

DIET APPROACHES TO INCREASE LENTIL CONSUMPTION
IN YOUTH
The D.A.I.L.Y. Project

A Thesis Submitted to the College of
Graduate Studies and Research
in Partial Fulfillment of the Requirements
for the Degree of Master of Science
in the Nutrition and Dietetic Program
University of Saskatchewan
Saskatoon, Saskatchewan
Canada

Theodosia Natasha Stadnyk Phillips

PERMISSION TO USE

In presenting this thesis in partial fulfillment of the requirements for a Postgraduate degree from the University of Saskatchewan, I agree that the Libraries of this University may make it freely available for inspection. I further agree that permission for copying of this thesis in any manner, in whole or in part, for scholarly purposes may be granted by the professor or professors who supervised my thesis work or, in their absence, by the Head of the Department or the Dean of the College in which my thesis work was done. It is also understood that any copying or publication or use of this thesis or parts thereof for financial gain shall not be allowed without my written permission. It is also understood that due recognition shall be given to me and to the University of Saskatchewan in any scholarly use which may be made of any material in my thesis. Requests for permission to copy or to make other use of material in this thesis in whole or part should be addressed to:

Dean of the College of Pharmacy & Nutrition
University of Saskatchewan
44 Campus Drive
Saskatoon, SK, Canada, S7N 5B3

ABSTRACT

Canada has emerged as the world's largest producer and exporter of lentils yet domestic consumption is low and estimated at 0.6 cups per week for Canadians. As children are future consumers of lentils, the D.A.I.L.Y. (Diet Approaches to Increase Lentil Consumption in Youth) project examined, via a questionnaire given to caregivers, benefits and barriers to lentil consumption, nutrition knowledge of pulse foods such as lentils, current lentil consumption data and demographics.

A convenience sample, obtained from six schools across different geographic locations in Saskatoon, Saskatchewan, targeted caregivers of children 3 to 11 years of age ($n = 401$). To be eligible for the questionnaire, caregivers needed to be 18 years of age or older and self-identified as having a role in meal preparation within their households. Respondents were primarily aged 26 to 45 years (75.7% female) and were employed fulltime outside the home (59%). Participants used a five-point Likert scale (strongly agree to strongly disagree) to rank 41 statements eliciting information about their beliefs around lentils. Internal consistency of the belief questions was high (Cronbach's $\alpha = 0.86$). The main benefits associated with lentils were health benefits particularly "I believe healthy food is important to my child's health" (98.3% agreement) and "I would like to eat healthier" (93.8% agreement). The main barriers associated with lentils pertained to family acceptance, mainly "if my child liked lentils I would make them more" (76.3% agreement). Fifty-eight percent of total respondents stated they "never or rarely" consumed lentils (non-consumers). Of non-consumers, the top barriers to lentil consumption include lack of knowledge on how to cook lentils (25.2%), belief that family members would not accept lentils (21%) and the belief that lentils take too long to prepare (15.3%).

The majority of respondents perceive there to be more benefits than barriers associated with lentil consumption. An understanding of the perceived benefits and barriers surrounding lentil consumption will help formulate strategies to influence beliefs about lentils.

ACKNOWLEDGEMENTS

I wish to thank my research advisor, Dr. Gordon Zello, for his guidance, dedication and insight over the past two years. In addition, I wish to thank my Advisory Committee Chair Dr. Carol Henry and other Committee Members Drs. Bert Vandenberg, Phil Chilibeck and Kerry Alcorn for their time and support to the project.

A sincere thank you to the Saskatoon Public School Division for allowing me to conduct research in their schools and to the families and volunteers that made it all possible. Also, to my fellow colleagues and lab mates, thank you for countless reviews and feedback.

To my husband and best friend, Aaron, thank you for supporting my goals as I couldn't have done it without you. The same goes to my father, Grant, who taught me the value of both pulses and agriculture and my Mama Suzanne for teaching me the love of food. To my sisters, Justine and Alanna, I appreciate your endless support and encouragement. Finally, I am grateful to have such a patient and intelligent grandmother, Nancy, who not only took the time to teach me about food but introduced me to the science of nutrition (and hence why I am a dietitian today).

In conclusion, thank you to the Saskatchewan Pulse Growers for funding the DAILY project.

TABLE OF CONTENTS

PERMISSION TO USE.....	i
ABSTRACT.....	ii
ACKNOWLEDGEMENTS.....	iii
TABLE OF CONTENTS.....	iv
LIST OF TABLES.....	vi
LIST OF FIGURES.....	vii
LIST OF ABBREVIATIONS.....	viii
CHAPTER 1: INTRODUCTION.....	1
CHAPTER 2: LITERATURE REVIEW.....	3
2.1 Pulses in Canada.....	3
2.2 Pulses and Health.....	4
2.2.1 Glycemic index and treatment of chronic disease.....	6
2.2.2 Cardiovascular disease.....	7
2.2.3 Obesity.....	8
2.2.4 Cancer.....	9
2.2.5 Diabetes.....	10
2.2.6 Health promotion and prevention.....	12
2.3 Diet Quality.....	12
2.4 Determinants of Healthy Eating.....	14
2.5 Food Choice/Preference.....	17
2.6 Food Choice in Caregivers & Children.....	18
2.7 Social Psychology of Food.....	19
2.8 Benefits and Barriers to Pulse Foods.....	21
2.9 Promoting Pulses.....	24
CHAPTER 3: OBJECTIVES.....	25
3.1 Objectives & Rationale.....	25
3.2 Research Questions.....	26
3.3 Hypothesis.....	27
CHAPTER 4: METHODOLOGY.....	28
4.1 Study Design.....	28
4.2 Sample.....	28

4.3 Questionnaire Design.....	30
4.3.1 Development of the Draft Questionnaire.....	31
4.3.2 Pretesting of Questionnaire.....	34
4.3.3 Interviewer Training	38
4.4 Questionnaire Delivery	38
4.5 Data Analysis	41
CHAPTER 5: RESULTS.....	43
5.1 Response Rate.....	43
5.2 Demographics of Participants.....	44
5.3 Pulse and Lentil Consumption Data	48
5.4 Benefits and Barriers to Lentil Consumption	50
5.4.1 Benefit and Barrier Question Validation	50
5.4.2 Benefit and Barrier Data	51
5.4.3 Benefit and Barrier Data and Pulse/Lentil Consumption	55
5.5 Nutrition Knowledge	57
CHAPTER 6: DISCUSSION.....	59
6.1 The DAILY Project.....	59
6.2 Benefits and barriers surrounding lentil consumption	60
6.3 Demographics, beliefs and lentil consumption.....	64
6.4 Knowledge, beliefs and lentil consumption.....	66
6.5 Lentil and pulse consumption.....	68
6.6 Strengths and Limitations of the DAILY Questionnaire	69
6.6.1 Internal Validity.....	70
6.6.2 External Validity.....	72
CHAPTER 7: CONCLUSIONS & RECOMMENDATIONS	75
7.1 Lentil Messaging and Communications.....	75
7.2 Implications for Dietetic Practice	77
REFERENCES	79

LIST OF TABLES

Table 2.1: Nutrients per 175ml of pulses.....	5
Table 2.2: Glycemic index of foods using glucose as reference standard	6
Table 4.1: Benefit and barrier questions associated with each construct	36
Table 5.1: Completed number of questionnaires by school.....	43
Table 5.2: Demographics of DAILY questionnaire	46
Table 5.3: Alpha levels for constructs surrounding lentil consumption	50
Table 5.4: % Agreement with benefits to lentils.....	53
Table 5.5: % Agreement with barriers to lentils	54
Table 5.6: Mean belief scores by lentil consumption	55
Table 5.7: Ranked barriers to lentil consumption of lentil non-consumers	57
Table 5.8: Mean knowledge scores.....	58
Table 6.1: Household income by neighbourhood.....	73

LIST OF FIGURES

Figure 2.1 Pulse industry supply chain.....	4
Figure 2.2: Population health promotion model	15
Figure 2.3: Conceptual model for the Canadian food and nutrition system	16
Figure 2.4: Theory of reasoned action	20
Figure 2.5: Theory of planned action.....	20
Figure 4.1: Response rate equation.....	29
Figure 4.2: Questionnaire development diagram.....	30
Figure 4.3: Questionnaire procedure algorithm	40
Figure 5.1: Comparison of caregivers' self-identified ethnicity.....	45
Figure 5.2: Comparison of family total gross annual income.....	47
Figure 5.3: Lentil consumption.....	48
Figure 5.4: Pulse consumption.....	49
Figure 5.5: Histogram of mean belief scores	52
Figure 5.6: Scatter-plot of total belief scores by lentil consumption.....	56
Figure 6.1: Hierarchy of nutrition knowledge	67

LIST OF ABBREVIATIONS

ANOVA – analysis of variance

CHD – coronary heart disease

CVD – cardiovascular disease

DAILY – Diet Approaches to Increase Lentil Consumption in Youth

EWCFG – Eating Well with Canada’s Food Guide

FFQ – food frequency questionnaire

GI – glycemic index

HC – high consumers of lentils

HEI – healthy eating index

LICO – low income cut-off

LC – low consumers of lentils

MANOVA – multi-variate analysis of variance

MC – medium consumers of lentils

NH – neighbourhood

PASW - Predictive Analytics SoftWare

SDOH – social determinants of health

SFFQ – short food frequency questionnaire

TPB – theory of planned behaviour

TRA – theory of reasoned action

CHAPTER 1: INTRODUCTION

Despite Saskatchewan being the world's largest producer of pulses, specifically lentils, reports indicate that Saskatchewan consumers are not eating these foods on a regular basis (Ipsos-Reid, 2010; Saskatchewan Pulse Growers, 2009). A growing body of evidence supports the nutrition quality of pulses (Health Canada, 2007). Specifically, pulses have demonstrated health benefits in weight maintenance, diabetes and cardiovascular disease (Anderson & Major, 2001; McCrory, Hamaker, Lovejoy, & Eichelsdoerfer, 2010; Thomas, Elliott, & Baur, 2007). However, the area of food choice is complex and multi-faceted. Researchers have studied the determinants of healthy eating and the social psychology of food for decades but little information is available regarding pulse foods and consumers' beliefs and practices around pulses.

Lentils are a special pulse crop because of their versatility in cooking. Unlike their other pulse counterparts, lentils do not require pre-soaking prior to cooking. This quality possibly makes lentils a more convenient option for families with young children. Therefore, the DAILY project explores benefits and barriers to lentils, pulse and lentil consumption habits and nutrition knowledge through the development and implementation of a questionnaire. Demographic information, known to affect food choice, is also captured in the questionnaire (age, gender, education, income and ethnicity). Questionnaire construction is built on the theory that benefits and barriers correlate to beliefs and attitudes. For example, if people perceive many barriers to eating lentils and few benefits, they are less likely to consume these foods. In contrast, people who perceive many benefits and fewer barriers may be more inclined to eat lentils.

The DAILY project focuses on children to examine food choice influencers early on in the lifecycle. However, children are dependent on their caregivers for nutritional care (Verrall, Berenbaum, Chad, Nanson & Zello, 2000). Infants are completely dependent on their caregiver for food, toddlers/youth can exhibit some influence on what food they select but ultimately choose from the food placed in front of them, adolescents can choose foods outside the home and adults are independent (Worthington-Roberts, 1996).

Due to the dependency of youth on their caregiver, the questionnaire was administered to caregivers of children ages 3 to 11.

Based on data recovered from the DAILY questionnaire, information may be useful in designing a nutrition intervention aimed at increasing lentil consumption in youth if intakes are indeed low. Questionnaire information could act as a needs assessment to guide future phases of research in the DAILY project.

CHAPTER 2: LITERATURE REVIEW

2.1 Pulses in Canada

Canada is the largest exporter of many pulses. Significant export markets have developed in South Asia, the Middle East and Europe. At approximately double the protein content of some grains, pulses provide roughly 10% of world dietary protein (Health Canada, 2008; Saskatchewan Pulse Growers, 2009). The majority of pea exports go to India (30%), Spain (20%), China (12%) with another 18% exported to Bangladesh, Pakistan and Belgium (Alberta Agriculture & Food, 2007). Lentils are primarily exported to Turkey, Algeria, United Arab Emirates and Colombia at just under 10% of exports each. Beans are exported to the United States of America (28%), United Kingdom (21%) and Italy (8%). Finally, chickpea markets are established in Pakistan (20%), India (14%) and Jordan (11%) (Alberta Agriculture & Food, 2007).

In Canada, Saskatchewan is the leading producer of peas, chickpeas and lentils while most beans are grown in Alberta, Manitoba, Ontario and Quebec (Saskatchewan Pulse Growers, 2009). Pulse acreage grew over 82% from 1996 to 2006 and was valued at over one billion dollars in 2006 (Pulse Canada, 2011; Alberta Agriculture & Food, 2007). Today, Saskatchewan produces 99% of Canada's lentil crop (Saskatchewan Pulse Growers, 2009).

Many variables affect crop production in Canada. The Canadian pulse industry has competing interests apart from the human food market as seen in Figure 2.1 (Alberta Agriculture & Food, 2007). Approximately 70 to 75% of pulse crops are sold to international markets but producers see domestic market potential (Alberta Agriculture & Food, 2007; Watts, 2006). In fact, pulse producers' levy dollars are increasingly used for research examining local opportunities including their application in food and their nutritional benefits (Watts, 2006).

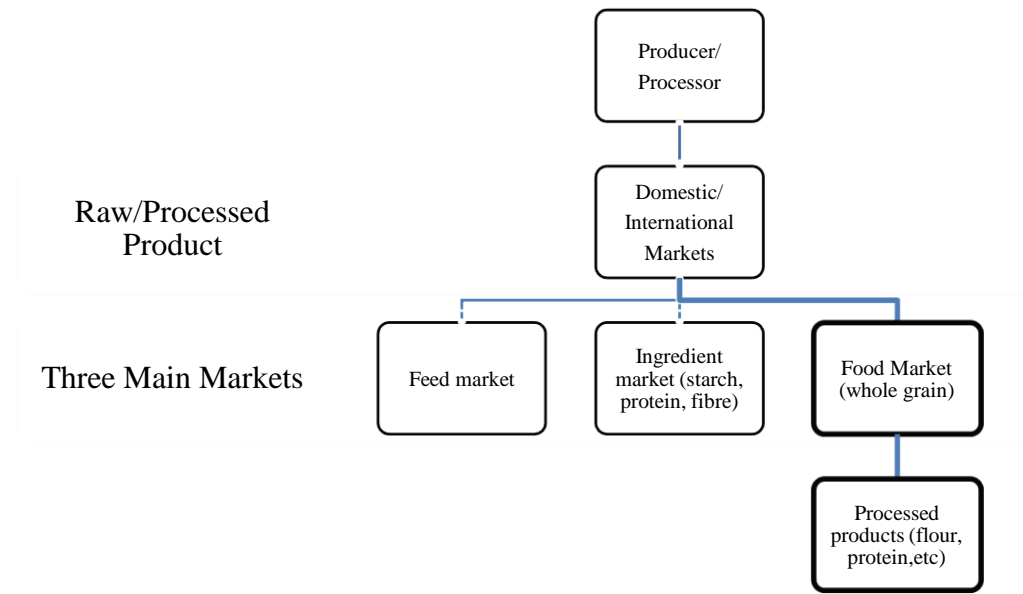


Figure 1.1: Pulse Industry Supply Chain (Alberta Agriculture & Food, 2007)

However, Canadian consumption reports do not indicate that individuals or families are eating pulse foods on a regular basis (Pulse Canada, 2007). Domestic use of pulses varies on crop and year but median weekly consumption is estimated at 0.6 cups per person (Ipsos-Reid, 2010; Dooper, 2009). Pulse consumption in Canada appears highest for beans and lowest for lentils (Ipsos-Reid, 2010). A recent analysis of data from the *Food Habits of Canadians* study concluded that energy in the diet of adults was derived mainly from breads, pasta, rice, grains and fluid milk. Protein intake was primarily derived from meat and dairy products while legumes, nuts, seeds, and eggs were not high protein contributors (Johnson-Down, 2006). An opportunity exists for Canadians to consume more pulses due to the availability of the food supply and low consumption rates.

2.2 Pulses and Health

All pulses, like lentils, peas, beans and chickpeas, are very nutritious and considered part of a healthy diet in Health Canada's (2007) resource *Eating Well with Canada's Food Guide (EWCFG)*. Pulses are high in fibre, low in fat, a good source of protein and have a low glycemic index. Pulses contain approximately double the protein content as some

grains and are classified as a meat alternative in EWCFG. Health Canada recommends “having meat alternatives such as beans, lentils...often” (2007). EWCFG defines one serving of pulses as 175 ml (3/4 cup). Canada does not have a recommended amount of legume consumption for adults, unlike the United States of America which recommends 3 cups of pulses weekly for most adults (United States Department of Agriculture, 2008; Whitney & Rolfes, 2008). Interestingly, American nutrition guidelines classify pulses as both a meat alternative and a vegetable choice. See Table 2.1 for summary of macro- and micronutrients of common pulse foods (Health Canada, 2008).

Table 2.1: Nutrients per 175ml (3/4 cup) of pulses

	White Beans, canned	Chickpeas, canned	Lentils, boiled	Split Peas, boiled
Weight (g)	194	178	146	145
Energy (kcal)	227	211	170	171
Protein (g)	14	9	13	12
Carbohydrate (g)	43	40	29	31
Dietary Fibre (g)	9.3	7.8	6.2	4.2
Total Fat (g)	1	2	1	1
Iron (mg)	5.8	2.4	4.9	1.9

(Health Canada, 2008)

Modifiable risk factors such as nutrition and a healthy diet are well documented to impact disease rates and improve health outcomes. Chronic diseases such as diabetes, cancer, obesity and cardiovascular disease are major health concerns in Canada. Almost 60% of Canadians are at risk for health problems due to being overweight or obese (Tjepkema, 2005). Heart attack and stroke are two of the leading causes of death in Canada (Heart and Stroke Foundation, 2011). The superior macronutrient profile of pulse foods aligns them with both health promotion messages and chronic disease dietary treatments which are explored in the following sections.

2.2.1 Glycemic index and treatment of chronic disease

The glycemic index (GI) is a ranking of carbohydrate foods, such as pulses, based on their effect on blood sugar levels (Jenkins et al., 1981). GI values are calculated by ingesting 50 grams of available carbohydrate from a test food and taking the area under the two-hour blood glucose response curve and comparing it to the response curve of a 50 gram carbohydrate standard (Jenkins et al., 1981). The GI compares foods to either glucose or white bread as standards (Foster-Powell & Brand-Miller, 2002). Three categories are used to rank foods using the glycemic index: low, medium and high. Low GI rated foods elude a glycemic response that is less than or equal to 55 of that elicited by the control; medium GI foods equals 56 to 69 and high GI foods higher than or equal to 70 (Foster-Powell & Brand-Miller, 2002). As illustrated in Table 2.2, most pulses have a GI of approximately half of that of other commonly eaten carbohydrate foods.

Table 2.2: Glycemic index (GI) of foods using glucose (GI=100) as reference standard

Food*	Green Lentils	Chickpeas	Kidney Beans	Long Grain White Rice	Oatmeal
Serving Size	150 g	150 g	150 g	150 g	250 g
GI	30 +/- 4	28 +/- 6	28 +/- 4	56 +/-2	58 +/- 4

(Foster-Powell & Brand-Miller, 2002)

Evidence is available regarding the health effects of both fibre and low glycemic index foods in the management of diabetes, promotion of weight loss and improvement of lipid profiles. Chronic disease is a major health concern in Canada and, as such, the promotion of low glycemic index foods such as lentils and other pulse products could be an important modifiable diet intervention.

A Cochrane Review, which is a comprehensive systematic review, concluded that low glycemic index foods can be simply incorporated into a person's lifestyle in order to promote weight loss and improve lipid profiles (Thomas, Elliott, & Baur, 2007). However, as noted by McCrory (2010), while pulses may help to increase satiety and, therefore help with weight control, longer term interventions are required to explore optimal doses of pulse intake and behavioural influences on pulse consumption.

2.2.2 Cardiovascular disease

Cardiovascular disease (CVD) refers to the diseases of the heart and blood vessels that can affect many different organs in the body (Public Health Agency of Canada, 2009). Heart attack and stroke are two of the leading causes of CVD death in Canada and account for over one-third of mortality in Canada (Mcpherson, Frohlich, Fodor & Genest, 2009; Heart and Stroke Foundation, 2011).

While mortality rates are decreasing, the incidence of CVD is on the rise which illustrates the importance of prevention (Mcpherson et al., 2009). In fact, according to the 2009 guidelines, health behaviour interventions, including diet, should “remain the cornerstone of chronic disease prevention, including CVD prevention” (Mcpherson et al., 2009). Diet recommendations include a diet that is low in sodium, low in simple sugars, increased consumption of vegetables, fruit and fibres, less saturated and Trans fats while ensuring a healthy body weight. Nutrition care goals mirror prevention recommendations while identifying and managing risk factors such as obesity, diabetes, high blood pressure and dyslipidemia (lowering LDL cholesterol).

To date, no research was found on lentils and CVD specifically but many studies have looked at plant-based diets, including legumes, on many CVD risk factors. One prospective cohort measured the frequency of legume intake and the incidence of coronary heart disease (CHD) and CVD (Bazzano, Jiang, Ogden, Loria, & Vupputuri, 2001). After an average of 19 years of follow up, CVD risk was lowered by 11% (95% confidence interval, 0.80-0.98) and CHD risk lowered by 22% (95% CI, 0.68-0.90) when legume intake was greater than four times per week compared to less than once a week. Another Korean study iso-calorically replaced cooked white rice for breakfast with a whole grain and legume powder (Jang, Lee, Kim, Park, & Lee, 2001). The article did not state which legume was used in the mix but demonstrated an improvement in risk factors associated with CVD (i.e. improved insulin response and glucose levels) (Jang, Lee, Kim, Park, & Lee, 2001). A meta-analysis conducted by Anderson and Major (2001) looked at eleven clinical trials relating non-soy legume interventions and serum lipids. The

analysis revealed that regular pulse consumption lowered LDL-cholesterol while having no significant effect on HDL-cholesterol levels (Anderson & Major, 2001). Anderson and Major (2001) attributed the hypocholesterolemic effects of pulses to be multi-factorial but ranked their soluble fibre content, vegetable protein and oligosaccharides as the top three important traits. Similar conclusions were illustrated in a 2011 meta-analysis of ten trials representing 268 participants (Bazzano et al., 2011). Bazzano et al. (2011) concluded that legume diets, compared to a control, demonstrated a mean net change in LDL-cholesterol of -8.0 mg/dL (95% CI, -11.4 to -4.6).

2.2.3 Obesity

Almost 60% of Canadians are at risk for health problems due to being overweight or obese (Tjepkema, 2005). The 2006 clinical practice guidelines on the prevention and management of obesity state that obesity is of epidemic proportions in both adults and children (Lau, Douketis, Morrison, Hramiak, Sharma, & Ur, 2007). The dietary treatment for obesity varies widely but there is good evidence supporting a nutritionally balanced diet that is low in fat and providing 30% of energy from protein to aid in satiety (Lau, Douketis, Morrison, Hramiak, Sharma, & Ur, 2007).

Pulse foods may help to increase satiety, and therefore result in reduced caloric intake, not only due to their macronutrient profile but also due to the slowly digested starch, amylase inhibitors and phytochemicals (McCrorry, Hamaker, Lovejoy, & Eichelsdoerfer, 2010). A thorough review by McCrorry (2010) provides a clear summary of pulse nutritional and anti-nutritional components that may help with weight management.

However, many studies are short term or lack compliance of diet interventions after one year (Venn et al., 2010; McCrorry, Hamaker, Lovejoy, & Eichelsdoerfer, 2010). More long term, well-designed interventions are required as the evidence does suggest a role for pulse foods in weight management and loss. Hypocaloric pulse diets, in addition to weight loss, have also reduced pro-inflammatory markers such as C-reactive protein, blood pressure and dyslipidemia compared to control groups ($p < 0.05$) (Hermsdorff, Zulet, Abete, & Martinez, 2010).

2.2.4 Cancer

The Canadian Cancer Society (2010) reports that an estimated 76,200 cancer related deaths occurred in 2010 with another 173,800 new diagnoses. According to the World Cancer Research Fund International (2008), there were 12.7 million new cases of cancer worldwide in 2008 with breast cancer the most common cancer in women and prostate cancer the most common cancer in men, the exception being Asia where lung cancer is the most common.

Cancer is deemed a preventable disease and current public health messages to decrease the incidence of cancer are summarized in the document *Food, Nutrition, Physical Activity and the Prevention of Cancer: a Global Perspective* (World Cancer Research Fund / American Institute for Cancer Research, 2007). Recommendations from the expert panel include to eat mostly plant-based foods in the diet and to limit red meat and processed meats. Specifically, the report states to consume “relatively unprocessed cereals (grains) and/or pulses (legumes), and other foods that are a natural source of dietary fibre, to contribute to a population average of 25 grams of non-starch polysaccharides”. Red meat consumption should not exceed eleven ounces weekly with little, if any, to be processed.

A study assessing cancer risk in Uruguay conducted a multi-site case-control using 3539 cancer cases and 2032 hospital controls assessing legume intake, bean intake and lentil intake (Aune, Boffetta, & Acosta, 2009). Intake was tiered into low, medium and high consumption of each test group. Multi-variate odds ratios (95% confidence level) were calculated for each diet at each cancer site and indicated that all legume-containing-diets decreased the risk of several types of cancer. Specifically, comparisons between low and high intakes of legumes indicated that higher bean consumption was associated with lower risk of oral cavity/pharynx, esophageal, larynx, upper digestive, stomach, colon, rectal, colorectal and bladder cancers. Lentil intake had similar results but, unlike bean intake, no significant associations were observed for bladder or stomach cancers but indicated a reduced odds ratio in kidney cancer. No significant associations with cancers

of the lung, breast or prostate were observed for any legume diets. Hartman and colleagues (2010) detected an improvement in fasting biomarkers of inflammation when comparing usual diets to both a high legume-containing diet and a healthy American diet. However, no difference was found between the legume-diet and the healthy American diet in relation to inflammatory biomarkers; however, results were possibly confounded with weight maintenance (Hartman et al., 2010).

The theories surrounding the mechanism for pulse-containing-diets offering cancer protection are multi-dimensional (Aune, Boffetta, & Acosta, 2009; Harman et al., 2010; Mathers, 2002; World Cancer Research Fund / American Institute for Cancer Research, 2007). Pulses contain nutritive and non-nutritive components that may be protective against oxidative diseases such as cancer (World Cancer Research Fund / American Institute for Cancer Research, 2007; Mathers, 2002). Nutrients such as resistant starch, non-starch polysaccharides, oligosaccharides, folate, selenium, zinc and bioactive constituents such as protease inhibitors, phytosterols, lectins and phytates are purported to decrease cancer risk through numerous mechanisms associated with digestion, fermentation of gut flora, DNA damage/repair and apoptosis of damaged cells (Mathers, 2002). Of note, nutritive components may only have a beneficial effect in the case of deficiency and, therefore, a food-first approach is warranted (World Cancer Research Fund / American Institute for Cancer Research, 2007; Duffield-Lillico et al., 2003).

2.2.5 Diabetes

Diabetes rates have increased 70% since 1998 with 1.8 million Canadians (5.5% of the population) living with diabetes (Canadian Diabetes Association Clinical Practice Guidelines Expert Committee, 2008). Approximately 10% of people who have diabetes have type 1 diabetes that is the result of the pancreas's inability to produce insulin. The remaining 90% have type 2 diabetes (Canadian Diabetes Association, 2009). Type 2 diabetes usually develops in adults who are overweight or members of high risk ethnic groups such as Aboriginal, Asian, Hispanic or African origin. Additional risk factors include impaired glucose tolerance, impaired fasting glucose, high blood pressure and hypercholesterolemia (Canadian Diabetes Association, 2009).

Nutrition is of utmost importance when it comes to the management of diabetes. Glycemic control, through adjustments of carbohydrates in the diet and medication, is the main priority. One way of assessing the glycemic response in foods is the glycemic index. While the utility of using the GI with people who have diabetes is controversial, the GI has resulted in improvements on both postprandial hyperglycemia and postprandial insulinemia (Kalergis, Grandpre, & Andersons, 2005). Research also demonstrates a reduction in the development in type 2 diabetes (Kalergis, Grandpre, & Andersons, 2005). Therefore, it appears that using the GI in both the management and prevention of diabetes is appropriate.

Research results on the use of pulses and diabetes is less clear. Many investigations classify pulses as a whole grain and, thus, also include trials using cereal grains (Jang, Lee, Kim, Park, & Lee, 2001; Jacobs, Meyer, Kushi, & Folsom, 1998). For instance, Venn and Mann (2004) examined both epidemiological and experimental literature in terms of the role of whole grain foods and legumes in diabetes. Epidemiological research, from both cross-sectional and prospective research designs, demonstrated a risk reduction for type 2 diabetes in people who consumed three or more servings of whole grains. The effect of legumes was less clear because legume intake may have been too small to show an effect (Venn & Mann, 2004). With intervention studies, results again were positive yet it was difficult to separate the effects of whole grains from the effects of legumes. Due to the improvement in interventions on glucose and lipid metabolism, authors concluded that “there is strong evidence to suggest that eating a variety of whole grains and legumes is beneficial in the treatment and management of diabetes” (Venn & Mann, 2004). Theoretically whole grains share many qualities of pulses such as high fibre content and lower glycemic index but it is important to investigate the effects of pulses alone.

A systematic review and meta-analysis was conducted in 2009 assessing pulse interventions and glycemic control in people with or without diabetes (Sievenpiper et al., 2009). Forty one studies were included and pooled into one of three categories: pulse alone, pulses in low GI interventions and pulses in high-fibre interventions. Conclusions

support the use of pulses to aid in the management of diabetes control in all three groups (Sievenpiper et al., 2009). However, authors stress the importance for more controlled interventions as there was high heterogeneity in results and they were unable to draw conclusions regarding pulse type and dose (Sievenpiper et al., 2009).

2.2.6 Health promotion and prevention

In addition to EWCFG, the Canadian Cancer Society (CCS) lists reducing the consumption of red meat and including higher-fibre foods as a measure in disease prevention (Canadian Cancer Society, 2009). Legumes such as red, yellow and green lentils are a source of soluble fibre and are a meat alternative which could be used to replace animal protein intake (Health Canada, 2007). Lentil intake, in particular, is hypothesized to decrease the risk of developing several types of cancers such as colorectal cancer and cancers of the oral cavity pharynx, esophagus and larynx (Aune et al., 2009).

As the number of clinical studies investigating pulses and their health benefits increase, many health agencies are recommending the addition of more plant-based foods in diets. As noted in a paper by Leterme (2002), health organizations appear to use positive campaigns to gain the attention of the common consumer in order to prevent disease by promoting plant-based food consumption. Although more research is required, given the nutrition profile of legumes, the public should be encouraged to consume more beans in general (Messina, 1999).

2.3 Diet Quality

In 1991, a nation-wide task force was created to address some of the health issues in our country. A partnership between the Canadian Institute for Health Information (CIHI), Health Canada and Statistics Canada was formed and from this the Canadian Community Health Survey (CCHS) was generated. The CCHS is completed annually, since 2007, and is a very useful tool in population health research and health surveillance (Statistics Canada, 2009).

The 2004 CCHS explored Canadian's eating habits and was the first national survey of its kind since the 1970s (Garriguet, 2007). Examination of the surveys shows that Canadians' average calorie consumption has not increased over the years. Within our target population range, young children's average calorie consumption decreased from 2300 calories to 2041 calories from 1972 to 2004 (Garriguet, 2007). The interpretation of the data should be made cautiously as two very different diet assessment techniques were used which may account for the difference. Regardless, the data offer insight into the diet quality of children.

A more recent article from Garriguet (2009) explored the diet quality of Canadians using the 2004 CCHS data. Using a validated Healthy Eating Index (HEI) tool, Garriguet (2009) assigned a single numerical score to the diet quality of certain populations on a scale of 1 to 100. A diet in line with the 1992 Canada Food Guide would score 95 or greater. Children aged 4 to 8 years had an average score of 65.4 and children aged 9 to 13 had an average score of 59.7 (boys) and 60.0 (girls) (Garriguet, 2009). These scores are well below what is recommended in Canada's Food Guide. The diet quality was better for women of all ages and also correlated with household education (Garriguet, 2009). Further work needs to be conducted using the HEI but using the newer 2007 version of Canada's Food Guide and separating meats from meat alternatives.

A research brief published in the May 2009 edition of the Journal of the American Dietetic Association sought to address whether consumption of pulses could improve the diet quality in the American population. Mitchell, Lawrence, Hartman & Curran (2009) compared pulse consumers versus non-consumers and concluded that all pulse consumers had higher intakes of fibre while consumption of ½ cup per day or more of pulses showed higher intakes of protein, carbohydrate, folate, magnesium, iron and zinc. This study gives strength to the theory that pulses have the potential to improve diet quality and highlights the importance of the DAILY questionnaire to further explore lentil intake in families and examine why they may or may not be eating lentils.

2.4 Determinants of Healthy Eating

Any approach to health promotion, including healthy eating strategies, should take into account the population health model and its application in creating healthy communities (Raine, 2005; Taylor, Evers, & McKenna, 2005). The Population Health Promotion Model (Figure 2.2) was created by Health Canada in 1996 to pictorially illustrate health in our country (Hamilton & Bhatti, 2006). The front face of the cube describes the “what” in terms of health, collectively known as the social determinants of health (SDOH). The right face describes “how” health can be affected while the top face lists the “who”. The model is not complete without the values and assumptions tab at the very bottom which demonstrates the importance of investigating beliefs and attitudes when looking at food choice.

In order to understand food choice, one must analyze both subjective inputs such as food supply and food distribution and objective influencers such as media, food literacy and income. One model, The Conceptual Model for the Canadian Food and Nutrition System (Figure 2.3), as used by Health Canada, illustrates the linkages between food supply, distribution, consumption, utilization and health outcomes. This model attempts to schematically depict the “Food to Health” pathway in order to identify gaps that exist in the system and highlight the key components of a proper food surveillance system. The model establishes that while food preferences influence food consumption patterns there are additional influencers that affect food supply, distribution and consumption.

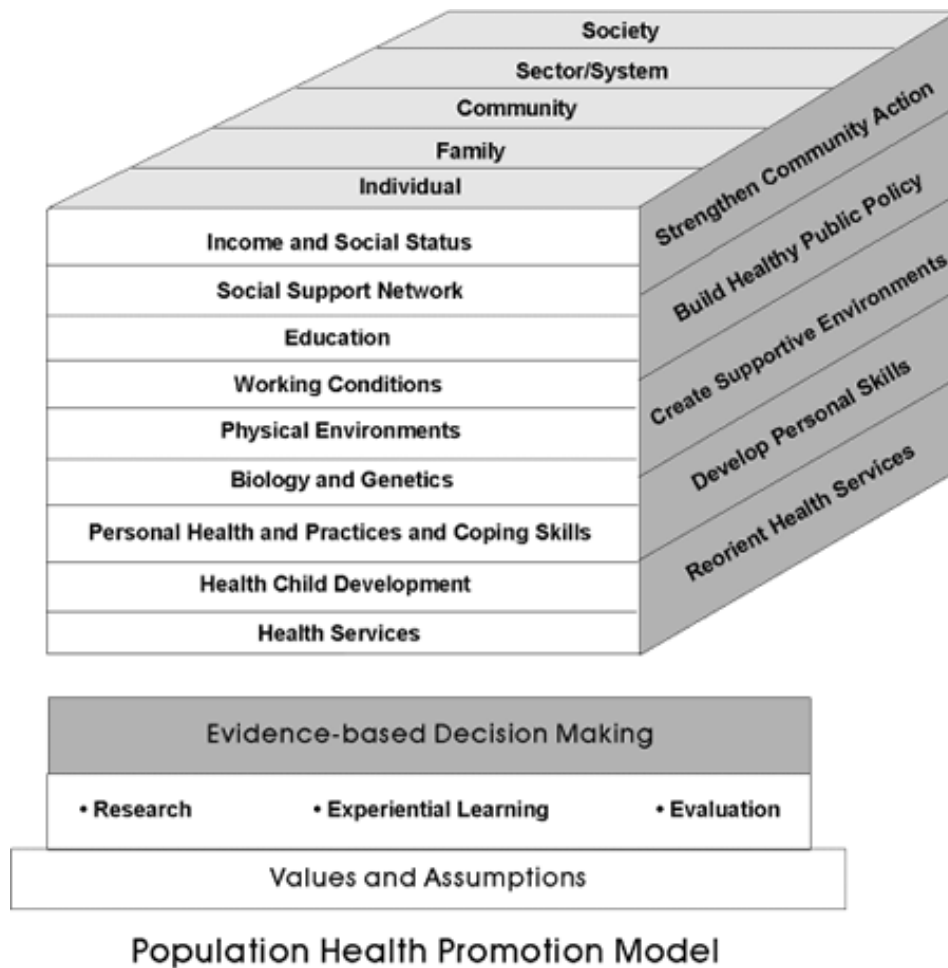
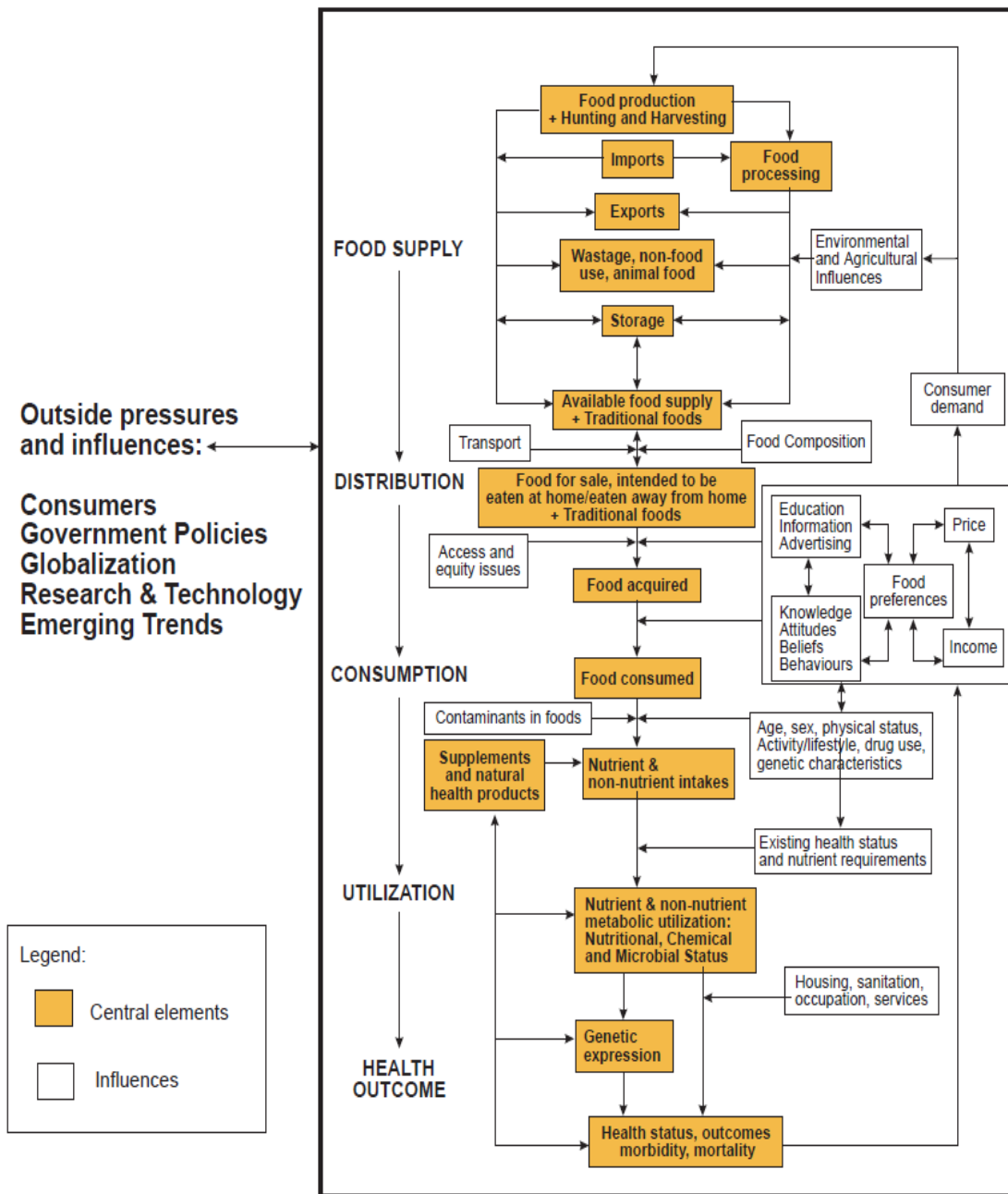


Figure 2.2: Population Health Promotion Model (Public Health Agency of Canada, 2001)

Conceptual Model for the Canadian Food and Nutrition System



*Adapted from the conceptual framework of the Australian food and nutrition system
Ref: Ian H. Lester. AUSTRALIA'S Food & Nutrition.
Australia Government Publishing Service, Canberra. 1994*

Figure 2.3: Conceptual model for the Canadian Food and Nutrition System (Health Canada, 2005)

The DAILY questionnaire focused on the consumption variables mentioned in the conceptual model. The framework illustrates that consumption is just one part of a much larger and complex model that has many influencers that are both subjective and objective.

Another approach by Raine (2005) at the Centre for Health Promotion Studies at the University of Alberta, organizes the determinants of healthy eating into:

- personal food choices
- physiology: age, health, functional ability
- food preference: innate, learned, cultural
- nutrition knowledge
- perceptions of healthy eating: beliefs, attitudes, tradition
- psychological: self esteem, body image
- collective determinants
- environmental: interpersonal influence such as family, physical environment, economics including marketing and media, social environment and culture
- public policy: creation of supportive environments such as healthy school food policy or agricultural policies influencing the food supply.

Understanding that there are many influencers on the determinants of healthy eating, the DAILY questionnaire has applied a population health promotion lens to the research in order to understand the impact that age, race, gender, education and income have on the food preference of caregivers of children 3 to 11 years of age. A better understanding of the contextual influencers will “provide insight into prioritizing research and action strategies for the promotion of healthy eating” (Raine, 2005).

2.5 Food Choice/Preference

The Canadian Council of Food and Nutrition publication, Tracking Nutrition Trends VI, revealed that the top four influencers on food choice in adults were taste (71%), nutrition (67%), cost (30%), and convenience (29%) (Jenkins, 2006). Variation also exists across different demographics according to education, income, gender and age (Ree, Riediger,

& Moghadasian, 2008). For example, Canadian women and older adults tend to rate nutrition higher in importance while only a small percentage of teenagers choose food for health reasons (Jenkins, 2006; Ree, Riediger, & Moghadasian, 2008).

In the United States Glanz, Basil, Maibach, Goldberg & Snyder (1999) reported the importance of taste, cost, nutrition, convenience and weight concerns with food choice. A study by M. Kearney, J. Kearney, Dunne & Gibney (1999) found quality, taste, healthy diet, other people's preferences and habit as top influencers in Irish adults. The differences between countries may underline the importance of culture in food choice.

According to Paquette (2005), "Greater understanding of the public's perceptions of healthy eating is essential to assess how current health promotion messages are interpreted and put into practice in daily life in order to develop successful healthy eating messages and interventions". In a clinical setting, understanding food choice allows health professionals to better tailor diet interventions appropriate for the target population (Glanz, 1998). Very little data currently exists regarding food choice and the consumption of lentils specifically.

2.6 Food Choice in Caregivers & Children

Food choices differ across the lifespan (Ree, Riediger, & Moghadasian, 2008). Caregivers decide the type of food purchased, the type of food brought into the home and the type of food prepared. Therefore, caregivers affect the eating habits of their family especially in young children (Hannon, Bowen, Moinpour & McLerran, 2003; Byrd-Bredbenner, Abbot & Cussler, 2008; Savage, Fisher, & Birch, 2007).

A review by Patrick and Nicklas (2005) cite many experts in the field relating to family and social determinants of children's eating patterns and discusses how eating behaviours are affected by children's food preferences, food access and parents' beliefs and attitudes. Concluding remarks in the review highlight the importance of using a multi-faceted approach to healthy eating and targeting parents when trying to promote healthier eating patterns in children.

Parents are also influenced by their children's likes and dislikes. One questionnaire revealed that 60% of parents admitted to giving in to "pester power" or, in other words, the demands on the parent by their child for certain foods in the grocery store (Turner, Kelly, & McKenna, 2006).

Future phases of the DAILY project target influencing the eating behaviours of youth and their families. Due to the dependency of youth on their caregiver, the DAILY project found it prudent to gather data from caregivers and to explore the level of "pester power" within the survey to guide the future phases of the project.

2.7 Social Psychology of Food

Many models of health behaviour try to explore the attitude-behaviour relationship. Of particular interest are the motivational models: health belief model, protection motivation theory, social cognitive theory and the theories of reasoned action and planned behaviour.

The health belief model uses perceived susceptibility, perceived severity, perceived benefits, perceived barriers, health motivation and cues to action as determinants of behaviour (Conner & Armitage, 2002). However, this model has been criticized because certain components do not have a clear and direct definition (Armitage & Conner, 2000).

Protection motivation theory is an index of the efforts people will make to preserve their own health but lacks predictive power (Conner & Armitage, 2002). Social cognitive theory discusses behaviour change in the context of situational, outcome expectancies and self-efficacy expectancies as key determinants (Conner & Armitage, 2002).

However, the central element of self-efficacy seems more important than the model itself.

The theory of reasoned action (TRA) asserts that behaviour intention is a function of attitudes and norms (Figure 2.4) but is best used with simple behaviours which food choice is not (Armitage & Conner, 2000).

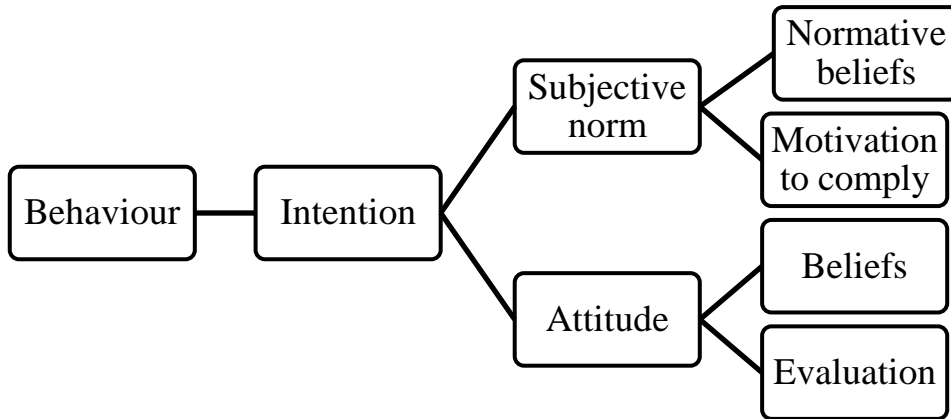


Figure 2.4: Theory of Reasoned Action

Finally, Azjen’s theory of planned behaviour (TPB) (Ajzen & Fishbein, 1980) is an expansion of the TRA and includes the measure of perceived control as a determinant to both intention and behaviour (Figure 2.5) (Armitage & Conner, 2000). In terms of behaviour prediction, the TPB is superior to other motivational models and is useful in predicting health-related behaviour (Conner & Armitage, 2002; Shepherd, 1999). On the other hand, intention does not always lead to behaviour; thus, motivational models only provide a “partial account of how motivation is translated into action” (Armitage & Conner, 2000).

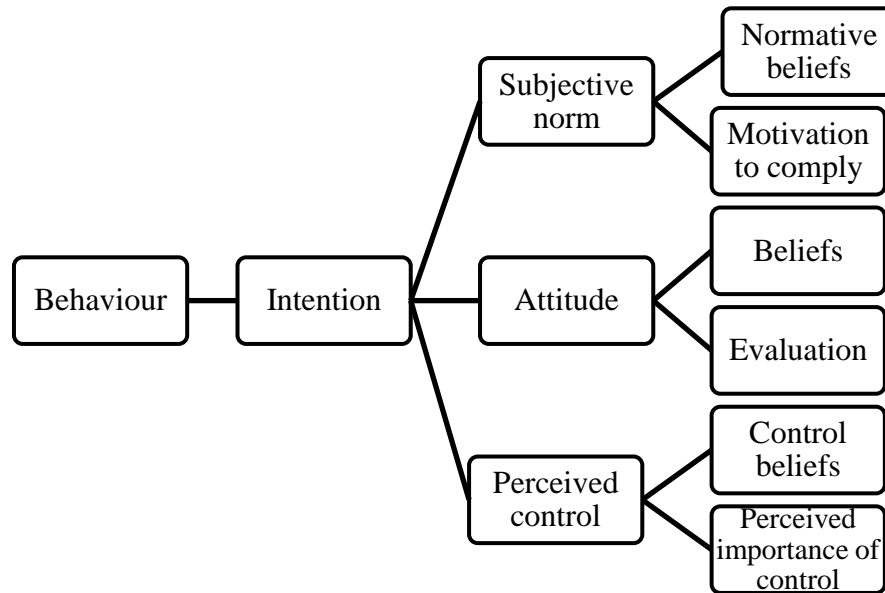


Figure 2.5: Theory of Planned Behaviour

Food is more than just sustenance. Social psychology of food is the impact of human thoughts, attitudes and beliefs on food choice. While knowledge, beliefs and attitudes are only one part of food choice (see Figure 2.3) and are not always good predictors of behaviour, these factors can be a useful tool in allowing researchers to understand food preference (Raine, 2005).

From a public health perspective, food preference variables offer a useful entry point to change behaviour and are possibly more acquiescent to change than socio-demographic variables (Armitage & Conner, 2000). Obtaining descriptive data on the benefits and barriers experienced by caregivers, in order to gain insight as to their beliefs and attitudes, is the first step in designing an appropriate dietary intervention in future phases of the DAILY project if future phases are warranted.

2.8 Benefits and Barriers to Pulse Foods

Many scientists have studied the benefits and barriers to eating a healthy diet, including plant-based diets (Balch, Loughrey, Weinberg, Lurie, & Eisner, 1997; Cox, Anderson, Lean, & Mela, 1998; Kearney & McElhone, 1999; Lappalainen, 1997; Lea, Crawford, & Worsley, 2006; Yeh et al., 2008; Zunft et al., 1997). As noted by Balch et al. (1997), conducting research on the benefits and barriers to food consumption “can be critical for developing communications that are consistent with consumer wants, needs and realities”. However, little research exists on the benefits and barriers to pulse consumption and, at the time of writing, no research on barriers to lentil consumption specifically. Due to this lack of information a research team (Zello, Chilibeck, Vandenberg, Bennett) at the University of Saskatchewan developed a survey to evaluate some of the influences to the consumption of pulses in the diet of athletes. Data suggested there were specific barriers to pulse consumption that were related to both beliefs and knowledge. It is prudent to anticipate that the same top influencers discussed in section 2.5 (taste, nutrition, cost, convenience) affecting food intake translates to pulse intake.

More recently, an Ipsos-Reid survey polled 1100 Canadians 18 years of age and older and conducted four focus groups (2 in the Alberta and 2 in Ontario) analyzing the factors influencing pulse consumption¹ (Ipsos-Reid, 2010). The majority of Canadians do not consume pulses on a regular basis, and not liking the taste or texture of pulses is one of the most frequent responses for not eating pulses. Other top responses for not eating pulses included not knowing how to cook or prepare pulses and not thinking about including pulses when meal planning (Ipsos-Reid, 2010). Results mirror the importance of taste and convenience in terms of food choice. Vegetarianism, education and ethnicity were all shown to be associated with pulse consumption and so was the value of health and nutrition. All factors are components of perceived benefits and barriers to pulse foods and, therefore, lentil consumption.

In 2001, a study was performed to assess dietitian use and preference for legumes, their practice and opinions about client attitudes towards legumes and their resource needs (Desrochers & Brauer, 2001). Lower fat and higher fibre diets have long been advocated for the prevention and treatment of obesity and type II diabetes, as described in section 2.2, and dietitians are health professionals who counsel people on healthy meal plans. Over 64% of dietitians stated they used pulses weekly themselves and almost all agreed that pulses had several health benefits (Desrochers & Brauer, 2001). Dietitians stated that they recommended the use of pulse foods by providing clients with brochures and pamphlets but they perceived their clients to have many barriers. Top barriers included clients' lack of knowledge on ways to cook legumes, clients' lack of familiarity with different legumes and perceptions around flatulence and time to cook were also of importance (Desrochers & Brauer, 2001). However, this study was a questionnaire based on dietitians' opinions. Nonetheless, the study concluded that more research was required to identify clients' issues surrounding pulse consumption (Desrochers & Brauer, 2001).

Evidence suggests that pulses may cause flatulence due to long chain carbohydrates called oligosaccharides but the question remains whether pulses produce more discomfort than other commonly eaten foods. Veenstra (2010) conducted a randomized, double-blind placebo-controlled cross over study with 21 healthy males. Participants had to

¹ The results of this survey were not available during the development of the DAILY questionnaire.

consume potatoes, chickpeas, lentils or green peas for 28 consecutive days and results dispelled the myth that pulses cause “intolerable levels of flatulence and gastrointestinal discomfort”. No significant difference between foods was detected in terms of bloating or cramping (Veenstra et al., 2010).

In terms of cost, Drewnowski (2010) compared nutrient density to price to “help consumers identify foods that are both affordable and nutritious”. Through complex statistics and mathematical modeling, Drewnowski created scores where high scores would indicate a nutrient-dense, affordable and appealing food. Legumes and beans were amongst the highest scoring foods indicating a cost-effective and nutritious food (Drewnowski, 2010). On the other hand, despite evidence demonstrating that pulse foods are economical, consumers could still perceive this as a barrier or a benefit.

Recognizing the value of demographics and knowledge in relation to attitudes is also important (Wardle & Steptoe, 2003). As demonstrated by other authors, healthier diets are affected by age, gender and education level (Kearney, Kearney, Dunne, & Gibney, 1999). The DAILY questionnaire has studied demographic differences in relation to the benefits and barriers of lentil consumption. Additionally, controversy exists as to whether nutrition knowledge, a potential benefit if knowledge is high or barrier if low, is correlated with consumption of a healthy diet. Nutrition knowledge has been positively correlated to improved intake of healthy foods and, therefore, was explored with a short nutrition knowledge section in the DAILY questionnaire (Gibson, Wardle, & Watts, 1998; Werblow, Fox, & Henneman, 1978). In addition, most nutrition interventions have a knowledge component. Therefore, the nutrition knowledge section will be crucial in tailoring an appropriate nutrition intervention in the future.

The DAILY questionnaire studies beliefs and attitudes through participants’ perceived benefits and barriers to food choice and examines the relationship with pulse consumption, measured through a food frequency questionnaire, with regards to age, gender, education, income and nutrition knowledge.

2.9 Promoting Pulses

The literature does not contain an abundance of data that focuses on promoting pulses or lentils. One non-randomized intervention assessed college students' familiarity with legumes before and after an introductory nutrition course (Lacey, 2004). One group was in a "bean themed" class while the other was in a standard course. Baseline knowledge was poor but did improve in the "bean themed" class. Students were given the opportunity to eat pulse foods and 86% said they would "be more likely to try beans in the future" but consumption habits were not measured (Lacey, 2004). Therefore, knowledge on pulses can successfully be introduced into college-level courses but cannot be used to predict pulse consumption based on this data.

Youth with type 1 diabetes attended a diabetes camp and were asked to complete self-report measures on overall acceptability of legumes and whole grains (Gellar, Rovner, & Nansel, 2009). Acceptability of legumes varied greatly but authors concluded that, of the 128 youth, most reported a general willingness to try legumes. Researchers theorized that commonly accepted foods like chili with beans, beans and baked beans were ranked high because children were familiar with them (Gellar, Rovner, & Nansel, 2009). Therefore, it is not an unwillingness to eat pulses but rather legumes compete with other highly accessible and familiar foods.

When looking at product promotion, even in health research, it is prudent to think of industry. Marketing research has much broader appeal than just in big business. A fundamental point to marketing research is that it helps decision makers "make better decisions in any of their areas of responsibility" (Churchill, 1996). Primary constructs of interest include demographics, attitudes, knowledge, motivation, behaviour, intentions and lifestyle characteristics (Churchill, 1996). The DAILY questionnaire had many overlaps to the primary data set in marketing research which may make the results important to both industry and health professionals using the information for health promotion and addressing any benefits and barriers caregivers perceive.

CHAPTER 3: OBJECTIVES

3.1 Objectives & Rationale

The consumption of pulse foods, including lentils, has important health benefits. Evidence illustrates that the micro- and macronutrient profile of pulses and the low glycemic response of pulse foods has benefits in chronic diseases such as diabetes, cardiovascular disease and obesity (Aune et al., 2009; Thomas, Elliott, & Baur, 2007; McCrory, Hamaker, Lovejoy, & Eichelsdoerfer, 2010; Bezzano, Jiang, Ogden, Loria, & Vupputuri, 2001; Anderson & Major, 2001; Hermsdorff, Zulet, Abete, & Martinez, 2010; Venn & Mann, 2004; Sievenpiper et al., 2009). Canada has emerged as the world's largest producer and exporter of lentils (Saskatchewan Pulse Growers, 2010). Yet, consumption of pulse foods is not high with 20% of Canadians indicating they have not consumed any pulse food at home or when eating out during the past six months and estimated weekly cooked pulse consumption of 0.6 cups when all Canadians are taken into account (Ipsos-Reid, 2010). Currently no recommended levels of pulse consumption in Canada exists but the United States Department of Agriculture recommends 3 cups of pulses weekly for most adults (United States Department of Agriculture, 2008; Whitney & Rolfes, 2008).

As children are future consumers of pulses, and potentially have the most to gain by establishing healthy habits early in their life cycle, this segment of the population is of particular interest. Since children depend upon adult caregivers for food, analyses need to be conducted on the food providers (Byrd-Bredbenner, Abbot, & Cussler, 2008; Hannon et al., 2002).

The area of food choice is complex. The Canadian Council of Food and Nutrition publication, *Tracking Nutrition Trends VI*, revealed that the top four influencers on food choice in adults were taste (71%), nutrition (67%), cost (30%), and convenience (29%) (Jenkins, 2006). One model predicting food choice analyzes the perceived benefits and perceived barriers to eating. Many scientists have studied the benefits and barriers to

eating a healthy diet, including plant-based diets but little is known about pulse-based diets (Balch, Loughrey, Weinberg, Lurie, & Eisner, 1997; Cox, Anderson, Lean, & Mela, 1998; Kearney & McElhone, 1999; Lappalainen, 1997; Lea, Crawford, & Worsley, 2006; Yeh et al., 2008; Zunft et al., 1997). As noted by Balch et al. (1997), conducting research on the benefits and barriers to food consumption “can be critical for developing communications that are consistent with consumer wants, needs and realities”.

Therefore, the DAILY project examined, via a questionnaire given to caregivers of children, the benefits and barriers to lentil consumption, nutrition knowledge of pulse foods such as lentils, and current lentil consumption. The researcher (TP) of the DAILY questionnaire sought an understanding of the influences surrounding lentil consumption which could aid health professionals in promoting nutrient-rich lentils into healthy eating plans.

3.2 Research Questions

The research questions explored in the questionnaire were:

1. What benefits and barriers surrounding lentil consumption exist in families with children 3 to 11 years of age in Saskatoon, Saskatchewan?
2. How do demographics, specifically between high income neighbourhoods and low income neighbourhoods, affect attitudes and consumption of lentils?
3. How does nutrition knowledge affect attitudes and consumption of lentils?
4. What are pulse consumption habits in Saskatoon?

3.3 Hypothesis

The main hypotheses tested by the DAILY questionnaire were:

1. Caregivers who perceive more benefits and fewer barriers to lentil consumption consume more pulses.
2. High income neighbourhoods have fewer barriers to lentil consumption versus low income neighbourhoods.
3. Caregivers with high nutrition knowledge eat pulses more frequently.
4. Pulse consumption is low in caregivers with young children in Saskatoon.

CHAPTER 4: METHODOLOGY

4.1 Study Design

The DAILY questionnaire gathered cross-sectional data from our target population through the creation and distribution of a questionnaire. The following sections describe the steps taken to administer the DAILY questionnaire including sampling, questionnaire development, interviewer training, data collection and analysis. A review of the relevant literature and pretesting of the questionnaire was incorporated within research instrument development and will be described in detail.

4.2 Sample

Subjects were caregivers of children aged 3 to 11 years of age in Saskatoon, Saskatchewan. They were recruited from elementary schools through a non-randomized sampling procedure. All forty-five elementary schools within the Saskatoon Public School Division (SPSD) were separated into high and low income area neighbourhood schools using census data from the City of Saskatoon website (retrieved from www.saskatoon.ca/DEPARTMENTS/Community%20Services/PlanningDevelopment/FutureGrowth/DemographicAndHousingData/Pages/NeighbourhoodProfiles.aspx). Low income cut-off values for a city with 100,000 to 499,999 residents were used to determine neighbourhood (Statistics Canada, 2007). Three schools from each income neighbourhood were randomly selected for a total of six schools. Contact was made with the principal of each of the six schools and discussions around survey delivery were initiated.

The survey was conducted at each school's three-way interviews (also called parent-teacher interviews). Three-way interviews were scheduled at each school on the evening of November 25 and the morning of November 26, 2010. The exception was one low income area neighbourhood school where interviews were conducted the evenings of November 24 and November 25, 2010. Within each school, interviewers targeted caregivers who satisfied three inclusion criteria: a) one or more children 3 to 11 years of

age; b) were 18 years of age or older and c) self-identified as having a role in cooking, shopping or planning meals in their household.

Sample size depends on how much sampling error can be tolerated, population size if known, how varied the population is and finally, the smallest group within the sample for which estimates are needed (Salant & Dillman, 1994). Using a 95% confidence level, accepting a 5% sampling error and estimating the number of caregivers in our six schools to be no greater than 2500, we estimated that we needed 333 completed questionnaires using sample size estimate tables provided in the research literature (Salant & Dillman, 1994; Polgar & Thomas, 1995). Anything above this number would provide little added benefit in terms of confidence. Significant differences were reported by Lea, Crawford & Worsley (2006) in an Australian survey using 415 returned questionnaires and a modest 51% response rate.

In the DAILY questionnaire, response rate was defined as the percentage of eligible and qualified participants (Answers Research, 2009). Figure 4.1 illustrates the equation used to calculate response rate.

$$\text{Response Rate} = \frac{\text{Completes}}{\left(\text{Completes} \right) + \left(\frac{\text{Completes}}{\text{Completes} + \text{Not Qualified}} \times \left(\text{Not Contacted} + \text{Refused} \right) \right)}$$

Figure 4.1: Response rate equation

Ethics approvals were obtained from both the University of Saskatchewan Behavioural Research Ethics Board and the Saskatoon Public School Division. The study design posed minimal risk to the target population; however, consent letters were provided to individuals prior to completing the questionnaire. All participants were informed that their participation in this study was voluntary and that they had the right to withdraw up to the point of handing the questionnaire in without any consequence from the teachers or the school. Participants were told to not write or provide any information that could

identify them on the questionnaire. Participants were not required to sign a consent form and were informed that handing in the questionnaire implied their consent to participate in the study. Although information would be reported, participants were assured any information would be presented solely in summative form. Please see Appendix 5 for sample consent letter and copies of ethics approval.

4.3 Questionnaire Design

The principal research instrument developed was a paper-based, descriptive questionnaire. The questionnaire was developed in three phases (Figure 4.2). Phase one occurred between September 2009 and April 2010 through a review of the literature on benefits and barriers to other novel foods. Phase two pre-tested a draft questionnaire with our target population from May 2010 to July 2010 and, finally, after changes were made from the pre-test, the questionnaire was reviewed by registered dietitians for content validity. The final questionnaire was then used in the main study conducted in November 2010.

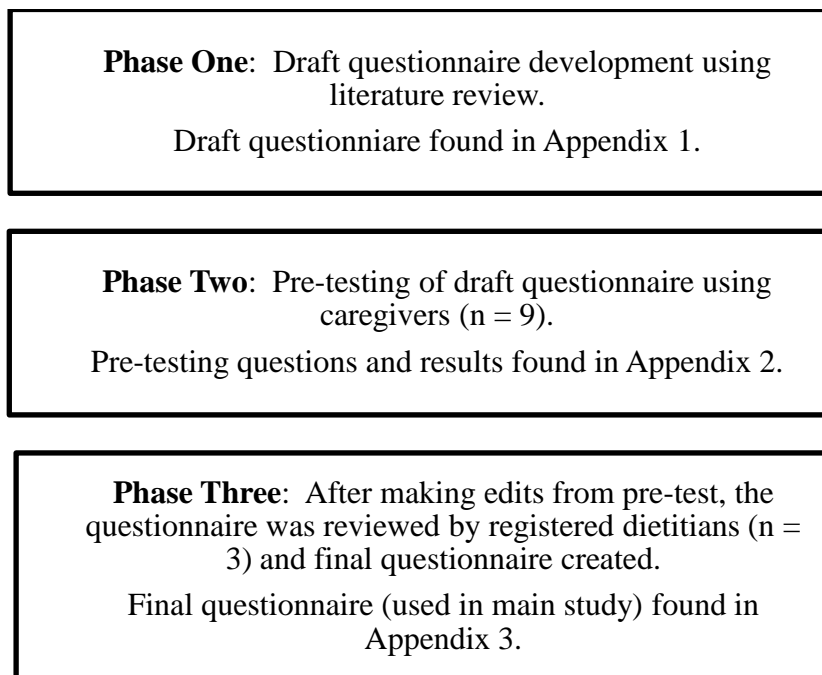


Figure 4.2: Questionnaire Development

Both the draft and final research instrument had four sections related to the objectives of the research. Part one addressed benefits and barriers to lentil consumption, part two captured consumption patterns, part three addressed nutrition knowledge and part four captured demographic data.

4.3.1 Development of the Draft Questionnaire

A questionnaire had to be developed to gather the data for this study as no validated tools were available in the literature. A research team at the University of Saskatchewan (Zello, Chilibeck, Vandenberg, Bennett) had adapted a questionnaire from Lea et al. (2006) to address the benefits and barriers regarding pulse consumption in a small sample of athletes (Bennett, Chilibeck, Barss, Oroz, Vandenberg, & Zello, 2009). The research data by Bennett et al. were used to correlate lentil intake with an experimental design investigating lentil consumption in soccer performance. However, given the differences in target population and the lack of focus on lentils of the previous research team, the DAILY questionnaire was greatly altered to include variables more pertinent to the target population. For instance, the variable of “influence of others” included children which may or may not be relevant to an athlete. In addition, the DAILY project was aimed at youth.

4.3.1.1 Benefit and Barrier Questions

The literature contained many articles on benefits and barriers to food intake; however, nothing was found on the benefits and barriers to lentil consumption specifically. The review did locate research on novel foods such as soy and healthy foods that are not as commonly eaten as vegetables and fruit (Balch, Loughrey, Weinberg, Lurie, & Eisner, 1997, Cox, Anderson, Lean & Mela, 1998, Gibson, Wardle, & Watts, 1998, Kearney & McElhone, 1999, Lappalainen, 1997, Lea, Crawford and Worsley, 2006, Schyver & Smith, 2005, Wardle & Steptoe, 2003, Werblow, Fox and Henneman, 1978, Yeh et al., 2008, Zunft et al., 1997). Based on the review of these studies the ten benefit and barrier constructs of interest to the DAILY questionnaire included: influence of others, self-

efficacy, food neophobia or a fear of trying new things, food cost, environmental concerns, taste, availability, food preparation, health/nutrition and time/convenience.

Forty-six statements, all relating to one of the ten constructs, were developed to analyze benefits and barriers to lentil consumption. Responses used a five-point Likert scale that ranged from strongly disagree to strongly agree with greater scores given to responses with the highest degree of agreement to benefit questions and fewer scores given to responses with the lowest level of agreement to benefit questions. Therefore, a higher score would indicate the subject had more benefits and fewer barriers while a lower score would indicate the opposite. The Likert scale does not, however, give weight to any sort of attribute. For example, if a participant indicated barriers around both taste and cost, there would be no way of indicating which barrier was most important to them. Therefore, the DAILY questionnaire also included one *forced ranking* question to evaluate the participants' opinion on their barriers to lentil consumption.

An informal conversation was held with five caregivers with children 3 to 11 years of age in February 2010. The interview let the participants discuss lentil intake and why they did or why they did not consume lentils. Two open-ended questions were posed to the caregivers: 1) Do you eat lentils as part of your regular diet? 2) For those who do not eat lentils, what are some of the reasons why you do not eat them? The conversation took place during an existing program for families with young children and was not recorded or structured. Open ended questions allowed the caregivers to lead the conversation and not be pre-empted from revealing their true responses. None of the caregivers were lentil consumers and all of their responses fell within the ten overriding benefit and barrier concepts included in the DAILY questionnaire. For example, caregivers mentioned that they do not know how to cook lentils, they do not have time to cook lentils and that they do not think their children would like lentils so it would be futile to prepare. Therefore, the researcher (TP) theorized that the constructs taken from the literature were applicable when exploring benefits and barriers to lentil consumption.

4.3.1.2 Lentil and Pulse Consumption

Part two of the questionnaire included a close-ended question about lentil consumption, a close-ended question about pulse consumption and a food frequency questionnaire (FFQ) exploring commonly eaten pulse dishes. Both pulse and lentil intake were analyzed since consumption estimates are low (Ipsos-Reid, 2010).

Research instruments in the literature were sought and a short food frequency questionnaire (SFFQ) created by Papadaki & Scott had been shown to “provide a fair estimate of legume consumption” (Papadaki & Scott, 2007). The SFFQ contained both legume and soy foods commonly consumed in Scotland. However, the Papadaki SFFQ questionnaire did not include foods commonly eaten in Canada so the following foods were included: baked beans, soup with beans, peas or lentils, chili with beans, peas or lentils, dips/spreads with beans, peas or lentils, salad with pulses or any legume containing mixed dishes such as curries, stews or burritos. The possible responses to items in the FFQ were never/rarely, 1-3 times per month, 1-2 times per week, 3-4 times per week, 5-6 times per week, 1 per day and 2+ per day. The FFQ also included a section for participants to indicate usual serving size. The addition of serving-size categories allowed ranking of participants into low, medium or high pulse consumers.

The format of the FFQ was determined by looking at numerous forms of FFQ and the design selected was similar to that found on the Fred Hutchison Cancer Research Centre sample FFQ (Fred Hutchison Cancer Research Centre, 2011). FFQ are less time consuming and can be self-administered which made it a superior dietary assessment method over 24-hour recall or food records for the DAILY questionnaire (Boyle & Morris, 1999; Gibson, 2006).

4.3.1.3 Nutrition Knowledge

A nutrition knowledge section was created by this researcher (TP) to assess knowledge of lentils and *Eating Well with Canada's Food Guide* (CFG). CFG was chosen as it is the

most widely accessed nutrition resource and it is meant to define and promote healthy eating for Canadians (Health Canada, 2007).

A total of eight close-ended nutrition knowledge questions were included in the pre-tested questionnaire. All questions were marked as correct or incorrect in order to tabulate a total knowledge score.

4.3.1.4 Demographics

Demographic information included age, gender, education, income and ethnicity since these variables are shown in the literature to affect food choice (Public Health Agency of Canada, 2003; Lappalainen, 1997; Lea, Crawford, & Worsley, 2006).

Questions relating to health or nutrition-related qualifications were added to distinguish a difference in knowledge scores amongst those who had education and those who did not. Additionally, questions were added on vegetarianism as this is something that could affect pulse consumption habits as pulses are meat alternatives according to *Eating Well with Canada's Food Guide* (Health Canada, 2007).

4.3.2 Pretesting of Questionnaire

The pre-test of the DAILY questionnaire transpired in two stages: stage one tested the draft questionnaire with subjects (n = 9) who met inclusion criteria (draft questionnaire is found in Appendix 1 and pre-test questions and results found in Appendix 2) and stage two was a review by registered dietitians (n = 3). Edits were made to the questionnaire prior to the dietitian review and final changes from dietitians resulted in the final questionnaire used in the main study (Appendix 3).

4.3.2.1 Pretest of Questionnaire with Caregivers

A pre-test establishes whether participants understood the questions in a way that the researcher intended and ensures responses are mutually exclusive and exhaustive

(Collins, 2003; Salant & Dillman, 1994; Fink, 2003). An initial pre-test was conducted with nine caregivers between May 27 and July 15, 2010. Participants met inclusion criteria (i.e., were 18 years of age or older and had a child 3 to 11 years of age and self-identified as having a role in meal preparation and grocery shopping in their household) and recruited through a convenience sample of friends and colleagues of the researcher (TP). They were asked to complete the questionnaire on their own and answer questions and/or provide suggestions for improvement to questionnaire.

Standardized questions for pre-testing the questionnaire were developed using the literature (Collins, 2003; Fink, 2003; Salant & Dillman, 1994; Presser, et al., 2004). Questions included specific questions on wording but also included questions such as “what do you think this question is asking” to explore cognitive interviewing techniques. Cognitive interviewing in particular “focuses mainly on the questionnaire rather than the survey process...thus allows covert as well as overt problems to be identified” (Collins, 2003). A complete list of pre-test questions and results are found in Appendix 2.

Several amendments were made to the draft DAILY questionnaire after the pre-test. In section one questions were worded to be more belief-driven statements. For instance, the statement “my child does not like the taste of lentils” was changed to “I believe my child would not like the taste of lentils”. Test subjects explained this would be easier to answer particularly if they were not regular lentil consumers. Furthermore, participants stated that section one was lengthy and suggested that it be broken into smaller sections. Average time to complete the survey was ten to twelve minutes.

Additionally, a question regarding where participants access healthy eating information was added to the knowledge section. Fifteen possible responses, including an open ended category, were provided using items found in the literature as common sources of information for healthy eating (Marquis, Dubeau, & Thibault, 2005). Participants could check as many items as possible to this question since people use various sources for healthy eating information.

4.3.2.2 Assessment with Registered Dietitians

With changes made from the pre-test, a revised version of the questionnaire was given to three registered dietitians to review. Minor grammatical and formatting changes occurred. The most significant change was the forced ranking question in the pre-tested survey was moved to a different section in the final survey and reorganized to rank constructs into their top three barriers to lentil consumption (i.e. participants asked to pick their top three barriers). See Appendix 3, page 103.

The final benefit and barrier questions used to measure the ten constructs of interest are found in Table 4.1 and the final version of the questionnaire used in the main study is found in Appendix 3.

Table 4.1: Benefit and barrier questions associated with each construct

Construct	Benefit & Barrier Question
Influence of Other	I believe my food choices influence what my child eats
	I often prepare a separate meal for my child
	I wish I could influence my child's eating habits more
	Lentils are part of my traditional diet
	I don't think my child would eat a meal containing lentils
	If my children liked lentils, I would make them more
	It I eat lentils, my child is more likely to eat lentils
	I believe that serving lentils would help me to look more trendy to my friends and family
Motivation	I don't want to change my eating habits or routine
	The type of food I fed my child has no impact on their health
	I would like to eat healthier
	I am not convinced about the benefits of eating healthy
	I believe healthy food is important to my child's health
	I am motivated to eat lentils

	I believe it is important for my children to consume lentil-based meals
Neophobia	I would get indigestion, bloating or gas eating lentils
	I would eat lentils if they had a more attractive appearance
	I believe lentils would upset my child's stomach
Health/Nutrition	Nutrition is not that important
	I believe lentils are a healthy food
	I believe that lentils are healthy for my child
Cost	It would be too expensive to eat lentils
	Lentils are expensive to add to meals
	I believe that lentil-based meals can help me to save money
Local/Environment	It is important for me to consume Saskatchewan produced foods
	It is important for my children to learn to consume Saskatchewan based foods
Taste	Lentils are not tasty enough
	Lentils can be a part of a tasty diet
	I believe my child would not like the taste of lentils
Availability/Selection	Lentil-based meals or snacks are not available when I eat out
	I would buy a prepackaged lentil-based snack
	I never think of using lentils when I cook
	I would try a lentil dish in a restaurant
	I would buy a prepackaged lentil-based meal
Food Preparation	I need more information about how to cook lentils
	I don't know how to prepare lentils
	I know how to cook lentils
	I believe that it is important for my child to learn how to prepare lentils
Time	I'm too busy to prepare a lentil-based meal
	I believe I would have to go shopping too often if I ate lentils
	It takes too long to prepare lentils

4.3.3 Interviewer Training

Senior undergraduate students, with a minimum of three years of university, from the College of Pharmacy and Nutrition were recruited to aid in the delivery of the DAILY questionnaire (n = 18). Each student attended mandatory training that covered survey procedures, tips to decrease researcher bias and an analysis of the questionnaire to become familiar with the techniques used in the DAILY survey. Training sessions covered common questions by respondents, how to answer questions while minimizing bias, interviewer roles and responsibilities, how to recruit subjects, ethics, confidentiality and procedures of the DAILY survey method. Opportunities to practice recruitment and interview-assisted methods were provided during training sessions. A training manual (Appendix 4) was created using information from the literature (Salant & Dillman, 1994; The Center for AIDS Prevention Studies, 1995; World Bank, 2002).

4.4 Questionnaire Delivery

Each school had two or three interviewers per day to recruit participants. Interviewers were asked to arrive 20 to 30 minutes prior to the three-way conferences to remind school administration of presence and to set up table and display indicating a University of Saskatchewan Research Study was taking place.

Interviewers, easily identified by wearing University of Saskatchewan t-shirts, strategically set up a table and display at the main entrance of each school in order to approach caregivers as they walked into the building. All caregivers were approached to see if they met inclusion criteria and have the opportunity to fill out the questionnaire.

Interviewers were instructed not to avoid participants that appeared intimidating or rushed. An algorithm was provided during training sessions to guide the interviewer's behaviour (Figure 4.3). The algorithm provided a step-by-step process for the interviewer to ensure that subjects were approached in a friendly manner, that subjects met the inclusion criteria, ensured that consent forms were reviewed and, finally, provided a safe option for those who were illiterate to have an interview assisted

questionnaire filled out. A tally sheet was provided at each school for interviewers to track the number of non-responses, the number of people who did not meet inclusion criteria and, finally, the number of people who did not know or recognize lentils. A petri dish containing three types of lentils (hulled green lentils, hulled red lentils, split red lentils) provided subjects a visual cue of lentils in an attempt to ensure that, when answering survey questions, they were referring to lentils and not another type of pulse.

Once questionnaires were completed, participants received a free pulse cookbook provided by the Saskatchewan Pulse Growers. Subjects were also entered into a draw for a grocery gift card. One gift card was available to be won at each school. All names put into the draw were separated from the questionnaire to ensure confidentiality.

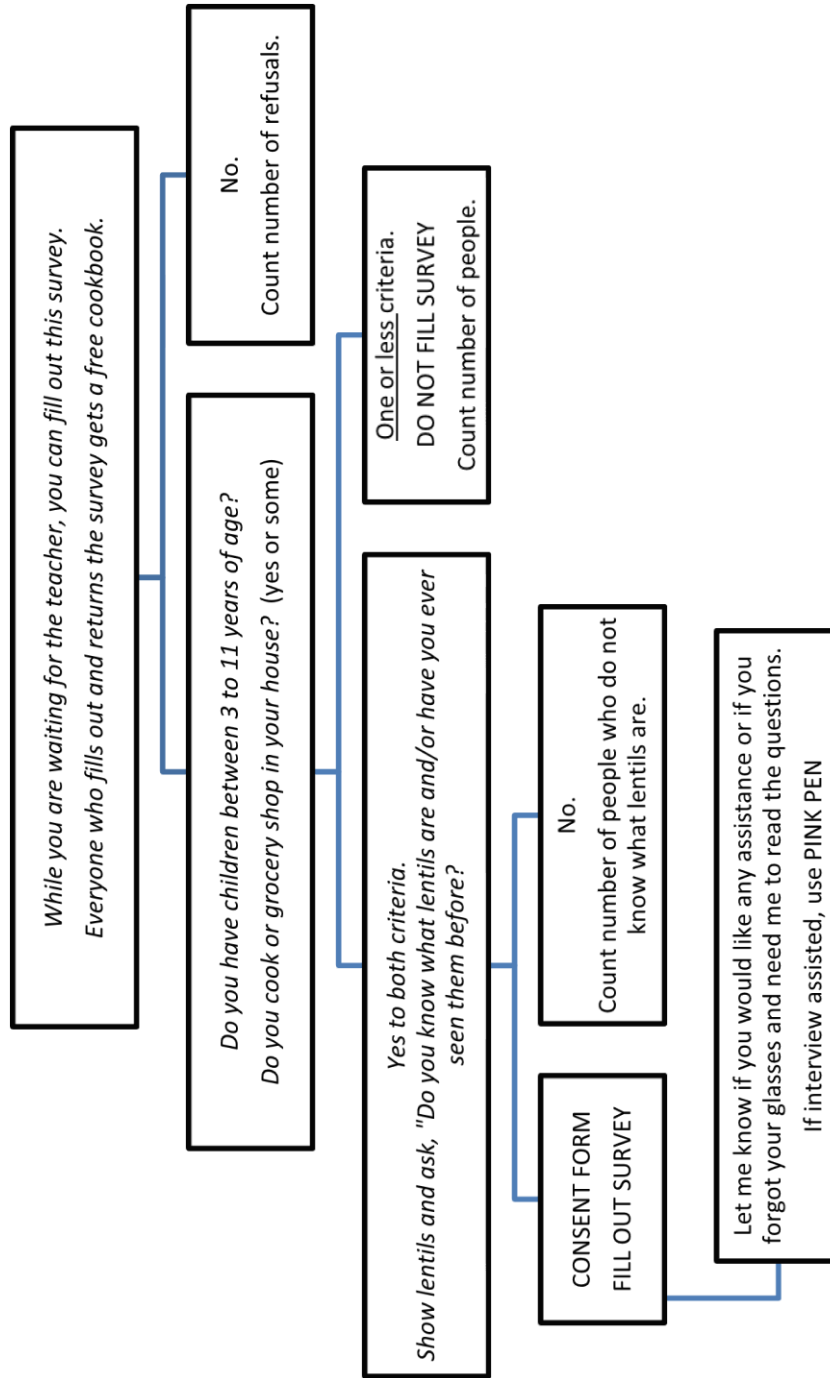


Figure 4.3: Questionnaire Procedure Algorithm

4.5 Data Analysis

Questionnaire data were coded and compiled onto a spreadsheet using Predictive Analytics Software (PASW) Statistics 18, Release Version 18.0.0 (SPSS, Inc, 2010). Statistical significance was defined as $p < 0.05$.

Benefits and barriers to lentil consumption: Benefit and barrier questions were coded 1 through 5 with a higher score indicating a more positive response. For example, the question “I would like to eat healthier” would score 5 for a “strongly agree” response and 1 for “strongly disagree”; conversely, the statement “nutrition is not that important to me” would score a 5 for “strongly disagree” and a 1 for “strongly agree”. All “not sure” responses scored 3. Therefore, when benefit and barrier questions were summed to comprise a belief score, a range of 41 to 205 was possible with a higher score indicating a more positive belief (more benefits and fewer barriers).

Lentil and pulse consumption: Pulse and lentil consumption were measured using close ended questions and a food frequency questionnaire. Consumption data were coded into seven categories (never or rarely, 1-3 times per month, 1-2 times per week, 3-4 times per week, 5-6 times per week, once a day or two or more times a day). If participants marked that they “never or rarely” ate pulses they proceeded to answer the next question asking them to rank barriers. Frequencies for all three parts of the question were calculated and assigned a value code; 3 for most important barrier, 2 for second most important barrier and 1 for third most important barrier. Each response was given a total score to elicit the top barriers to lentil consumption of lentil non-consumers.

Nutrition Knowledge: Correct responses were given a value of zero and incorrect responses coded as one. Incomplete answers were coded as incorrect.

Descriptive statistics were used to describe benefits and barriers to lentil consumption, knowledge results, consumption reports and demographics. Frequencies of responses to the questionnaire items were measured and cross-tabulations (Pearson chi-square (χ^2) test

of statistical significance) by sex, income, age, education and neighbourhood were performed.

Inferential statistics were also employed. To investigate the homogeneity of the benefit and barrier scale Cronbach's alpha was used to test the internal consistency as it reflects how well the different items complement each other in their measurement of different aspects of the same variable. A good measure should have a Cronbach's alpha of at least 0.60 and anything over 0.90 is very good (Aron, Aron, & Coups, 2006).

Correlation analyses were conducted between pulse/lentil intake data, knowledge and belief scores. An effect size of 0.10, 0.30 and 0.50 were deemed small, medium and large effect sizes, respectively (Aron, Aron, & Coups, 2006).

Student t-test for independent samples, using Levene's test for equality of variance, were employed to test for differences in belief and knowledge scores between neighbourhoods while ANOVA, using Tukey's post hoc testing, was used to detect differences in belief scores between low, medium and high pulse consumers and differences in belief scores between the three different income levels. To consider the differences between neighbourhoods for each belief score construct, a multivariate ANOVA was used with the constructs as the dependent variable and neighbourhood as the independent variable. Only constructs that demonstrated good internal consistency were entered into the model. Although less robust, to protect against type I errors MANOVA was used instead of ANOVA. Post-hoc testing of univariate results was not required as neighbourhood only contains two groups.

CHAPTER 5: RESULTS

5.1 Response Rate

Research teams approached 652 people to fill out the survey, of which 132 refused to participate, 81 did not meet the inclusion criteria, 21 surveys were not filled out (i.e. only one or two questions were answered), 13 participants met inclusion criteria but did not know what a lentil was and 4 surveys were returned to the schools after the data collection date and were not entered into analysis. Therefore, a total of 401 completed questionnaires were used in our analysis. Using the response rate equation in section 4.2 the percentage of eligible and qualified participants equated to a 76% response rate². Table 5.1 displays the number of completed surveys at each school. Only one questionnaire was in pink pen illustrating an interview-assisted survey was completed.

Table 5.1: Completed number of questionnaires by school

School	Number of completed questionnaires
Low income area school A	67
Low income area school B	26
Low income area school C	66
High income area school D	75
High income area school E	101
High income area school F	66
TOTAL	401

Distribution between neighbourhoods was 168 completed questionnaires from low income neighbourhood areas (41.9%) and 233 questionnaires from high income neighbourhood areas (58.1%).

² where the number of “not contacted” equaled 25 (21 not fully completed + 4 returned late), the number of “not qualified” equaled 94 (81 did not meet inclusion criteria + 13 unaware of what a lentil was), the number of “completes” equaled 401 and the number of “refused” equaled 132

5.2 Demographics of Participants

The questionnaire was completed by predominantly females (74.6%) and the majority of respondents were in two age categories: 26 to 35 years (35.9%) and 36 to 45 years (46.6%). A summary of demographic characteristics is found in Table 5.2. No statistically significant differences were found between neighbourhoods within age categories ($p>0.05$). In addition, the majority of respondents came from homes with a total of 4 people in their household (45.4%). Most households had one (39.4%) or two (39.4%) children between the ages of 3 to 11 years of age ($n=362$). Most respondents were married or common law (79.1%) and were employed full-time outside the home (57.9%). The majority of respondents were Caucasian (75%) with 11% self-identifying as Aboriginal (Figure 5.1).

In regards to nutrition-related qualifications, 67 subjects indicated that they had some nutrition training. When asked to specify the type of training, 12 subjects did not answer and 8 subjects listed a disease (i.e. high cholesterol, diabetes, etc.) instead of a profession or course. However, of the remaining responses, 11 indicated registered nurse, 6 listed a health worker such as a laboratory technologist, oral health care worker, x-ray technician or registered massage therapist, 6 indicated a pharmacy related professional, 3 listed they had a food safe course, 3 were dentists, 3 nursing students or nursing aids, 2 graduate students, 2 had nutrition degrees, 2 chefs, 1 stated nutritional consultant and 1 veterinarian. Independent samples t-test did not reveal significant differences in knowledge scores in regards to nutrition-related qualification ($p>0.05$).

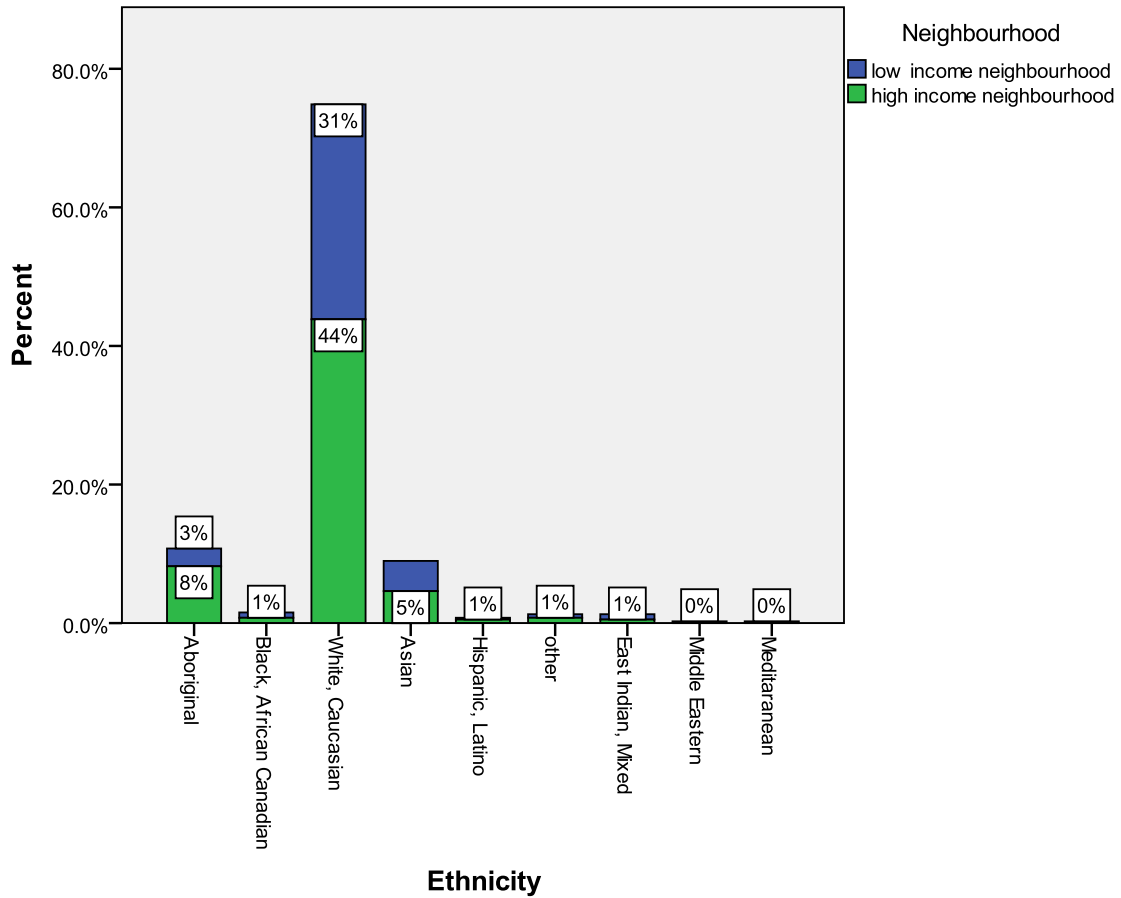


Figure 5.1: Comparison of caregivers' self-identified ethnicity by neighbourhood (n = 390). No statistically significant differences found between neighbourhoods (Chi-square, $p > 0.05$).

Table 5.2: Demographics of DAILY questionnaire

	Frequency	Percent
Gender (n= 395)		
- male	96	23.9
- female	299	74.6
Age (n = 396)		
- 25 years or younger	7	1.7
- 26 to 35 years	144	35.9
- 36 to 45 years	187	46.6
- 46 to 55 years	55	13.7
- 56 to 65 years	3	0.7
- 66 years or older	0	0
Marital Status (n = 395)		
- single	43	10.7
- married or common law	317	79.1
- separated or divorced	26	6.5
- widowed	3	0.7
- would rather not say	6	1.5
Employment Status (n = 393)		
- full-time caregiver	57	14.2
- employed full-time outside of the home or self-employed	232	57.9
- employed part-time outside of the home or self-employed	67	16.7
- unemployed	16	4
- a student	21	5.2
- retired	0	0
Education (n = 398)		
- some high school	20	5
- completed high school diploma	51	12.7
- some post-secondary such as technical school, college, university	86	21.4
- completed technical school or college	83	20.7
- completed a university degree	158	39.4
Household Annual Income (n = 372)		
- less than \$39,999	70	17.5
- \$40,000 to \$79,999	111	27.7
- more than \$80,000	191	47.6
Ethnicity (n = 390)		
- Aboriginal (First Nations, Metis, Inuit)	42	10.5
- Black, African Canadian	6	1.5
- White, Caucasian	292	72.8
- Asian	35	8.7
- Hispanic, Latino	3	0.7
- Other	5	1.2
Vegetarianism (n= 393)		
- not a vegetarian	376	93.8
- pesco-vegetarian	9	2.2
- lacto-ovo vegetarian	7	1.7
- vegan	1	0.2

Income ranges were kept broad yet 29 people did not answer this question (Figure 5.2). A higher percentage of individuals in the high income neighbourhood (22.0%) self-identified as having an income <\$40,000 versus individuals living in a low-income neighbourhood (14.6%) but results were not statistically significant ($p>0.05$).

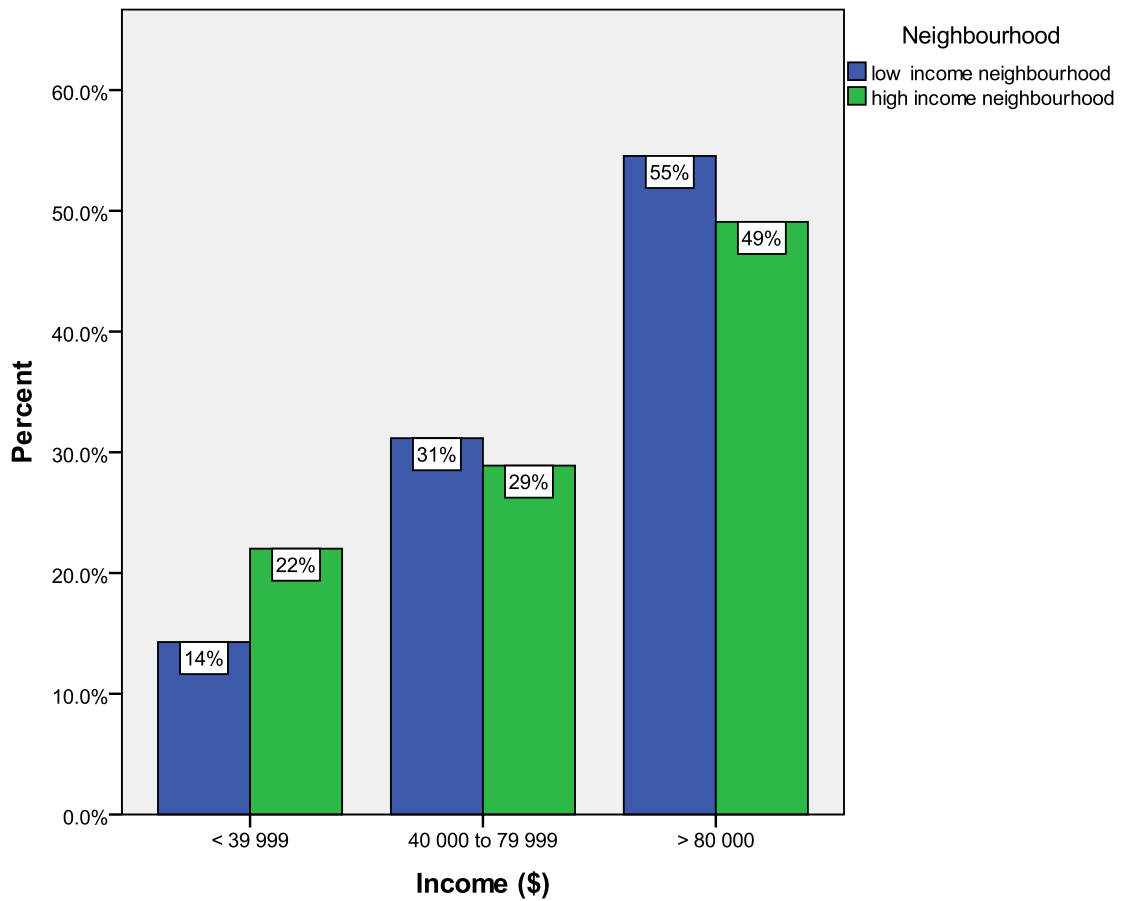


Figure 5.2: Comparison of family total gross annual income (n = 372). No statistically significant differences found between neighbourhoods (Chi-square, $p>0.05$).

5.3 Pulse and Lentil Consumption Data

The DAILY questionnaire contained questions specific to lentil consumption, pulse consumption and included a food frequency questionnaire exhibiting commonly eaten pulse dishes. Over half of participants never or rarely consumed lentils (57.7%) as seen in figure 5.3. Pulse consumption was greater than lentil consumption as in Figure 5.4. The majority of the subjects (44.0%) consumed pulses 1 to 3 times per month while 21.7% stated they never or rarely ate any pulse foods.

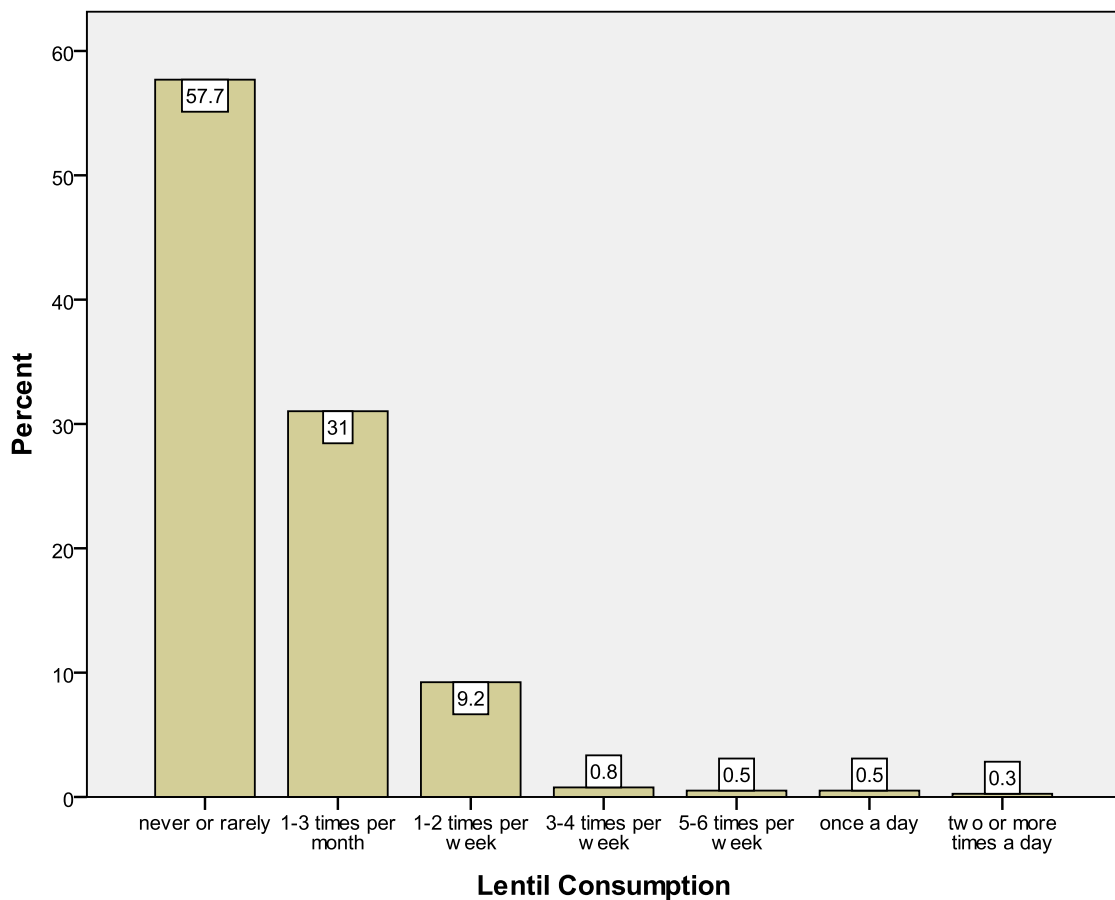


Figure 5.3: Lentil consumption. Chi-square analysis revealed no significant difference in distribution detected between neighbourhoods, income levels, gender, education, age or ethnicity with lentil consumption (n = 390; p>0.05).

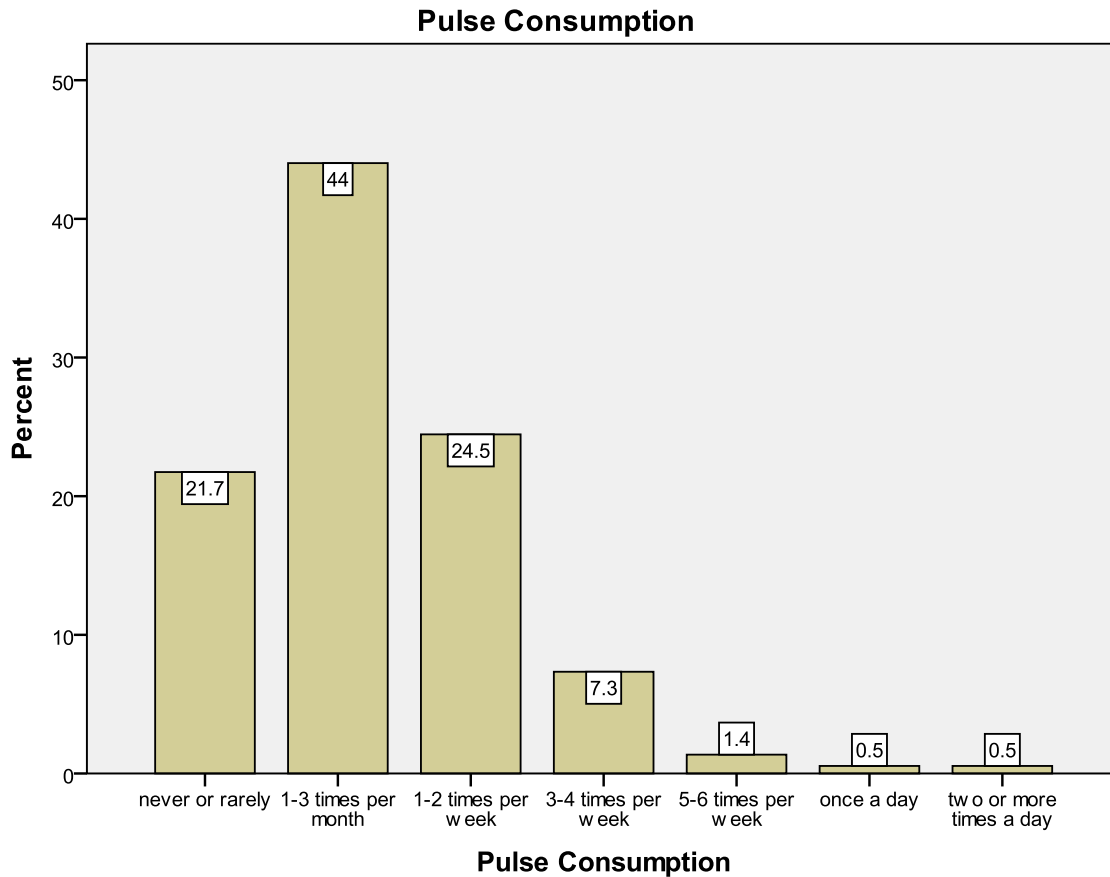


Figure 5.4: Pulse consumption. Chi-square analysis indicated there were no significant differences in distribution detected between neighbourhoods, income levels, gender, education, age or ethnicity (n = 368; p>0.05).

Food frequency data asked subjects to both (a) define how often they ate certain pulse foods and, (b) estimate how big a usual serving size was. Responses for frequency information were high but when asked to estimate serving sizes there were many non-response items for each food product (ranging from 51 to 101 missing responses). Therefore, results focused on frequency information only.

The food frequency questionnaire (FFQ) included six commonly eaten dishes containing pulses such as baked beans, soup made with pulses, chili, dips or spreads, pulse salads and mixed pulse dishes like curries. The most common response for baked beans, soup, chili and mixed dishes was “1 -3 times per month” while bean dips and salads were commonly eaten “never or rarely”. Based on the FFQ, the most commonly eaten pulse

dishes were chili and mixed dishes such as curries and burritos while dips and salads made with pulses were the least consumed dishes.

A correlation matrix was created between both pulse consumption and the food frequency questionnaire items and lentil consumption and the food frequency questionnaire items. Pulse consumption correlated the highest with soup ($r = 0.438, p < 0.01$) and mixed dish consumption ($r = 0.404, p < 0.01$). Lentil consumption correlated the highest with soup ($r = 0.463, p < 0.01$) and salad ($r = 0.327, p < 0.01$). Overall, pulse consumption was positively correlated to lentil consumption ($r = 0.491, p < 0.01$). Little to no correlation ($r = 0 \pm 0.1$) existed between consumption habits and ethnicity or vegetarianism.

5.4 Benefits and Barriers to Lentil Consumption

5.4.1 Benefit and Barrier Question Validation

The final version of the DAILY questionnaire had 41 benefit or barrier questions relating to lentil intake. Each of the 41 questions related to at least one of ten constructs influencing lentil intake. Using a five-point Likert scale (strongly agree to strongly disagree) statements were ranked eliciting information about their beliefs around lentils. Internal consistency of all 41 belief questions was high (Cronbach's $\alpha = 0.86$). Internal consistency of each construct was also tested to demonstrate how well the questions related to the specific construct of interest (Table 5.3).

Table 5.3: Alpha levels for constructs surrounding lentil consumption. Cronbach's alpha was 0.86 for all 41 questions.

Construct	Alpha Level
Influence of others	0.404
Motivation	0.511
Neophobia	0.534
Health/Nutrition	0.539
Cost	0.696*

Local/Environment	0.826*
Taste	0.670*
Availability	0.438
Food preparation	0.120
Time	0.691*

(*) indicates good internal consistency or $\alpha > 0.6$

The two constructs of health/nutrition and motivation were combined resulting in an improved alpha of 0.66 (health/motivation).

5.4.2 Benefit and Barrier Data

Responses were coded as per section 4.5 with higher scores indicating a higher degree of agreement with benefits to lentil consumption. Belief data were presented descriptively using a mean and standard deviation of total belief scores (n = 401) (Figure 5.5).

An independent samples t-test revealed that mean belief scores of low income area neighbourhoods (138.8 ± 14.6) were significantly different from mean belief scores of high income area neighbourhoods (144.2 ± 15.8) ($p < 0.01$). Mean belief scores in high income neighbourhoods were slightly higher which indicates more benefits and fewer barriers to intake. However, ANOVA did not result in significant differences in belief scores between specific income levels (<\$39,999, \$40,000-79,999, >\$80,000) ($p > 0.05$). Multivariate analysis of variance (MANOVA), with the constructs as the dependent variable and neighbourhood as the independent variable, was significant ($p < 0.01$). Univariate results showed significant differences in neighbourhoods with the constructs of cost, taste, time and health/motivation ($p < 0.01$).

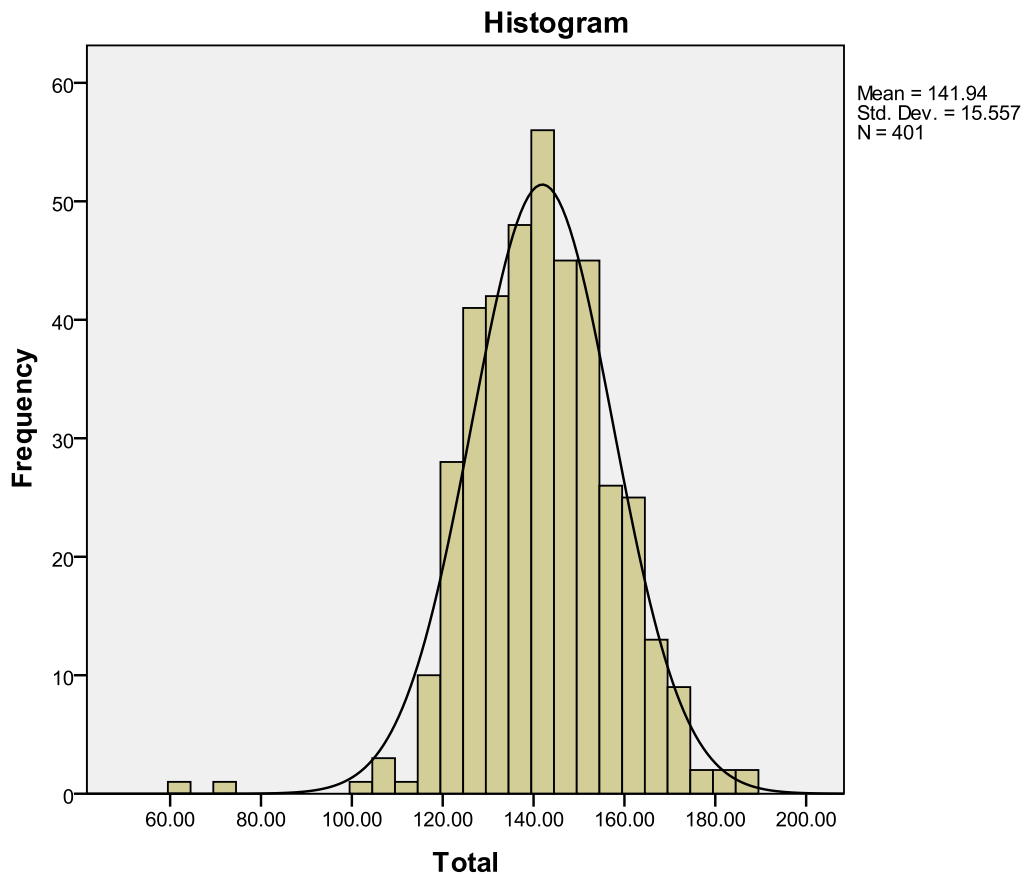


Figure 5.5: Distribution of mean belief scores (n = 401). Range of scores 41 to 205.

Tables 5.4 and 5.5 provide a summary of the percentage agreement with the benefit and barrier questions, respectively. Both tables illustrate the strength of the caregivers' response to the 41 benefit and barrier questions. Top benefits relate to the constructs surrounding health and nutrition while the top perceived barriers relate to the constructs of influence of others, pulse availability and food skills.

Table 5.4: % Agreement with Benefits to Lentils

Benefit Question: Agreeing to questions shows more positive belief	% Agree (%Not Sure)
I believe healthy food is important to my child's health	98.3 (0.2)
I would like to eat healthier	93.8 (2.2)
I believe my food choices influence what my child eats	93.5 (1.7)
I believe lentils are a healthy food	91.3 (6.7)
I believe that lentils are healthy for my child	89.8 (9.5)
If I eat lentils, my child is more likely to eat lentils	80.0 (11.0)
Lentils can be a part of a tasty diet	68.3 (26.4)
I would try a lentil meal in a restaurant	65.1 (21.7)
I need more information about how to cook lentils	63.3 (10.0)
It is important for me to consume Saskatchewan produced foods	59.9 (26.2)
I believe that it is important for my child to consume lentil-based meals	56.6 (33.9)
I would buy a pre-packed lentil-based snack	53.1 (35.4)
It is important for my child to consume Saskatchewan produced foods	52.9 (30.9)
I would buy a pre-packed lentil based meal	51.1 (34.4)
I believe that it is important for my child to learn how to prepare lentils	49.6 (31.7)
I am motivated to eat lentils	47.6 (34.4)
I know how to cook lentils	45.9 (17.2)
I believe that lentil-based meals can help me to save money	35.4 (59.9)
Lentils are part of my traditional diet	21.7 (12.5)
I believe that serving lentils would help me to look more "trendy" to my friends and family	12.0 (38.9)

Table 5.5: % Agreement with Barriers to Lentils

Barrier Question: Agreeing to questions shows more negative belief	% Agree (%Not Sure)
If my child liked lentils, I would make them more	76.3 (17.0)
I wish I could influence my child's eating habits more	65.8 (10.5)
Lentil-based meals or snacks are not available when I eat out	56.6 (30.2)
I never think of using lentils when I cook	54.4 (10.7)
I don't know how to prepare lentils	40.9 (12.2)
I often prepare a separate meal for my child	25.9 (4.5)
I don't want to change my eating habits	25.4 (18.2)
I don't think my child would eat a meal containing lentils	21.7 (37.4)
I would eat lentils if they had a more attractive appearance	21.4 (30.4)
I'm too busy to prepare lentil based meals	19.2 (27.4)
I believe my child would not like the taste of lentils	16.2 (46.1)
Lentils are not tasty enough	15.2 (34.9)
I believe it takes too long to prepare lentils	14.7 (40.4)
The type of food I feed my child has no impact on their health	11.7 (4.7)
I would get indigestion, bloating or gas eating lentils	9.0 (42.6)
I am not convinced about the benefits of eating healthy	7.7 (2.5)
I believe lentils would upset my child's stomach	3.5 (36.7)
Nutrition is not that important to me	3.5 (1.7)
I believe I would have to go shopping too often if I ate lentils	3.0 (27.7)
I believe it would be too expensive to eat lentils	2.7 (28.9)
Lentils are expensive to add to meals	2.7 (37.4)

5.4.3 Benefit and Barrier Data and Pulse/Lentil Consumption

Correlation analysis demonstrated a medium effect size between lentil intake and total belief scores ($r = 0.399$, $p < 0.01$) while a weaker effect is seen with pulse consumption and belief scores ($r = 0.266$, $p < 0.01$). Mean belief scores (Table 5.6) trend higher with more frequent lentil consumption.

Table 5.6: Mean belief scores by lentil consumption (n = 390)

Lentil Consumption	Mean	N	Std. Deviation
never or rarely	135.8	225	12.2
1-3 times per month	150.8	121	15.8
1-2 times per week	152.4	36	12.9
3-4 times per week	149.7	3	11.7
5-6 times per week	157.0	2	8.5
once a day	137.5	2	.7
2 or more times a day	165.0	1	.0
Total	142.3	390	15.5

Due to the small number of participants consuming lentils, variables were re-coded into low, medium and high lentil consumers. Low consumers (LC) included the “never or rarely” group ($n = 225$), medium consumer (MC) included the “1-3 times per month” group ($n = 121$) and high consumers (HC) included all caregivers that indicated they ate lentils weekly ($n = 44$) (Figure 5.6).

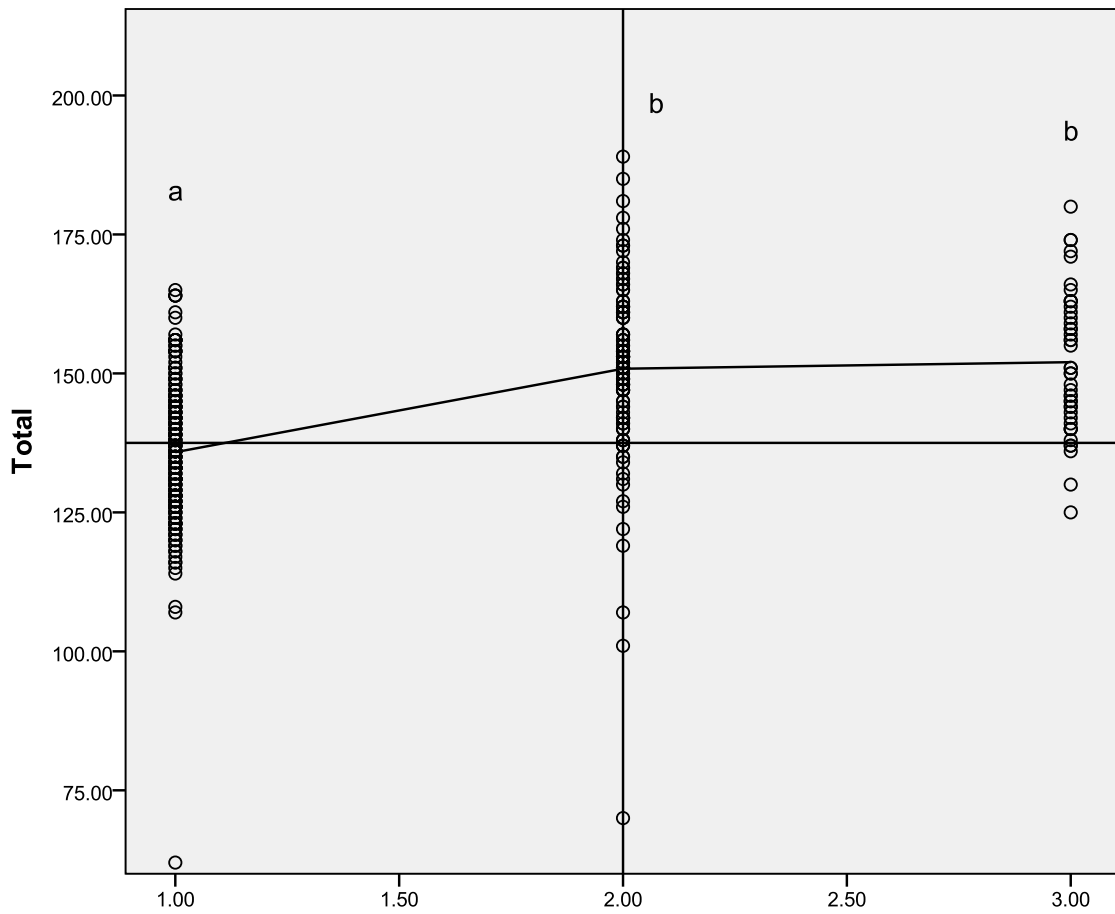


Figure 5.6: Total belief scores by low (LC), medium (MC) and high (HC) lentil consumption. ANOVA and Tukey's post hoc testing reveals that belief scores in LC is significantly different than MC and HC but belief scores of MC are not significantly different than HC ($p < 0.05$). Total belief scores as the dependent variable and LC, MC, HC as the independent variables [$F = (2,387) = 61.54$, $p < 0.05$]. Homogeneity of variance was demonstrated using Levene statistic.

All caregivers classified as a low consumer (never or rarely ate lentils) were asked to list their top three barriers to lentil consumption in a three part question. Of the 225 low consumers for this question, 207 people answered part one of the question, 187 answered part two of the question and 166 answered part three of the question (Table 5.7).

Table 5.7: Ranked barriers to lentil consumption of lentil non-consumers

Barrier	Total Score (Frequency of response x value*)	Ranking
I do not know how to cook lentils	384	1
I believe my family would not like lentils	262	2
Lentils take a long time to cook	184	3
Lentils do not taste good	166	4
I do not know where to find lentils	129	5
Other	102	6
I do not want to try new foods	39	7
I believe lentils are expensive	17	8

(*) value = 3 if listed as most important barrier; value = 2 if listed as second most important barrier; value = 1 if listed as third most important barrier

The open-ended question “other” elicited responses such as “I don’t think of using lentils when I cook” (n = 19) and “I need more recipes using lentils” (n = 15) as other barriers that were not listed on the DAILY questionnaire.

5.5 Nutrition Knowledge

Nine questions were included in the nutrition knowledge section along with another question determining where subjects accessed nutrition information. Scores ranged from 11% to 100% (Table 5.8).

Table 5.8: Mean Knowledge Scores. Separate independent sample t-tests did not reveal significant differences between neighbourhoods, gender, income levels (<\$39,999 and >80,000 only) or nutrition training (p>0.05).

Sample	Mean Knowledge Score (percent correct) ± SD
Total Population	73.2% ± 14.3 (n = 401)
High Income Neighbourhoods	74.3% ± 13.3 (n = 233)
Low Income Neighbourhoods	71.6% ± 15.4 (n = 168)

The two questions most often answered incorrectly were question one that indicated 55% of subjects were not able to correctly recognize that lentils were a meat alternative according to Canada’s Food Guide and 98% could not identify an accurate serving size on question three. Additionally, 27.2% of subjects did not recognize that lentils were a source of iron while 11% of subjects did not identify that lentils were grown in Saskatchewan.

When correlating nutrition knowledge to belief scores (Pearson’s r), a small effect size was seen (r = 0.166, p<0.01). Virtually no effect size was seen between knowledge scores and lentil or pulse consumption (p>0.05).

The nutrition knowledge section asked where consumers accessed information on healthy eating. Fourteen responses were provided with opportunity to add their own responses. Respondents were allowed to check as many answers that applied to them. Frequencies were done on responses and the top five sources of healthy eating information in order were (n = 392):

1. Internet = 283 responses (72%)
2. Cookbooks = 242 responses (62%)
3. Magazines = 240 responses (61%)
4. Food labels = 204 responses (52%)
5. Friends and family = 199 responses (51%)

Least commonly reported sources of information social media (4%), radio (7%), chefs (12%) and the library (15%).

CHAPTER 6: DISCUSSION

6.1 The DAILY Project

The long-term objective of the DAILY project is to ensure families in Saskatoon are eating healthy foods. Lentils are a healthy food choice that is low-cost, versatile, grown locally and promoted by Eating Well with Canada's Food Guide (Health Canada, 2007). Thus, the first step in the project was to initiate the DAILY questionnaire to quantify lentil intake in young families and to determine perceived benefits and barriers to consuming lentils.

At the onset of the research study, little information was found in the literature surrounding benefits and barriers to pulse consumption and even less data relating specifically to lentils. Pulses are the edible seeds of legumes and include peas, beans, lentils, chickpeas and faba beans (Saskatchewan Pulse Growers). The DAILY questionnaire targeted caregivers of children 3 to 11 years of age. Since children are dependent on their parents for their food and money, the questionnaire was designed for the adult food providers of the children. Thus, this target population is of importance in order to facilitate healthier choices into adulthood and increase the likelihood of lifelong pulse consumption. Furthermore, the DAILY questionnaire provides data that could be used by both industry and health professionals to encourage healthy eating patterns and provide a unique body of research to base marketing strategies and media campaigns.

Questionnaires are used extensively in research to collect data about phenomena not easily observed such as beliefs and attitudes (Gall, Gall, & Borg, 2007). To date, this is the first study to look at the barriers to lentil consumption specifically. The research questions answered include:

1. What benefits and barriers surrounding lentil consumption exist in families in Saskatoon, Saskatchewan?
2. How do demographics, specifically between high income neighbourhoods and low income neighbourhoods, affect attitudes and consumption of lentils? and

3. How does nutrition knowledge affect attitudes and consumption of lentils?
4. What are pulse and lentil consumption habits?

6.2 Benefits and barriers surrounding lentil consumption

A Likert scale was chosen for the questionnaire as it is the most common response scale for attitudinal surveys (Gall, Gall, & Borg, 2007; Polgar & Thomas, 1998). Forty-one statements, all relating to one of the ten constructs, were asked with both positive and negative attributes regarding lentil consumption. For example, in regards to the construct of “taste” the following two statements were provided:

- Lentils are not tasty enough.
- Lentils can be part of a tasty diet.

In order to decrease subject apathy, questions were provided with both positive and negative attributes.

Examination of the responses to the benefits and barriers to lentil consumption indicated that, in general, caregivers perceived more benefits and fewer barriers to lentil consumption as indicated by the mean belief scores (Figure 5.5). Caregivers appeared to understand that lentils are a healthy food and that healthy food is important to their child’s health. Caregivers also concede they would like to eat healthier and acknowledge their food choices impact their child’s food choices. Over 75% of caregivers agreed they would make lentil-containing-meals more if their child liked lentils. Food choice is multifaceted and becomes even more complex when dealing with families. Caregivers are the gatekeepers to food in the household and have the power to set the social context of mealtimes (Birch & Fisher, 1998; Campbell, Crawford, & Hesketh, 2006; Hannon, Bowen, Moinpour, & McLerran, 2003). As described by Hart, Herriot, Bishop & Truby (2003), caregivers affect the food environment and can impact child acceptance patterns through both the foods they make available and role modeling. Of course this can be both positive and negative. For example, a child may grow up with very little exposure to cooking skills and not develop confidence in the kitchen if taught by a busy parent who relies on convenience foods that come out of a box, bag or can. Conversely, the parent who involves a child in cooking and grocery shopping may be able to instill skills with

label reading and food preparation (Birch & Fisher, 1998; Campbell, Crawford, & Hesketh, 2006; Hannon, Bowen, Moinpour, & McLerran, 2003; Savage, Fisher, & Birch, 2007). However, as child's own food preference can also be viewed as a barrier to healthy behaviours, caregivers have a responsibility to provide a healthy diet and have some amount of perceived control over their child's nutrition. Hart et al. (2003) discussed the importance of perceived control of caregivers and highlighted that control lessens as children age and spend more time outside the home. The DAILY questionnaire indicates that 65.8% of caregivers wished they had more influence with their child's eating habits despite 93.5% understanding their food choices influence their child's eating habits. One possible explanation of this result is the many influencers on a child's food choice, so the caregivers' role alone cannot explain all variation.

Consistently, the top influencers of food choice in the literature are taste, cost, time/convenience and health/nutrition (Ree, Riediger, & Moghadasian, 2008; Glanz, 1998; Canadian Council of Food and Nutrition, 2008). Comparing the DAILY results to these four constructs we find some similarities and some differences.

- When examining the construct of taste, 68% of people thought that lentils could be a tasty addition to a meal while 16% of caregivers agreed that their child would not like lentils and 15% indicated that lentils were not tasty enough. Initial analysis indicated that taste was not a barrier but when examining the number of "not sure" responses the barrier is less clear. Forty-six of caregivers were unsure if their child would like the taste of lentils and 35% were unsure if lentils were tasty. A possible explanation of the number of "not sure" responses is that many people have never eaten lentils or do not eat them regularly and thus cannot accurately answer the question.
- In terms of cost, less than 3% of respondents thought that lentils would be expensive to add to meals. However, 35% of caregivers thought that lentil based meals could save them money and 60% were not sure. Again, unsure responses may be due to the low numbers of people shopping for lentils and, therefore, their lack of confidence as to what the price is. In general, cost does not appear to be a major influence in lentil use.

- Time and convenience appear to have moderate influence as to the barriers and benefits to lentil consumption. Slightly less than 20% of caregivers thought that they were too busy to prepare a lentil meal, 14% thought it took too long to cook lentils while only 3% thought they would have to shop too frequently. Therefore, respondents see the time investment in preparing lentils as a barrier and frequency of shopping for lentils not as a barrier.
- Health and nutrition appear to be a benefit in that 98% of respondents agree that healthy food is important to their child's health and 91% agreed that lentils were a healthy food.

However, as demonstrated in the social psychology of food (section 2.7), often beliefs, attitudes and knowledge do not lead to the intended behaviour (Armitage & Conner, 2000; Conner & Armitage, 2002). Since, despite attitudes and beliefs, there is another layer of intention that influences the decision a person makes (Armitage & Conner, 2000). This is one explanation that sheds some insight as to why educational programs alone do not always work.

Another result of the DAILY questionnaire was the significant difference in belief scores between neighbourhoods ($p < 0.05$). However, an ANOVA test did not reveal significant differences between income levels with belief scores. Therefore, this researcher (TP) hypothesized that barriers to lentil consumption transcend demographics and this concept is explored in section 6.3. Nonetheless, further analysis was conducted to consider the effect that each construct had on neighbourhood belief scores. A MANOVA was used with the constructs as the dependent variable and neighbourhood as the independent variable. Only the five constructs that demonstrated good internal consistency (time, cost, local, taste, health/motivation) were entered into the model. Univariate analysis demonstrated a significant difference between neighbourhoods with time, cost, taste and health/motivation (not the construct of local) which may be used to explain the variance between belief scores and adds to the literature supporting the importance of these factors surrounding food choice ($p < 0.05$).

When asked to pick the most important barrier as to why they do not or rarely eat lentils, not knowing how to cook lentils was the clear top barrier identified by 163 caregivers, followed by the belief that family would not like lentils (131 caregivers) and 95 stated they believe lentils take a long time to cook. Given that lentils boil up like many other grains, the difficulty of preparing lentils is minimal. Therefore, this is a perceived barrier and not an actual barrier. This perceived barrier would be well suited to cooking programs and marketing or promotional campaigns addressing both cooking skills and taste (explored further in chapter 7). Similar studies on other plant-based diets have shown similar barriers. An Australian study that conducted focus groups on adults concluded that top barriers to including pulses into an eating pattern was difficult due to the lack of knowledge on how to prepare them to be tasty and perceived length of preparation (Lea, Worlsey, & Crawford, 2005). Yeh et al. (2008) demonstrated that perceived lack of time and extensive preparation time was a barrier to including more vegetables in the diets of adults. Similarly, using soy as the test food, barriers to consumption included food preparation, availability of soy foods and the image of soy (Schyver & Smith, 2005). These barriers cannot be underestimated as a lack of convenience of healthy foods, such as lentils, will be replaced with less healthy alternatives. Focus groups performed with 7 to 17 year olds found that the top barrier to healthful eating was convenience and whichever food was available, had very little preparation and was quick to grab and eat, was the food of choice when they got home from school (O'Dea, 2003).

Supporting the DAILY questionnaire findings is a report released on factors influencing pulse consumption put forth by the Government of Alberta in February 2010 (Ipsos-Reid, 2010). The report conducted 1,100 online interviews with adults, 230 interviews with South Asian immigrants and four focus groups with Canadian adults in Edmonton and Toronto. Similarly to the DAILY questionnaire findings, the report found that Canadians generally have a positive attitude toward pulses (i.e. recognize their nutritional benefits and see them as a tasty healthy food). However, “not thinking about including pulses in meal planning or preparation (58%) and not knowing how to cook or prepare pulses

(43%)” were the biggest limitations to consumption. Taste (21%) and family members not liking pulses (32%) were also notable barriers listed (Ipsos-Reid, 2010).

6.3 Demographics, beliefs and lentil consumption

The DAILY questionnaire specifically investigated potential differences between high income and low income neighbourhoods. The choice to compare neighbourhoods instead of income levels was deliberate as it would impact future phases of the DAILY project since, if future phases warranted, interventions are best offered universally in a specific location versus targeting a specific income level (Russell, 2004). However, in the DAILY questionnaire, demographics were not able to significantly explain many differences in responses. The exception to this was belief scores by neighbourhood which was explored in section 6.2.

In contrast, many studies have demonstrated differences in food choice using demographics. Garriguet (2007) used analytical techniques to analyze results from the 2004 Canadian Community Health Survey and found that high income households were more likely to eat more vegetables and fruits versus low income households³. Ree, Riediger, & Moghadasian (2008) illustrated differences across education levels and gender roles stating that individuals that completed higher levels of education and women tended to make healthier food choices versus those with a lower level of education and men, respectively. Evidence from this study also supported that individuals from a higher income household tended to make healthier food choices and be more health-motivated (Ree, Riediger, & Moghadasian, 2008). Similar findings to Ree et al. are supported in the literature (Glanz, 1998; Kearney, Kearney, Dunne, & Gibney, 1999).

One explanation for the lack of significance in demographics was that there were not enough differences between neighborhoods. Chi-square analysis illustrated that no significant difference in distribution existed between income levels in each neighbourhood. Therefore, despite sampling taking place in both high and low income neighbourhoods, our sample was fairly homogeneous. One explanation for this was that

³ Lowest household income: \$10,000 if 1 to 4 people; <\$15,000 if ≥ 5 people and lower middle household income: \$10,000 to \$14,999 if 1 or 2 people; \$10,000 to \$19,999 if 3 or 4 people; \$15,000 to \$29,999 if ≥ 5 people

the day of data collection it was very cold in Saskatoon. Therefore, a low income family who did not own a vehicle and relied on public transportation would be less able to arrive to parent/teacher interviews. In fact, a conversation with a family on the day of data collection informed researchers that they were waiting over one hour to get a taxi to the school. Therefore, DAILY questionnaires had a low number of low income families (17.5%). The same neighbourhood had the lowest attendance of caregivers to their three way interviews. However, refusal rates were higher in high income neighbourhoods compared to low income neighbourhoods; 85 refusals out of 233 (36%) and 47 refusals out of 168 (28%) in high and low income neighborhoods, respectively.

Finally, another explanation as to why demographics did not significantly explain many results is that barriers to lentil consumption may permeate demographics. Stated in another way, barriers to lentil consumption are the same for all income levels. Lentils are not a common staple food in Saskatoon, and regardless of income or where you live, families have similar low consumption patterns and similar barriers transcending demographics. Therefore, both low income and high income non-consumers could benefit from a nutrition intervention aimed at increasing lentil intake. A universal program, regardless of neighbourhood, would reach non-consumers and could focus on addressing other barriers as per DAILY results.

Upon first glance, ethnic diversity of the questionnaire appears to be low with 42 respondents (10.5%) self-identifying as Aboriginal. However, this ratio corresponds with 2006 information by Statistics Canada which stated there were 9% Aboriginal people living in the census metropolitan area of Saskatoon (Statistics Canada, 2006). Most respondents (73%) were Caucasian and 9% of respondents were Asian. Given the variable interpretation of Asian, and the lentil consumption patterns within this ethnic group, future questions should distinguish ethnicities between White, Black, Chinese, Japanese, Korean, Latin American, Southeast Asian (Vietnam, Cambodia, Thailand, etc.), South Asian (India, Pakistan, Sri Lanka, etc.), West Asian (Iran, Iraq, Afghanistan, etc.) and other.

Pulse Canada reported demographic differences with pulse consumption increasing in individuals with a higher level of university education, a greater household income and an increased household size (Ipsos-Reid, 2010). Pulse consumption also varied by age with younger Canadians consuming fewer pulses (Ipsos-Reid, 2010). Specifically with lentils, consumption was lowest in the 18 to 34 year age group (34%) and 35 to 54 years (38%) versus those aged 55 years or older (60%). Similar findings were found amongst peas and beans while there were no age differences with chickpea consumption.

6.4 Knowledge, beliefs and lentil consumption

As mentioned in chapter two, controversy exists as to whether nutrition knowledge has the potential to impact dietary behaviour. Complexities exist because both knowledge and behaviour have many influencers (Worlsey, 2002). Knowledge has the potential to impact intention and beliefs which, in turn, can influence behaviour (Werblow, Fox, & Henneman, 1978; Worlsey, 2002). However, results often support the value of including nutrition knowledge as a target for health education campaigns and maintain that a caregiver's nutritional knowledge relates to consumption of healthful foods (Gibson, Wardle, & Watts, 1998; Wardle, Parmenter, & Waller, 2000; Vreecken & Maes, 2010).

Item difficulty of knowledge questions is “not useful if answered correctly by more than 80% or fewer than 20% of respondents” (Parmenter & Wardle, 1999; Kaplan, 2009). Other studies investigating attitudes and nutrition knowledge reported mean knowledge scores of 71.2% and 67.7% in a population of caregivers of children with and without cerebral palsy and female athletes, respectively (Werblow, Fox & Henneman, 1978; Verrall, 2000). The DAILY questionnaire mean knowledge score was 73.2% (n = 401). Participants correctly identified lentils as a good source of protein and fibre while being low in saturated fat. Participants also responded that eating a proper diet will help to reduce their risk of certain types of diseases. Caregivers were less consistent in identifying lentils as a meat alternative and identifying a proper serving size as per *Eating Well with Canada's Food Guide*. Additionally, over a quarter of caregivers did not mark lentils as a source of iron. Future educational campaigns should focus on lentils as a source of iron and a meat alternative to improve consumers' knowledge on these

attributes. Certain populations, such as young children, tend to be picky eaters and could benefit from including lentils in their diet if meat consumption is limited.

According to Wansink, Westgren & Cheney (2005) the type of knowledge is what matters and not the amount of knowledge (Figure 6.1). Therefore, another explanation of knowledge scores is differentiating between food-specific attribute knowledge and consumption-consequence knowledge. Food attributes of lentils include low levels of fat, a source of protein, fibre and iron. Consumption consequences include statements such as “eating a diet low in saturated fat is good for your heart” or “eating low fat foods helps you to lose weight”. DAILY respondents correctly identified many attributes of lentils but the questionnaire did not ask consumption consequence knowledge questions. Therefore, a person might be able to recognize why a lentil is healthy but will be less likely to consume it if they do not understand what the personal benefit to consuming it is. Future promotion should link food attributes to personal health consequences.



Figure 6.1: Hierarchy of nutritional knowledge (Wansink, Westgren, & Cheney, 2005).

Barriers to lentil consumption may also be related to optimistic bias. Optimistic bias is a phenomenon which has caregivers appearing very confident in their nutritional habits yet their actions may not represent actual healthy standards (Hart, Herriot, Bishop, & Truby, 2003; Shepherd, 1999). Optimistic bias can lead to ambivalence about food and healthy eating since, if one thinks they are doing something right, they are less likely to take notice of health messaging. So, in spite of caregivers’ awareness of the potential benefits to eating lentils, little motivation is present to change eating habits if they feel their diet is adequate already, as demonstrated by the small effect size seen between knowledge and belief scores ($r = 0.166$, $p < 0.01$) and virtually no effect size between knowledge scores

and lentil or pulse consumption ($p > 0.05$). Other studies observe correlations between nutrition knowledge and dietary intake between the 0.1 and 0.4 range indicating that knowledge contributes to intake but also that other factors influence food choice (Wardle, Parmenter, & Waller, 2000; Werblow, Fox, & Henneman, 1978; Dickson-Spillman & Siegrist, 2010).

The DAILY study revealed that the top source of accessing healthy eating information was the internet with cookbooks, magazines and food labels also listed as common sources of information. These findings are supported by another study conducted by the Government of Alberta on factors influencing pulse consumption which listed food labels and cookbooks as the top two sources of healthy eating information in February 2010 (Ipsos-Reid, 2010). The Canadian Council of Food and Nutrition also listed product labels (68 per cent), the Internet (51 per cent), magazines, newspapers and books (46 per cent), and friends and relatives (41 per cent) as the top sources of nutrition information (Canadian Council of Food and Nutrition, 2008). Although, in yet another study, while 82 per cent of Canadians believe dietitians were the most credible source of nutrition information, the DAILY study ranked health professionals ninth out of fifteen as a source they access (Canadian Council of Food and Nutrition, 2008). Differences exist between where people get their information and which sources they view as dependable but ideally the most trustworthy source should be accessible (Wansink, Westgren, & Cheney, 2005).

6.5 Lentil and pulse consumption

Dietary assessment is a very complex area. Dietary methods are used to assess an individual's or a group's usual food intake and can be used to estimate potential dietary inadequacies (Boyle & Morris, 1999). Commonly used assessment techniques include diet histories, twenty-four-hour recalls, diet records and food frequency methods. The food frequency questionnaire (FFQ) has been used with mixed success but was the best choice in the DAILY questionnaire as it provides a good estimate of usual intake and is a commonly used tool to report the frequency of consumption and portion size of a food

over a specified period of time while decreasing subject burden (Turconi et al, 2003; Roumelioti & Leotsinidis, 2009; Papadaki & Scott, 2007).

Correlation coefficients (r), a measure of effect and not causation, and correlation analysis demonstrated a medium effect size between lentil intake and total belief scores ($r=0.399$, $p<0.01$) while a weaker effect is seen with pulse consumption and belief scores ($r=0.266$, $p<0.01$). Mean belief scores (Table 5.6) trend higher (indicating more benefits and fewer barriers) with more frequent lentil consumption ($p<0.05$). While this finding may be slightly intuitive, it draws strength to the validity of the questionnaire. A plausible explanation of this finding is that there may be *perceived* barriers to eating lentils and not *actual* barriers. Overall, results illustrate that caregivers are not regularly consuming lentils. However, when people do eat lentils they realize that many preconceived thoughts may not be reality. For example, if someone did not think that they enjoyed the taste of lentils, they may be surprised when eating a tasty lentil dish. Hence, they would be more likely to eat a lentil dish in the future.

The Pulse Canada report on the factors influencing pulse consumption also demonstrated differences between pulse consumers and non-consumers (Ipsos-Reid, 2010). For non-consumers, taste was the single most important factor when choosing to eat pulses. For light to moderate/heavy consumers of pulses, health, followed by taste, were the important factors. Similar findings have been demonstrated using soy foods and illustrates that, for non-consumers, health benefits alone are not enough to change behaviour (Schyver & Smith, 2005).

6.6 Strengths and Limitations of the DAILY Questionnaire

Measurement tools, including questionnaires, need to produce results that are accurate and reproducible (Polgar & Thomas, 1998). All tools will have some level of error but the researcher needs to decide how much error is too much. This relationship can be expressed as:

$$\textit{Observed value} = \textit{true value} \mp \textit{error}$$

(Polgar & Thomas, 1998).

Four types of errors exist in questionnaires: coverage error, sampling error, measurement error and non-response error (Salant & Dillman, 1994). *Coverage error* deals with how your survey sample differs from the population of interest. *Sampling error* occurs with all studies that use a sample versus a census. Sampling error is the only error that can be quantitatively estimated and is reduced with more uniform and larger samples.

Measurement error cannot be estimated but occurs at all points in the survey method including the questionnaire, the researcher/interviewer and the respondent. The concepts of *validity* (accuracy of responses) and *reliability* (reproducible responses) are important in terms of measurement error. *Non-response error* occurs when a large number of participants do not participate in the study. Internal and external validity will be discussed in detail and how the researcher (TP) attempted to reduce the error in study design (Salant & Dillman, 1994; Gall, Gall, & Borg, 2007; Polgar & Thomas, 1998).

6.6.1 Internal Validity

In order to decrease measurement error and increase the internal validity of the DAILY questionnaire, pre-testing using cognitive interviewing techniques were used as per section 4.3.2. Cognitive interviewing ensures that respondents are answering questions accurately. Despite the cognitive interview in the pre-test and the review by registered dietitians, two questions appeared to provide invalid results: the serving size question on the food frequency questionnaire and the health/nutrition qualifications question. While these questions would have provided some further interpretation of the data, these questions did not reflect directly upon the research questions of the DAILY questionnaire and, therefore, were not major threats to internal validity.

Additionally, internal consistency of benefit and barrier response items was analyzed using Cronbach's alpha coefficient. While a limitation of the DAILY questionnaire was that we did post-hoc analysis, we were able to provide a high alpha level of all 41 benefit and barrier questions upon completion of the questionnaire. A high alpha of 0.86 signified good overall reliability of the set of questions in the questionnaire as a group. However, when separated into the ten constructs of interest, alpha levels dropped illustrating low inter-item correlation (Table 5.3). Low internal consistency between

constructs reveals that either more items should have been added to improve validity or that the questions were not measuring the same construct (i.e. measuring several attributes).

A possible explanation for a low alpha is a poorly related question. Item analysis was conducted on constructs with alpha levels lower than 0.6 to see if alpha levels could be improved by removing certain questions.

- In regards to the influence of others, removing the question “I believe my food choices influence what my child eats” would raise alpha to 0.44 from 0.40 and removing the question “I believe that serving lentils would help me to look more trendy to my friends and family” would also raise alpha to 0.44. Conversely, the question “I don’t think my child would eat a meal containing lentils” strongly related to alpha and removing same would drop alpha levels. This indicates this question is important to both the questionnaire and the construct of influence of others.
- Another construct, neophobia, had an alpha level of 0.53 that could be increased to 0.63 by removing the question “I would eat lentils if they had a more attractive appearance”.
- The construct of food preparation had a very low alpha of 0.12 that would indicate that this section is poorly constructed. Item analysis did not explain any improvements of this alpha level and instead produced a negative result which indicates a negative average covariance among items that could not be explained when coding double checked. One explanation is that you can only ask about cooking skills in so many ways so perhaps this construct is better evaluated using another method (multiple choice or open-ended question).
- Finally, the constructs of health and motivation were combined to improve the alpha level to 0.66. These two sections were difficult to separate into different constructs as they asked similar questions. For example, the questions “I would like to eat healthier” and “I believe lentils are a healthy food” are asking about health and nutrition and motivation to eat healthier. Therefore, these sections were logical to combine and improve alpha levels. Item analysis did not indicate

an improvement in alpha levels if questions were removed with the combined constructs.

In summary, future uses of the DAILY survey should remove questions that reduce alpha levels. This would improve reliability and decrease subject burden by reducing the length of the questionnaire.

In terms of non-response error, every reasonable effort was made to increase the number of responses including monitoring questionnaire length, offering of incentives and thorough interviewer training. A poor response rate can affect survey validity and incentives have been shown to increase response rates (Salant & Dillman, 1994; Castiglioni, Pforr, & Krieger, 2008). Response rates vary depending upon which method is chosen to carry out the survey. A face-to-face, paper based survey was decided upon for the DAILY questionnaire instead of a mailed or online survey. Mailed surveys traditionally have lower response rates and online surveys require participants to have internet access (Salant & Dillman, 1994; Bucevska, 2000). Therefore, another strength to the DAILY questionnaire was the 76% response rate that is typical of face-to-face questionnaires (Gall, Gall, & Borg, 2007; Salant & Dillman, 1994).

6.6.2 External Validity

The DAILY questionnaire chose schools in neighbourhoods of differing socioeconomic status and results were used with careful interpretation. However, further investigation into neighbourhood demographics revealed the following income levels (Table 6.1). Originally, when choosing low and high income neighbourhoods the 2006 median household income levels were used. Median income levels were more appropriate as they were less influenced by high and low income levels compared to mean incomes and 2009 income levels were only estimates. Low income cut-offs (LICO) for a city with a population of 100,000 to 499,999 people in 2004 were \$32,576 and \$36,912 for a family of four and a family of five, respectively (Canadian Council on Social Development, 2010). Therefore, when asking about income levels, the DAILY questionnaire used less than \$39,999, \$40,000 to \$79,999 and over \$80,000 as possible income responses. Future use of the DAILY questionnaire should have more sensitive income brackets in

\$20,000 increments. Additionally, as per Table 6.1, high income neighbourhood D and low income neighbourhood C were not very different if looking at 2009 estimate data. Therefore, an important limitation to the questionnaire is neighbourhood selection. DAILY researcher (TP) should have clearly defined what a high income neighbourhood was and increased the differences in income levels between neighbourhoods.

Table 6.1: Household income by neighbourhood schools

	2009 Estimates \$ (mean income)	2006 Census \$ (Average household income)	2006 Census \$ (Median household income)
Low income A	53, 171	53, 810	47, 209
Low income B	44, 921	39, 084	36, 500
Low income C	59, 721	55, 357	32, 451
High income D	61, 481	60, 485	58, 929
High income E	98, 792	90, 875	90, 000
High income F	119, 875	119, 119	100, 992

Another limitation of the DAILY study was that due to young children’s dependence on their caregivers for food, the DAILY questionnaire was administered to adults.

Therefore, if designing nutrition interventions for young children, further research should be conducted on young children themselves.

One strength of the DAILY questionnaire was that the number of returned questionnaires (n = 401) exceeded the sample size estimate of 333 to provide a 95% confidence level (plus or minus 5% error). Therefore, our sampling error was minimized with the number of returned questionnaires. Similar sample sizes were used by Lea et al. (2006) during a mailed survey researching consumers’ readiness to eat a plant-based diet. However, although the sample size was large and exceeded sample size estimates, participant selection was not random. Random selection is ideal as each individual in the population has an equal probability of being selected, which provides a sample that is representative of the population and allows for generalization (Polgar & Thomas, 1995; Salant & Dillman, 1994). Although the desire may be to apply the results from the current study to caregivers across Saskatoon or even the province – such a generalization is problematic as the convenience sample used in this study means that any inference about the sample

may not be present in the population. Researcher (TP) did not investigate differences between caregivers who attended three-way conferences and those who did not. Therefore, subject bias is present and the results are most applicable to the sample that consisted of caregivers of young children who attended three-way conferences.

CHAPTER 7: CONCLUSIONS & RECOMMENDATIONS

The purpose of this study was to describe the benefits and barriers to lentil consumption in families with young children. Evidence from the nutrition literature on both the food-attributes and consumption-consequences of lentils provided the rationale for this study along with agricultural statistics dictating the abundance of this crop in Saskatchewan. This study was important because, to date, no research has been conducted on the benefits and barriers to lentil consumption alone. Lentils are an adaptable food crop that cooks very quickly, lending their versatility to future cooking and nutrition interventions.

Many food decision influencers exist as demonstrated by Byrd-Bredbenner, Abbot and Cussler (2008) and market segmentation should not always use gender or socio-demographic status to discriminate between groups. Additionally, strategies need to be multi-faceted and, depending on resources, should target all caregivers including child-care facilities, schools and families. Interventions geared toward young children are particularly important as is repeated experiences with a food (Savage, Fisher, & Birch, 2007; Patrick & Nicklas, 2005; Scaglioni, Salvioni, & Galimberti, 2008; Birch & Fisher, 1998). A review conducted by Patrick and Nicklas (2005) concluded that, in the case of fruit and vegetables, a campaign aimed at caregivers explaining how food preferences are formed and offering practical food examples are important to make the food available and accessible. Following this example would be prudent in the context of lentil and pulse containing foods.

7.1 Lentil Messaging and Communications

Future health promotion strategies, including lentil marketing campaigns, should be targeted at a specific segment of the target population in both children and their caregivers. Children are an important target, but due to the complexities of their physical and social environments, interventions or future promotions should target many layers including promotions geared towards caregivers (Patrick & Nicklas, 2005). Broad efforts to change food habits should also be more focused on the gatekeepers to the food – the cook, the grocery shopper, the meal planner – and not just all caregivers (Wansink,

2007). Caregivers are the gatekeepers to the food choices in their household and affect both the social context of eating and are role models for their children (Birch & Fisher, 1998) (Campbell, Crawford, & Hesketh, 2006). However, food marketing aimed at children does also affect the food made available to the child due to “pester power” or increased frequency of requests for a certain item (Campbell, Crawford, & Hesketh, 2006).

Another recommendation is not to focus on socioeconomic differences but, rather, alternate methods of market segmentation. DAILY questionnaire results illustrate differences in attitudes between pulse consumers and non-consumers. The Pulse Canada report suggested that taste was a key motivator for non-consumers and health and taste were motivators for consumers (Ipsos-Reid, 2010). Additionally, the report states there were five market segments based on attitudes towards pulse consumption. On either end of the spectrum are the “informed champions” who are highly motivated pulse consumers and the “disinterested unreachables” who, despite all efforts, are likely to not become pulse consumers (Ipsos-Reid, 2010). Messaging should not be geared at those two segments but should instead be focused on the in-between segments to increase pulse consumption. Similar reports were found by Lea et al. (2006) when investigating consumers’ readiness to eat a plant-based diet. The study concluded that, using the stages of change, many people in the pre-contemplation stage would have the largest number of barriers to overcome (Lea, Crawford, & Worsley, 2006).

Using the caregiver specific results of the DAILY project, the messages to be communicated to these groups include:

- The promotion of tasty, delicious lentil recipes to non-consumers. Messaging also needs to clearly state the convenience, ease of preparation and cooking skills required to prepare lentil dishes. Additionally, as found by Campbell, Crawford & Hesketh (2006), caregivers often support the view that “involving children in the preparation, cooking or growing of food had a positive impact on food choices”. Providing samples in supermarkets or other places where families are may be a good way to expose non-consumers to tasty lentil meals. Providing

samples of in-store convenience foods using lentils would also highlight the ease of preparation of these foods.

- Light to heavy lentil consumers need to have access to healthy tasty recipes but caregivers need to be convinced their children will eat the food so recipe books aimed at children or child-friendly school nutrition projects could be initiated. This group also needs to understand both the food-attribute (i.e. low in fat, high in fibre, source of protein) and consumption consequences (i.e. heart health, weight loss/maintenance) of eating lentils.

Both the Ipsos-Reid report and this DAILY questionnaire report that the internet be utilized to relay lentil communication messages. Both sets of results also exemplify the importance of cookbooks and recipes when accessing both pulse and nutrition information. The internet would also be a useful medium when targeting both children and caregivers with age-appropriate information geared at each target.

7.2 Implications for Dietetic Practice

Pulse products, including lentils, have the potential to improve diet quality and be used in the treatment of numerous chronic diseases (i.e. obesity, diabetes, dyslipidemia).

Dietitians are seen as a reliable source of nutrition information; however, they are often not the most accessed resource for healthy eating information (Marquis, Dubeau, & Thibault, 2005) (Ipsos-Reid, 2010). Nutrition professionals (i.e. registered dietitians) have a unique opportunity to be able to use food choice influencers and tailor educational and informational strategies to better match benefits and barriers to lentil consumption. Dietitians, therefore, require current resources on both a) the current scientific literature on the health benefits of pulses and b) resources, recipes and pamphlets to give to clients to assist in promoting these healthy foods. Dietitian counselors who use pulses are more likely to recommend them to their clients (Desrochers & Brauer, 2001). Therefore, a campaign targeted at nutrition professionals or cooking workshops for health professionals would increase the practitioners' confidence in these foods and make them more comfortable with future recommendations into meal plans. As found by Lacey

(2004), improved familiarity of pulses through the use of handouts and taste tests may help alter dietary habits.

In conclusion, the important results of the DAILY questionnaire include: 1) barriers transcend demographics and, therefore, apply to all families regardless of socioeconomic status; 2) caregivers perceive accurate benefits to eating pulses but communication around both food-attribute and consumption-consequences need to be communicated to families with young children; 3) very few people eat lentils on a regular basis; 4) consumers who eat lentils perceive fewer barriers and more benefits; and 5) top barriers to lentil consumption surround cooking skills and negatively perceived family acceptance. The DAILY project would benefit from future research projects, specifically, communications and interventions aimed at addressing the top barriers to lentil intake in both caregivers and children and through communicating pulse research to nutrition health professionals.

REFERENCES

- Ajzen, I., & Fishbein, M. (1980). *Understanding Attitudes and Predicting Social Behavior*. Englewood Cliffs: Prentice Hall.
- Alberta Agriculture & Food. (2007). *The pulse industry in western Canada*. Retrieved April 1, 2011, from [www1.agric.gov.ab.ca/\\$department/deptdocs.nsf/all/econ11950/\\$file/pulseindustryreport.pdf?OpenElement](http://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/econ11950/$file/pulseindustryreport.pdf?OpenElement)
- Anderson, J. & Major, A. (2001). Pulses and lipaemia, short- and long-term effect: Potential in the prevention of cardiovascular disease. *British Journal of Nutrition* , S263–S271.
- Anderson, J., Randles, K., Kendall, C., & Jenkins, D. (2004). Carbohydrate and Fiber Recommendations for Individuals with Diabetes: A Quantitative Assessment and Meta-Analysis of the Evidence. *Journal of the American College of Nutrition*, 5-17.
- Answers Research. (2009). *Response Rate Calculator*. Retrieved April 15, 2011, from <http://www.answersresearch.com/response.php>
- Armitage, C., & Conner, M. (2000). Social Cognition Models and Health Behaviour: A Structured Review. *Psychology and Health*, 173-189.
- Aron, A., Aron, E., & Coups, E. (2006). *Statistics for Psychology*. New Jersey: Pearson Education Inc.
- Arthritis Society of Canada. (2010). Retrieved March 4, 2010, from <http://www.arthritis.ca>
- Aune, D., Stefani, E., Ronco, A., Boffetta, P., Deneo-Pellegrini, H., Acosta, G., & Mendilaharsu, M. (2009). Legume intake and the risk of cancer: a multisite case-control study in Uruguay. *Cancer Causes Control*, 1605-1615.
- Balch, G., Loughrey, K., Weinberg, L., Lurie, D., & Eisner, E. (1997). Probing consumer benefits and barriers for the National 5 a Day campaign: focus group findings. *Journal of Nutrition Education*, 178-183.
- Bennett, C., Chilibeck, P., Barss, T., Oroz, I., Vandenberg, A., & Zello, G. (2009). The Effect Of High And Low Glycemic Index Meals On Soccer Tournament Performance. *Medicine & Science in Sports & Exercise*, 100.
- Bazzano, L., Jiang, H., Ogden, L., Loria, C., & Vupputuri, S. (2001). Legume consumption and risk of coronary heart disease in US men and women. *Archives of Internal Medicine*, 2573-2578.

- Bazzano, L., Thompson, A., Tees, M., & Nguyen, C. (2011). Non-soy legume consumption lowers cholesterol levels: a meta-analysis of randomized controlled trials. *Nutrition, Metabolism and Cardiovascular Diseases*, 94-103.
- Birch, L. & Fisher, J. (1998). Development of Eating Behaviors Among Children and Adolescents. *Pediatrics*, 539-549.
- Boyle, M. & Morris, D. (1999). *Community Nutrition in Action: An Entrepreneurial Approach*. Belmont: Wadsworth Publishing Company.
- Bucevska, V. (2000). Designing a web versus a paper questionnaire-some general and special issues. *Public Opinion Quarterly*, 1-8.
- Byrd-Bredbenner, C., Abbot, J., & Cussler, E. (2008). Mothers of young children cluster into 4 groups based on psychographic food decision influencers. *Nutrition Research*, 506-516.
- Campbell, K., Crawford, D., & Hesketh, K. (2006). Australian parents' views on their 5-6 year old children's food choices. *Health Promotion International*, 11-18.
- Canadian Cancer Society. (2009). Retrieved August 27, 2009, from www.cancer.ca
- Canadian Cancer Society. (2010). *General cancer statistics for 2010*. Retrieved April 20, 2011, from Canadian Cancer Society: http://www.cancer.ca/Canada-wide/About%20cancer/Cancer%20statistics/Stats%20at%20a%20glance/General%20cancer%20stats.aspx?sc_lang=en
- Canadian Council of Food and Nutrition. (2008). *Tracking Nutrition Trends VII*. Mississauga: Canadian Council of Food and Nutrition.
- Canadian Council on Social Development. (2010). *Canadian Council on Social Development*. Retrieved February 2011, from Canadian Council on Social Development <http://www.ccsd.ca/>
- Canadian Diabetes Association Clinical Practice Guidelines Expert Committee. (2008). Canadian Diabetes Association 2008 clinical practice guidelines for the prevention and management of diabetes in Canada. *Can J Diabetes*, pp. 32 (S1): S1-S201.
- Canadian Diabetes Association. (2009). *Diabetes Fact sheet*. Retrieved April 25, 2011, from <http://www.diabetes.ca/diabetes-and-you/what/facts/>
- Canadian Institute for Health Information. (2006). Retrieved February 26, 2010, from http://secure.cihi.ca/cihiweb/dispPage.jsp?cw_page=home_e
- Canadian Institute of Health Research; Natural Sciences and Engineering Research Council of Canada; Social Sciences; Humanities Research Council of Canada. (n.d.).

Panel on Research Ethics. Retrieved October 2, 2009, from Government of Canada: www.pre.ethics.gc.ca

Canadian Obesity Network. (n.d.). *Canadian Obesity Network*. Retrieved February 26, 2010, from www.obesitynetwork.ca

Canadian Public Health Association, Health and Welfare Canada, and the World. (1986). *World Health Organization*. Retrieved November 5, 2009, from http://www.who.int/hpr/NPH/docs/ottawa_charter_hp.pdf

Castiglioni, L., Pforr, K., & Krieger, U. (2008). The effect of incentives on response rates and panel attrition: results of a controlled experiment. *Survey Research Methods*, 151-158.

Churchill, G. (1996). Basic Marketing Research. *Basic Marketing Research* (259-277). Orlando: The Dryden Press.

City of Saskatoon. (2006). *City of Saskatoon*. Retrieved 2009, from 9th Edition Neighbourhood Profiles: www.saskatoon.ca

Collins, D. (2003). Pretesting survey instruments: An overview of cognitive methods. *Quality of Life Research*, 229-238.

Conner, M. & Armitage, C. (2002). *The Social Psychology of Food*. Philadelphia: Open University Press.

Cox, D., Reynolds, J., Mela, D., Anderson, A., McKellar, S., & Lean, M. (1996). Vegetables and fruits: barriers and opportunities for greater consumption. *Nutrition and Food Science*, 44-47.

Cox, D., Anderson, A., Lean, M., & Mela, D. (1998). UK consumer attitudes, beliefs and barriers to increasing fruit and vegetable consumption. *Public Health Nutrition*, 61-68.

Desrochers, N. & Brauer, P. (2001). Legume promotion in counseling: an email survey of dietitian. *Can J Diet Pract Res*, Winter; 62(4): 193-8.

Dickson-Spillman, M. & Siegrist, M. (2010). Consumers' knowledge of healthy diets and its correlation with dietary behaviour. *Journal of Human Nutrition and Dietetics*, 54-60.

Dooper, Y. (2009). Pulse Destination: From Field to Plate. *Pulse Point Magazine*.

Drewnowski, A. (2010). The Nutrient Rich Foods Index helps to identify healthy, affordable foods. *The American Journal of Clinical Nutrition*, 1095S-1101S.

Duffield-Lillico, A., Dalkin, B., Reid, M., Turnbull, B., Slate, E., Jacobs, E., Marshall, J., & Clark, L. (2003). Selenium supplementation, baseline plasma selenium status and

incidence of prostate cancer: an analysis of the complete treatment period of the Nutritional Prevention of Cancer Trial. *BJU International*, 91(7), 608-612.

Fink, A. (2003). *The Survey Handbook, 2nd Edition*. Thousand Oaks: Sage Publications Inc.

Foster-Powell, K. & Brand-Miller, J. (2002). International table of glycemic index and glycemic load values. *American Journal of Clinical Nutrition*, 5-56.

Fred Hutchison Cancer Research Centre. (2011). *Fred Hutchison Cancer Research Centre*. Retrieved March 2010, from Fred Hutchison Cancer Research Centre: http://www.fhrc.org/science/shared_resources/nutrition/ffq/sampleffq.html

Gall, M., Gall, J., & Borg, W. (2007). *Educational Research, 8th edition*. Boston: Pearson Education Inc.

Garriguet, D. (2007). Canadians' Eating Habits. *Statistics Canada, Catalogue 82-003, Health Reports, Vol. 18, No. 2*.

Garriguet, D. (2009). Diet Quality In Canada. *Statistics Canada, Catalogue no. 82-003-XPE, Health Reports, Vol. 20, No. 3*.

Gellar, L., Rovner, A., & Nansel, T. (2009). Whole grain and legume acceptability among youths with type 1 diabetes. *The Diabetes Educator*, 422-427.

Gibson, E., Wardle, J., & Watts, J. (1998). Fruit and vegetable consumption, nutrition knowledge and beliefs in mothers and children. *Appetite*, 205-228.

Gibson, R. (2006). *Principles of Nutrition Assessment*. Dunedin: Oxford University Press.

Glanz, K., Basil, M., Maibach, E., Goldberg, J., & Snyder, D. (1998). Why Americans eat what they do: Taste, nutrition, cost, convenience, and weight control concerns as influences on food consumption. *Journal of the American Dietetic Association*, 1118-1126.

Government of Saskatchewan. (2007). *Saskatchewan Health*. Retrieved November 5, 2009, from <http://www.health.gov.sk.ca/ministry-overview>

Hamilton, N. & Bhatti, T. (2006). *Public Health Agency of Canada*. Retrieved August 20, 2009, from www.phac-aspc.gc.ca/ph-sp/php-psp/index-eng.php

Hannon, P., Bowen, D., Moinpour, C., & McLerran, D. (2003). Correlations in perceived food use between the family food preparer and their spouses and children. *Appetite*, 77-83.

Hartman, T., Albert, P., Zhang, Z., Bagshaw, D., Kris-Etherton, P., Ulbrecht, J., Miller, C., Bohe, G., & Colburn, N. (2010). Consumption of a legume-enriched, low-glycemic index diet is associated with biomarkers of insulin resistance and inflammation among men at risk for colorectal cancer. *Journal of Nutrition*, 60-67.

Hart, K., Herriot, A., Bishop, J., & Truby, H. (2003). Promoting healthy diet and exercise patterns amongst primary school children: a qualitative investigation of parental perspectives. *J Hum Nutr Dietet*, 89-96.

Health Canada. (2001). *A Review of Weight Guidelines*. Retrieved March 15, 2010, from Health Canada: http://www.hc-sc.gc.ca/fn-an/nutrition/weights-poids/guide-ld-adult/review_weight_guide-examen_guide_relatives_poids-entire-eng.php

Health Canada. (2004). Canadian Community Health Survey Cycle 2.2. *Nutrient Intakes from Food Provincial, Regional and National Summary Data Tables , 1* .

Health Canada. (2007). *Eating Well with Canada's Food Guide: A Resource for Educators and Communicators*. Ottawa.

Health Canada. (2007, December 20). *Food and Nutrition*. Retrieved August 27, 2009, from www.hc-sc.gc.ca/fn-an/food-guide-aliment/index-eng.php

Health Canada. (2005). *Health Canada*. Retrieved 2009, from Health Canada: www.hc-sc.gc.ca/fn-an/surveill/conceptual_model-eng.php

Health Canada. (2008). *Nutrient Value of Some Common Foods*. Health Canada.

Health Canada: Office of Nutrition Policy and Promotion/Health Products and Food Branch. (2006). *Canadian Community Health Survey, Cycle 2.2, Nutrition (2004)—A Guide to Accessing and Interpreting the Data*. Health Canada Publications.

Heart and Stroke Foundation. (2010). *Healthy Eating*. Retrieved April 27, 2011, from Heart and Stroke Foundation: http://www.heartandstroke.sk.ca/site/c.inKMILNIEmG/b.4119683/k.47B/Healthy_Living__The_DASH_Diet_to_lower_blood_pressure.htm

Heart and Stroke Foundation. (2011). *Heart and Stroke Foundation*. Retrieved April 20, 2011, from Statistics: <http://www.heartandstroke.com/site/c.ikIQLcMWJtE/b.3483991/k.34A8/Statistics.htm>

Hermisdorff, H., Zulet, M., Abete, I., & Martinez, J. (2010). *European Journal of Nutrition*, 50, 61-69.

House, J., Su, J., & Levy-Milne, R. (2006). Definitions of Healthy Eating Among University Students. *Canadian Journal of Dietetic Practice and Research*, 67.

Hu, F. (2003). Plant-based foods and prevention of cardiovascular disease: an overview. *American Journal of Clinical Nutrition* , 544S–551S.

Institute of Medicine. (2006). *Dietary Reference Intakes*. Washington: The National Academies Press.

Ipsos-Reid. (2010). *Factors influencing pulse consumption in Canada*. Government of Alberta and Pulse Canada.

Jacobs, D., Meyer, K., Kushi, L., & Folsom, A. (1998). Whole-grain intake may reduce the risk of ischemic heart disease death in postmenopausal women: the Iowa Women's Health Study. *American Journal of Clinical Nutrition*, 248–257.

Jang, Y., Lee, J., Kim, O., Park, H., & Lee, S. (2001). Consumption of Whole Grain and Legume Powder Reduces Insulin Demand, Lipid Peroxidation, and Plasma Homocysteine Concentrations in Patients With Coronary Artery Disease: Randomized Controlled Clinical Trial. *Arteriosclerosis, Thrombosis, and Vascular Biology*, 2065–2071.

Jenkins, D., Wolever, T., Talor, R., Barker, M., Fielden, H., Baldwin, J., Bowling, A., Newman, H., Jenkins, A., & Goff, D. (1981). Glycemic index of foods: a physiological basis for carbohydrate exchange. *American Journal of Clinical Nutrition*, 362-366.

Jenkins, R. (2006). *Tracking Nutrition Trends 6*. Retrieved August 20, 2009, from Canadian Council of Food and Nutrition.

Johnson-Down, L., Ritter, H., Starkey, L., & Gray-Donald, K. (2006). Primary food sources of nutrients in the diet of Canadian adults. *Canadian Journal of Dietetic Practice and Research*, 67(1): 7-13.

Kalergis, M., De Grandpre, E., & Andersons, C. (2005). A role of the glycemic index in the prevention and management of diabetes: A review and discussion. *Canadian Journal of Diabetes*, 27-38.

Kaplan, R. (2009). *Psychological Testing: Principles, Applications, and Issues* . Belmont: Wadsworth Centage Learning.

Kearney, J. & McElhone, S. (1999). Perceived barriers in trying to eat healthier - results of a pan-EU consumer attitudinal survey. *British Journal of Nutrition*, S133-S137.

Kearney, M., Kearney, J., Dunne, A., & Gibney, M. (1999). Sociodemographic determinants of perceived influences on food choice in a nationally representative sample of Irish adults. *Public Health Nutrition*, 219-226.

Kristal, A. & Shattuck, A. (1992). Food frequency questionnaires for diet intervention research. *National Nutrient Databank Conference*, 110-125.

Lacey, J. (2004). Improving familiarity with legumes in an introductory tertiary nutrition course in Pennsylvania, USA. *Nutrition & Dietetics*, 159-161.

Lappalainen, R. (1997). Difficulties in trying to eat healthier: descriptive analysis of perceived barriers for eating healthy. *European Journal of Clinical Nutrition*, 51 (Suppl 2), S36-S40.

Lau, D., Douketis, J., Morrison, K., Hramiak, I., Sharma, A., & Ur, E. (2007). 2006 Canadian clinical practice guidelines on the management and prevention of obesity in adults and children. *Canadian Medical Association Journal*, 176 (Suppl 8), 1-117.

Lea, E., Crawford, D., & Worsley, A. (2006). Consumers' readiness to eat a plant-based diet. *European Journal of Clinical Nutrition*, 342-351.

Lea, E., Crawford, D., & Worsley, A. (2006). Public views of the benefits and barriers to the consumption of a plant-based diet. *European Journal of Clinical Nutrition*, 828-837.

Lea, E., Worsley, A., & Crawford, D. (2005). Australian adult consumers' beliefs about plant foods: a qualitative study. *Health Education and Behaviour*, 795-808.

Leterme, P. (2002). Recommendations by health organizations for pulse consumption. *British Journal of Nutrition*, S239-S242.

Litwin, M. (2003). *The Survey Kit: How to Assess and Interpret Survey Psychometrics, 2nd edition*. Thousand Oaks, CA : Sage Publications Inc.

MaCorr Research. (2003-2011). *MaCorr Research*. Retrieved 2010, from MaCorr Research: www.macorr.com/ss_calculator.htm

Marquis, M., Dubeau, C., & Thibault, I. (2005). Canadians' Level of Confidence in Their Sources of Nutrition Information. *Canadian Journal of Dietetic Practice*, 170-175.

Mathers, J. (2002). Pulses and carcinogenesis: potential for the prevention of colon, breast and other cancers. *British Journal of Nutrition*, 88 (Suppl), S273-S279.

McCrary, M., Hamaker, B., Lovejoy, J., & Eichelsdoerfer, P. (2010). Pulse consumption, satiety and weight management: a review. *Advances in Nutrition* (1), 17-30.

Mcpherson, R., Frohlich, J., Fodor, G., & Genest, J. (2009). 2009 Canadian Cardiovascular Society/Canadian guidelines for the diagnosis and treatment of dyslipidemia and prevention of cardiovascular disease in the adult - 2009 recommendations. *Canadian Journal of Cardiology*, 567-579.

Meldrum, L., & Willows, N. (2006). Food Insecurity in University Students Receiving Financial Aid. *Canadian Journal of Dietetic Practice and Research*, 67.

- Messina, M. (1999). Legumes and soybeans: overview of their nutritional profiles and health effects. *American Journal of Clinical Nutrition*, 439S-450S.
- Mirmiran, P., Esmailzadeh, A., & Azizi, F. (2006). Under-reporting of energy intake affects estimates of nutrient intakes. *15*(4).
- Mitchell, D., Lawrence, F., Hartman, T., & Curran, J. (2009). Consumption of dry beans, peas, and lentils could improve diet quality in the US population. *Journal of the American Dietetic Association*, 909-913.
- Nishida, C., Ko, G., & Kumanyika, S. (2010). Body fat distribution and noncommunicable diseases in populations: overview of the 2008 WHO Expert Consultation on Waist Circumference and Waist Hip Ratio. *64*.
- O'Dea, J. (2003). Why do kids eat healthful food? Perceived benefits of and barriers to healthful eating and physical activity among children and adolescents. *Journal of the American Dietetic Association*, 497-501.
- Papadaki, A. & Scott, J. (2007). Relative validity and utility of a short food frequency questionnaire assessing the intake of legumes in Scottish women. *J Hum Nutr Diet*, 467-475.
- Paquette, M. (2005). Perceptions of Healthy Eating. *Canadian Journal of Public Health*, (Suppl.3): S15.
- Parmenter, K. & Wardle, J. (1999). Development of a general nutrition knowledge questionnaire for adults. *European Journal of Clinical Nutrition*, 298-308.
- Patrick, H. & Nicklas, T. (2005). A review of family and social determinants of children's eating patterns and diet quality. *Journal of the American College of Nutrition*, 83-92.
- Polgar, S. & Thomas, S. (1998). *Introduction to Research in the Health Sciences, 3rd Edition*. Melbourne: Churchill Livingstone.
- Presser, S., Couper, M., Lessler, J., Martin, E., Martin, J., Rothgeb, J., & Singer, E. (2004). Methods for Testing and Evaluating Survey Questions. *Public Opinion Quarterly*, 109-130.
- Public Health Agency of Canada. (2003). Retrieved March 4, 2010, from <http://www.phac-aspc.gc.ca/index-eng.php>
- Public Health Agency of Canada. (2009). *Cardiovascular Disease* . Retrieved April 25, 2011, from <http://www.phac-aspc.gc.ca/cd-mc/cvd-mcv/index-eng.php>

Public Health Agency of Canada. (2001). *Public Health Agency of Canada*. Retrieved 2009, from Public Health Agency of Canada: <http://www.phac-aspc.gc.ca/ph-sp/php-ppsp/index-eng.php>

Pulse Canada. (2007). *Pulse Canada*. Retrieved August 26, 2009, from Pulse Canada: <http://www.pulsecanada.com/uploads/wv/nr/wvnr5qGWIi8Rqbl22UyY8g/Canadas-Pulse-Industry-in-the-Global-Market-Sep-07.pdf>

Pulse Canada. (2011). *Statistics*. Retrieved April 2011, 20, from Pulse Canada: www.pulsecanada.com

Raine, K. (2005). Determinants of Healthy Eating in Canada. *Can J Pub Health*, (Suppl.3): S8-S14.

Ree, M., Riediger, N., & Moghadasian, M. (2008). Factors affecting food selection in Canadian population. *European Journal of Clinical Nutrition*, 1255-1262.

Roumelioti, M. & Leotsinidis, M. (2009). Relative validity of a semiquantitative food frequency questionnaire designed for schoolchildren in Western Greece. *Nutrition Journal* .

Russell, J. (2004). *Best practices for child nutrition programs: A review of the literature*. Breakfast For Learning, Canadian Living Foundation.

Sacks, F., Svetkey, L., Vollmer, M., Appel, L., Bray, G., Harsha, D., Obarzanek, E., Conlin, P., Miller, E., & Simons-Morton, D. (2001). Effects on blood pressure of reduced dietary sodium and the dietary approaches to stop hypertension (DASH) diet. *The New England Journal of Medicine*, 3-10.

Salant, P. & Dillman, D. (1994). *How to Conduct Your Own Survey*. New York: John Wiley & Sons, Inc.

Saskatchewan Pulse Growers. (n.d.). Retrieved March 1, 2011, from Saskatchewan Pulse Growers: <http://www.saskpulse.com/producer/industry/index.php>

Saskatchewan Pulse Growers. (2009). Retrieved August 26, 2009, from www.saskpulse.com/industry/index.php?page=10

Saskatchewan Pulse Growers. (2010). *Saskatchewan Pulse Growers*. Retrieved July 15, 2011, from Saskatchewan Pulse Growers: <http://www.saskpulse.com/producer/industry/index.php?page=10>

Savage, J., Fisher, J., & Birch, L. (2007). Parental influence on behaviour: conception to adolescence. *Journal of Law, Medicine & Ethics*, 22-34.

Scaglioni, S., Salvioni, M., & Galimberti, C. (2008). Influence of parental attitudes in the development of children eating behaviour. *British Journal of Nutrition*, S22-S25.

Schyver, T. & Smith, C. (2005). Reported attitudes and beliefs towards soy food consumption of soy consumers versus nonconsumers in natural foods or mainstream grocery stores. *Journal of Nutrition Education Behaviour*, 292-299.

Shepherd, R. (1999). Social determinants of food choice. *Proceedings of the Nutrition Society*, 807-812.

Shepherd, R., Sparks, P., & Guthrie, C. (1995). The application of the theory of planned behaviour to consumer food choice. *European Advances in Consumer Research*, Volume 2, 360-365.

Sievenpiper, J., Kendall, C., Esfahani, A., Wong, J., Carleton, A., Jiang, H., Bazinet, R., Vidgen, E., & Jenkins, D. (2009). Effect of non-oil-seed pulses on glycaemic control: a systematic review and meta-analysis of randomised controlled experimental trials in people with and without diabetes. *Diabetologia*, 1479-1495.

SPSS, Inc. (2010). Predictive Analytics SoftWare. Chicago.

Statistics Canada. (2006). *2006 Aboriginal Population Profile for Saskatoon*. Retrieved April 20, 2011, from <http://www.statcan.gc.ca/pub/89-638-x/2010003/article/11080-eng.htm>

Statistics Canada. (2011). Retrieved April 20, 2011, from Statistics Canada: <http://www5.statcan.gc.ca/cansim/a05;jsessionid=719CF538BEF5C86B47DE603A468B9A05?id=20019&stByVal=3&lang=eng>

Statistics Canada. (2009). *Canadian Community Health Survey 2.2 Nutrition*. Retrieved March 18, 2009, from Statistics Canada: www.statcan.gc.ca/cgi-bin/imdb/p2SV.pl?Function=getSurvey&SDDS=3226&lang=en&db=imdb&adm=8&dis=2

Statistics Canada. (2009). *Canadian Community Health Survey*. Retrieved October 21, 2009, from Statistics Canada: www.statcan.gc.ca/cgi-bin/imdb/p2SV.pl?Function=getSurvey&SDDS=3226&lang=en&db=imdb&adm=8&dis=2

Statistics Canada. (2007). *Statistics Canada*. Retrieved 06 2011, from Statistics Canada: <http://www12.statcan.ca/census-recensement/2006/ref/dict/tables/table-tableau-18-eng.cfm>

Taylor, J., Evers, S., & McKenna, M. (2005). Determinants of healthy eating in children and youth. *Canadian Journal of Public Health*, S20-S26.

- The Center for AIDS Prevention Studies. (1995). *The Center for AIDS Prevention Studies*. Retrieved October 18, 2010, from The Center for AIDS Prevention Studies: www.caps.ucsf.edu/projects/VCT/pdf/VCTinterviewertrainingmanual.pdf
- Thomas, D., Elliott, E., & Baur, L. (2007). Low glycaemic index or low glycaemic load diets for overweight or obesity (Review). *The Cochrane Collaboration*, 1-40.
- Tjepkema, M. (2005). *Adult obesity in Canada: Measured height and weight*. Ottawa: Statistics Canada.
- Tjepkema, M. (2008). *Statistics Canada*. Retrieved July 24, 2009, from Statistics Canada: <http://www.statcan.gc.ca/pub/82-620-m/2005001/article/adults-adultes/8060-eng.htm>
- Turconi, G., Bazzano, R., Rogg, C., & Cena, H. (2003). Reliability of a dietary questionnaire on food habits, eating behaviour and nutritional knowledge of adolescents. *European Journal of Clinical Nutrition*, 753-763.
- Turner, J., Kelly, J., & McKenna, K. (2006). Food for thought: parents' perspectives of child influence. *British Food Journal*, 181-191.
- United States Department of Agriculture. (2008). *Center for Nutrition and Policy Promotion*. Retrieved April 12, 2011, from http://www.mypyramid.gov/pyramid/vegetables_amount_table.html
- University of Saskatchewan. (2007). *Policies and Procedures for Ethics in Human Research*.
- USDA National Nutrient Database for Standard Reference. (2008). Retrieved August 26, 2009, from www.nal.usda.gov/fnic/foodcomp/search
- Vareecken, C. & Maes, L. (2010). Young children's dietary habits and associations with the mothers' nutritional knowledge and attitudes. *Appetite*, 44-51.
- Veenstra, J., Duncan, A., Cryne, C., Deschambault, B., Boye, J., Benali, M., Marcotte, M., Tosh, S., Farnsworth, E., & Wright, A. (2010). Effect of pulse consumption on perceived flatulence and gastrointestinal function in healthy males. *Food Research International*, 552-559.
- Venn, B., Green, T., Skeaff, M., Aitken, W., Moore, N., Mann, J., Wallace, A., Monro, J., Bradshaw, A., Brown, R., Skidmore, P., Doel, K., O'Brien, K., Frampton, C., & Williams, S. (2010). The effect of increasing consumption of pulses and wholegrains in obese people: a randomized control trial. *Journal of the American College of Nutrition*, 29 (4), 365-372.
- Venn, B. & Mann, J. (2004). Cereal grains, legumes and diabetes. *European Journal of Clinical Nutrition* 1443-1461.

Verrall T., Berenbaum, S., Chad, K., Nanson, J., & Zello G. (2000). Children with cerebral palsy: caregivers' nutrition knowledge, attitudes and beliefs. *Canadian Journal of Dietetic Practice*, Fall; 61(3): 128-134.

Wang, C. & Burris, M. (1997). Photovoice: Concept, Methodology, and Use for Participatory Needs Assessment. *Health Education and Behaviour*, 24.

Wansink, B. (2007). *Marketing Nutrition: soy, functional foods, biotechnology, and obesity*. Chicago: University of Illinois Press.

Wansink, B., Westgren, R., & Cheney, M. (2005). Hierarchy of nutritional knowledge that relates to the consumption of a functional food. *Nutrition*, 264-268.

Wardle, J. & Steptoe, A. (2003). Socioeconomic differences in attitudes and beliefs about healthy lifestyles. *Journal of Epidemiology and Community Health*, 440-443.

Wardle, J., Parmenter, K., & Waller, J. (2000). Nutrition knowledge and food intake. *Appetite*, 269-275.

Watts, P. (2006). *Pulse Point Magazine*. Retrieved October 2010, from Saskatchewan Pulse Growers: <http://www.saskpulse.com/media/pdfs/pp-2006jan-pcanada-reports.pdf>

Werblow, J., Fox, H., & Henneman, A. (1978). Nutritional Attitudes, and food patterns of women athletes. *Journal of the American Dietetic Association*, 242-246.

Whitney, E. & Rolfes, S. (2008). *Understanding Nutrition*. Belmont: Thomas Learning Inc.

World Bank. (2002). *Task Force for Child Survival and Development & Early Childhood Development Team*. Retrieved October 18, 2010, from <http://siteresources.worldbank.org/INTECD/Resources/CNAToolkitTrainingManual.pdf>

World Cancer Research Fund / American Institute for Cancer Research. (2007). *Food, Nutrition, Physical Activity, and the Prevention of Cancer: a Global Perspective*. Washington: AICR.

World Cancer Research Fund International. (2008). *Cancer Facts and Figures*. Retrieved May 20, 2011, from http://www.wcrf.org/cancer_facts/millions_new_cancer_worldwide.php

World Health Organization. (2006). *Body Mass Index Classification*. Retrieved March 18, 2010, from http://apps.who.int/bmi/index.jsp?introPage=intro_3.html

World Health Organization. (1985). *Energy and Protein Requirements. Reports of a Joint FAO/WHO/UNU Expert Consultation. Technical Report Series 724*. Geneva.

World Health Organization. (1985). *Energy and Protein Requirements. Reports of a Joint FAO/WHO/UNU Expert Consultation. Technical Report Series 724*. Geneva.

Worlsey, A. (2002). Nutrition knowledge and food consumption: can nutrition knowledge change food behaviour. *Asia Pacific Journal of Clinical Nutrition* , S579 - S585.

Worthington-Roberts, B. & Williams, S. (1996). *Nutrition Throughout the Lifecycle, 3rd ed.* St. Louis: Mosby Publishing.

Yeh, M., Ickes, S., Lowenstein, L., Shuval, K., Ammerman, A., Farris, R., & Katz, D., (2008). Understanding barriers and facilitators of fruit and vegetable consumption among a diverse multi-ethnic population in the USA. *Health Promotion International*, 42-51.

Zunft, H., Friebe, D., Seppelt, B., de Graaf, C., Margetts, B., Schmitt, A., & Gibney M, (1997). Perceived benefits of healthy eating among a nationally-representative sample of adults in the European Union. *European Journal of Clinical Nutrition*, S41-S46.