

**FACTORS INFLUENCING PULSE CONSUMPTION AMONG UNIVERSITY
STUDENTS**

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STUDENTS**

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ABSTRACT

The amount, frequency, and type of pulses consumed by university students were explored using a cross-sectional online survey. Daily pulse consumers made up just 6% of participants, with 5% of the total participants eating more than three cups of pulses per week. It was found that a significant predictor of the amount of pulses consumed in a week was having more positive environmental attitudes ($p < .001$). There was a statistically significant difference between perceived body size groups and amount of pulses consumed in a week $F(4, 243) = 2.715, p = .031$, and the frequency of pulse consumption $F(3, 257) = 3.712, p = .012$, with post-hoc tests revealing a statistically significant difference between the overweight and below average weight groups, with the frequency of pulse consumption increasing as the perceived body size declined (mean difference 0.665). Eighty-five per cent of participants were more likely to consume pulses because they contain a high amount of vitamins and minerals. These findings suggest that understanding the attitudes and behaviours of university students towards pulse crops' impact on health, nutrition, and the environment may help to inform initiatives aiming to increase pulse consumption among this group.

Keywords: pulse crops, pulses, lentils, beans, legumes, university students

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LIST OF ABBREVIATIONS

| | |
|----|--------------------|
| M | Mean |
| MD | Mean difference |
| N | Sample size |
| SD | Standard deviation |

CHAPTER I: Introduction

Pulses are the low-fat, dry, edible seeds that are harvested from pods of annual leguminous plants. The most commonly eaten pulses across the globe include kidney beans, navy beans, fava beans, chickpeas, dried or split peas, mung beans, black-eyed peas, and several varieties of lentils (Food and Agriculture Organization of the United Nations, 2016). Canada is the second largest producer of pulse crops in the world (Hoover, Hughes, Chung & Lui, 2010). The most commonly grown pulse crops in Canada are lentils (*Lens culinaris*), chickpeas (*Cicer arietinum*), dry beans (primarily *Phaseolus vulgaris*), and dry peas (*Pisum sativum*) (Tosh & Yada, 2010). Pulses are rich in nutrients that are important for a healthy diet and relevant to managing chronic diseases such as diabetes (Curran, 2012). Studies have shown that pulse consumption is associated with reduced body weight, waist circumference, and risk of obesity (Mollard, Wong, Luhovyy, & Anderson, 2011). In addition to providing direct health benefits, increasing the prevalence of pulse crops could also bring about several positive environmental changes. Pulse crops fix between 70 to 90% of their nitrogen from the air and the rest from the soil, therefore eliminating the need to use nitrogen fertilisers (Carlyle, 2004). This enhances soil fertility, and reduces greenhouse gas emissions and land clearing. The decrease in emissions resulting from pulse farming could potentially lead to a decrease in global warming, as nitrogen fertilisation is responsible for half of all greenhouse gas emissions within the agricultural sector (Magrini et al., 2016). In addition, pulse crops can be grown in marginal or degraded lands (Jensen et al., 2012), which can be beneficial in areas that do not have access to as much water, or helpful to those who are not able to afford the costs of nitrogen fertiliser. This makes pulse crops a healthy and environmentally favourable solution to improving health and mitigating climate change,

which is becoming increasingly important as global populations increase and sustainability becomes paramount.

Despite the obvious benefits to producing and eating pulses, pulse consumption in Canada is low, with only 13% of the population consuming pulses daily (Ramdath, Renwick, & Duncan, 2016). Barriers to pulse consumption have been explored in the general Canadian population with attention being focused on the South Asian immigrant population (Ipsos Reid, 2010). This study will continue the exploration of factors influencing pulse consumption, focusing exclusively on university students. The aim of this study was to determine whether sociodemographic and socio-economic factors and knowledge of health and environmental benefits influence pulse crop consumption among students at the University of Lethbridge. This topic is important as it may help to enhance both the social and physical environments, as an increase in pulse consumption can support population health, reduce grocery costs, improve environmental conditions, and boost the local agricultural sector.

University students were the target population in the study because they are old enough to make their own meal choices but generally young enough that a change in dietary habits could provide decades of improved nutrition and health. They are also often on a limited budget, and pulse crops – which are high in protein, fibre, carbohydrates and minerals – can provide nutritional security to low-income individuals as they are inexpensive and easy to store long-term. University students are typically at a stage in their lives where they are forming identities and solidifying the foundations of personal beliefs and attitudes, suggesting that a change of habit at this age can make a significant improvement to their personal health over many years (Vermeir & Verbeke, 2008). They

also have the potential to be future decision makers, researchers, policy makers, scientists, and leaders, so having more knowledge of pulse crops could influence policy and overall population health. Additionally, concern over environmental issues has been increasing, and research supports the assumption that there is an increasing concern about the environment amongst university students (Cortes, Dias, Fernandes, & Pamplona, 2016). It is possible that increased knowledge of the environmental significance of pulse crops could motivate students to adopt dietary changes, which could ultimately assist in mitigating the current food system's environmental impact in addition to bringing improvements to health.

Research Questions

The purpose of the study was to determine whether socio-demographic and socio-economic factors, and knowledge of health and environmental benefits influence pulse crop consumption among students at the University of Lethbridge. This research aimed to explore the following questions:

1. What is the level and frequency of pulse consumption among university students?
2. What factors influence pulse consumption? Specifically:
 - a. What are the socio-demographic and socioeconomic differences between non-consumers and heavy consumers?
 - b. How do perceptions of pulses influence consumption?
 - c. What are students' attitudes towards healthy eating and pulses?
 - d. Does knowledge about health and environmental benefits of pulses influence purchase and consumption?

Research Hypotheses

It was predicted that the study would reveal that pulse crop consumption among university students to be reasonably low, and that their level of consumption would influence their attitudes. In addition, it was predicted that a lack of knowledge of how to prepare pulses would be the largest barrier to consumption. It was not expected that socioeconomic factors would be major factors on whether university students purchase and consume pulses.

CHAPTER II: Literature Review

A brief overview of pulses is required to fully recognise the importance of pulse crops to current issues such as chronic disease, agronomic and nutritional benefits, the role of pulses in food security, and their impacts on climate change. This section will outline notable benefits of pulse consumption. A review of the existing literature on factors influencing pulse consumption will follow.

Pulse Consumption in Canada

Although Canada is a large global exporter of many pulse crops (Hoover et al., 2010), Canadians do not eat pulses on a regular basis. Consumption of pulses varies among Canadians with lentils being the least consumed (Ipsos Reid, 2010). The estimated median weekly consumption of cooked pulses among Canadians is 1.0 cup per person, with South Asian immigrants consuming an average of 2.5 cups per week (Ipsos Reid, 2010). The large consumption differences between the general Canadian population and the South Asian immigrant population demonstrates that pulse consumption in Canada likely does not compare to that of other countries around the world. Given their cooking convenience, lentils are consumed widely in many countries like Sri Lanka, regardless of income level (Anoma, Collins, & McNeil, 2014).

Plant-based Proteins

There is a strong relationship between diet, environmental sustainability, and human health, and foods that contain similar nutrients and have comparable impacts on health can have significantly different environmental impacts (Tilman & Clark, 2014). Greenhouse gas emissions are strongly influenced by dietary composition, with plant-based foods having lower greenhouse gas emissions than animal-based foods (Tilman &

Clark, 2014). In addition, consumption of plant proteins is more environmentally beneficial to consuming meat protein. This is because meat has an inherently inefficient conversion, with six kilograms of plant protein being required to produce one kilogram of meat protein (Pimentel & Pimentel, 2003). Chickpeas and lentils contain 22% and 26% protein (dry weight), respectively, with slight variances based on growing condition, plant species, maturity, and variety (Pulse Canada, n.d.). This compares to 23% protein for lean ground chicken and 26% protein for medium ground beef (Health Canada, n.d.). This similarity in protein content is relevant because if consumers are more aware of the impacts that meat consumption has on the environment, they may be more likely to increase their consumption of pulses to fulfill their nutritional requirements.

Pulses, particularly lentils, are often used as a meat substitute in developing countries (Erskine, Sarker & Kumar, 2011). Many people in developing nations rely on pulses for protein and energy requirements. Vegetable proteins are the most beneficial in terms of cost for a large proportion of populations in impoverished countries (Singh, Chung, & Nelson, 2007). Pulse crops also make up a large portion of dietary protein for many in countries, such as Sri Lanka, where meat is not accessible to many in the population due to high costs (Ariyawardana, Collins & McNeil, 2014), or consumption of animal protein is not permitted due to cultural or religious traditions and practices (e.g. Seventh Day Adventists and Jainists).

Consumer awareness and/or misconceptions about plant-based protein sources could be impeding a change in human consumption habits away from meat (Hartmann & Siegrist, 2017). However, Kristensen et al. (2016) found that a pulse-based meal of beans and peas favourably influenced appetite sensations and energy intake compared to an animal-based meal that had similar energy and protein content. In addition, this same

study found that a vegetable-based meal with low protein content was found to be as palatable and satiating as an animal-based meal that had a high content of protein. As a lower cost alternative to meat protein, many populations rely on plant-based proteins such as pulses to meet their dietary requirements. Pulse crops can provide nutritional security to low-income individuals in developing nations, particularly in Asia (Erskine et al., 2011).

With the increased attention on climate change and environmental sustainability, the fact that meat contributes to higher production of greenhouse gases and carbon dioxide emission than vegetable products has increased advocacy in reducing the consumption of protein from animal sources. This can be achieved by increasing plant-based protein consumption, as an environmentally friendly approach, which can also lead to increased consumption of fibre (Kristensen et al., 2016).

Agronomic Benefits of Pulse Crops

The leading pulse crops in Saskatchewan, which is Canada's largest pulse producer, include dry field pea, lentil, and chickpea (Carlyle, 2004). The rapid spread of these crops over the last three decades can be partially attributed to their ability to fix nitrogen from the air. Working together with particular bacteria (rhizobia), which are found in soils of many natural ecosystems, pulse crops convert atmospheric nitrogen into nitrogen compounds that can be used by plants. This improves soil fertility and reduces dependency on synthetic fertilisers. This favourable process has resulted in many farmers incorporating pulses into their crop rotations. Not only do pulse crops contribute to transferring nitrogen from the air into the soil, but they also improve residual soil water and significantly enhance system productivity in rainfed dry areas (Gan, Hamel, Kutcher,

& Poppy, 2017). Additionally, pulse crops stimulate the productivity of the crops that follow (Jensen et al., 2012). Spring wheat harvested from fields following pulse crops averaged higher yields and protein content than other rotations, even when the same amount of nitrogen was made available for the different crops (Miller et al., 2002). Additionally, instead of fallowing, farmers can plant grain crops after pulse crops to reduce soil degradation and benefit from the income gained from the pulse harvest (Carlyle, 2004). These factors combine to make pulses a compelling economic benefit to successful agricultural practices.

Pulses and Climate Change

As previously mentioned, pulse plants fix atmospheric nitrogen in the soil and therefore, they do not need nitrogen fertilisers. It has been estimated that Canada's agricultural sector is responsible for approximately 8% of all greenhouse gas emissions in the country (Gan, Liang, Wang, & McConkey, 2011). Improving cropping systems by incorporating pulse crops can reduce greenhouse gas emissions. For example, a study in Saskatchewan found that durum crop preceded by lentils or chickpeas the previous year decreased its carbon footprint by 17% compared to durum preceded by cereal crops (Gan et al., 2011).

The role of carbon dioxide in anthropogenic climate change has resulted in both consumers and food product manufacturers searching for new products with functional and nutritional benefits that have reduced carbon footprints (Boye, Zare, & Pletch, 2010). Crop rotations containing pulses have lower carbon dioxide emissions compared with non-pulse crops (Lemke, Zhong, Campbell, & Zentner, 2007). Replacing cereal crops with pulse crops has also been shown to reduce overall carbon dioxide emissions related

to energy inputs (Lemke et al., 2007). In addition, pulse crops do not require as much water as other crops (Angadi et al., 2008). Due to anthropogenic climate change, there is likely to be less water available for agriculture in some regions. These factors could make increasing the production and consumption of pulses appealing to consumers, farmers, and food product manufacturers.

Nutritional Benefits of Consuming Pulses

Pulses are known for their nutritional and health-promoting properties. They are an excellent source of fibre, protein, carbohydrates, and minerals, and play a role in decreasing the risk of certain cancers, managing obesity, and lowering cholesterol and rates of type 2 diabetes (Roy, Boye, & Simpson, 2010). One distinguishing feature of pulses is their higher proportions of protein compared to other plant foods (Curran, 2012). Pulses are a rich source of dietary fibres, both soluble and insoluble, that improve numerous beneficial physiological effects in human health (Tosh & Yada, 2010). In addition to containing high amounts of nutrients and minerals such as folate, iron, niacin, phosphorus, potassium, selenium, thiamin, and zinc, they also provide phytonutrients (including antioxidants) and potentially bioactive nutrients that could improve glycemic control to protect against cancer, hypercholesterolemia, and type 2 diabetes (Curran, 2012). Benefits of fibre in pulses can be experienced through not only consuming whole pulses, but also through the consumption of flours and fractions from pulses. These can be used to increase soluble and insoluble dietary fibre in processed foods, which has been shown to benefit health (Tosh & Yada, 2010).

Because of the numerous nutritional benefits, several national food guides encourage the consumption of pulses. For example, it has been suggested that Canadians

often eat "meat alternatives such as beans [and] lentils" (Health Canada, 2011), and the Eatwell Guide in the UK recommends incorporating more pulses into one's diet (Public Health England, 2016).

Pulses and Diabetes

The Canadian Diabetes Association recommends eating more high fibre foods, and specifically names lentils, dried beans, and peas as part of its recommended foods for diabetes prevention and management (Canadian Diabetes Association, n.d.). A 2016 review of observational studies and clinical trials that examined effects of pulse consumption on health outcomes that are key to diabetes management demonstrated evidence of improvements in glycemic control, reduction of blood lipids, and regulation of body weight among participants with increased pulse consumption (Ramdath et al., 2016).

Pulses contain natural enzyme inhibitors that can potentially slow the breakdown of lipids and carbohydrates in the small intestine (Ramdath et al, 2016). Pulses have been found to attenuate peak blood glucose rise – the incremental area under the blood glucose response curve – relative to similar amounts of starchy foods in healthy individuals, and also in those with type 2 diabetes (Ramdath et al., 2016). This makes pulses useful in the management of type 2 diabetes, or among those with impaired glucose tolerance, because it may delay the onset of overt diabetes (Ramdath et al., 2016). In addition, the risk for obesity is also lowered with increased pulse consumption because of improved satiety, reduced food intake, and regulation of body weight (Ramdath et al., 2016).

Specific amounts of pulses per day have been recommended based on their anti-diabetic properties found using in vitro research, which suggests that pulses should be a

permanent part of a balanced diet, especially for those with type 2 diabetes (Getek et al., 2014). A study examining the effects of yellow pea flours on fasting insulin and insulin resistance in hypercholesterolaemic and overweight human subjects found that diabetes and cardiovascular disease risk factors were improved with 50 grams per day (Marinangeli & Jones, 2010). Long-term effects of a pulse-rich diet in individuals with type 2 diabetes have consistently shown improvements in markers of glycemic control in recent studies, and it has been suggested that individuals with type 2 diabetes should have two-thirds of a cup of pulses per day to manage hyperlipidemia (Ramdath et al., 2016).

Potential Healthcare Savings From Increasing Pulse Consumption

Diet-related diseases are associated with healthcare and related costs, and this societal financial burden has the potential to be aided by managing diet-related chronic disorders such as obesity, type 2 diabetes, and cardiovascular disease. Increasing pulse consumption among Canadians has the potential to help reduce healthcare costs by reducing disease and managing healthcare resources associated with type 2 diabetes and cardiovascular disease due to the many nutritional benefits that pulses provide. Abdullah, Marinangeli, Jones, and Calberg (2017) looked at the potential annual healthcare and societal cost savings that could be attributed to reducing complications from type 2 diabetes and incidence of cardiovascular disease in Canada following a low glycemic index/high fibre diet that includes pulses, or 100 gram per day pulse intake. In their study, the researchers estimated the proportions of individuals who are likely to eat pulses, evaluated the reductions in established risk factors for cardiovascular disease and type 2 diabetes, assessed the percent reduction in incidences or complications of the two diseases, and calculated the potential annual savings in relevant healthcare and related

costs (Abdullah et al., 2017). Using these estimations, the researchers found that a low glycemic index or high fibre diet that included pulses and 100 gram per day pulse intake could potentially yield \$6.2 million in savings on annual healthcare and related costs of type 2 diabetes, and \$31.6-\$315.5 million in savings for cardiovascular disease in Canada (Abdullah et al., 2017). Looking specifically at potential provincial savings, Abdullah et al. (2017) estimated that Alberta could save between \$2.8 million and \$28.2 million per year following a low glycemic index/high fibre diet that includes pulses, or 100 gram per day pulse intake. The potential savings that could be incurred by increasing pulses in the Canadian diet could be used in other areas of healthcare or other major areas in need of financial assistance.

Incorporating Pulses into Food Products

Increasing overall pulse consumption could be helped by encouraging companies to incorporate pulses in convenient food products such as cookies and crackers. Zucco, Borsuk, and Arntfield (2011) examined the effects of adding pulse flours on the chemical, nutritional, and physical characteristics of cookie formulations, and found that cookies with acceptable physical characteristics and improved nutrition could be produced with a complete or partial replacement of wheat flour with pulse flour. Pulses can also be used to change the textures in food products by binding and retaining moisture and fat (Tosh & Yada, 2010), making them suitable for use in food products.

The demand for gluten-free products has been on the rise over the last two decades with Canada's gluten-free market having a compound annual growth rate of 27% from 2008-2012 (Packaged Facts, 2013). As diagnoses of gluten allergies and intolerances increase, the sales of gluten-free products will bring with it increased

manufacturing in upcoming years. Pulses can contribute to this emerging market by providing alternatives to gluten-containing cereal crops such as wheat or barley.

Pulse proteins have unique functional properties including fat binding, foaming, gelation, and water holding, which gives them the ability to have their use expanded into the development of a wide range of food products (Boye, Zare & Pletch, 2010). Recently, vegan food enthusiasts have discovered the versatility of “aquafaba,” which is chickpea brine that would normally be discarded from canned chickpeas. Several recipe sites and published books are now available showing the many uses of aquafaba for creating egg- and dairy-free meringues and mousses. This example demonstrates the potential for using pulses as an alternative for common allergens such as soybean, gluten, dairy, and eggs.

A study by Han, Janz, and Gerlat (2010) focused on developing a cracker using pulse flours and fractions. The researchers looked at texture and colour profiles, consumer acceptability, and nutritional analyses to evaluate the eight prototype crackers that were produced. Results found that pulse-based crackers have good potential for both appealing to the consumer market and for imparting health benefits (Han et al., 2010). Gluten-free crackers made with pulses are an opportunity for the snack industry in Canada to provide an alternative to popular cereal-based snacks for an environmentally and health conscious consumer base.

Factors Impacting Pulse Consumption

Few Canadian studies have focused on the factors that influence pulse consumption. The largest study undertaken in Canada was conducted by survey-based marketing research firm Ipsos Reid in 2010. Consisting of an online survey and four focus groups, the study was directed by Alberta Agriculture and Rural Development,

Pulse Canada, and the Alberta Pulse Growers Commission, and funded by the federal-provincial-territorial program Growing Forward (Ipsos Reid, 2010). The aim of the Ipsos Reid (2010) study was to explore the factors that influence Canadians' pulse consumption. Individuals in the focus groups explained that many people do not know what pulses are, which is a barrier in communicating their benefits in advertising. Participants indicated that two major reasons for eating pulses were health benefits and personal incidence of disease (Ipsos Reid, 2010). Taste was also an influencing factor, since individuals who have not been exposed to pulse dishes may have the perception that they do not taste good, while those who knew how to prepare pulses indicated that they do taste good (Ipsos Reid, 2010). The results indicated that 43% of did not eat pulses because they did not like them, while 11% indicated that it was the flavour/taste that they specifically did not like (Ipsos Reid, 2010). The main motivators of eating pulses were: "tastes good/I like them" (36%), and "healthy/good for you" (34%) (Ipsos Reid, 2010).

Other than the nation-wide research by Ipsos Reid (2010), there have been two recent studies in Saskatchewan examining pulse consumption. A study by Phillips, Zelo, Chilibeck, and Vandenberg (2015) looked specifically at participants' perceived barriers and benefits to lentil consumption. The researchers conducted the study using a self-administered questionnaire that measured nutritional knowledge and perceived barriers and benefits to the consumption of lentils in families with young children (Phillips et al., 2015). The study found that 84% of participants associated lentils with health benefits, and that the most common barrier revealed was "if my child liked lentils I would eat them more" (76%).

The second study in Saskatchewan was an intervention at a childcare facility, undertaken by Froehlich Chow, Leis, Humbert, Engler Stringer, and Muhajarine (2015) at

the University of Saskatchewan in Saskatoon. This intervention introduced pulse education and lentils to childcare workers, and the children that they care for. Results revealed that once educators familiarised children with pulse crops, they enjoyed both learning about pulses and consuming them, which demonstrated that an increased knowledge of pulses can have a positive impact on consumption (Froehlich Chow et al., 2015). Due to the positive response from the children, educators were encouraged to continue serving more pulse based-meals and seek out new pulse-based recipes (Froehlich Chow et al., 2015).

There has also been scant international research on factors influencing pulse consumption. Pulse consumption in Europe is lower than many other regions in the world, such as Africa, Asia, and Latin America; therefore, Schneider (2002) looked at factors limiting the consumption of pulses in Europe. Like Canada, Europe is a major pulse-producing region but residents have a low consumption compared to other areas (Schneider, 2002). The study by Schneider (2002) showed that the main factors limiting the consumption of pulses in Europe are the lack of products adapted to modern life, a small home supply of pulses, and competition from cheaper imports.

Lea, Worsley, and Crawford (2005) conducted a study in Melbourne, Australia using focus groups to determine factors that influenced pulse consumption. Participants of the study consisted of workplace employees, members of community groups, inner-city residents, and university students. The results showed that the top barriers to consuming pulses were a lack of knowledge on how to prepare them so that they taste good, and the perceived length of time it takes to prepare them (Lea et al., 2005). Among individuals in these focus groups, health benefits, versatility, environmental benefits, variety, and taste were the top motivators to consuming pulses (Lea et al., 2005).

In the United States, a study by Lucier, Lin, Allshous, and Kantor (2000) found that race/ethnic origin, sex, and income level appeared to affect the consumption of pulses, specifically cooked dried beans. Using data from the United States Department of Agriculture's 1994-1996 Continuing Survey of Food Intakes by Individuals, the study found that the growing Hispanic population has contributed to the increasing popularity in cooked dried bean consumption. Cooked dried beans are a culturally important food for this population, which also accounts for a disproportionate share of the population living in poverty in the U.S. (Lucier et al., 2000). The study found that the lowest income individuals consumed more lima and pinto beans, while chickpeas and black beans are favoured by individuals in the highest income bracket. Additionally, results from the survey suggested that men tend to consume more cooked dried beans because of their larger overall caloric intake (Lucier et al., 2000).

A study by Leterme and Carmenza Muñoz (2002) shows that there are differing factors that influence the consumption of pulses in Latin America. Lower income, living rurally, eating a traditional diet, and favouring consumption of locally produced foods are some of the factors that positively influence the consumption of pulses in Latin America. Pulses, particularly beans, have been a staple food among most Latin American populations, which continues to impact the amount of pulses consumed by individuals living in these populations (Leterme & Carmenza Muñoz, 2002). In addition, the study found that urbanisation has led to a decrease in pulse consumption due to having more access to processed foods, less time to cook, and the influence of the media (e.g. billboards, newspapers, etc.) on food choices (Leterme & Carmenza Muñoz, 2002).

In Brazil, a telephone survey was conducted between 2006 and 2009 to determine the trends in frequency of consumption of beans (Velásquez-Meléndez et al., 2012). Beans

are a part of the traditional Brazilian diet, and an adequate consumption of beans is associated with protection against several diseases (Velásquez-Meléndez et al., 2012). The study revealed that individuals with a low or normal Body Mass Index consumed the most beans, while individuals with twelve or more years of schooling had the lowest frequencies of consumption. The study also suggested that location also had an impact on levels of bean consumption, as populations in the North and South of Brazil had lower consumption of beans than those living in the middle (Velásquez-Meléndez et al., 2012).

In Tanzania, a study by Mfikwa and Kilima (2014) showed that a number of factors affect the amount of pulses consumed; this differs in rural and urban areas, with overall consumption being higher in rural areas. Although there are both unique and common factors influencing pulse consumption among urban and rural residents, the study showed that for those living rurally, household size, prices of pulses, and education levels of decision makers were the most influencing factors. According to the results of the study, in urban areas, age and sex of main household decision maker, education levels, and households' total expenditure on food were the factors that most influenced pulse consumption (Mfikwa & Kilima, 2014).

The results from these studies show that globally, there are some shared and unique factors that influence pulse consumption at the individual and population level. Common factors appear to include an individual's level of education, perceived health benefits, being part of one's traditional diet, and geographic location (i.e. rural/urban). Also of note is that there is a clear lack of data on university students within any of the current literature. Additionally, other than the two Canadian studies previously mentioned (Froehlich Chow et al., 2015; Phillips et al., 2015), no other studies have looked at how levels of knowledge of the health and environmental benefits of pulses influences

consumption. This study has attempted to fill these gaps to address the factors influencing pulse consumption among university students in Alberta.

Chapter III: Methods

This study examined whether knowledge of environmental and health benefits of pulse crops and socio-demographic/socioeconomic factors influence pulse consumption among university students. This research aimed to explore the following questions:

1. What is the level and frequency of pulse consumption among university students?
2. What factors influence pulse consumption? Specifically:
 - a. What are the socio-demographic and socioeconomic differences between non-consumers and heavy consumers?
 - b. How do perceptions of pulses influence consumption?
 - c. What are students' attitudes towards healthy eating and pulses?
 - d. Does knowledge about health and environmental benefits of pulses influence purchase and consumption?

Attitudes towards pulses and healthy eating were collected by a self-report online survey. It was predicted that socioeconomic factors would be similar among all participants and would therefore not influence a student's purchase and consumption of pulses. A lack of knowledge of how to prepare pulses was expected to be the largest barriers to consumption.

A study by Phillips et al. (2015) on perceived benefits and barriers surrounding lentil consumption in families found only 3% of respondents perceived cost as a barrier; thus, we can assume that cost does not appear to be a major influence on the consumption of lentils and perhaps other pulse crops. Since the price of pulses does not appear to be a factor, an exploration into other potential factors influencing pulse consumption – such as socio-demographic factors and knowledge of health and environmental benefits – was explored. These results were collected and analysed as outlined in the following sections.

Population, Sampling, and Recruitment

The focus on university students in this study reflects the fact that they constitute a unique population in Canada; university students of today have the potential to be the architects of an increasingly sustainable future that includes a healthy population. The population for this online survey study was drawn from the University of Lethbridge student body, which had 8,558 students in the fall term of 2017, with the majority (59%) of students being female (University of Lethbridge, 2017). This study sought participants specifically from the University of Lethbridge because many pulse crops are grown in and around this area. The sample population included full- or part-time students aged 18 years or older currently attending the University of Lethbridge.

This population was primarily surveyed using convenience sampling, by placing flyers on tables in classrooms and study areas on campus, hanging recruitment posters around the campus (see Appendix A), and posting an announcement on the University of Lethbridge's Notice Board. In addition, instructors in different faculties and departments were asked to mention the survey to their students. To get a diverse representation of the student body, instructors of courses in areas including Physics, Sociology, and Health Sciences provided information about the survey to their students.

The target population was also recruited using targeted Facebook posts to members of the "University of Lethbridge Graduate Students' Association," "Faculty of Health Sciences," and "Nursing Education in Southwestern Alberta – NESA" groups on Facebook. Additional participants were recruited through snowball sampling, by asking colleagues and friends to tell students that they may know (with which they do not have a power imbalance) about the survey.

As an incentive to participate, the survey concluded with an option to enter to win one of three \$50 prizes. The prizewinners were randomly selected from the participants who completed the survey and provided a name and valid University of Lethbridge email address.

Data Collection

The purpose of this study was to examine the relationships between socio-demographic and socioeconomic factors, knowledge of health and environmental benefits of pulse crops, and levels of pulse consumption among university students. A cross-sectional survey design was implemented to collect quantitative data to summarise attitudes, opinions, and trends within the sample population. An online survey was the preferred type of data collection procedure for this study because of the rapid turnaround in data collection, the economy of the design, greater generalisability, and external validity. Additionally, individuals in the surveyed population are typically tech savvy, as they spend significant amounts of time on social media and would be comfortable completing the survey online.

Within the survey, demographic and personal characteristics were divided into background information about the participants (i.e. age, sex, income, main ethnic background, etc.) and information about the motivations and barriers to consumption, knowledge, and perceptions of pulses (see Appendix C). The exploration of background information was important to this study because it was hoped that it would be possible to identify characteristics and factors contributing to differences in pulse consumption. Likert scales (e.g. strongly disagree to strongly agree) and categorical scales (e.g. male, female, other) were used for most of the questions.

The survey questions were drawn from questions included in previous Canadian surveys (Ipsos Reid, 2010; Phillips et al., 2015), combined with newly constructed questions on health and the environment topics that had not yet been explored in earlier research. The survey included six questions on diet, grocery shopping, and pulse consumption, 10 demographic questions, 23 questions in which participants indicated their level of agreement/disagreement relating to attitudes towards pulses, and 12 questions asking participants to indicate whether knowing pulses' health and environmental benefits makes participants more/less likely to eat them. These questions were selected specifically to determine how perceptions of pulses and knowledge of various health and environmental benefits of pulses may contribute to consumption levels.

The survey was built using Qualtrics Research Suite, which is a Web-based platform used for creating and conducting online surveys. Six individuals pilot tested the survey to improve the format, flow, questions, and scales. The survey took testers and participants approximately ten minutes to complete. Data collection took place over a three-week period in November and December of 2017. Participants were prevented from taking the survey more than once by using one of the features in Qualtrics that places a cookie on respondents' Web browsers when they submit responses.

Data Analysis

The purpose of this study was to identify potential barriers and motivators to consuming pulses, which may vary among university students due to a wide range of characteristics such as age, sex, and economic background. As such, the overall data analysis included cross-tabulation with relevant demographic, health, behavioural, and

attitudinal variables. Correlations between independent and dependent variables were also considered to provide a preliminary investigation of the relationships between the variables.

The independent variables (e.g. age, sex, main ethnic background, etc.) were collected in the first section of the survey, and the dependent variables (e.g. frequency of pulse consumption, amount of pulses eaten in a week) were collected in the second section.

Analysis was carried out using IBM SPSS Statistics 25 software. This software is useful for statistical analysis, data management, and data documentation. Kruskal-Wallis H, Kendall's tau, Pearson r, One-Way ANOVA, and *t* tests were used to determine results such as whether males and females had differing levels of pulse consumption, if there was a difference between students who had a specific household income level with respect to their pulse consumption levels, and if the frequency of pulse consumption was related to perceived body size. Multiple Linear Regression tests were also conducted to consider the relative contribution of individual predictors of pulse consumption, and the potential interactions between these predictors. It was anticipated that quantitative statistical analysis would reveal larger patterns or generalisations about this population's pulse consumption and knowledge. Detailed results, including a factor analysis and Cronbach's alphas, are presented in Chapter IV.

Ethical Issues

The study was approved by the University of Lethbridge Human Subjects Research Ethics Board in November 2017. Ethical standards within this research study followed the Public Health Code of Ethics of the American Public Health Association and the Public Health Leadership Society, and were guided by the three core principles of the Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans, which are respect for persons, concern for welfare, and justice (Canadian Institutes of Health Research, National Sciences and Engineering Research Council of Canada, & Social Sciences and Humanities Research Council of Canada, 2010).

No ethical issues were anticipated and no participants brought forward any issues prior to, during, or after participating in the survey. A letter of invitation and consent form (Appendix B) outlining the purpose, rationale, and research procedures was provided at the beginning of the survey. This included a detailed explanation of the participant's right to withdraw from the survey at any time without consequence. Participants were assured of the maintenance of confidentiality with regard to the information they would provide in their responses to the survey questions. The letter concluded with a statement indicating that submission of the participants' responses was accepted by the researcher as implied consent to participate.

CHAPTER IV: Results

Sample Demographics & Statistics

Two hundred and sixty-eight responses were received for the survey, all of which were used in the analysis. This number of responses makes up approximately 3% of the total University of Lethbridge student body, which was 8,558 in the fall term of 2017 (University of Lethbridge, 2017). All responses were retained in each analysis; no missing data were replaced, and no outliers were identified.

The majority of respondents were female (77%), single (78%), with a European background (70%) (see Table 1). Seventy per cent were from a city with a population between 50,000-99,000, and 13% were from a city with a population over 1,000,000.

Table 1. *Demographic Characteristics of University of Lethbridge Students*

| Variable | % | Variable | % |
|-------------------------------------|-------|---|-------|
| Main Ethnic Background (n = 264) | | Population size of city/town (n = 263) | |
| Indigenous North American | 3.79 | Less than 1,000 | 1.90 |
| British or Irish | 32.95 | 1,000-4,999 | 4.56 |
| Continental European | 37.50 | 5,000-14,999 | 2.66 |
| West Indian/Caribbean | 0.76 | 15,000-34,999 | 1.14 |
| Latin, Central or South American | 2.65 | 35,000-49,999 | 0.38 |
| East or Southeast Asian | 5.30 | 50,000-99,999 | 69.96 |
| South Asian | 4.55 | 100,000-199,999 | 3.04 |
| West Central Asian/Middle Eastern | 0.38 | 200,000-499,999 | 0.38 |
| African | 2.65 | 500,000-999,999 | 1.14 |
| Other | 6.82 | Over 1,000,000 | 12.93 |
| Don't know | 2.65 | Don't know | 1.90 |

Note. The variation in sample size between the main ethnic background and population size is due to the response to each of the questions being optional within the survey. Some participants who selected “Other” for main ethnic background filled in an answer indicating that they were Dutch, and German or Scottish mixture.

Nearly 60% of participants were 21 years of age or under (59%), with an average age of 23, and most commonly occurring age of 20 (see Figure 1).

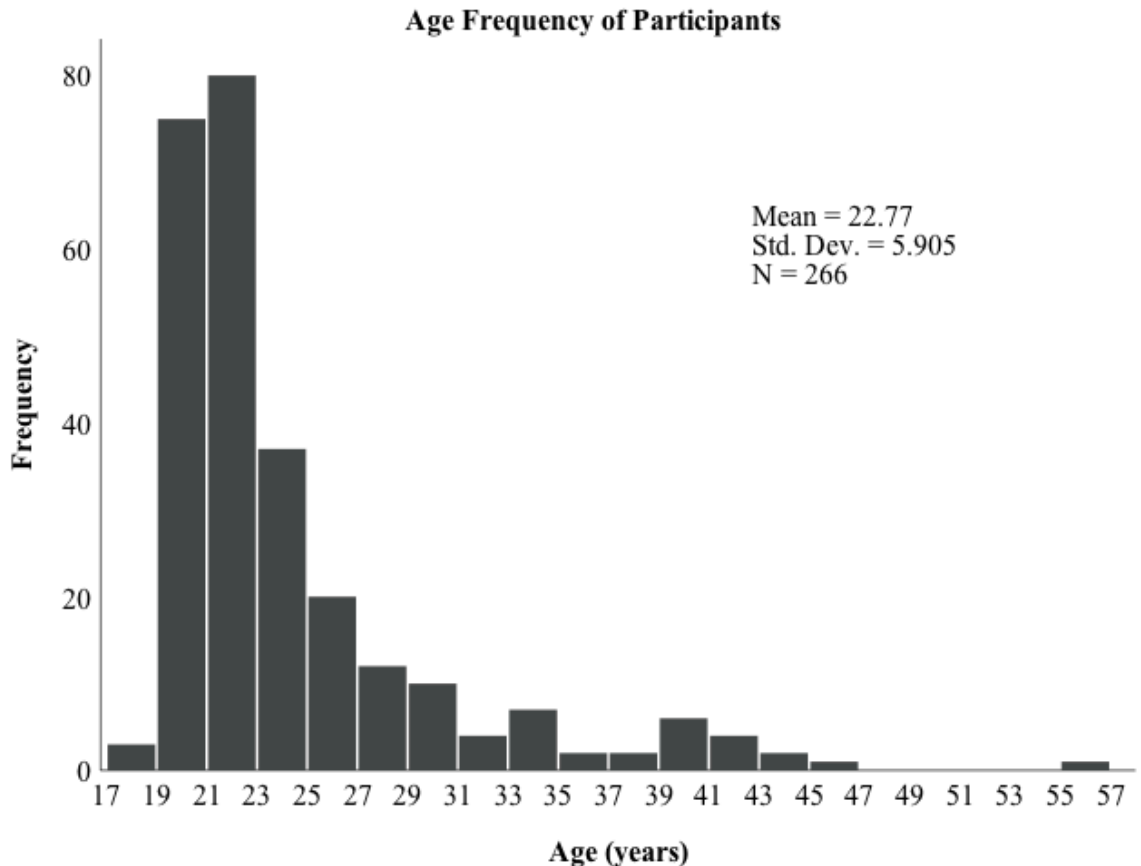


Figure 1. Age frequency of survey participants, ranging from 17 to 55 years of age.

A Kendall's tau-b correlation was applied to examine the strength of the relationship between the student's age ($M = 22.772$, $SD = 5.905$) and the in the frequency of pulse consumption reported ($M = 2.830$, $SD = .903$). The results found that there is no correlation between age and the frequency of pulse consumption within this sample ($\tau_b = -.078$, $p = .115$ (2-tailed)).

Just over one-quarter (26%) of respondents were living in a four-person household, 20% of respondents were living alone, and another 20% lived in a two-person household. In addition, an omnivorous diet was followed by 78% of the participants, with 15% of respondents following a vegetarian, vegan, or other specialised non-specified diet.

The majority of survey respondents represented three different academic disciplines. Students from disciplines within the sciences accounted for 35% of the sample, 22% were from the health sciences, and 15% were from management. The remaining participants had a current academic background in social sciences (9%), education (6%), humanities (6%), fine arts (3%), and other non-specified disciplines (4%). A Kruskal-Wallis test was performed to assess whether the amount of pulses consumed varies with the students' academic disciplines. The test did not identify significant differences between the groups $\chi^2(7, N = 248) = 7.612, p = .368$.

Looking at employment status, most of the participants (56%) were full-time students, with 26% engaging in full-time employment, and 6% in part-time employment. A Pearson correlation test was performed to test the correlation between annual household income with the amount of pulses eaten in a week. The Pearson correlation was found to be $-.088$, which is not statistically significant ($p = .166$), indicating that a student's annual household income did not seem to impact the amount of pulses eaten in one week.

Daily pulse consumers made up just 6% of participants, while 27% eat pulses four or more times per week, and nearly half of the respondents (49%) eat pulses just one to three times per month. Only 13% of participants eat pulses less than once a month, and 5% of participants never eat pulses.

Five per cent of participants indicated that they typically eat more than three cups of pulses per week, 35% eat between one-quarter cup and one cup of pulses per week, and just 10% typically eat no pulses in a week (see Figure 2).

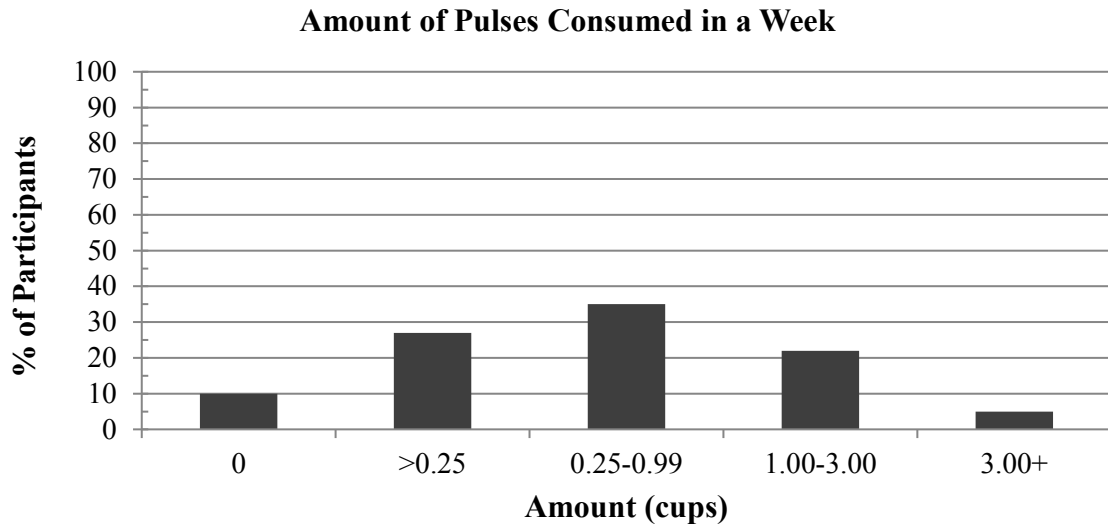


Figure 2. Amount of pulses consumed in a week by participants.

A *t* test was performed to assess whether the amount and frequency of pulse consumption was equivalent between females and males in the population. The *frequency* of pulse consumption between the two groups is statistically significant $t(257) = 2.088, p = .038$, but the difference in the *amount* of pulses consumed in a week by females ($M = 2.79; SD = 1.052$) and males ($M = 3.04; SD = .942$) is not $t(244) = -1.595, p = .112$. This indicates that males tend to eat pulses less frequently than females, but they eat larger amounts.

Chickpeas (28%), black beans (22%), and kidney beans (19%) were by far the most commonly eaten pulses among this group, and pinto beans were the least commonly consumed type of bean from the specified list of pulses provided in the survey question (see Figure 3).

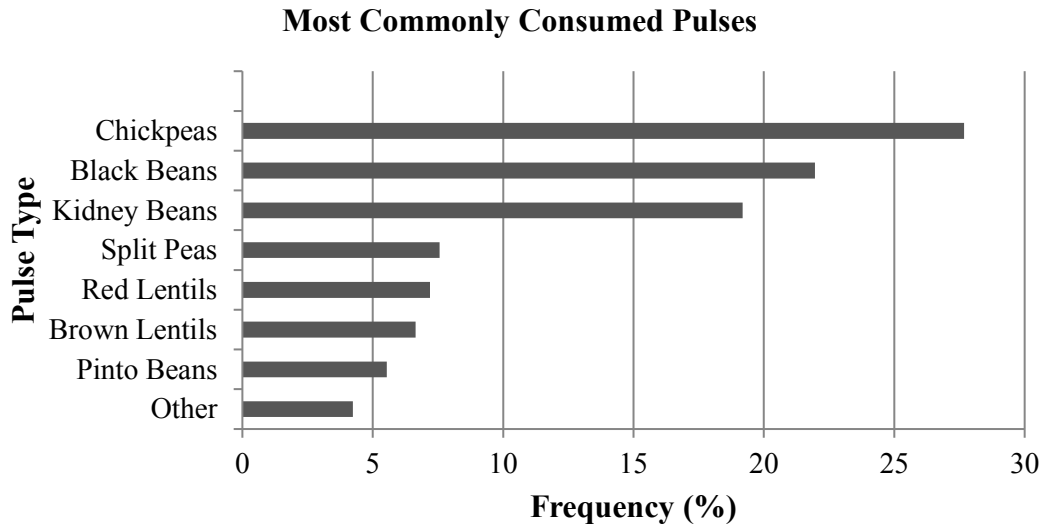


Figure 3. Most commonly consumed pulses. Split peas, red/brown lentils, and pinto beans were the least common types of pulses consumed from the specified list of pulses provided in this survey question.

Seventy-one per cent of respondents in both the lowest annual household income group (less than \$20,000) and the highest income group (more than \$100,000) most commonly consume chickpeas and black beans. Pinto beans are consumed by just 11% of the lowest income group (less than \$20,000), 17% of the middle-income groups (\$20,000-\$100,000), and 10% of the highest income group (more than \$100,000).

Nearly nine-tenths (87%) of participants agreed that they knew where to buy pulses and 62% agreed that they know how to cook pulses (see Table 2). Sixty-six per cent of participants believe that pulses are inexpensive, and 34% indicated that they are not too busy to prepare pulses.

A large percentage (59%) of respondents indicated that their cultural identity does not impact their food choices, with just 29% indicating that pulses are part of their traditional diet (see Table 3). In addition, 76% of respondents agreed that they liked the

taste of pulses, 69% usually look at nutritional labels when buying foods, and 81% agreed that they like to try out new or different types of foods or recipes.

Table 2. *Weighted Percentages of Level of Agreement About Knowledge and Attitudes Towards Pulses Regarding Preparation, Availability, and Cost*

| | Strongly disagree | Some-what disagree | Neither agree nor disagree | Some-what agree | Strongly agree |
|--------------------------------------|-------------------|--------------------|----------------------------|-----------------|----------------|
| I know how to cook or prepare pulses | 9.30 | 14.34 | 14.73 | 40.31 | 21.32 |
| I know where to buy pulses | 5.43 | 5.04 | 2.71 | 32.95 | 53.88 |
| I believe pulses are inexpensive | 2.76 | 6.69 | 24.41 | 35.83 | 30.31 |
| I am too busy to prepare pulses | 15.23 | 18.75 | 30.47 | 29.30 | 6.25 |
| Pulses are available at restaurants | 3.52 | 19.53 | 18.75 | 45.31 | 12.89 |
| I would buy packaged pulse snacks | 11.72 | 17.58 | 17.19 | 35.94 | 17.58 |

Table 3. *Weighted Percentages of Level of Agreement About Knowledge and Attitudes Towards Pulses Regarding Nutrition, Taste, and Cultural Identity*

| | Strongly disagree | Some-what disagree | Neither agree nor disagree | Some-what agree | Strongly agree |
|--|-------------------|--------------------|----------------------------|-----------------|----------------|
| Pulses are nutritious | 1.94 | 1.55 | 7.36 | 34.50 | 54.65 |
| Pulses are part of my traditional diet | 20.31 | 26.95 | 23.83 | 20.70 | 8.20 |
| My cultural identity affects my food choices | 35.46 | 23.11 | 16.33 | 14.34 | 10.76 |
| I usually look at nutritional labels when buying foods | 5.53 | 14.62 | 10.67 | 38.34 | 30.83 |
| I like to try new or different types of foods or recipes | 3.16 | 6.32 | 9.88 | 42.29 | 38.34 |
| I like the taste of pulses | 4.69 | 4.69 | 14.84 | 46.09 | 29.69 |
| My family members like eating pulses | 3.53 | 12.55 | 18.43 | 43.14 | 22.35 |
| My friends like eating pulses | 1.56 | 14.84 | 38.28 | 35.55 | 9.77 |

The survey revealed that 72% of respondents' perceptions of their bodies influenced the foods they eat, and 71% were concerned about weight control (see Table 4). Nearly half of the participants (47%) neither agreed nor disagreed about believing that pulses increase indigestion, and 30% disagreed about pulses causing indigestion. However, 59% agreed that eating pulses increases flatulence. Additionally, 23% are concerned about managing and/or preventing diabetes.

Table 4. *Weighted Percentages of Level of Agreement About Knowledge and Attitudes Towards Pulses Regarding Health and Environmental Responsibility*

| | Strongly disagree | Some-what disagree | Neither agree nor disagree | Some-what agree | Strongly agree |
|---|-------------------|--------------------|----------------------------|-----------------|----------------|
| I believe that eating pulses increases indigestion | 10.16 | 19.53 | 46.88 | 17.97 | 5.47 |
| I believe that eating pulses increases flatulence | 5.47 | 8.98 | 26.17 | 43.36 | 16.02 |
| My perceptions of my body influences the foods that I eat | 6.77 | 10.36 | 10.76 | 46.61 | 25.50 |
| I am concerned about weight control | 6.35 | 12.70 | 9.92 | 44.44 | 26.59 |
| I am concerned about managing/preventing diabetes | 18.58 | 36.76 | 21.34 | 15.81 | 7.51 |

Multiple Linear Regression was performed to determine how well we can predict the amount of pulses eaten in a typical week from weight/body attitudes in four of the survey questions: pulses can help with weight control, my perceptions of my body influences the foods that I eat, I am concerned about weight control, and pulses help control appetite (see Table 5). These independent variables account for 0.3% of the variance in the dependent variable and they are not statistically significant predictors of the dependent variable $F(4, 231) = .810, p = .520$.

Table 5. *Multiple Regression Analysis Summary for Predicting Amount of Pulses Consumed in a Week – Weight/Body Factors*

| Variable | Coefficients (<i>B</i>) | Standard error | Standardised coefficients (β) | Semi-partial correlations |
|---|------------------------------|-------------------|---|------------------------------|
| Pulses can help with weight control | .071 ^{NS} | .369 | .061 | .044 |
| My perceptions of my body influences the foods that I eat | .063 ^{NS} | .106 | .071 | .063 |
| I am concerned about weight control | -.006 ^{NS} | .066 | -.007 | -.005 |
| Pulses help to control appetite | .029 ^{NS} | .072 | .025 | .018 |
| Constant | 2.237 ^{NS} | .369 | | |

Note. $R = .118$; Adjusted $R^2 = -.003$; NS = non-significant

Attitudes relating to characteristics of pulses and whether the knowledge of characteristics affects participants' consumption of pulses showed that pulses being an affordable source of protein would make nearly half (48%) of participants much more likely to consume them, and 33% somewhat more likely to consume them (see Table 6). Additionally, approximately three-quarters of the participants stated that they would be more likely to consume pulses because they are high in fibre (72%), reduce the risk of diabetes (74%), and reduce the risk of heart disease (78%). Eighty-four per cent would be more likely to consume pulses because they contain a high amount of vitamins and minerals.

Environmentally sustainable agricultural practices do not appear to have much influence on participant's food buying practices in this sample, with 30% neither agreeing nor disagreeing with the statement that they influence food purchases (see Table 7). The

majority of respondents (71%) agreed that it is important to eat locally grown foods, and 62% are trying to choose plant-based options more often.

Table 6. *Weighted Percentages of How Likely Knowledge of Health Characteristics of Pulses Affects Their Consumption*

| Statement | Much less likely | Somewhat less likely | Would make no difference | Somewhat more likely | Much more likely |
|---|------------------|----------------------|--------------------------|----------------------|------------------|
| Pulses are very high in fibre (15g per cup) | 0.80 | 1.59 | 25.50 | 46.61 | 25.50 |
| Pulses have a low Glycemic Index (GI) | 1.59 | 3.19 | 35.86 | 38.65 | 20.72 |
| Pulses help reduce the risks of diabetes | 1.59 | 0.40 | 24.30 | 46.22 | 27.49 |
| Pulses help reduce the risks of heart disease | 1.20 | 1.20 | 19.12 | 48.61 | 29.88 |
| Pulses are high in vitamins and minerals | 0.40 | 0.40 | 15.60 | 48.00 | 35.60 |
| Pulses help control appetite | 0.80 | 3.61 | 22.49 | 38.55 | 34.54 |
| Pulses can help with weight control | 1.20 | 1.99 | 23.51 | 35.86 | 37.45 |
| Pulses are an affordable source of protein | 0.40 | 0.80 | 17.13 | 33.47 | 48.21 |

Table 7. *Weighted Percentages of Level of Agreement About Knowledge and Attitudes Towards Pulses Regarding Plant-Based, Locally Grown Foods, and Environmental Responsibility*

| | Strongly disagree | Some-what disagree | Neither agree nor disagree | Some-what agree | Strongly agree |
|--|-------------------|--------------------|----------------------------|-----------------|----------------|
| I am trying to choose plant-based options more often | 6.35 | 16.67 | 14.68 | 41.67 | 20.63 |
| It is important to eat locally grown foods | 2.79 | 5.58 | 20.32 | 43.82 | 27.49 |
| Environmentally sustainable agricultural practices influence my food purchases | 10.67 | 20.72 | 29.88 | 28.29 | 10.36 |
| I advocate for the protection and responsible use of the natural environment | 3.19 | 8.37 | 20.72 | 39.44 | 28.29 |

Multiple Linear Regression was conducted to determine how well we can predict the amount of pulses eaten in a typical week from environmental attitudes in four of the survey statements: environmentally sustainable agricultural practices influence my food purchases, pulse crops contribute to sustainable agriculture, pulse crops reduce greenhouse gases, and pulse crops improve soil health and reduce the need for fertilisers (see Table 8). It was found that the four independent variables as a group account for 9.2% ($R^2 = .092$) of the variance in the amount of pulses eaten in a week. These independent variables as a group are statistically significant predictors of the amount of pulses eaten in a week $F(4, 231) = 6.944, p < .001$; however, the fact that pulse crops contribute to sustainable agriculture contributes the most to this model.

Table 8. *Multiple Regression Analysis Summary for Predicting Amount of Pulses Consumed in a Week – Environmental Factors*

| Variable | Coefficients (<i>B</i>) | Standard error | Standardised coefficients (β) | Semi-partial correlations |
|--|------------------------------|-------------------|---|------------------------------|
| Pulse crops reduce greenhouse gases | 0.071 | 0.108 | 0.058 | .041 |
| Pulse crops improve soil health and reduce the need for fertilizers | -0.083 | 0.158 | -0.065 | -.033 |
| Pulse crops contribute to sustainable agriculture | 0.371* | 0.157 | 0.291 | .147 |
| Environmentally sustainable agricultural practices influence my food purchases | 0.082 | 0.062 | 0.093 | .083 |
| Constant | 1.154 | 0.351 | | |

Note. $R = .328$; adjusted $R^2 = .092$; $*p < .05$

Sixty-seven per cent of participants would be more likely to consume pulses because pulse crops reduce greenhouse gases, 71% would be more likely to consume

pulses because they improve soil health and reduce the need for fertilisers, and 71% also would be more likely to consume pulses because they contribute to sustainable agriculture (see Table 9).

Table 9. *Weighted Percentages of How Likely Knowledge of Environmental Characteristics of Pulses Affects Their Consumption*

| Statement | Much less likely | Somewhat less likely | Would make no difference | Somewhat more likely | Much more likely |
|---|------------------|----------------------|--------------------------|----------------------|------------------|
| Pulse crops reduce greenhouse gases | 0.81 | 1.61 | 31.05 | 38.31 | 28.23 |
| Pulse crops improve soil health and reduce the need for fertilisers | 0.81 | 0.40 | 28.23 | 42.34 | 28.23 |
| Pulse crops contribute to sustainable agriculture | 0.81 | 0.00 | 27.94 | 40.49 | 30.77 |
| Pulse crop production and consumption improves our local economy | 0.40 | 1.21 | 25.81 | 42.74 | 29.84 |

One-Way ANOVA tests were performed to determine whether students vary in the frequency of pulse consumption on each of three independent variables: main ethnic background, education level, and perceived body build. There was no significant difference among students from different ethnic backgrounds, $F(9, 251) = 1.530, p = .129$, or education levels, $F(6, 255) = 1.715, p = .118$. However, One-Way ANOVA tests provided evidence of a difference in the frequency of pulse consumption based on perceived body build $F(3, 257) = 3.712, p = .012$, with a Tukey post-hoc test revealing a statistically significant difference between the overweight and below average weight groups (MD = 0.665, $p = .016$) (see Table 10). These results demonstrated that the frequency of pulse consumption increased as the perceived body size declined.

Table 10. *Number and Means for Perceived Body Size Groups (Frequency)*

| Perceived Body Size | N | M | SD |
|----------------------|-----|------|------|
| Obese | 8 | 2.38 | .916 |
| Overweight | 53 | 3.06 | .886 |
| Average weight | 177 | 2.84 | .897 |
| Below average weight | 23 | 2.39 | .839 |
| Total | 261 | 2.83 | .904 |

A One-way ANOVA test was conducted including only three variables: overweight, average, and underweight $F(2, 236) = 1.566, p = .211$. Follow-up Tukey tests were conducted to evaluate pairwise differences among the group means. Tukey post-hoc tests revealed that there are no significant differences between overweight and average weight (MD = $-.202, p = .454$), overweight and below average weight (MD = $-.449, p = .196$), and average weight and below average weight (MD = $-.247, p = .522$).

Table 11. *Number and Means for Perceived Body Size Groups (Amount)*

| Perceived Body Size | N | M | SD |
|----------------------|-----|------|-------|
| Obese | 8 | 3.50 | 1.195 |
| Overweight | 47 | 2.64 | .987 |
| Average weight | 169 | 2.84 | 1.020 |
| Below average weight | 23 | 3.09 | 1.083 |
| Total | 247 | 2.85 | 1.039 |

Factor Analysis of Instrument

A factor analysis was used to determine if there were a number of factors underlying the results. Using the Maximum Likelihood procedure with Varimax rotation, the analysis yielded seven factors: 1- Environmental Benefits; 2 - Health Benefits; 3 - Purchasing and preparing foods; 4 - Locally grown/sustainable agriculture; 5 - Positive Qualities of Pulses; 6 - Health Concerns; and 7 - Social/traditional attitudes. These factors

explain a total of 44.342% of the variance for the entire set of variables (see Table 12).

The Cronbach's alpha for each factor is listed in Table 13.

Table 12. *Factor Loadings After Varimax Rotation^a*

| | Factor | | | | | | |
|---|--------|------|-------|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| I believe that eating pulses increases flatulence (gas) | -.139 | | | | | | |
| Pulse crops reduce greenhouse gases | .584 | | | | | | |
| Pulse crops improve soil health and reduce the need for fertilizers | .786 | | | | | | |
| Pulse crops contribute to sustainable agriculture | .861 | | | | | | |
| Pulse crop production and consumption improves our local economy | .569 | | | | | | |
| Pulses are very high in fibre (15g per cup) | | .372 | | | | | |
| Pulses have a low Glycemic Index (GI) | | .519 | | | | | |
| Pulses help reduce the risks of diabetes | | .922 | | | | | |
| Pulses help reduce the risks of heart disease | | .781 | | | | | |
| I know how to cook or prepare pulses | | | .819 | | | | |
| I know where to buy pulses | | | .600 | | | | |
| Pulses are nutritious | | | .442 | | | | |
| I am too busy to prepare pulses | | | -.391 | | | | |
| I believe pulses are inexpensive | | | .286 | | | | |
| I like to try out new or different types of foods or recipes | | | .399 | | | | |

| | Factor | | | | | | |
|--|--------|---|---|------|------|------|------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| I am trying to choose plant-based options more often | | | | .390 | | | |
| Environmentally sustainable agricultural practices influence my food purchases | | | | .687 | | | |
| I advocate for the protection and responsible use of the natural environment | | | | .579 | | | |
| It is important to eat locally grown foods | | | | .566 | | | |
| Pulses are high in vitamins and minerals | | | | | .438 | | |
| Pulses help control appetite | | | | | .747 | | |
| Pulses can help with weight control | | | | | .715 | | |
| Pulses are an affordable source of protein | | | | | .444 | | |
| I believe that eating pulses increases indigestion | | | | | | .101 | |
| I am concerned about weight control | | | | | | .903 | |
| I am concerned about managing/preventing diabetes | | | | | | .462 | |
| I usually look at nutritional labels when buying packaged foods | | | | | | .419 | |
| My perceptions of my body influences the foods that I eat | | | | | | .462 | |
| Pulses are part of my traditional diet | | | | | | | .446 |
| Pulses are available at restaurants | | | | | | | .230 |
| I would buy packaged pulse snacks | | | | | | | .481 |
| I like the taste of pulses | | | | | | | .575 |
| My family members like eating pulses | | | | | | | .426 |

| | Factor | | | | | | |
|--|--------|---|---|---|---|---|------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| My friends like eating pulses | | | | | | | .240 |
| My cultural identity affects my food choices | | | | | | | .205 |

^aRotation converged in eight iterations

Table 13. *Internal Consistency for Each Factor*

| Factor | Cronbach's alpha |
|---|------------------|
| 1 - Environmental Benefits | .690 |
| 2 - Health Benefits | .814 |
| 3 - Purchasing and preparing foods | .387 |
| 4 - Locally grown/sustainable agriculture | .729 |
| 5 - Positive Qualities of Pulses | .815 |
| 6 - Health Concerns | .615 |
| 7 - Social/traditional attitudes | .586 |
| Overall Cronbach's Alpha | .850 |

Missing Data

In order to see the patterns of missing data shown in the variables and to determine whether it was reasonable to consider randomness of missing data, *missing values analysis* was conducted on the non-demographic responses. The results revealed that there were eleven different patterns of missing data. The most common pattern was one with no missing data, which was the pattern in over 94% of the responses.

Overall, the survey questions with the most commonly skipped responses were those at the end of the survey, suggesting that the data is not missing at random but rather as a result of participants leaving the survey or skipping through questions the farther along they progressed (see Table 14).

Table 14. *Variable Summary of Missing Data*

| | Missing | | Valid N |
|--|---------|---------|---------|
| | N | Percent | |
| Pulse crops contribute to sustainable agriculture: | 21 | 7.8% | 247 |
| Pulse crop production and consumption improves our local economy: | 20 | 7.5% | 248 |
| Pulse crops improve soil health and reduce the need for fertilisers: | 20 | 7.5% | 248 |
| Pulse crops reduce greenhouse gases: | 20 | 7.5% | 248 |
| Pulses help control appetite: | 19 | 7.1% | 249 |
| Pulses are high in vitamins and minerals: | 18 | 6.7% | 250 |
| Pulses are an affordable source of protein: | 17 | 6.3% | 251 |
| Pulses can help with weight control: | 17 | 6.3% | 251 |
| Pulses help reduce the risks of heart disease: | 17 | 6.3% | 251 |
| Pulses help reduce the risks of diabetes: | 17 | 6.3% | 251 |
| Pulses have a low Glycemic Index (GI) (i.e. control spikes in blood sugar and insulin after eating): | 17 | 6.3% | 251 |
| Pulses are very high in fibre (15g per cup): | 17 | 6.3% | 251 |
| My perceptions of my body influences the foods that I eat: | 17 | 6.3% | 251 |
| My cultural identity affects my food choices: | 17 | 6.3% | 251 |
| It is important to eat locally grown foods: | 17 | 6.3% | 251 |
| I advocate for the protection and responsible use of the natural environment: | 17 | 6.3% | 251 |
| Environmentally sustainable agricultural practices influence my food purchases: | 17 | 6.3% | 251 |
| I am concerned about weight control: | 16 | 6.0% | 252 |
| I am trying to choose plant-based options more often: | 16 | 6.0% | 252 |
| I like to try out new or different types of foods or recipes: | 15 | 5.6% | 253 |
| I usually look at nutritional labels when buying packaged foods: | 15 | 5.6% | 253 |
| I am concerned about managing/preventing diabetes: | 15 | 5.6% | 253 |
| I believe pulses are inexpensive: | 14 | 5.2% | 254 |

CHAPTER V: Discussion

This research has focused on university students as end consumers of pulses and how their attitudes can potentially motivate changes in behaviour towards increasing pulse consumption. It was predicted that a lack of knowledge of how to prepare pulses would be the largest barrier to consumption within this population. However, 62% of participants indicated that they knew how to cook or prepare pulses. This suggests that most individuals know how to cook pulses, although they may choose not to do so. In addition, 58% agree that pulses are available at restaurants and 54% would buy packaged pulse snacks, indicating that purchasing ready-to-eat pulses is clearly seen as an option for many individuals.

As many participants were concerned about weight control (71%) and were trying to choose more plant-based options (62%), increased consumption of pulses could be seen as being viewed as beneficial among this group since meals based on beans and peas have been found to be more satiating than meals based on animal protein sources (Kristensen et al., 2016).

Comparisons of the Results to Previous Studies

Overall, a positive attitude towards pulses can be seen in the responses, with the majority of participants recognising the nutritional and environmental benefits that can be provided by pulses. Perceived health benefits motivate individuals to consume pulses, as found in the current study and in previous studies in Australia and Canada (Lea et al., 2005; Phillips et al., 2015). Among Australian individuals in focus groups that included university students, the top motivator to consuming plant foods such as legumes/pulses was perceived health benefits (Lea et al., 2005), and 84% of Canadian individuals were

found to associate lentils with health benefits (Phillips et al., 2015). This is comparable to the current study that found 85% of participants are more likely to consume pulses because they contain a high amount of vitamins and minerals, 72% of participants are more likely to consume pulses because they are high in fibre, 74% are more likely to consume pulses because they reduce the risk of diabetes, and 78% are more likely to consume pulses because they reduce the risk of heart disease.

Results from the current study suggest that participants also widely recognise that pulses are not cost prohibitive. Fewer than 3% of respondents strongly disagreed with pulses being inexpensive, which is the same percentage of participants that Phillips et al. (2015) reported as believing lentils would be expensive to add to meals.

Participants in the current study consumed lentils less often than other more popular pulses such as chickpeas, black beans, and kidney beans. This corresponds to the results found in a previous Canadian study that showed lentils being the least consumed pulses among Canadians (Ipsos Reid, 2010).

A recent Brazilian study found that individuals with a low or normal Body Mass Index consumed the most beans (Velásquez-Meléndez et al., 2012). The current study shows similar results to the study in Brazil, as the amount of pulses consumed in a week in the present study was a statistically significant predictor of perceived body size (i.e. obese, overweight, average weight, underweight) among university students. However, it is important to acknowledge that participants in the present study self-reported their perceived body size, while the Brazilian study had participants self-report their height and weight, with the BMI calculated by the researchers, which could impact the strength of the comparison.

Although similarities were found between findings within the current study and in previous pulse studies, certain findings from the current study do not correspond to results previously reported in the literature. Firstly, chickpeas and black beans were the two types of pulses most commonly consumed by participants in the current study. These two types were previously found to be favoured by individuals in the highest income bracket in the United States (Lucier et al., 2000). However, the current study showed that students in the lowest household income group (less than \$20,000) were consuming chickpeas and black beans just as much as those with the highest household incomes (over \$100,000), with 71% of individuals in both groups favouring these types of beans. Additionally, Lucier et al. (2000) found that the lowest income individuals in the United States typically consumed pinto beans, but approximately the same percentage of participants in the current study consumed pinto beans in the lowest and highest income brackets, at 11% and 10%, respectively. In the United States, people of Hispanic origin are the leading consumers of pinto beans (Lucier et al., 2000), thus, the significantly lower number of Hispanics in Lethbridge compared to that of many centres in the United States likely affected these results, due to a lower sample size from this ethnic group. In 2016, 17.8% of the population in the United States identified as Hispanic or Latino (United States Census Bureau, 2016), compared to 2.7% of participants in this study and 2.3% of Lethbridge residents identifying with Latin, Central and South American origins (Statistics Canada, 2016).

Secondly, Ipsos Reid (2010) reported that 43% of Canadian survey respondents indicated that they do not eat pulses because they do not like them, and Lea et al. (2005) suggest that a lack of knowledge on how to prepare pulses so that they taste good was a top barrier to consumption in Australia. Results from those two studies are significantly

different than the results from the current study, which showed that only 9% of participants do not like the taste of pulses.

Due to the homogeneity of participants in this sample, it is difficult to determine whether certain demographic factors such as ethnic background impact pulse consumption in these students. The majority of participants are not affiliated with an ethnic background that typically eats a large amount of pulses – such as Hispanic or South Asian – therefore, it is difficult to determine whether the ethnic background strongly affects consumption within this particular group, as results from the present study demonstrated that it does not $F(9, 251) = 1.530, p = .129$.

In addition to ethnic background potentially affecting overall levels of pulse consumption, living in a rural or urban location has also been found to play a role. The amount of pulses consumed has been found to be higher in rural areas, as found in studies in both Tanzania (Mfikwa & Kilima, 2014) and Latin America (Leterme & Carmenza Muñoz, 2002). While it is likely that Tanzania and Latin America have different socio-demographic and geographical contexts than other parts of the world, it could be assumed that rurality may play a role in pulse consumption in Canada. The current survey found that only about 11% of the participants were from a city/town with a population under 50,000 (see Table 1), and these lower numbers make it difficult to determine whether rurality has an impact on the amount of pulses consumed within this population, as the difference in the amount of pulses consumed by those living in rural and non-rural locations was not statistically significant $t(246) = -.553, p = .581$.

Association with Diabetes Management and Prevention

Six per cent of University of Lethbridge students in this sample eat pulses daily, which is lower than the 13% of the Canadian population consuming pulses on a daily basis as reported by Ramdath et al. (2016). Additionally, just 5% of participants ate more than three cups of pulses per week. Consuming pulses is recommended for both the prevention and management of diabetes. The fibre content of half a cup per day of yellow peas was found to improve diabetes risk factors by reducing fasting insulin concentrations and markers of insulin resistance independent of food and energy intake (Marinangeli & Jones, 2011), and it has been suggested that individuals with type 2 diabetes should have two-thirds of a cup of pulses per day to manage hyperlipidemia (Ramdath et al., 2016). This amount works out to nearly five cups per week, which is significantly higher than the amount consumed by most respondents in this survey, and much higher than the estimated median consumption of cooked pulses among Canadians which is 1.0 cup per week, and 2.5 cups per week among Canadian South Asian immigrants (Ipsos Reid, 2010). However, 74% of participants in the present survey said that they were more likely to consume pulses because they help reduce the risks of diabetes and 23% of participants agreed that they are concerned about preventing or managing diabetes. Although the majority seemed to be aware and concerned about the effects that diet can have on diabetes prevention and management, they are not currently putting that knowledge into practice by incorporating high levels of pulses into their diets.

Pro-Environmental Attitudes

The attitudes revealed in the survey results on sustainable agriculture and local foods demonstrate the participants' orientation to the importance of environmental

practices. The survey included four questions about the environment to determine whether perceptions and knowledge of the environmental benefits of pulses would impact whether participants would be likely to eat them based on these benefits. The four independent variables as a group were a statistically significant predictor of the amount of pulses eaten in a week. Although only agreement with the sustainable agriculture statement statistically predicted consumption.

The participants' academic disciplines were intentionally examined in this study as previous findings suggested that disciplines may influence pro-environmental behaviour (Talay, Gündüz, & Akpınar, 2004). Rodríguez-Barreiro et al. (2013) suggest that environmental education is directly tied to pro-environmental behaviours, and although it is not clear whether the participants in the current study had an environmental science or related background, 35% had an academic discipline in the sciences, suggesting that this group of participants could favour more pro-environmental behaviours. However, this suggestion was not supported by the results, as having an academic discipline in the sciences was not linked to the amount of pulses consumed ($p = .046$) or to environmental variables $F(4, 242) = .637, p = .637$.

The results of this study also provided evidence about different socio-demographic variables, which have an apparent influence pro-environmental behaviour (Vicente-Molina, Fernández-Sáinz, & Izagirre-Olaizola, 2013). However, the actual causality between environmental knowledge and behaviour is difficult to measure (Dagiliūtė & Niaura, 2014), as behaviour may be determined by factors such as age (Zsóka, Szerényi, Széchy, & Kocsis, 2013), culture, gender, and motivation (Vicente-Molina, et al., 2013). Results of the present study did not reveal statistically significant differences between socio-demographic/socioeconomic variables such as annual

household income ($p = .166$), age ($\tau_b = -.078$, $p = .115$ (2-tailed)), ethnic background ($F(9, 251) = 1.530$, $p = .129$), or education level ($F(6, 255) = 1.715$, $p = .118$) on pulse consumption in this population, which differs from previous study findings that demonstrated a link between pulse consumption and ethnic background (Lucier et al., 2000), education level (Mfikwa & Kilima, 2014), and annual household income (Leterme & Carmenza Muñoz, 2002; Lucier et al., 2000).

Limitations

The main limitation to this design is that the primary variables were self-reported; therefore, there is a potential for response bias and social desirability bias. Volunteer bias also appears to be evident, as demonstrated in the high rate of response by female participants. Results showed that 77% of the participants were female even though females comprise 59% of the University of Lethbridge student body.

Additionally, as this study only examined students who are enrolled at the University of Lethbridge, it is not representative of the general population, and results may not be generalisable to university students across Canada. University students have a higher level of literacy compared with that of other groups in the general population, which may also affect the generalisability of the study to less literate populations. However, the findings could lay the groundwork for future investigations concerning factors influencing pulse consumption in dissimilar populations.

The use of a new survey tool is also a potential limitation. The tool used was not previously validated, however, this is counterbalanced by the use of elements from previous surveys (Ipsos Reid, 2010; Phillips et al., 2015), and performing the factor analyses, which demonstrated the survey questions grouped into seven factors, with

strong overall internal consistency (Cronbach alpha- 0.85) and good Cronbach alphas for all but two factors..

Finally, being a novice researcher is another limitation of this research study; however, advice from my thesis supervisor and committee members has served as a way to counterbalance this limitation. Although there are a number of limitations, providing participants with an incentive to complete the survey likely helped to improve the response rate, which may have resulted in a larger and more diverse sample. Nonetheless, it is important to recognise that the participants included in the study were not a random sample, which would have presented a greater chance of minimising sampling error.

Recommendations

The intent of this study was to understand the barriers and motivators of pulse consumption among university students, with the goal of making recommendations on ways to work towards increasing pulse consumption among this population. The importance of understanding the attitudes and behaviours of university students towards pulse crops' impact on health and the environment and of finding ways to influence this behaviour through education is critical to create a positive change in consumption. These results could be used to create age-targeted educational campaigns focusing on addressing the misconceptions or lack of knowledge of pulse crops. Ultimately, this study can further aid in informing efforts to increase pulse consumption in Canada, which could support efforts to the solution of sustainable land use, environmentally conscious practices, and improving health in Canada.

The economic benefits of increased pulse consumption also cannot be overlooked as university students often have limited food budgets and may be seeking cost-effective,

yet nutrient-rich foods. Publicising the fact that pulses can be easily prepared and stored can be one way to promote the use of them in meals. As pulses can be purchased dried, canned, or frozen, they are convenient to store for long periods of time, and can be easily cooked in the microwave or on the stovetop, which can be of beneficial for students who may be living in shared accommodations or in on-campus residences. Educating students about the convenience of pulses could potentially increase their appeal among this population.

In particular, males would be a good market to target in order to increase the overall quantity of pulses consumed by university students because they typically have higher overall caloric requirements than females. The estimated energy requirements for an active-level male in the 19-30 year-old age range is 3000 calories per day, while it is just 2350 for females in the same age range (Government of Canada, 2011). This suggests that males have the potential to add more servings of pulses to their diets to meet their daily caloric requirements.

Conducting this study has raised awareness of the contribution of pulse crops to healthy, balanced diets and sustainable food production. Having 3% of the student body participate in this online survey has already increased students' exposure to beneficial characteristics of pulses, which had the potential to increase their familiarity and knowledge. Educating students on the nutritional benefits of pulses can be an important component of improving their dietary habits. To further increase their knowledge of pulses' health and environmental benefits, resources such as recipes and information pamphlets could be made available at various locations around campus. The University of Lethbridge Health Centre, Student Success Centre, Iniskim Services, and Campus Women's Centre could be areas to target in getting this information into the hands of

students to promote the benefits of eating pulses. Pamphlets could include how to cook dry pulses, or recipes that use ready-to-eat pulses such as canned chickpeas or lentils, both of which are inexpensive and easy ways to incorporate more protein and fibre into one's diet.

The majority of the study participants are at a stage in their lives where they are forming identities and solidifying the foundations of personal beliefs and attitudes, and it has been suggested that a change of habit at this age can make a significant improvement to their personal health over many years (Vermeir & Verbeke, 2008). To potentially increase pulse consumption we can emphasize motivating factors that were revealed in the survey results. These factors included that pulses:

- are high in vitamins and minerals (84%);
- are an affordable source of protein (82%);
- help with weight control and controlling appetites (73%);
- are high in fibre (72%);
- improve soil health and reduce the need for fertilisers (71%); and
- contribute to sustainable agriculture (71%).

The percentages shown above demonstrate the likelihood of participants to consume pulses based on that factor. It may be possible to influence pulse consumption by targeting students' interests by presenting these motivating factors in a way that will appeal to them. Providing knowledge of the benefits of pulses that are in line with the most important benefits found in this study's results is not only important for increasing the consumption of pulses but increased consumption may also influence overall pulse production, which may in turn lead to improving the environment and boosting the local agricultural sector.

Future research could look at encouraging university students to incorporate more pulses into their diets to determine what might make pulses easier to access or more appealing to eat. If the university community works to enable choice then students will be afforded the opportunity to purchase pulses easily on campus. Not only would enabling choice be beneficial to increasing pulse consumption, but guiding choices could also contribute. On-campus food establishments could guide choices by changing default policies in various ways, such as by offering pulses as the standard side dish rather than fries, so that the default option is the healthier option. Additionally, targeted labelling on food products to highlight their nutritional and environmental benefits is another way to have them showcased, as 69% of participants reported that they looked at nutritional labels, and 68% advocated for the protection and responsible use of the natural environment. Using simple language, packaging could say things like “Locally grown” or “Grown on the Canadian Prairies” to entice consumers to purchase pulses as many students are concerned about buying foods that are grown locally as an attempt to reduce their carbon footprints and support the local economy.

Given that this study focused on students’ perceptions and attitudes towards pulses and their characteristics, the findings may be useful when creating advertising campaigns targeting this specific population. Targeted marketing could be most impactful as this market segment is both the current and future consumer of pulse crops. Such advertising campaigns could help students become better at being able to manage their health, which could be addressed by adopting habits that could increase the overall consumption of pulses in their diets.

New students living in the majority of residence units at the University of Lethbridge are enrolled in a mandatory dining plan, in which the funds can be used at

several specified dining locations on campus. If the dining locations at which the students have to eat provide more bean and lentil options, the students could be more likely to purchase and eat them. With many students being required to purchase much of their food on campus, providing information to food establishments at the university could potentially increase the availability of pulses for purchase on campus. Information brochures could be distributed to the eating establishments about students' preference towards healthy foods and attitudes about various pulse characteristics. If these eating establishments knew that the majority of students like the taste of pulses and are interested in purchasing pulse snack products, they may be more likely to add pulses to their menu items. This information could help the staff at the on-campus food establishments to increase their confidence in the preparation and popularity of pulse-based foods, which could in turn make pulses more likely to appear on the menus, thus placing pulses within a typical student meal plan. The introduction of more pulse based food products on campus has the potential for consumer appeal and increased communication of the health benefits of pulses. As pulse crops are grown within Alberta, the idea of increasing pulse consumption among students – and within the community in general – could resonate with local restaurant proprietors as they too have a vested interest in the regional economy due to their roles as local business owners. The food establishments can situate themselves as part of a sustainable food system that supports the local community and producers, without placing excessive drain on environmental and economic resources.

Looking to influence at a larger scale into the broader community outside of university students, the government can work to guide choice through incentives by offering fiscal or other incentives for individuals to purchase pulses, by ensuring

affordable prices for pulses in grocery stores or offering coupons/rebates. Food choices can often be attributed to characteristics such as convenience, cost, taste, and ethics. Given that 71% of the present study's participants indicated that it is important to eat locally grown foods and 39% indicated that environmentally sustainable agricultural practices influenced their food purchases, if pulse food packaging showcased that pulse crops can contribute to sustainable agriculture and support the local economy then consumers may have more incentives to purchase them.

Research conducted, such as in the present study, can play an integral role in creating evidence-based solutions that can be put into practice by government agencies and food industry organisations. By addressing some of the gaps in knowledge, opportunities can be created to increase pulse consumption. Increasing the amount of pulses purchased and eaten by current pulse consumers, as well as engaging new consumers, will be essential for increasing the overall consumption of pulses in Canada.

These findings also support the potential for new pulse-based products to enter the market. It is important that innovative pulse products, such as ready-to-eat snacks, be created in order to meet the current food market demands of the modern-day consumer. Consumers in general, but particularly students who often have hectic schedules, could benefit from having readily available, packaged foods that can be easily taken to work/school or quickly eaten at home.

The study revealed that the majority of participants indicated that they were aware of how to cook pulses, and had knowledge of pulses' nutritional, health, and environmental benefits. Despite this knowledge, the findings suggest that this knowledge is not being translated into practice by resulting in a larger consumption of pulses. Future research could look at ways to determine how the knowledge of pulse benefits and

characteristics can best be used to entice students, and the general population, to add more pulses into their diets.

Dissemination

The publication of this thesis is the initial stage of research dissemination. Results may further be shared with organisations including, but not limited to, Alberta Pulse Growers, Pulse Canada, Alberta Agriculture and Forestry, and Alberta Health. Creating a policy brief to summarise the issues and make recommendations to policymakers will be another method used to attempt to raise awareness on the factors influencing pulse consumption among university students. Submitting articles to journals such as *The Crop Journal*, *Journal of Food Research*, *Canadian Food Studies*, *CuiZine: The Journal of Canadian Food Cultures*, and *Journal of Functional Foods* will also be a method of disseminating the findings from this study. In addition, results of the study may be presented at Canadian Seed Trade Association meetings and conferences such as the Farmer Smarter and Cypress conferences in Alberta, and the Grow Canada Conference, and Canadian Association for Food Studies Conference. Finally, relevant findings will be presented to on-campus food establishments both in-person and in an informational brochure.

Conclusion

The current study provides preliminary evidence about university students' motivations for and against eating pulses. Based on the current study's findings, university students may be more motivated to consume pulses because of various health and environmental benefits. Vegetable proteins are the most economical source of protein that, as shown in the present study, can be affordable for consumers in all annual

household income brackets. By introducing more affordable food choices, students can play a role in improving agricultural production systems and moving towards a more food secure world.

Previous research indicated that taste is a major barrier in pulse consumption (Ipsos Reid, 2010; Lea et al., 2005) but results in the present study demonstrated that just 9% of participants indicated that taste was a barrier. This is an important result, as one of the main barriers to consumption is simply not seen in these participants, revealing that this population would likely be receptive to the idea of consuming more pulses. Additionally, participants consumed chickpeas and black beans across all income ranges in the present study, whereas these two types of beans were previously found to be consumed more frequently among those in higher income brackets (Lucier et al., 2000). Offering these types of popular pulses at university food establishments would be a good strategy for potentially increasing overall pulse consumption.

The results highlight the impact of gender and perceived body size on pulse consumption, and the importance of health and environmental benefits that pulse crop production and consumption may provide. Results are more applicable to the female population because the participants were primarily female (77%). These findings help to fill a gap in the literature by exploring factors influencing pulse consumption specifically among university students and within this population by placing a focus on positive environmental benefits of pulse crops, which had previously not been explored.

This study presents several findings that suggest some possible ways in which we can increase pulse consumption among university students, as their attitudes seem to be receptive to implementing the inclusion of more pulses in their diets because of the health and environmental benefits. An increase in the knowledge of the environmental

significance of pulse crops could potentially motivate students to adopt dietary changes, which can help mitigate the present impact that the current food system has on the environment, as well as bring about a number of improvements to health.

An increase in pulse consumption can boost the social and physical environment by enhancing population health, reducing grocery costs, improving environmental conditions, and boosting the local agricultural sector. These analyses further confirm the importance of health and environmental factors among university students, and also highlight the potential benefits of promoting increased consumption of pulses among this population. If more individuals adopt a diet that includes high levels of pulses, the public health benefits and environmental benefits could improve overall population health.

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Appendix A – Recruitment Poster

PARTICIPANTS NEEDED FOR RESEARCH ON KNOWLEDGE AND CONSUMPTION LEVELS OF LENTILS, BEANS, and PEAS (PULSE CROPS)

I am looking for volunteers to take part in a study of *factors influencing consumption of lentils, beans, and dry beans (pulses) among students at the University of Lethbridge.*

You would be asked to complete an online survey that will take approximately 10 minutes to complete.

Participation is anonymous and confidential. You must be a University of Lethbridge student and 18 years or older to participate in this survey.

In appreciation for your time, you will have the opportunity to **enter a draw to receive one of three \$50 cash prizes.**

To complete the survey, visit:
<http://scholar.ulethbridge.ca/km>



For more information about this study please contact:

Kristie Masuda

Faculty of Health Sciences

Phone: 403-329-2674 or Email: *kristie.masuda@uleth.ca*

This study has been reviewed for ethical acceptability and approved by the University of Lethbridge Human Subject Research Committee.

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Appendix B – Letter of Invitation and Consent Form



Letter of Invitation: Online Survey

Please read the following letter of information carefully before beginning the survey:

Principal Investigator: Kristie Masuda, Faculty of Health Sciences, University of Lethbridge

What is this study about? You are invited to participate in an anonymous online survey of students at the University of Lethbridge. This is a research study of the knowledge and consumption levels of beans, lentils, and dry peas (pulse crops). Through your participation, I hope to better understand the factors influencing pulse consumption among university students in southern Alberta. This invitation to participate is being extended to all students at the University of Lethbridge. You must be a University of Lethbridge student and 18 years or older to participate in this survey

What is expected of you? The will take approximately ten minutes to complete. You will be asked to respond to demographic questions and statements asking you how accurate they are or how much you agree with them.

What are the anticipated uses of the data collected? The responses to the survey will be analysed and presented in a thesis in aggregate form. The findings may also be published in scholarly presentations and publications.

What are the risks and benefits of participating? There are no anticipated risks from participating in this study. However, if you experience food insecurity then answering survey questions about eating and food-purchasing habits could cause distress or discomfort. If you feel uncomfortable as a result of this survey, contact information for Counselling Services at the University of Lethbridge can be found at the end of the survey.

How will your confidentiality and anonymity be protected? Participation is voluntary and your responses will not be identified with you personally as the survey collects no identifying information; however, as with any online survey, neither anonymity nor confidentiality can be completely guaranteed. The survey is being hosted by Qualtrics and their privacy policy can be accessed at <https://www.qualtrics.com/privacy-statement>. The responses to this survey will be kept on a restricted password-protected computer, and will be deleted two years after data collection has been completed.

At the end of the survey, you will have the opportunity to enter into the draw to win one of three \$50 cash prizes. The draw entry form is entirely separate from the survey and your name and email address will be used only for the draw, and will then be destroyed. The odds of winning are estimated to be 1 in 33.

How can a participant withdraw? Your participation is completely voluntary. You may withdraw your participation at any time without penalty or loss of benefits to which you

are otherwise entitled by simply closing your browser before you submit your responses and they will not be included. If you choose to discontinue participation after you have submitted your responses, it will not be possible to withdraw your responses because they will not have identifying information linked to them.

Who is conducting this research? For more information on this study or for a summary of the findings, you may contact me at kristie.masuda@uleth.ca or my supervisor Dr. Peter Kellett at peter.kellett@uleth.ca. Questions regarding your rights as a participant in this research may be addressed to the Office of Research Ethics, University of Lethbridge (Phone: 403-329-2747 or Email: research.services@uleth.ca).

This research study has been reviewed for ethical acceptability and approved by the University of Lethbridge Human Subject Research Committee.

If you wish to participate, please proceed to the questions now by click on the arrow below. Submission of your responses will be accepted as implied consent to participate. Thank you in advance for your participation.

Appendix C – Survey Questions

Gender:

- Female (1)
- Male (2)
- Other (3)

Age:

Marital status:

- Single (1)
- Married/Common law (2)
- Separated/Divorced (3)
- Widowed (4)
- Other (5) _____

Employment status (select all that apply):

- Part-time employment (1)
- Full-time employment (2)
- Full-time student (7)
- Part-time student (6)
- Unemployed (3)
- Retired (4)
- Other (5) _____

Education level:

- Some high school (1)
- Completed high school (2)
- Some post-secondary (college or university) (3)
- Completed college/technical school program (4)
- Completed undergraduate degree program (5)
- Completed graduate degree program (6)
- Other (7) _____
- Prefer not to say (8)

Current academic discipline:

- Education (1)
- Fine Arts (2)
- Health Sciences (3)
- Humanities (4)
- Management (5)
- Sciences (6)
- Social Sciences (7)
- Other (8)

Annual household income:

- Less than \$20,000 (1)
- \$20,000-\$39,999 (2)
- \$40,000-\$59,000 (3)
- \$60,000-\$79,000 (4)
- \$80,000-\$99,000 (5)
- \$100,000-\$149,000 (6)
- More than \$150,000 (7)
- Don't know (8)
- Prefer not to say (9)

Number of people in your household:

What is the main ethnic background of your ancestors?

- Indigenous North American (1)
- British or Irish (2)
- Continental European (3)
- West Indian/Caribbean (4)
- Latin, Central, or South American (5)
- East or Southeast Asian (6)
- South Asian (7)
- West Central Asian or Middle Eastern (8)
- African (9)
- Oceanian (10)
- Other (11) _____
- Don't know (12)

Population size of current city/town (Lethbridge has a population of 98,198):

- Less than 1,000 (1)
- 1,000-4,999 (2)
- 5,000-14,999 (3)
- 15,000-34,999 (4)
- 35,000-49,999 (5)
- 50,000-99,999 (6)
- 100,000-199,999 (7)
- 200,000-499,999 (8)
- 500,000-999,999 (9)
- Over 1,000,000 (10)
- Don't know (11)

Please select a diet in which you most commonly follow (select all that apply):

- Omnivore (I eat everything) (1)
- Vegetarian (I don't eat meat) (2)
- Vegan (I don't eat meat, dairy, or eggs) (3)
- Pescatarian (I don't eat meat but I eat fish) (4)
- Celiac (5)
- Diabetic (6)
- Gluten-sensitive (7)
- Other specialised diet (8)
- Prefer not to say (9)

For your height and weight, would you say you are:

- Obese (1)
- Overweight (2)
- Average weight (3)
- Below average weight (4)
- Prefer not to say (5)

Chickpeas, lentils, and dry beans and peas are collectively known as pulses. Common dishes that contain pulses include: chili, curries, refried beans, hummus, salads, burgers, soups, and stews.



Please use this information to help you answer the following questions.

How often do you eat pulses?

- Daily (1)
- 4 or more times per week (2)
- 1-3 times per month (3)
- Less than once a month (4)
- Never (5)

[Skip to *What type of pulses do you most commonly eat?* if *How often do you eat pulses?* = Never]

Where do you normally buy your pulses?

- Regular grocery store or supermarket (1)
- Speciality store (e.g. organic, bulk, or health food store) (2)
- Ethnic grocery store (3)
- Other (4)
- I do not buy pulses (5)



1 cup



1/2 cup



1/4 cup

In a typical week, approximately how many cups of prepared pulses do you eat?

- None (1)
- Less than 1/4 cup (2)
- About 1/4 cup to slightly less than 1 cup (3)
- About 1 cup to slightly less than 3 cups (4)
- More than 3 cups (5)

What type of pulses do you most commonly eat? (select all that apply)

- Chickpeas (1)
- Black beans (2)
- Red lentils (3)
- Brown lentils (4)
- Split peas (5)
- Pinto beans (6)
- Kidney beans (7)
- Other (8)

Please indicate your agreement or disagreement with the following statements:

- **I know how to cook or prepare pulses:**
 - **I know where to buy pulses:**
 - **Pulses are nutritious:**
 - **I am too busy to prepare pulses:**
 - **Pulses are part of my traditional diet:**
 - **I believe pulses are inexpensive:**
 - **Pulses are available at restaurants:**
 - **I would buy packaged pulse snacks:**
 - **I like the taste of pulses:**
 - **My family members like eating pulses:**
 - **My friends like eating pulses:**
 - **I believe that eating pulses increases indigestion:**
 - **I believe that eating pulses increases flatulence (gas):**
 - **I am trying to choose plant-based options more often:**
 - **I am concerned about weight control:**
 - **I am concerned about managing/preventing diabetes:**
 - **I usually look at nutritional labels when buying packaged foods:**
 - **I like to try out new or different types of foods or recipes:**
 - **Environmentally sustainable agricultural practices influence my food purchases:**
 - **I advocate for the protection and responsible use of the natural environment:**
 - **It is important to eat locally grown foods:**
 - **My cultural identity affects my food choices:**
 - **My perceptions of my body influence foods I eat:**
- Strongly disagree (1)
 - Somewhat disagree (2)
 - Neither agree nor disagree (3)
 - Somewhat agree (4)
 - Strongly agree (5)

The following sections list facts about pulses. Please indicate if knowing this information about pulses makes you more likely or less likely to eat them.

- **Pulses are very high in fibre (15g per cup):**
 - Much less likely (1)
 - Somewhat less likely (2)
 - Would make no difference (3)
 - Somewhat more likely (4)
 - Much more likely (5)
- **Pulses have a low Glycemic Index (GI):**
- **Pulses help reduce the risks of diabetes:**
- **Pulses help reduce the risks of heart disease:**
- **Pulses are high in vitamins and minerals:**
- **Pulses help control appetite:**
- **Pulses can help with weight control:**
- **Pulses are an affordable source of protein:**
- **Pulse crops reduce greenhouse gases:**
- **Pulse crops improve soil health and reduce the need for fertilisers:**
- **Pulse crops contribute to sustainable agriculture:**
- **Pulse crop production and consumption improves our local economy:**