regularly but not daily
- Unsure how to answer this question
- Intermittently
- Never
- Prefer not to answer

What barriers influence your eating habits? (Select all that apply)
- Price of healthy foods
- Cooking skills
- No time
- I don't know enough about healthy eating
- Experts keep changing their minds
- Family's influence
- Friend's influence
- None
- Other, please specify ____________________
- Prefer not to answer

Which of the following factors do you consider determinants of your healthy behaviors? (Select all that apply)
- Cost
- Time
- Convenience
- Self-discipline
- Desire to maintain health
- Internet blogs about food/healthy eating
- Social media sites (e.g. Facebook, Twitter, Instagram, Snapchat)
- Family's advice
- Friend's advice
- Other, please specify ____________________
- Prefer not to answer
Which of the following is your primary source of information for your own nutrition? (Select all that apply)

- Personal healthcare provider (e.g. dietician)
- Nurse
- Government agencies
- Peer-reviewed journal articles
- Google search
- Health, food, nutrition blogs
- YouTube/other health videos online
- Food expert on the media (e.g. TV or radio commercials)
- Books/magazines
- Social media sites (e.g. Facebook, Twitter, Instagram, Snapchat)
- Family member
- Friend
- Personal trainer
- University lectures
- Campus resources
- Food company/manufacturer
- Grocery store
- Other, please specify_________________________

To your knowledge, how much information do you think exists on human nutrition?

- Very high amount
- Moderate amount
- Unsure
- Small amount
- None
- Prefer not to answer

Overall, how confident are you in knowing how to make changes to your own diet?

- Strongly confident
- Moderately confident
- Neither confident nor unconfident
- Moderately unconfident
- Strongly unconfident
- Prefer not to answer

Overall, how confident are you in knowing where to find information about your own nutrition?

- Strongly confident
- Moderately confident
- Neither confident nor unconfident
- Moderately unconfident
- Strongly unconfident
- Prefer not to answer
In your opinion, how easy is it to find information about your own nutrition?

- Very easy
- Moderately easy
- Unsure
- Moderately difficult
- Very difficult
- Prefer not to answer

How much do you trust each of the following?

<table>
<thead>
<tr>
<th>Source</th>
<th>A great deal</th>
<th>A lot</th>
<th>A moderate amount (3)</th>
<th>A little (4)</th>
<th>None at all (5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regulatory standards set for human food industry</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Family doctors recommending certain diets</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Advice from a physician for your own nutrition</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The messages the media portrays with regards to your own nutrition</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Advice from a health professional who’s sponsored by a certain food company</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Online sources for your own nutrition</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Now you will answer a similar set of questions for your pet. These questions apply to your pet(s) that you currently have or had at home. If you have more than one dog, please choose one dog to answer the survey about. Similarly, if you have more than one cat, please choose one cat to answer the survey about. If you have both dogs and cats, then you will be able to answer the survey about one of the dogs and one of the cats.
Do you currently have or have had a dog(s) (with you or at home)?
- Yes
- No
If No Is Selected, Then Skip To Do you currently have a cat(s)?

How many?
- 1
- 2
- 3
- 4
- 5 or more
If 1 Is Selected, Then Skip To Does the dog live with you?

Reminder: please pick one dog to answer the rest of the questions in this survey about.

Does the dog live with you?
- Yes, my dog lives with me currently
- No, my dog lives somewhere else (e.g. with family, partner)
- Prefer not to answer

Are you the primary caregiver?
- Yes
- No

Pet's Gender
- Male
- Male Neutered
- Female
- Female Spayed

Pet's age
- Months _______________________
- Years _______________________

Breed(s)

Do you currently have a cat(s) (with you or at home)?
- Yes
- No
  If No Is Selected, Then Skip To Dog Section.

How many?
- 1
- 2
Reminder: please pick one cat to answer the rest of the questions in this survey about.

Does the cat live with you?
- Yes, my cat lives with me currently
- No, my cat lives somewhere else (e.g. with family, partner)
- Prefer not to answer

Are you the primary caregiver?
- Yes
- No

Pet's Gender
- Male
- Male Neutered
- Female
- Female Spayed

Pet's age
- Months ____________________
- Years ____________________

Breed(s) ____________________

**DOG OWNER SECTION**

Now let’s consider your dog’s nutrition. The following set of questions will allow you to offer your insight on how you feed your dog.

What type of food do you currently feed your dog?
- Dry
- Wet
- Semi-moist
- Homemade cooked diets
- Homemade raw diets
- Commercial raw diets
- Other, please specify ____________________
- Prefer not to answer
How often do you feed your dog treats?

- Daily
- Few times a week
- Few times a month
- Rarely
- Prefer not to answer

Where do you purchase your dog's food? (Select all that apply)

- Supermarket/Grocery Store
- Big-box stores (e.g. Walmart, Costco)
- Veterinary clinic/hospital
- Online
- Pet store
- Purchase the raw products and make my own food
- Other, please specify ____________________
- Prefer not to answer

How do you decide what to feed your dog? (Select all that apply)

- Veterinarian's or veterinary technician's recommendation
- Cost
- What's on sale
- Convenience
- Packaging of pet food
- Ingredients of pet food
- Loyalty to certain brand(s)
- Feeding what my family/friends have been feeding their pet(s)
- Feeding my dog what I think it enjoys eating
- Feeding my dog what I think it should eat
- Current health status of my dog
- Activity levels of my dog
- Reading about diets online
- Other

Select the statement(s) that best describe how you currently feed your dog. (Select all that apply)

- I measure my dog's food using measuring cups
- I measure my dog's food using a scale
- I feed my dog with a scheduled, portion controlling feeding method
- I feed my dog with a scheduled feeding method without portioning
- I free-feed my dog
How healthy do you think your dog’s diet is?

- Very healthy
- Moderately healthy
- Neither healthy nor unhealthy
- Moderately unhealthy
- Very unhealthy
- Prefer not to answer

To what extent do you think about your dog’s nutrition?

- Every time they eat
- Regularly but not daily
- Unsure how to answer this question
- Intermittently
- Never

Which of the following would motivate you to make an effort to change your dog’s diet? (Select all that apply)

- Veterinarian’s or veterinary technician’s recommendation
- Cost
- Family’s encouragement
- Friend’s encouragement
- Reading about a new diet online
- Pet food advertisements
- My dog’s health
- Other, please specify ____________________

What barriers might you face in changing your dog’s diet? (Select all that apply)

- Too costly
- Too much work
- My dog might not like it
- Experts keep changing their minds
- Change of diet causes health problems
- I do not know enough about pet nutrition
- I’d like to stick to what my family fed their pets
- Other, please specify ____________________

Take a moment to think about how your dog spends their time at home and the relationship that you share with them. When you are ready, click the next button to continue.

Which of the following best describes how you think of yourself with respect to your dog?

- Owner
Pet parent
Caregiver
Companion
Friend
Family member
Other, please specify ____________________
Prefer not to answer

Which of the following activities do you do with your dog? (Select all that apply)

Pet or cuddle your dog
Groom your dog
Play fetch
Play with toys together
Watch your dog play
Obedience/agility training
Sleep together
Talk to your dog
Walk/run together
Ride in the car
Watch TV together
Eat together
Watch your dog eat
Go to work together
Other, please specify ____________________
Prefer not to answer

Which of the following statements best describes how you feel when you think of prioritizing your nutrition AND your dog's nutrition?

Healthy nutrition for myself is much more important than for my dog
Healthy nutrition for myself is more important than for my dog
Healthy nutrition for myself is of equal importance to that of my dog
Healthy nutrition for myself is less important than more dog
Healthy nutrition for myself is much less important than for my dog

Which of the following is your primary source of information for your dog's nutrition? (Select all that apply)

Veterinarian
Veterinary technicians and other staff
Government agencies
Peer-reviewed journal articles
Google search
Pet health, food, nutrition blogs
- YouTube/other health videos online
- Pet health expert on the media (e.g. TV or radio commercials)
- Health websites
- Books/magazines
- Social media sites (e.g. Facebook, Twitter, Instagram, Snapchat)
- Family member
- Friend
- Breeder/trainer
- University lectures
- Campus resources
- Pet food company/manufacturer
- Grocery stores
- Other, please specify ____________________

To what degree do you rely on your veterinarian as a source for your dog’s nutrition?

- Always rely on his or her recommendation
- Regularly rely on his or her recommendation
- Unsure
- Rarely rely on his or her recommendation
- Do not ever rely on his or her recommendation
- Prefer not to answer

How often do you discuss your dog’s general nutrition with your veterinarian (aside from receiving a diet recommendation)?

- Each visit
- Only when my veterinarian asks me
- Only when I ask my veterinarian
- I would discuss it with my veterinarian when there is a specific health concern for my dog
- Rarely
- Prefer not to answer

Which factors have played a role in whether you discuss nutrition with your veterinarian? (Select the top 3 most influential)

- Your own experiences with your veterinarian
- Your university professors
- Your family/their experiences
- Your friends/their experiences
- Something that you read online
- Pet food commercials
- Discussions at the pet food store
- Dog trainer’s / breeders/ groomers/ sitters advice
To your knowledge, how much information do you think exists on dog nutrition?

- Very high amount
- Moderate amount
- Unsure
- Small amount
- None
- Prefer not to answer

Overall, how confident are you in knowing how to make changes to your dog's nutrition?

- Strongly confident
- Moderately confident
- Neither confident nor unconfident
- Moderately unconfident
- Strongly unconfident
- Prefer not to answer

Overall, how confident are you in knowing where to find information about your dog's nutrition?

- Strongly confident
- Moderately confident
- Neither confident nor unconfident
- Moderately unconfident
- Strongly unconfident
- Prefer not to answer

In your opinion, how easy is it to find information about your dog's nutrition?

- Very easy
- Moderately easy
- Unsure
- Moderately difficult
- Very difficult
- Prefer not to answer

How much do you trust each of the following?

<table>
<thead>
<tr>
<th>Regulatory standards set for pet food industry</th>
<th>Strongly distrust</th>
<th>Moderately distrust</th>
<th>Neither trust nor distrust (3)</th>
<th>Moderately trust (4)</th>
<th>Strongly trust (5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Veterinarians</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>
In your opinion, which of the following describes pet food companies’ motivations for advertising their products? (Select all that apply)

- Profit
- Providing pet owners with various diet options
- Educating pet owners about pet nutrition
- Investing into research surrounding pet nutrition
- Ensuring ethical production of products
- Utilizing marketing schemes to attract customers
- Competing with other players in the industry
- Transparency
- Other, please specify ____________________
- Prefer not to answer

Which of the following played a role in what you think of pet food companies’ motivations? (Select all that apply)

- Your own experiences
- Your family/ their experiences
- Your friends/ their experiences
- Your neighbours/ their experiences
- Media
END OF DOG SECTION

CAT OWNER SECTION

Now let's consider your cat's nutrition. The following set of questions will allow you to offer your insight on how you feed your cat.

What type of food do you currently feed your cat?

- Dry
- Wet
- Semi-moist
- Canned
- Homemade cooked diets
- Homemade raw diets
- Commercial raw diets
- Other, please specify____________________
- Prefer not to answer

What type of treats do you currently feed your cat? (Select all that apply)

- Daily
- Few times a week
- Few times a month
- Rarely
- Prefer not to answer

Where do you purchase your cat's food? (Select all that apply)

- Supermarket/ Grocery Store
- Big-box stores (e.g. Walmart, Costco)
- Veterinary clinic/ hospital
- Online
- Pet store
- Purchase the raw products and make my own food
- Other, please specify____________________
- Prefer not to answer
How do you decide what to feed your cat? (Select all that apply)

- Veterinarian's or veterinary technician's recommendation
- Cost
- What's on sale
- Convenience
- Packaging of pet food
- Ingredients of pet food
- Loyalty to certain brand(s)
- Feeding what my family/friends have been feeding their pet(s)
- Feeding my cat what I think it enjoys eating
- Feeding my cat what I think it should eat
- Current health status of my cat
- Activity levels of my cat
- Reading about diets online
- Other, please specify

Select the statement(s) that best describes how you currently feed your cat.

- I measure my cat's food using measuring cups
- I measure my cat’s food using a scale
- I feed my cat with a scheduled, portion controlling feeding method
- I feed my cat with a scheduled feeding method without portioning
- I free-feed my cat

How healthy do you think your cat's diet is?

- Very healthy
- Moderately healthy
- Neither healthy nor unhealthy
- Moderately unhealthy
- Very unhealthy
- Prefer not to answer

To what extent do you think about your cat's nutrition?

- Every time they eat
- Regularly but not daily
- Unsure how to answer this question
- Intermittently
- Never
- Prefer not to answer

Which of the following would motivate you to make an effort to change your cat's diet? (Select all that apply)
Veterinarian's or veterinary technician's recommendation
Cost
Family's encouragement
Friend's encouragement
Reading about a new diet online
Pet food advertisements
My cat's health
Other, please specify ________________

What difficulties might you face in changing your cat's diet? (Select all that apply)

Too costly
Too much work
My cat might not like it
Experts keep changing their minds
Change of diet causes health problems
I do not know enough about pet nutrition
I'd like to stick to what my family fed their pets
Other, please specify ________________

Take a second to think about how your cat spends their time at home and the relationship that you share with them. When you are ready, click the next button to continue.

Which of the following best describes how you think of yourself with respect to your cat?

Owner
Pet parent
Caregiver
Companion
Friend
Family member
Other, please specify ________________
Prefer not to answer

Which of the following activities do you do with your cat? (Select all that apply)

Pet or cuddle your cat
Groom your cat
Play with toys together
Sleep together
Watch TV together
Talk to your cat
Eat together
Other, please specify ________________
Prefer not to answer
Which of the following statements best describes how you feel when you think of prioritizing your nutrition AND your cat’s nutrition?

- Healthy nutrition for myself is much more important than for my cat
- Healthy nutrition for myself is more important than for my cat
- Healthy nutrition for myself is of equal importance to that of my cat
- Healthy nutrition for myself is less important than for my cat
- Healthy nutrition for myself is much less important than for my cat

Which of the following is your primary source of information for your cat’s nutrition? (Select all that apply)

- Veterinarian
- Veterinary technicians and other staff
- Government agencies
- Peer-reviewed journal articles
- Google search
- Pet health, food, nutrition blogs
- YouTube/other health videos online
- Pet health expert on the media (e.g. TV or radio commercials)
- Health websites
- Books/magazines
- Social media sites (e.g. Facebook, Twitter, Instagram, Snapchat)
- Family member
- Friend
- Breeder/trainer
- University lectures
- Campus resources
- Pet food company/ manufacturer
- Grocery stores
- Other, please specify ____________________

To what degree do you rely on your veterinarian as a source for your cat’s nutrition?

- Always rely on his or her recommendation
- Regularly rely on his or her recommendation
- Unsure
- Rarely rely on his or her recommendation
- Do not ever rely on his or her recommendation
- Prefer not to answer

How often do you discuss nutrition with your veterinarian?

- Each visit
- Only when my veterinarian asks me
- Only when I ask my veterinarian
I would discuss it with my veterinarian when there is a specific health concern for my cat
Rarely
Prefer not to answer

Which factors have played a role in whether you go to your veterinarian as a source of information for your cat’s nutrition? (Select the top 3 most influential)
- Your own experiences with your veterinarian
- Your university professors
- Your family/their experiences
- Your friends/their experiences
- Something that you read online
- Pet food commercials
- Discussions at the pet food store
- Cat trainer’s/breeders/groomers/sitters advice

To your knowledge, how much information do you think exists on cat nutrition?
- Very high amount
- Moderate amount
- Unsure
- Small amount
- None
- Prefer not to answer

Overall, how confident are you in knowing how to make changes to your cat’s nutrition?
- Strongly confident
- Moderately confident
- Neither confident nor unconfident
- Moderately unconfident
- Strongly unconfident
- Prefer not to answer

Overall, how confident are you in knowing where to find information about your cat’s nutrition?
- Strongly confident
- Moderately confident
- Neither confident nor unconfident
- Moderately unconfident
- Strongly unconfident
- Prefer not to answer

In your opinion, how easy is it to find information about your cat’s nutrition?
- Very easy
- Moderately easy
• Unsure
• Moderately difficult
• Very difficult
• Prefer not to answer

How much do you trust each of the following?

<table>
<thead>
<tr>
<th></th>
<th>Strongly distrust</th>
<th>Moderately distrust</th>
<th>Neither trust nor distrust (3)</th>
<th>Moderately trust (4)</th>
<th>Strongly trust (5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regulatory standards set for pet food industry</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Veterinarians recommending certain diets</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The safety of commercial diets for pets</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Advice from a veterinarian for your pet’s nutrition</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The messages the media portrays with regards to your pet’s nutrition</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Advice from a veterinarian who’s sponsored by a certain food company</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Online sources for your pet’s nutrition</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

In your opinion, which of the following describes pet food companies’ motivations for advertising their products? (Select all that apply)

- Profit
- Providing pet owners with various diet options
- Educating pet owners about pet nutrition
- Investing into research surrounding pet nutrition
- Ensuring ethical production of products
Utilizing marketing schemes to attract customers
Competing with other players in the industry
Transparency
Other, please specify __________________________

Which of the following played a role in what you think of pet food companies’ motivations? (Select all that apply)

Your own experiences
Your family/ their experiences
Your friends/ their experiences
Your neighbours/ their experiences
Media
Internet
Degree of transparency offered by the company
Class/school
Breeder/ trainer
Clubs/ professional affiliations
Special interest groups
Other, please specify __________________________

END OF CAT SECTION

ALL OWNERS SECTION

How knowledgeable do you think you are on pet nutrition?

Very unknowledgeable
Barely knowledgeable
Unsure
Moderately knowledgeable
Very knowledgeable
Prefer not to answer

Which of the following is the top factor that influenced your bond with your current pet?

Growing up with family pet
Feeling of company at home
Feeling of responsibility for pet
Other, please specify __________________________
Prefer not to answer

Lastly, consider these statements with respect to your pet(s)’ nutrition…

| Strongly disagree | Disagree | Neither agree nor disagree | Agree (4) | Strongly agree (5) |
| Commercial pet food is increasing prevalence of obesity | (3) | (3) | (3) | (3) | (3) |
| I worry about filler ingredients in my pet food | (3) | (3) | (3) | (3) | (3) |
| I want to provide my pet with the best nutrition possible | (3) | (3) | (3) | (3) | (3) |
| Treats communicate love from owners to their pets | (3) | (3) | (3) | (3) | (3) |
| The differing opinions of different veterinarians makes me question their recommendations | (3) | (3) | (3) | (3) | (3) |

**NUTRITION EDUCATION SECTION**

How informed do you currently consider yourself regarding pet nutrition?
- Strongly uninformed
- Poorly informed
- Neither informed or uninformed
- Moderately informed
- Strongly informed
- Prefer not to answer

Which of the following statements best applies to you when thinking about pet food recommendations?
- I am not aware of any pet food recommendations
- I am aware that pet food recommendations exist, but not sure what they are
- I am aware of what pet food recommendations exist but do not know where to find them
- I am aware of what pet food recommendations exist and know where to find them
- I am aware of what pet food recommendations exist and I know how to apply them

How important do you think nutrition education is as part of the veterinary curriculum?
- Not at all important
- Slightly important
- Neither important nor unimportant
- Moderately important
When you think of your nutrition education preparing you for nutrition consultation in clinical practice, rate your level of agreement with each statement.

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly disagree</th>
<th>Disagree</th>
<th>Neither agree nor disagree (3)</th>
<th>Agree (4)</th>
<th>Strongly agree (5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nutrition education should prepare me to provide a nutritional assessment at each client visit</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Nutrition should only be discussed when a client asks a veterinarian</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Nutrition should only be discussed when there’s a specific health concern for the pet</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Nutrition should only be discussed with the veterinarian brings it up</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
</tbody>
</table>

When you think of an ideal veterinarian-client-patient relationship, which of the following consultation skills are most important? (Select all that apply)

- Ability to communicate effectively with owners
- Personalized nutrition recommendations to both client's and pet's need
- Being presented with range of options tailored to client's budget
- Client's relationship with pet incorporated into consultation
- Use of language that clients can understand and implement
- Confidence to correct client’s nutrition misinformation
- Respecting client's decisions
- Presenting information to clients in more than one for
- Other, please specify ____________________________________________________________
- Prefer not to answer

How much emphasis do you think is placed on nutrition education in the veterinary curriculum compared to other subjects?

- Much more emphasis than other areas
- Moderately more emphasis than other areas
- Same amount of emphasis as other areas
- Moderately less emphasis than other areas
- Much less emphasis than other areas
- Prefer not to answer
Do you think you will have enough training in each of the following areas once you graduate veterinary school to enter private veterinary practice?

<table>
<thead>
<tr>
<th>Area</th>
<th>Yes</th>
<th>Somewhat</th>
<th>No</th>
<th>Unsure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surgery</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medicine</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nutrition</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Behaviour</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Communication</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anatomy/Physiology</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pharmacology</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

How confident do you feel you will be in discussing nutrition with clients upon graduating based on your veterinary nutrition education?

- Not at all confident
- Slightly confident
- Neither confident nor unconfident
- Moderately confident
- Extremely confident

Please rate your anticipated level of confidence in applying your veterinary nutrition education with each statement:

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly disagree</th>
<th>Disagree</th>
<th>Neither agree nor disagree (3)</th>
<th>Agree (4)</th>
<th>Strongly agree (5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I believe that I can apply the veterinary nutrition education that I will receive to my current companion animal</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>If I practiced every day, I could develop enough skill to consult on nutrition</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I can manage to learn nutrition information if I receive a great deal of support from others</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Once I’ve decided to accomplish something that’s important to me, I keep trying to accomplish it, even if it is harder than I thought</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

How would you prefer to learn about nutrition during veterinary school in order to prepare you for your clinical roles? (Select all that apply)

- By listening to lectures
- Hands-on learning
During clinical practice
Field trips to pet food companies
Presentations from pet food company representatives
Studying materials/resources
Online discussions
Other, please specify ________________________________________________
Prefer not to answer

Congratulations! You have reached the end of the questionnaire. Please click ‘>>’ to ensure that your answers get recorded. Once you proceed, you will be automatically redirected to a short form that will enter you into the draw for the chance of winning an iPad. DO NOT EXIT THE BROWSER BEFORE BEING REDIRECTED, otherwise you will not be entered into the draw.
Online Questionnaire Tool Developed to Capture Pet Owners’ Nutrition Attitudes, Beliefs and Nutrition Information-Seeking Behaviours.

PET OWNERS QUESTIONNAIRE – USA AND CANADA

**This is a Word version of a Qualtrics online survey, therefore formatting in this document is not the same as it would appear on the online version.

Dear Pet Owner,

Thank you for taking the time to participate in this important research. Information collected from the questionnaire will only be analyzed by May Kamleh, PhD Candidate and Dr. Deep Khosa, BVMS, PhD. Your opinions and experiences will help us to better understand pet owners’ perceptions of their own nutrition, their pet's nutrition and the nutrition information that they receive from their doctor and veterinarian. Data generated from this study could be useful in improving how nutrition is delivered to veterinarians so that communication of this information to clients can be more effective. The questionnaire is anonymous, and your participation is completely voluntary. If the results of the study are published, your name will not be used and no information that discloses your identity will be released or published. If you wish to receive a copy of the results, you may contact the research team for a copy of a published manuscript whenever available.

If you choose to participate, please click "I consent to participate in this survey" button at the bottom of this page. Please try to answer all parts of each question. The estimated time to complete the questionnaire is 20-25 minutes.

Upon submission of the questionnaire, you will have the opportunity to enter your name into a separate form in order to be entered into a draw to win 1 of 13 Visa card prizes:

2x $150        4x $100        3x $50        4x $25

The winners will be chosen using a random draw generator. The chances of winning will depend on the number of people who enter the draw. You are free to withdraw at any time without penalty by closing your browser. You are also free to skip any question(s) that you do not wish to answer and still submit the questionnaire. If you choose to withdraw prior to submission, you will not be eligible to enter the draw. If you withdraw after your responses have been submitted, you will still be entered into the draw but will not be able to withdraw your data. No identifiers will be linked to your data however.

This study has been approved by the Research Ethics Board of the University of Guelph (REB#16JA309). If you have any questions or concerns, please feel free to contact May Kamleh, PhD Candidate at mkamleh@uoguelph.ca. I have read and understand the above
information and agree to participate in this study. You can download a full printable version of
the form here: Printable consent form-PO

- I consent to participate in this study

We recognize that you may have more than one pet. In order to get the most accurate
response, please focus on ONLY ONE PET when answering the remainder of the
questionnaire.

What is the species of the pet you would like to answer the questionnaire about?
- Dog
- Cat
- Bird
- Reptile
- Fish
- Rabbit
- Other (please specify) ______________________________________________

How old is your pet?
Months ________________________________
Years ________________________________

How long have you owned the pet?
Months ________________________________
Years ________________________________

Where did you get your pet from?
- Rescue center/Adopted/Shelter
- Breeder
- Home-bred
- Pet store
- Online
- Family/friend
- Other (please specify) ______________________________________________

How would you rate your level of attachment to your pet.
- Not attached
- Neutral
- Extremely Attached

How would you describe your relationship with your pet? Please select one answer that best fits
your relationship.
- Pet
- Family member
- Friend/companion
- Child

Where does your pet spend most of his/her time?
- Inside
- Outside
What type of food do you currently feed your pet? (Check all boxes that apply)

<table>
<thead>
<tr>
<th>Food Type</th>
<th>Yes (5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry/ kibble diet</td>
<td>o</td>
</tr>
<tr>
<td>Wet/ canned diet</td>
<td>o</td>
</tr>
<tr>
<td>Home cooked food</td>
<td>o</td>
</tr>
<tr>
<td>Raw diet (home-made or commercial)</td>
<td>o</td>
</tr>
<tr>
<td>Table scraps</td>
<td>o</td>
</tr>
<tr>
<td>Vegetarian diet</td>
<td>o</td>
</tr>
<tr>
<td>Prescription/ therapeutic diet</td>
<td>o</td>
</tr>
<tr>
<td>Commercial treats</td>
<td>o</td>
</tr>
<tr>
<td>Homemade treats</td>
<td>o</td>
</tr>
<tr>
<td>Bones</td>
<td>o</td>
</tr>
<tr>
<td>Other (please specify)</td>
<td>o</td>
</tr>
</tbody>
</table>

Display This Question:
If What type of food do you currently feed your pet? (Check all boxes that apply) = Home cooked food [ Yes ]

What are your reasons for feeding a home cooked diet? Please select all that applies.
- Belief that it is healthier for my pet
- Recommended by veterinarian or vet tech/nurse
- Cheaper than commercial pet food
- Easier than buying commercial pet food
- No commercial diet available that fits pet's medical needs
- Recommended in books/online/media
- Preference of my pet
- Recommended by family/friend
- Other (please specify) ________________________________

Display This Question:
If What type of food do you currently feed your pet? (Check all boxes that apply) = Raw diet [ Yes ]

What are your reasons for feeding a raw diet? Please select all that applies.
- Belief that it is healthier for my pet
- Recommended by veterinarian or vet tech/nurse
- Cheaper than commercial pet food
- Easier than buying commercial pet food
- No commercial diet available that fits pet's medical needs
- Recommended in books/online/media
- Preference of my pet
❑ Recommended by family/friend
❑ Other (please specify) _______________________________________________

How often do you feed your pet vitamins or supplements?
❖ Daily
❖ Weekly
❖ Monthly
❖ Never

Where do you usually go to buy your pet's food? Please select all that apply.
❖ Supermarket
❖ Veterinary clinic/hospital
❖ Online
❖ Pet Store
❖ Purchase the raw products and make my own food
❖ Other _______________________________________________

What factors are important to you when buying food or other products for your pet? Please select all that apply.
❖ Price
❖ Expiration date
❖ Natural ingredients
❖ Safety
❖ Size/quantity of package
❖ Recommendation by a veterinarian
❖ Recommendation by other pet owners
❖ Packaging
❖ Environmentally friendly products
❖ Other (please specify) _______________________________________________

In an average week, how many hours of exercise does your pet get?
________________________________________________________________

How important is it to you that your pet exercises regularly?
❖ Not at all important
❖ Slightly important
❖ Moderately important
❖ Very important
❖ Extremely important

To the best of your knowledge, please rate your pet's current general health status.
❖ Terrible
❖ Poor
❖ Average
❖ Good
❖ Excellent

How healthy do you think your pet's current diet is?
❖ Terrible
How often do you think about your pet's nutrition?
- Always
- Most of the time
- Sometimes
- Never

How knowledgeable do you think you are about pet nutrition?
- None at all
- A little
- A moderate amount
- A lot

When it comes to your pet's well-being, how important is each of the following factors?

<table>
<thead>
<tr>
<th>Not at all important</th>
<th>Moderately important</th>
<th>Extremely important</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Health/life expectancy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Energy level</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weight</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Happiness</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Behavioral issues</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

How did you decide on what to feed your pet? Please select the top 2 factors that apply to you most.
- Information from veterinarian
- Information from veterinarian clinic staff (e.g. nurse, vet tech)
- Information from breeder/rescue center
- Information on pet food packaging
- Information online
- Cost of diet
- Information from pet store staff
- From information in book/magazine/TV
- It is how my family/ friends have always fed their pet
- It is similar to my own diet
- Other (please specify)  ________________________________________________
How do you decide how much to feed your pet? Please select the top 2 that apply to you most.

- Instructions from veterinarian / nurse
- Instructions on food can or package
- Until pet stops eating
- Assess body condition and adjust
- It is how my family/ friends have always fed their pet
- Read about the instructions online
- Other (please specify) ____________________________________________

Do you know how much your pet weighs?

- Yes
- No

Using the guidelines in the images above, select a body condition score for your pet:

- Very thin
- Underweight
- Ideal
- Overweight
- Obese

Display This Question:
If Using the guidelines in the images above, select a body condition score for your pet: = Obese
Or Using the guidelines in the images above, select a body condition score for your pet: = Overweight

Why do you think your pet is overweight?

- Too much food
- Too little exercise
- Medical condition
- Unsure

Display This Question:
If Using the guidelines in the images above, select a body condition score for your pet: = Very thin
Or Using the guidelines in the images above, select a body condition score for your pet: = Underweight

Why do you think your pet is underweight?

- Not enough food
- Too much exercise
- Medical condition
- Unsure

Are you aware that the quality of your pet's nutrition can affect their risk for disease?

- Yes
- No

Do feel your pet is at risk for any of the following?

<table>
<thead>
<tr>
<th>Susceptibility</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Condition</td>
<td>Yes</td>
</tr>
<tr>
<td>---------------------------------</td>
<td>-----</td>
</tr>
<tr>
<td>Vitamin/ nutrient deficiency</td>
<td>☐</td>
</tr>
<tr>
<td>Obesity</td>
<td>☐</td>
</tr>
<tr>
<td>Underweight</td>
<td>☐</td>
</tr>
<tr>
<td>Digestive disease</td>
<td>☐</td>
</tr>
<tr>
<td>Diabetes</td>
<td>☐</td>
</tr>
<tr>
<td>Kidney disease</td>
<td>☐</td>
</tr>
<tr>
<td>Heart disease</td>
<td>☐</td>
</tr>
<tr>
<td>Bone disease</td>
<td>☐</td>
</tr>
<tr>
<td>Dental disease</td>
<td>☐</td>
</tr>
</tbody>
</table>

Please respond to each statement about your beliefs surrounding your pet’s risk for nutrition-related diseases.

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly disagree</th>
<th>Somewhat disagree</th>
<th>Neither agree nor disagree</th>
<th>Somewhat agree</th>
<th>Strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>It is possible that my pet needs a different diet.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I believe my pet’s nutrition should be assessed at every veterinary appointment.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>It is likely my pet will get sick from nutrition-related diseases.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I cannot see any visible symptoms of weight-related problems in my pet.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>My pet looks healthy compared to other pets I know.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

When thinking of your pet’s nutrition, do you feel like any of the following conditions would pose serious health risks?

<table>
<thead>
<tr>
<th>Condition</th>
<th>Serious Condition</th>
<th>Not Serious Condition</th>
<th>Unsure (3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vitamin/ nutrient deficiency</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Obesity</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Underweight</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Digestive disease</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Diabetes</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Kidney disease</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Heart disease</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Bone disease</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Dental disease</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>

Please respond to each statement about your beliefs surrounding severity of nutrition-related diseases.

<table>
<thead>
<tr>
<th>Strongly disagree</th>
<th>Somewhat disagree</th>
<th>Neither agree nor disagree</th>
<th>Somewhat agree</th>
<th>Strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

1. Nutrition-related health problems in my pet (e.g. obesity, diabetes) are a serious health concern.
2. If my pet were to become ill, it would change my or my family's life.
3. If I do not know enough about my pet's nutrition, it would cause me emotional distress.
4. If my pet were to become ill, it would lead to financial problems for me.
5. Thinking about nutrition-related problems in my pet frightens me.

Have you ever tried to change your pet's weight?
- ☐ Yes, I tried to reduce it
- ☐ Yes, I tried to increase it.
- ☐ No, I never tried to change my pet's weight.

*Display This Question:*
If Have you ever tried to change your pet's weight? = Yes, I tried to reduce it

How did you try to achieve weight loss (select all that apply)?
- ☐ Ask veterinarian
- ☐ Look for information online
- ☐ Change diet
- ☐ Reduce food
- ☐ Increase exercise
- ☐ Ask family/friends
- ☐ Ask breeder
- ☐ Other (please specify)____________________________________________________

*Display This Question:*
If Have you ever tried to change your pet's weight? = Yes, I tried to reduce it
Or Have you ever tried to change your pet's weight? = Yes, I tried to increase it.

Please respond to each statement about why you did try to alter your pet's weight?

Strongly disagree | Somewhat disagree | Neither agree nor disagree | Somewhat agree | Strongly agree |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>------------------------------</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>I am worried about health problems in my pet.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I want to improve my pet's quality of life.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aesthetic reason (want my pet to look healthier)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

If your veterinarian gave you dietary recommendation on any of the following topics, what is your intention to will follow each advice?

<table>
<thead>
<tr>
<th>Topics</th>
<th>Definitely will not</th>
<th>Probably will not</th>
<th>50/50 Chance</th>
<th>Probably will</th>
<th>Definitely will</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increase my pet's weight</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reduce my pet's weight</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Increase my pet's amount of exercise</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Change the way I feed my pet</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reduce or stop giving treats</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Give my pet vitamins-supplements</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Feed my pet a more expensive diet</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

How often do you take your pet to a veterinarian?
- More than once a year
- About once a year
- Less than once a year
- Never, no veterinarian

Display This Question:
If How often do you take your pet to a veterinarian? = About once a year
Or How often do you take your pet to a veterinarian? = More than once a year

What are your reasons for regularly visiting your veterinarian?
- Strongly
- Somewhat
- Neither
- Somewhat
- Strongly
When I get regular pet health checkups, it is good for my pet's health.  

When I get regular pet health checkups, it is good for my peace of mind.  

When I ask my veterinarian about my pet's health, I do not have to look for information elsewhere.  

I prioritize my pet's health over my own.  

How often do you discuss nutrition with your veterinarian?  
- Only when my veterinarian brings it up  
- Each visit  
- Only when I have a specific question  
- Only when my pet presents with a health condition  

When was the last time you received nutrition advice from your veterinarian?  
- Never  
- In the past year  
- In the past three years  
- More than three years ago  

Please rate your agreement with each statement below.  

<table>
<thead>
<tr>
<th>Strongly disagree</th>
<th>Somewhat disagree</th>
<th>Neither agree nor disagree</th>
<th>Somewhat agree</th>
<th>Strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

It is good for my health to ask my veterinarian about nutrition regularly.  

When I ask my veterinarian about my pet's nutrition, I do not have to look for information elsewhere.  

When I discuss nutrition with my veterinarian, I am decreasing my pet's chances of becoming sick.  

Knowing more about my pet's nutrition from my veterinarian can help me do good to others (e.g. give other pet owners advice).
My veterinarian can provide me with the necessary medical options and prescribe medications.

My veterinarian’s nutrition advice is effective in helping me manage my pet’s diet and health.

I do not know how often to ask my veterinarian about nutrition.

I do not discuss nutrition with my veterinarian because I am afraid to find out if my pet has a serious health problem.

I do not have time or financial ability during an appointment to discuss nutrition with my veterinarian.

I do not think that I will get valuable nutrition information from the veterinarian.

Nutrition discussions with my veterinarian can be embarrassing or uncomfortable.

Where do you get the majority of pet nutrition information from? Please select the top 2 that apply to you most.

- Veterinarian
- Nurse or veterinary technician
- Pet stores
- Books
- Social media (e.g. Facebook, Instagram, Twitter)
- Online videos
- Pet Blogs
- Advertisements
- Online websites
- Other (please specify)________________________________________________

Which of the following cues would motivate you to discuss nutrition with your veterinarian?

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>My family/friends advising me to do so.</td>
<td>☒</td>
<td>☐</td>
</tr>
<tr>
<td>My family/friends’ pets getting sick.</td>
<td>☒</td>
<td>☐</td>
</tr>
<tr>
<td>My pet developing a health problem.</td>
<td>☒</td>
<td>☐</td>
</tr>
<tr>
<td>Others judging me unfairly based on my pet’s weight.</td>
<td>☒</td>
<td>☐</td>
</tr>
<tr>
<td>Having my pet at a healthy weight would help me with my personal or professional goals.</td>
<td>☒</td>
<td>☐</td>
</tr>
<tr>
<td>I read on a social media website (e.g., Facebook, Twitter, Pinterest, Instagram, etc.) about the health risks of nutrition-related diseases in pets.</td>
<td>☒</td>
<td>☐</td>
</tr>
<tr>
<td>I am presented with information about the health risks of poor nutrition in pets in an advertisement, radio, television, or podcast program.</td>
<td>☒</td>
<td>☐</td>
</tr>
</tbody>
</table>
If a health professional reminded me about nutrition when I came in for a veterinarian’s visit.

When looking for pet nutrition information, how does each statement apply?

<table>
<thead>
<tr>
<th>Strongly disagree</th>
<th>Somewhat disagree</th>
<th>Neither agree nor disagree</th>
<th>Somewhat agree</th>
<th>Strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

- It is easy for me to find information on pet nutrition.
- When I encounter information about pet nutrition, I am likely to stop and think about it.
- I trust the pet nutrition advice I get from my veterinarian.
- I consider veterinarians a knowledgeable resource on pet nutrition.
- I can easily understand the pet nutrition advice from my veterinarian.
- I know how to apply the nutrition advice I get from my veterinarian to my pet’s lifestyle.
- I would be more confident of understanding and acting on health instructions from my veterinarian if I was referred to an informational website for more information.

The following section will ask you some questions about your current lifestyle behaviors.

Describe your average level of exercise (hours per week).

How important is exercise to you?
- Extremely important
- Very important
- Moderately important
- Slightly important
- Not at all important

To the best of your knowledge, please rate your current general health status.
- Terrible
- Poor
- Average
- Good
- Excellent
During the past 4 weeks, to what extent has your physical health or mental health interfered with your work or social activities (like visiting friends, chores, etc.)?
- Not at all
- Slightly
- Moderately
- Quite a bit
- All of the time

How healthy do you think your current diet is?
- Terrible
- Poor
- Average
- Good
- Excellent

The following section will ask you some questions about your own nutrition.

How often do you think about your own nutrition?
- Always
- Most of the time
- Sometimes
- Never

How knowledgeable do you think you are about human nutrition?
- None at all
- A little
- A moderate amount
- A lot

When you think about your health and well-being, what comes to mind? Please rate by importance.

<table>
<thead>
<tr>
<th></th>
<th>Not at all important</th>
<th>Moderately important</th>
<th>Extremely important</th>
</tr>
</thead>
<tbody>
<tr>
<td>Health/life expectancy</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Energy level</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weight</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Happiness</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

How do you decide on your overall eating habits? Please check the top two that apply to you.
- Advice from doctor
- Advice from clinic staff (e.g. nurse)
From information/diets online
❑ Information from supermarket staff
❑ Information from government food guide
❑ From information in book/magazine/TV
❑ It is how my family/ friends have always eaten
❑ From information on food packaging
❑ Other (please specify) __________________________________________

Do you know how much you currently weigh?
❑ Yes
❑ No

How would you describe your own body condition?
❑ Underweight
❑ Healthy range
❑ Overweight
❑ Obese

Display This Question:
If How would you describe your own body condition? = Obese
Or How would you describe your own body condition? = Overweight

Why do you think you have become overweight?
❑ Too much food
❑ Too little exercise
❑ Medical condition
❑ Unsure

Display This Question:
If How would you describe your own body condition? = Underweight

Why do you think you are underweight?
❑ Not enough food
❑ Too much exercise
❑ Medical condition
❑ Unsure

Are you aware of any nutrition-related health risks associated with eating habits?
❑ Yes
❑ No

Do feel you are at risk for any of the following?

<table>
<thead>
<tr>
<th></th>
<th>Susceptibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vitamin/ nutrient</td>
<td>Yes</td>
</tr>
<tr>
<td>deficiency</td>
<td>○</td>
</tr>
<tr>
<td>Obesity</td>
<td>○</td>
</tr>
<tr>
<td>Underweight</td>
<td>○</td>
</tr>
<tr>
<td>Digestive disease</td>
<td>Diabetes</td>
</tr>
<tr>
<td>-------------------</td>
<td>----------</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Please respond to each statement about your beliefs surrounding your risk for nutrition-related diseases.

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly disagree</th>
<th>Somewhat disagree</th>
<th>Neither agree nor disagree</th>
<th>Somewhat agree</th>
<th>Strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>I am confident my eating habits are healthy enough.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I believe my nutrition should be assessed at every medical appointment.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>It is likely I will get sick from nutrition-related diseases.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I cannot see any visible symptoms of weight-related problems.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I look healthy compared to others I know.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

How serious do you think each of these conditions are on a person’s health?

<table>
<thead>
<tr>
<th>Condition</th>
<th>Severity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vitamin/ nutrient deficiency</td>
<td>Serious</td>
</tr>
<tr>
<td>Obesity</td>
<td></td>
</tr>
<tr>
<td>Underweight</td>
<td></td>
</tr>
<tr>
<td>Digestive disease</td>
<td></td>
</tr>
<tr>
<td>Diabetes</td>
<td></td>
</tr>
<tr>
<td>Kidney disease</td>
<td></td>
</tr>
<tr>
<td>Heart disease</td>
<td></td>
</tr>
<tr>
<td>Bone disease</td>
<td></td>
</tr>
<tr>
<td>Dental disease</td>
<td></td>
</tr>
</tbody>
</table>
Please respond to each statement about your beliefs surrounding severity of nutrition-related diseases.

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly disagree</th>
<th>Somewhat disagree</th>
<th>Neither agree nor disagree</th>
<th>Somewhat agree</th>
<th>Strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nutrition-related health problems (e.g. obesity, diabetes) are a serious health concern.</td>
<td><img src="image" alt="Rating" /></td>
<td><img src="image" alt="Rating" /></td>
<td><img src="image" alt="Rating" /></td>
<td><img src="image" alt="Rating" /></td>
<td><img src="image" alt="Rating" /></td>
</tr>
<tr>
<td>If I were to become ill, it would change my or my family’s life.</td>
<td><img src="image" alt="Rating" /></td>
<td><img src="image" alt="Rating" /></td>
<td><img src="image" alt="Rating" /></td>
<td><img src="image" alt="Rating" /></td>
<td><img src="image" alt="Rating" /></td>
</tr>
<tr>
<td>If I do not know enough about my nutrition, it would cause me emotional distress.</td>
<td><img src="image" alt="Rating" /></td>
<td><img src="image" alt="Rating" /></td>
<td><img src="image" alt="Rating" /></td>
<td><img src="image" alt="Rating" /></td>
<td><img src="image" alt="Rating" /></td>
</tr>
<tr>
<td>If I were to become ill, it would lead to financial problems for me.</td>
<td><img src="image" alt="Rating" /></td>
<td><img src="image" alt="Rating" /></td>
<td><img src="image" alt="Rating" /></td>
<td><img src="image" alt="Rating" /></td>
<td><img src="image" alt="Rating" /></td>
</tr>
<tr>
<td>Thinking about nutrition-related problems for own self frightens me.</td>
<td><img src="image" alt="Rating" /></td>
<td><img src="image" alt="Rating" /></td>
<td><img src="image" alt="Rating" /></td>
<td><img src="image" alt="Rating" /></td>
<td><img src="image" alt="Rating" /></td>
</tr>
</tbody>
</table>

Have you ever tried to change your weight?
- Yes, I tried to reduce it
- Yes, I tried to increase it.
- No, I never tried to change my weight.

*Display This Question:
If Have you ever tried to change your weight? = Yes, I tried to reduce it

How did you try to achieve weight loss (select all that apply)?
- Asked doctor/nurse
- Worked with nutritionist
- Looked for information online
- Changed diet
- Reduced food
- Increased exercise
- Asked family/friends
- Other (please specify) ________________________________________________

*Display This Question:
If Have you ever tried to change your weight? = Yes, I tried to reduce it
Or Have you ever tried to change your weight? = Yes, I tried to increase it.

Please respond to each statement about why you did try to alter your weight?

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly disagree</th>
<th>Somewhat disagree</th>
<th>Neither agree nor disagree</th>
<th>Somewhat agree</th>
<th>Strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly disagree</td>
<td>Somewhat disagree</td>
<td>Neither agree nor disagree</td>
<td>Somewhat agree</td>
<td>Strongly agree</td>
<td></td>
</tr>
</tbody>
</table>
I was worried about health problems.

I did not want my quality of life to be affected.

Aesthetic reason (e.g. looking healthy)

Based on advice from a doctor, what is your intention to do each of the following:

<table>
<thead>
<tr>
<th>Activity</th>
<th>Definitely Will Not</th>
<th>Probably Will Not</th>
<th>50/50 Chance</th>
<th>Probably Will</th>
<th>Definitely Will</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduce my weight</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Increase my weight</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Increase my amount of exercise</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Change my diet</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Take vitamins/supplements</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spend more money on my food</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

How often do you visit a doctor for a routine health check-up?

- I do not get regular health check-ups (i.e. only go for emergencies)
- Less than once a year
- About once a year
- More than once a year

Which of the following factors plays a role in your decision to ask your doctor about your nutrition.

<table>
<thead>
<tr>
<th>Factor</th>
<th>Strongly Disagree</th>
<th>Somewhat Disagree</th>
<th>Neither Agree Nor Disagree</th>
<th>Somewhat Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>It is good for my health to ask my doctor about nutrition regularly.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
When I ask my doctor about my nutrition, I do not have to look for information elsewhere.

When I discuss nutrition with my doctor, I am decreasing my chances of becoming sick.

Knowing more about nutrition from my doctor can help me do good to others (e.g. give my family advice).

My doctor can provide me with the necessary medical options and prescribe medications.

My doctor’s nutrition advice is effective in helping me manage my diet and health.

I do not know how often to ask my doctor about nutrition.

I do not discuss nutrition with my doctor because I am afraid to find out if I have a serious health problem.

I do not have time or financial ability during an appointment to discuss nutrition with my doctor.

I do not think that I will get valuable nutrition information from the doctor.

Nutrition discussions with my doctor can be embarrassing or uncomfortable.

How often do you discuss nutrition with your doctor?
- Only when my doctor brings it up
- Each visit
- Only when I have a specific question
- Only when I present with a health condition

When was the last time you received nutrition advice from your doctor?
- Never
- In the past year
- In the past three years
- More than three years ago

Where do you get the majority of nutrition information for your own health from? Please select the top 2 that apply to you most.
- Doctor
- Nurse
- Nutritionist
- Supermarket
- Books
- Social media (e.g. Facebook, Instagram, Twitter)
- Online videos
- Health/food blogs
- Advertisements
- Online websites (e.g. MedlinePlus)
- Other (please specify) ________________________________________________

Which of the following cues would motivate you to discuss nutrition with your doctor?

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>My family/friends advising me to do so.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>My family/friends getting sick.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Developing a health problem.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Others judging me unfairly based on my weight.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Being at a healthy weight would help me achieve</td>
<td></td>
<td></td>
</tr>
<tr>
<td>my personal or professional goals.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I read on a social media website (e.g., Facebook,</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Twitter, Pinterest, Instagram, etc.) about the</td>
<td></td>
<td></td>
</tr>
<tr>
<td>health risks of nutrition-related diseases.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I am presented with information about the health</td>
<td></td>
<td></td>
</tr>
<tr>
<td>risks of poor nutrition in an advertisement,</td>
<td></td>
<td></td>
</tr>
<tr>
<td>radio, television, or podcast program.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>If a health professional reminded me about</td>
<td></td>
<td></td>
</tr>
<tr>
<td>nutrition when I came in for a doctor’s visit.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

When looking for nutrition information, how does each statement apply?

<table>
<thead>
<tr>
<th></th>
<th>Strongly disagree</th>
<th>Somewhat disagree</th>
<th>Neither agree nor disagree</th>
<th>Somewhat agree</th>
<th>Strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>It is easy for me to find information on nutrition.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>When I encounter information about nutrition, I</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>am likely to stop and think about it.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I trust the nutrition advice I get from my doctor.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I consider doctors a knowledgeable resource on</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>nutrition.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I am confident that I can understand the nutrition</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>advice from my doctor.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I know how to apply the nutrition advice I get</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>from my doctor to my lifestyle.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I would be more confident of understanding and</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>acting on health instructions from my doctor if I</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>was referred to an informational website for more</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>information.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
In what year were you born?
________________________________________________________________

What is your sex?
☐ Male
☐ Female
☐ Intersex
☐ Prefer not to answer

What is your marital status?
☐ Single (never married)
☐ Married or living with someone
☐ Divorced or separated
☐ Widowed
☐ Prefer not to answer

Do you have any children? If so, please write the number.
☐ Yes, they live with me. ________________________________
☐ Yes, but they live elsewhere. ________________________________
☐ I do not have any children.

Where do you currently live?
☐ Africa
☐ Asia
☐ Antarctica
☐ Canada
☐ Central America
☐ Europe
☐ Mexico
☐ Middle East
☐ Oceania (Australia, New Zealand, Polynesia, Pacific Islands)
☐ USA
☐ West Indies

Which of the following best describes the area you live in?
☐ Urban
☐ Suburban
☐ Rural

Do you work in the human or veterinary health care field?
☐ Yes
☐ No

Does any household member work in the human or veterinary health care field?
☐ Yes
☐ No

How you ever taken at least one professional nutrition course (e.g. in college, university, online...
What is the highest degree or level of school you have completed? *If currently enrolled, highest degree received.*
- Less than high school
- High school graduate
- Some college
- 2-3 year Diploma
- 4 year Bachelor’s degree
- Professional degree (e.g. JD, MD, PharmD)
- Master’s or Doctorate

What is your current employment status?
- Employed full time
- Employed part time
- Unemployed
- Retired
- Student
- Prefer not to answer

Please choose the range that includes your current household income:
- less than $19,999
- $20,000 - $39,000
- $40,000 - $59,000
- $60,000 - $79,999
- $80,000 - $99,999
- $100,000 +
- Prefer not to answer

Thank you for taking her time to complete this survey. Your opinions are very valued. As a small thank you for your efforts, you will now be redirected to a survey to input your name, email and phone to be entered into a draw to win 1 of 13 Visa Gift Cards.