Knowledge, attitude, practice, and barrier to pulses consumption among elementary school students of Saskatoon, Saskatchewan

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Abstract

The prevalence of overweight and obesity has risen among children and adolescents in Canada since late 1970s. Although there has been a declining rate in obesity among children over the last few years, the disease burden associated with childhood obesity is still a concern. Intake of greater amount of high fat, high salt, and high sugar is one of the reasons for increasing obesity and overweight among children. Research supports that as a part of healthy diet, pulses can be beneficial for weight management and may reduce obesity among young generation as they contain low fat and high protein which is one of the solutions for achieving healthy weight. Considering the nutrient content of pulses, the researchers from the College of Pharmacy and Nutrition, University of Saskatchewan carefully designed Pulse Makes Perfect Sense (PMPS)- a pulse-based nutrition education intervention targeting the grade 4-8 students. The purpose of this study was to provide baseline information of the students participating PMPS intervention with regard to self-reported knowledge, attitude, practice and barrier to pulses consumption.

A cross-sectional study was conducted in four Saskatoon schools randomly selected from a pool of schools that receive CHEP (Children Hunger and Education Program) Good Food Inc. provided lunch through their "Centralized Kitchen" program. Self-administered questionnaire was used to capture knowledge, attitude, practice, and barrier to pulses consumption from 247 students of grade 4-8, between ages 9 to 14 years. Approximately 48% participants were female and 47% were male. The remaining 5% choose not to report their gender. Half (50%) of the students correctly answered 10 out of 15 knowledge questions. Mean knowledge score was significantly higher in female than male students ($p<.001$). Although not significant, similar differences were observed in pulse consumption and attitude scores. The study did not find any association between higher knowledge score and pulse consumption. However, significant positive correlation was found between knowledge and attitude ($r=0.241$, $p<.001$), and pulses consumption and attitude ($r=0.376$, $p<.001$). Majority of the students (74.9%) believe that pulses are healthy food for growth and development of body. Furthermore, two thirds (64.4%) of the students conceded that they would eat pulses if their parents had served pulse-based dishes and about the same proportion (63.2%) of students believed that parents' encouragement would make them eating pulses. Preference of other foods over pulses appeared as a barrier for not eating pulses reported by most of the students (30.8%). No significant difference in knowledge, attitude, practice and barrier was found between schools, grades and age groups of the students.

This study was important because, to our knowledge, limited information was available in the literature around child-reported knowledge, practice, attitude, and barriers to pulses consumption. The information generated from this study can fill this evidence gap and may contribute in designing of interventions to promote healthy eating practice among children. Also, the questionnaire developed for this study could serve as the basis for designing future research tools.

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Dedication

I dedicate this thesis to my mother, Noor Sayeda Rahman and father, Abdul Khaleque, without whose endless support, care, love, generosity and patience, I would not be the person I am.

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List of Acronyms & Abbreviations

ANOVA	Analysis of Variance
Beh-REB	Behavioral Research Ethics Board
BFL	Breakfast for Learning
BMI	Body Mass Index
CHEP	Children Hunger and Education Program
FAO	Food and Agriculture Organization
FFT	Food for thought
FTCC	Farm to Cafeteria Canada
HOPS	Healthier Options for Public School
KAP	Knowledge, Attitude, and Practice
LDL	Low Density Lipoprotein
MMI	Milk and milk alternatives
NSLP	National School Lunch Program
PCS	Pulse Consumption Screener
PDTK	Pulse Discovery Tool Kit
PFQ	Pulse frequency questionnaire
PMPS	Pulse Makes Perfect Sense
Pre-K-12	Pre-school- kindergarten- Grade 12
Se	Serum
SFFQ	Short food frequency questionnaire
SHCP	Shaping Healthy Choice Program
SLHDP	Sandy Lake Health and Diabetes Prevention
SPSD	Saskatoon Public School Division
SPSS	Statistical Package for Social Science
UIN	Unique identification number
USA	United States of America
Zn	Zinc
WHO	World Health Organization

1. BACKGROUND

1.1 Obesity trend and associated disease burden in Canada

Over the last few years, the eating pattern of the children of the western world has changed into intake of greater amount of high fat, high salt and high sugar resulting in childhood and adult obesity and associated disease burden (Stevenson, Doherty, Barnett, Muldoon, & Trew, 2007). Increasing the availability of energy-dense food, and the marketing of such food to children is one of the major factors in changing the food habit (Stevenson et al., 2007).

Canada is also showing similar change in eating pattern since last decade with unhealthy dietary intake increasing among children and youth. During 90's, soft drink consumption increased among student of sixth to eight grades whereas vegetable consumption was reduced (Winson, 2008). Furthermore, in 2008, about 70% of young children of 4-7 of years age did not consume fruits and vegetables according to the Canada Food Guide (Winson, 2008).

Childhood obesity and overweight trends increased in Canada since late 1970s (Shields, 2006; Spurgeon, 2002). In 1981, childhood obesity among age group of 7-13 years was 5% whereas, in 1996 the rate increased to 17% for boys and 15% for girls in the same age group (Spurgeon, 2002). About 20 years later, the Canadian Community Health Survey 2004 showed that almost 23.1% of 18 years of age or older Canadian population were obese. The same survey shows that almost 68.1% of the total population in Saskatchewan province were overweight or obese (Tjepkema, 2004). Following that survey, Statistics Canada 2005 reported that the rate of obesity is increasing faster among the Canadian youth than any other population (Winson, 2008). The Standing Committee on Health of the House of Commons Report 2007 also stated that the Canadian youth's obesity rate is highest compared to other developed countries (Canada Parliament House of Commons Standing Committee on Health, 2007). The data from 2009 to 2011 supported the statement by revealing that the obesity or overweight rate had raised into 19.8% and 11.7% respectively among the children of 5-17 years of age. The obesity rate was higher among the boys than the girls which was 15.1% and 8.0% respectively (Roberts, Shields, Groh, Aziz, & Gilbert, 2012). However, the recent data from the self-reported overweight and obesity report, 2014 released by Statistics Canada indicate that approximately one fourth (23.1%) of 12-17 years age population of Canada reported overweight and obese. The percentage of overweight and obesity was 16.9% and 6.1% respectively in 2014 which is

almost similar as in 2013 (Statistics Canada, 2015). Comparing with Canadian Health Measure Survey data 2009-2011, the percentage of obesity and overweight is lower in 2014. Moreover, the recent statistics revealed that childhood obesity is significantly lower in Canada compared to the United States which is 13% and 17.5% respectively although the prevalence was similar in both countries in late 1970s (The Daily, 2015).

Although statistics are indicating that obesity among children has been decreasing over the last few years; the disease burden associated with the obesity is still a concern. Several non-communicable diseases such as cardiovascular disease, hepatic, type 2 diabetes etc. are increasing alarmingly due to overweight and obesity (McLaren, Zarrabi, Dutton, Auld, & Herbert Emery, 2012). Along with developing serious health condition, the childhood obesity is also associated with the psychosocial crisis. Due to overweight, children deal with various behavior problems, depression and low self-esteem (Moreno, Johnson-Shelton, & Boles, 2013). Therefore, despite showing the recent decreasing trend of childhood obesity, it is still a challenge and public health concern to address.

1.2 Rationale of the study

Consumption of pulses is beneficial to young children to improve their growth and development as they get different types of nutrient from it such as protein, folates, low glycemic carbohydrates, fiber, and micronutrients such as iron and zinc (Basu, Thomas, & Acharya, 2007). Its low fat and high protein content also help in weight management and reduces the obesity of young generation. Prior to incorporating pulses in the food menu, it is necessary to understand children's choice for pulses. However, there is limited information of pulses consumption among elementary school students.

An earlier intervention "Pulse Discovery Tool Kit (PDTK) Nutrition Education Intervention" was conducted in Saskatoon from 2015-2017 with pre-school aged students attending child-care centers with the aim of promoting healthy eating behavior by incorporating pulses in their food menu (Jazeri, 2019) and formed the impetus for this study. The intervention comprised lesson plans by introducing pulses as healthy food choice and incorporating pulses in children's food menu. Parents were also included in the intervention by introducing several recipes of pulse-based dishes and snacks and providing information on pulses and healthy diet through the newsletter. The evaluation of intervention showed there was significant increase of knowledge of pulses among children. Sensory rating exhibited that more than half of the children liked the recipes made of pulses. Moreover, children were highly active with the lesson

plan activities (Henry et al, 2016). The success of this intervention exhibits that pulses are acceptable to the young generation who find it delicious and that it can be introduced to their diet using recipes for different preparations by engaging children in various activities.

It is assumed that similar intervention will also benefit the older aged children (elementary school). Research shows that if healthy eating habits can be built among the elementary school students (which is a critical stage of life to establish any behavior) by developing and implementing school based healthy eating program, the habit will eventually be sustained and continued into the adulthood (Day, Strange, McKay, & Naylor, 2008; Stock et al., 2007a; Veugelers & Fitzgerald, 2005). To improve the healthy eating behavior of children of grades 4-8, researchers from the College of Pharmacy and Nutrition, University of Saskatchewan carefully designed Pulse Makes Perfect Sense (PMPS)- a pulse-based nutrition education intervention. The overall aim of this seven-week intervention was to increase the demand for pulses by increasing awareness and consumption among elementary school children. The intervention included three different type of activities: 1) pulse focused nutrition education; 2) provision of pulse-based lunch; and 3) pulse focused nutrition education and pulse-based lunch. An appropriate evaluation of this project was designed to capture the desired effectiveness of the intervention. The purpose of the present study was to provide baseline information of the students participating PMPS intervention with regard to self-reported knowledge, attitude, practice, and barriers to pulses consumption.

1.3 Objectives

General objective:

To collect the baseline information of the students participating in the PMPS intervention.

Specific objectives:

1. To assess elementary school children's knowledge on pulses
2. To determine the elementary school children's attitude towards pulses consumption
3. To assess the practice of pulses consumption among elementary school children
4. To identify the perceived barriers of the elementary school children that influence their pulse intake

2. LITERATURE REVIEW

2.1. Significance of pulses in achieving healthy eating and lifestyle behaviours

For proper growth and development, it is essential that children consume healthy food and beverages. Research revealed that children who eat healthy food exhibit more intellectual ability and perform better in school (Public Health Nutritionists of Saskatchewan, 2016). On the other hand, the unhealthy eating habit has a strong negative impact on health outcome which results of obesity and type 2 diabetes (Mudryj, Aukema, Fieldhouse, & Yu, 2016).

Pulses are part of the legume family and there are several varieties of pulses available. The most common varieties are dried peas, edible beans, lentils and chickpeas (Pulse Canada, 2017b). Research supports that a healthy diet which is low in fat and high in protein is one of the solutions for achieving healthy weight (McCrory, Hamaker, Lovejoy, & Eichelsdoerfer, 2010). Pulses contain high protein & fibre and low energy, fat and sodium (Venter, & Eyssen, 2001). They also have minerals; e.g.; iron, zinc, phosphorus, folate and other B-vitamins (Pulse Canada, 2017a). Considering their nutrient value, regular consumption of pulses can be beneficial for weight management and to combat with non-communicable diseases such as diabetes and cardiovascular disease (Phillips, Zello, Chilibeck, & Vandenberg, 2015). Pulses contain soluble fibre which reduces the risk of cardio-vascular disease by lowering the serum and LDL cholesterol (Patterson, Maskus, & Dupasquier, 2009). Their insoluble fibre helps in gastrointestinal activity (Tosh & Yada, 2010). Se, Zn, Fibre, Folate and Phytic acid of pulse have anticarcinogenic effect; therefore, pulses are highly recommended by the World Cancer Research Fund to reduce cancer risk (Patterson et al., 2009; Winham, Webb, & Barr, 2008). Pulses are part of a healthy, balanced diet and have an important role to play in enhancing health & wellness, and food & nutrition security in various households. Scientific evidence shows that the consumption of pulses may help in the management of a number of diseases such as diabetes, obesity and other non-communicable diseases (Ramdath, Renwick, & Duncan, 2016).

Despite having several health benefits of pulses, its consumption is low among the Canadian population. IPSOS REID (2010) reported that about 60% Canadian consume at least one type of pulses “less than once a month” to as much as “three times per month” and about 20% Canadian considered as non-consumers as they did not consume any type of pulses in last six months (IPSOS REID, 2010). During 2004, pulse consumption rate among Canadian adult was 13.2% and the highest pulse consumers were found in British Columbia (Mudryj et al., 2012). In Saskatchewan, only 11.3% adult consumed pulses despite of having its large pulse

growing industry. Asian Canadian consumed more pulses than any other cultural origin and their pulse consumption rate was 3.6 time higher than the Caucasian. Adult age 51-70 years consumed more pulses (12.2%) whereas consumption was low among the 19-30 year age group of people, which was 11.5% (Mudryj et al., 2012).

Canada's Food Guide includes pulses in the recommended food groups. To ensure the healthy diet, Government of Canada has developed Canada's Food Guide for all age group and sex which recommends healthy food and number of servings for individuals and families. This guideline is prepared based on the foods which are easily available, affordable and accessible in Canada. Canada's Food Guide divided the food into four groups (Vegetable and Fruit, Grain Products, Milk & Alternative, and Meat & Alternative) and provides a guideline for adding mixed dishes. According to Canada's Food Guide, the serving size of cooked legume is 175 ml (3/4 cup) (Health Canada, 2007).

A new Canada's Food Guide was introduced in January 2019. This guide encourages plant-based eating and reduces the emphasis on meat and dairy. The four food groups have been reduced into three- vegetables and fruits, whole grain and protein foods. The two previous food groups "meat and alternatives food groups" and the "milk and alternatives food groups" have been merged and redefined as "Protein Foods". The guide emphasizes on getting protein from plant-based sources such as beans, lentils, and nuts. In addition, the new Canada's Food Guide emphasizes on replacing sugary drink by water. Serving size has also been removed from the new guide. Instead the guide uses a plate to show how much of each food group should be included in diets. The emphasize is now on the proportion of food with a plate consisting of half fruits and vegetables, and the remaining half divided into whole grains and proteins (Government of Canada, 2019).

Canada has the largest pulse growing industry where more than 2.3 million hectors land are used for growing crops in every year. During 2014, Canada produced the highest amount of pulses which was more than 6 million ton and in 2015 the production of the pulses was 5.9 million ton. Saskatchewan not only has the largest industry for the production of peas, lentils, and chickpeas but also is among the largest exporter of pulses to various countries across the globe (Pulse Canada, 2017a). Considering the health status of the Canadian population and having the opportunity of the largest pulse growing province, Saskatchewan can utilize its pulse industry as a potential solution to reduce the obesity burden.

2.2 Factors influence children's food choice and healthy eating behavior

The childhood is described as the critical period in which established healthy dietary behaviors can prevent chronic illness such as overweight and obesity (Olstad, Raine, & Nykiforuk, 2014). Young children depend on their caregivers to support their wellbeing and promote healthy development, including healthy eating behaviors. Children's food preferences and willingness to try new foods are often influenced by the people around them (Bellows & Anderson, 2006). Parents who feel they have a healthy diet often have children with a healthy diet as well (Anzman, Rollins, & Birch, 2010). In addition, studies have shown that children who observe and participate in growing food are more likely to taste and regularly consume the targeted food (Graham, Beall, Lussier, McLaughlin, & Zidenberg-Cherr, 2005).

Data suggest that there is an increasing trend of intake of unhealthy diet among the Canadian children results decreasing consumption of recommended food. Moreover, there is concern about the low intake of fruits and vegetables and high intake of soft drink and less healthy food (e.g. fast food and candy) (Taylor, Evers, & McKenna, 2005). Recent data also showed that more than 50% of the children age 12 years or older do not consume recommended serving number of fruits and vegetables (Health Canada, 2016). Furthermore, 80% of 13-18 years age consume at least one sugar-sweet beverage in a day (Vanderlee, Manske, Murnaghan, Hanning, & Hammond, 2014). Studies suggest that regular intake of breakfast is related with intake of healthy food such as fruits, vegetables and dairy food (Barr, Vatanparast, & Smith, 2018). However, studies conducted in Canada revealed that breakfast consumption decreases with increasing age; therefore, elementary school students has tendency to skip their breakfast and increase consumption of snacks and beverage (Evers, Taylor, Manske, & Midgett, 2001). Recent studies also presented the similar finding. By using 24 hour recall data from Canadian Community Health Survey 2004, Barr, DiFrancesco, & Fulgoni (2014) reported that breakfast consumption decreases with increasing age and 10% children of 4-18 years age reported did not consume breakfast on the day of 24 hour recall (Barr, DiFrancesco, & Fulgoni, 2014). Similar result has been found in the study conducted by using the data from Canadian Community Health Survey 2015 (Barr et al., 2018).

Studies support that food preference is one of the important determinants for children to select any food for consumption particularly taste or liking of any food often guide children's food preference (Scaglioni, Arrizza, Vecchi, & Tedeschi, 2011). Sometimes repeated exposure and consumption of any specific food can be a strong determinant for preference of that food among children such as vegetable intake (Scaglioni et al., 2018; Skinner, Carruth, Bounds,

Ziegler, & Reidy, 2002). Several studies reported that daily exposure of any specific food influences children's preference and increases liking and consumption of that food (Gahagan, 2012; Wardle, Herrera, Cooke, & Gibson, 2003).

Food choice is often guided by children's nutrition knowledge which is related with parents' food preference as well (Patrick & Nicklas, 2005). Studies suggest that children who have better knowledge on nutrition have good understand about the relation between food choice and health, and demonstrate more positive attitude towards healthy eating (Kostanjevec, Jerman, & Koch, 2013). Parents' nutrition knowledge also influences children's food habit by their food purchasing decision and availability of healthy food at home (Cluss et al., 2013). Studies suggest that there is an association between parents' educational level and healthy eating behaviour in children and adolescents. Children of mothers with a high educational level intake healthy food and consume more fruits and vegetables than children of mothers with a low educational level (Harrison et al., 2015; Wen, Kong, Eiden, Sharma, & Xie, 2014). Parents' belief in healthy food and their own experience also influence children's food intake (Scaglioni et al., 2018). For example, parents who think whole milk is healthy for children than reduced fat milk and never tried reduced fat milk themselves were most likely to serve their children whole milk (Dennison, Erb, & Jenkins, 2001). Recent studies also support that children often observe and imitate parents' and caregivers eating behavior which is an important determinant for developing children's eating habit (Zarychta, Mullan, & Luszczynska, 2016). Although children's food habit is mostly influenced by parents; however, few studies suggests that peers also have role in developing the food habit (Boddy et al., 2012; Salvy, de la Haye, Bowker, & Hermans, 2012).

Participation in food preparation at household is connected with food preference of children. A study conducted in Alberta among the grade five students revealed that the selection and eating of healthy diet is higher among those children who help to prepare meal at home (Chu et al., 2013).

Children's healthy eating habit is also driven by the availability of food at home (Patrick & Nicklas, 2005). Children's consumption and preference are developed for those foods which are regularly available at home (Birch, 2009; Tibbs et al., 2001). Family meal has positive influence on diet quality (Larson, Neumark-Sztainer, Hannan, & Story, 2007). Study revealed that consumption of healthy food among children increase if healthy food is available at dinner (Ranjit et al., 2015). However, food availability doesn't always act as a determinant for healthy eating. Research shows that although parents provide healthy homemade food to the children; however, children do not always like those foods (Shepherd et al., 2005).

Food price is one of the important determinants for food choice as the high price might restrict to have healthy diet intake (Fuller et al., 2018). Therefore, limited household income results in inadequate intake of healthy food among children (Kirkpatrick et al., 2015). Moreover, it may lead to selection and consumption of high fat and sugar containing foods when these foods prices are less than other diet which provides dietary energy (Darmon & Drewnowski, 2015; Fuller et al., 2018).

Children's food choice is most often influenced by the mass media and product marketing (Scaglioni et al., 2018; Taylor et al., 2005). The attractive food advertisements very frequently promote less healthy foods which contain high fat and high sugar compared to the fruits and vegetables. As a result, there is increase in snack food intake and overall calories, and a decrease in consumption of fruits and vegetables (Kovács et al., 2015). Children's food preference diverts to those foods that they see in the advertisement. This is a barrier to healthy eating as children are more likely to request to purchase those foods that they see in the advertisement (Marquis, M., Dagenais, F., Filion, 2002). There is a concern as the advertisement of food and beverage often show the misleading and incomplete information which confuses the children; therefore, it may have effect on the children's food and nutrition knowledge (Hart, Bishop, & Truby, 2002). Recent studies also reveal that marketing of unhealthy food and beverages influence children's food choice and preferences (Boyland et al., 2016). This type of unhealthy food marketing has impact on increase consumption of high fat and high sugar containing food among children (World Health Organization, 2016). Moreover, study conducted by Shepherd et al. 2005 revealed that personal preference for fast food and snacks consumption is an important barrier of healthy diet among children (Shepherd et al., 2005). Easy accessible and low cost fast food also influence children to have these foods (Hawkes et al., 2015).

Inadequate service of school meal is also another factor to prevent intake of healthy food among the elementary school children (Shepherd et al., 2005). Mullally et al. 2010 revealed that foods available in the schools are not healthy as the high-fat, high-sugar, and low nutrient dense foods and beverages are highly available to the students through vending machine (Mullally et al., 2010). However, a proper nutrition guideline and policy can enable the school environment for students healthy eating (Pan-Canadian Public Health Network, 2017). For example, the elementary school students of the Prince Edward Island were more likely to have recommended serving of fruits and vegetables compared to the unhealthy food after introduction of a school nutrition policy (Mullally et al., 2010). Currently, almost 50.8%

schools in Canada has committee who are responsible to develop, manage, and implement the policy related to healthy eating (Pan-Canadian Public Health Network, 2017).

2.3 Importance of school based intervention

As childhood obesity is becoming epidemic; global awareness is raising to develop various interventions and policies targeting the children and youth (Wang & Lim, 2012). Given this scenario, Canada Government has developed a framework in 2011 with proposing three strategies to help Canadian society to live longer and healthy. The three strategies consist of "(1) making childhood overweight and obesity a priority at all government levels (federal, provincial, and territorial); (2) creating environments supportive of healthy eating and physical activity among children; and (3) preventing of excess weight early in children, with ongoing research and evaluation of collective efforts addressing the issue of childhood overweight and obesity" (Quintanilha et al., 2013). Therefore, it is the responsibility of parents, school, and society to ensure a healthy growth and environment for children to create a positive impact on their future well-being (Saskatchewan Ministry of Education, 2009).

Researchers exhibit that schools can contribute positively to reduce the weight gain through several obesity prevention interventions (Kropski, Keckley, & Jensen, 2008; Shaya, Flores, Gbarayor, & Wang, 2008; Spiegel & Foulk, 2006; Zenzen & Kridli, 2009). Considering the context and prioritizing the Canada Government strategy to reduce childhood obesity, the school can be an ideal place for enabling the environment to develop a healthy eating behavior by promoting school based healthy eating programs (Quintanilha et al., 2013; Veugelers & Fitzgerald, 2005). School is a strong platform to develop any school based health intervention to reach the students and to sensitize them; as students spend most of their working hours in school and eat at least two meals during school hour (Quintanilha et al., 2013). Therefore, interventions such as school feeding program is seen as one of the most effective way to address students' nutrition and to improve their future health and well-being by promoting healthy eating behavior (Veugelers & Fitzgerald, 2005).

2.4 School feeding program in the USA

Before introducing the school feeding program, the US had some local initiatives for child's nutrition, which eventually united and initiated the National School Lunch Program (NSLP) in 1946 and the School Breakfast Program established in 1975 (Gougeon, Henry, Ramdath, & Whiting, 2011; Jakobsen, Nureddin, & Chin, 2016). NSLP is federally funded and

legislated child nutrition program in the USA run by a specific policy that provides emphasis on access of healthy food for all children in the Schools of United States (Henry, Allison, & Garcia, 2003). The NSLP not only provides meal and snacks in all the sectors including public, private and residential care child institute but also it has the provision of subsidies for those institutes which provide meal according to the federal requirement (Jakobsen et al., 2016). One of the objectives of the NSLP in the US is to provide free or reduced price meal to those students who fall under the poverty category (Henry et al., 2003). Through NSLP, US has covered near about 31 million children in 2012 and 99,000 schools in 2014. Moreover, about 92% American students are under the provision of the NSLP (Jakobsen et al., 2016).

2.5 Context of school feeding program in Canada

A national school feeding program is a federal program where funding and guideline are provided to ensure the access of heathy and nutritious food for all children. School feeding program also educates the students on nutrition, food and its nutrition benefits. Although Canada is the most developed country, it is the only country in G7 group which does not have national feeding program (Hyslop, 2014). However, instead of the national school feeding program, Canada has various initiatives ongoing nationwide schools, e.g. school gardening & greenhouse and purchasing, selling, cooking, preserving and serving local foods etc. to promote healthy and nutritious diet (Farm to Cafeteria Canada, n.d.) and to combat with the obesity and associated health problems.

Back in 1990, the school feeding program in Canada came to attention and some community organizations and other groups took the leadership and initiate the food supply in the schools (Dayle & McIntyre, 2003). There are more than 2,200 programs ongoing which are supporting child nutrition by providing breakfast, snacks, and lunches across Canada (Russell, Evers, Dwyer, Uetrecht, & Macaskill, 2008).

The school feeding programs in Canada is operating either by grants or by private funding (Carlsson & Williams, 2008). Provinces have direct funding program or indirect financial support by different organizations (Russell et al., 2008). Few provinces provide a fund which goes to the external organization for school feeding program (Hyslop, 2014). Such as PepsiCo and Coca-Cola has sponsorship for one-third of the school of Manitoba to run school feeding program (Winson, 2008).

The drawback of not having any federal government legislated school feeding program in Canada is provincial differences for nutrition guideline, policy and implementing and

managing the programs (Winson, 2008). Most of the provinces and territories of Canada have its own school food policy; however, some provinces or territories do not have any policy or program at all, e.g. Yukon. There are some territories which are in the process of developing its school feeding program and one of such territories is Nunavut. In Nova Scotia, there is a policy for food and nutrition for public school which states that most of the served food and beverage should be classified as maximum nutrition, replace the poor nutritional beverages by milk & milk product, and water and ban the deep fry food and junk foods (Winson, 2008). In order to eliminate the poor nutritional product and for school fund raising, the New Brunswick also has adopted the similar policy (Winson, 2008). The schools of British Columbia has a very successful school food policy since its implementation period (2005), as half of the schools (50%) were able to eliminate the unhealthy food (Niebylski et al., 2014). The school feeding program in Northern Ontario is designed to prevent diabetes by providing healthy and culturally accepted food and engage the students of 3-5 grade by banning of those food and snacks which has high fat and sugar. This program not only provides the healthy diet to the students but also educates them on healthy food habit. This program was successfully able to reduce the fat intake by 2% within one year of its implementation and increased the knowledge on healthy diet and healthy lifestyle among the students (Jakobsen et al., 2016).

2.6 Saskatchewan school food guidelines

There is a total of 27 school divisions across the Saskatchewan province which comprise of eighteen Public school division, eight Catholic school division, and one Francophone school division. All the school divisions have elementary school, secondary school, and post-secondary institutions (Government of Saskatchewan, n.d.-a). In Greater Saskatoon, there is a total of 49 elementary schools under Public school division and 43 elementary schools under Catholic school division (Greater Saskatoon Catholic Schools, 2017; Saskatoon Public Schools, n.d.). Elementary school covers grade 1 to 8; however, children enroll in pre-kindergarten and kindergarten school before starting of the elementary school (Government of Saskatchewan, n.d.-c). Ministry of education of Saskatchewan along with the elected local school board is responsible for operating these schools. The Ministry of Education contributes by setting the goal and objective for the education system. It also provides recommendation, course instruction, guideline for the curriculum to the school's management and school division, and resource material for study curriculum. The locally elected school board is responsible for day-to-day operation of school-Kindergarten to grade 12 according to

the Ministry of Education's guidelines and regulation within school divisions (Government of Saskatchewan, n.d.-b).

Like other territories and provinces in Canada, the schools of Saskatchewan province have a school food guideline named "*Nourishing Minds: Eat well, Learn well, Live well"* introduced in 2008 by the Saskatchewan Ministry of Education. "Nourishing Minds" is the guideline for implementation of all kind of school food-related programs and activities. It also focuses on the school division nutrition policy development provided by the Saskatchewan School Board Association (Opoku, 2016). Nourishing Mind states that the schools should follow the healthy eating guideline for the food items provided in their breakfast, snack or lunch programs (Saskatchewan Ministry of Education, 2009).

Healthy Eating, Nutrition, and Food Safety Guidelines is instructed to be used in all Pre-K-12 schools in the Saskatchewan where food is sold, or food items are provided in breakfast, snack or lunch programs to encourage healthy eating. This guideline has been prepared based on *Canada Food Guide* and Saskatchewan Ministry of Health's *Healthy Foods for My School*. *Healthy Foods for My School* is a tool for schools of Saskatchewan for selecting served or sold food and beverage that comply with the Nourishing Mind- Schools of Saskatchewan's nutrition standard guideline (Public Health Nutritionists of Saskatchewan Working Group, 2014).

Based on the recommendation from Canada Food Guide and Healthy Foods for My Schools, *Saskatchewan's Nutrition guideline for Schools* has been developed which recommends the number of food groups and number of servings for lunch and breakfast for all schools of Saskatchewan. The guideline recommends at least one serving from each of the 4 food groups from the Canada Food Guide for lunch and one serving from 3 of the 4 food groups for breakfast (Public Health Nutritionists of Saskatchewan Working Group, 2009).

2.7 Organizations working for school feeding program in Saskatchewan

There are several organizations working together with the school divisions for the school feeding program in Saskatchewan. One of the most recognized organization is CHEP (Children Hunger and Education Program) Good Food Inc. which is a non-profit community organization working since late 1980 in order to provide support for Children Nutrition Program through breakfast, snack and lunch programs in schools in collaboration with Saskatoon Public School Division (SPSD). Since then, CHEP is covering about 45% to 50% of the schools in Saskatoon by fulfilling the need of nutrition of school children specially who

are from low income family by providing support for snacks or meals for school feeding program (Gougeon et al., 2011).

CHEP runs several programs for children at schools to ensure children's nutritional need by offering food and nutrition education. "Centralized Kitchen" is CHEP's one of the successful programs for those schools which do not have their own school nutrition program. Through this program CHEP provides fresh food and lunch in the schools of Saskatoon prepared in the centralized kitchen developed by CHEP. CHEP served more than 22,000 lunches in 24 schools of Saskatoon in the 2018-2019 school years through their Centralized Kitchen situated in the Saskatoon (CHEP Good Food Inc., 2019).

"Fresh Food for Kids" is CHEP's another program which has the provision of buying fresh fruits, vegetables and milk from CHEP in subsidized price for the Saskatoon Community schools nutrition programs. Moreover, to ensure milk consumption of elementary school children, CHEP provides thousands of litres of milk in every year to the schools of Saskatoon by their program "Milk Matters". "Chefs in Training" is another program of CHEP where students actively participate in a five-week after school training program. This program helps to develop the skills on cooking and provides education on healthy eating to the children. Students of 10 to 15 years age participate in this training to learn the skills essential for handling of safe food, safety measure for kitchen, and students identify healthy food recipes and prepare food. "Fresh Food Buffet" is an initiative of CHEP where hot school lunches such as pizza, chicken fries, hot dogs are provided at schools. To encourage healthy eating and to make familiar with different variety of food, "Fresh Food Buffet" offers different types of food which includes vegetables, fruit, grain products, lentils, beans, and cheese to the children. This program also provides opportunity to the teachers to discuss about the healthy food choice and nutrition. "Nutrition Positive" is another initiative where CHEP provides support with the partnership between the local school divisions, the Saskatchewan Health Authority, CHEP Good Food, the Heart and Stroke Foundation of Saskatchewan, and the University of Saskatchewan's College of Pharmacy and Nutrition to enhance curriculum and school food policy by offering programs and resources to the schools (CHEP Good Food Inc., 2018). Along with all the programs and initiatives, CHEP provides several of recipes with the nutrient food ingredient in their website including breakfast, lunch, appetizer, main course, dessert (CHEP Good Food Inc., 2010).

Another pioneer organization is Breakfast for Learning (BFL) which helps to initiate and maintain programs by providing fund, education and organizational resource (Russell et al., 2008) across the Saskatchewan province. PotashCorp is also working since 2012 to support

the school food program. They are working through Food for thought (FFT) to serve the Saskatoon Public School Division and Greater Saskatoon Catholic School Division. FFT is an initiative through which Potash Crop is providing nutritional education to the schools and committed to work to bring the behavior change towards healthy eating of the students (Opoku, 2016). Other than the provincial policy and external organizations, there are also some informal local projects which are dedicated to promote healthy eating and improve food environment in the schools such as Farm to Cafeteria Canada (FTCC) (Winson, 2008). Their vision is to "build capacity, strengthen partnerships and influence policy to bring local, healthy and sustainable foods into all public institutions". FTCC provides education and hand- on training on school gardening and food system. (Farm to Cafeteria Canada, n.d.).

2.8 Nutrition education interventions in Canada and USA

There are several school-based nutrition interventions have been conducted in USA and Canada to potentially improve the healthy eating and therefore, reduce the obesity burden. Table 2.1 (Page 19) compiles selected interventions conducted among the elementary schools in USA and Canada.

A multi component intervention, "Shaping Healthy Choice Program" (SHCP) was conducted among the 4th grade school students (age 9-10 years) of northern and central California to develop healthy eating behaviour and to prevent obesity. The SHCP intervention had five components which included: i) improve nutrition knowledge by classroom education, ii) garden-enhanced education and promotion by cooking and school gardening, iii) involvement of family and community by provision of family newsletter with the information of healthy eating and physical activity, and conducting health fair at intervention schools, iv) increase availability and consumption of fruits and vegetables by installing salad bar in the school lunchroom, and v) establishment of school wellness committee and development of policy. A clustered randomized control study was conducted to evaluate the effectiveness of this intervention. After one year of the intervention, it was found that the students of the intervention schools had improved knowledge on nutrition (2.2; p<.001) and vegetable identification (1.18; p<.001) along with significant decrease in BMI percentile (-6.08; p<.01) (Scherr et al., 2017, 2014).

In the Fort Albany, Ontario, a pilot comprehensive school nutrition intervention was conducted from 2009-2010 school years with 6 to 8 grade school students. The intervention was mainly focusing on improving knowledge, intention, self-efficacy and intake of milk and

milk alternatives (MMI) to develop a healthy eating behaviour based on the recommended Canada's Food Guide. The school program included the policy, education, food provision, family and community involvement, and program evaluation components. Each grade students received one 30 minutes education session at every week to improve their knowledge. Food provision ensured by providing healthy breakfast and snacks contained fruit and vegetable, grain products, protein, milk and its alternative according to the Canada's Food Guide. Parents were involved in this intervention by receiving handouts regularly from the students at home. The program was evaluated to assess the impact of the intervention and usefulness of the program materials. Pre and post assessments were conducted to identify the change in knowledge, self-efficacy and intention of taking healthy diet (milk and its alternative). After one year of the program, significant improvement of students' knowledge ($p<.05$) and intention ($p<.01$) for taking milk and its alternative had been observed although the intake of MMI was remained inadequate before and after the intervention (Gates, Hanning, Gates, Isogai, et al., 2013).

The Sandy Lake Health and Diabetes Prevention Intervention (SLHDP) was a school based one-year program conducted in the Ojibway-Cree students (native Canadian students) in the 3rd, 4th, and 5th grades students with the aim of increasing students' knowledge, skill, self-efficacy and positive behaviour change for healthy diet and physical activity. It was a culturally appropriate intervention with inclusion of learning process through observation, practice, storytelling, role modelling and emphasis on the tradition. The components of this intervention included; i) Culturally appropriate curriculum component focused on adopting healthy eating behaviour by knowledge and skill development and information on food and physical activity. Storytelling on healthy lifestyle was another method to educate students incorporated in the curriculum. It was a 16 week education curriculum taught by the teachers to the students of 3rd to 5th grade; ii) Family Component included provision of information to the parents and family members on healthy eating and physical activity through weekly community radio show where parents were encouraged to prepare healthy food for their children; iii) Peers component was an activity through which children acted as a role model. In this component, children had their video cooking club and participated in a radio show known as "Diabetes Kids"; iv) Environmental component was developed in order to create an enabling environment for healthy eating at school. A school policy had been developed by the Sandy Lake board of education and school principals with the help of project staffs to ban those foods in the schools which contains high fat and sugar; v) Provision of school meal was another component of this intervention where students were provided low fat and sugar containing food in the school

lunch. Later a breakfast program was also included into this component. A pre-post test, single sample design study was conducted to assess the effect of the intervention. The result revealed that students' knowledge, self-efficacy, intention and preference for healthy eating significantly increased (p<.001) from the baseline. Significant association was found between intervention exposure and increased knowledge on low fat containing food (Saksvig et al., 2005).

A multicomponent three-year intervention "HEALTHY" study was conducted in randomly assigned 21 schools in the United States with the students of 6^{th} to 8^{th} grades to reduce the risk factors for obesity and type 2 diabetes. The integrated components of this intervention were; i) Nutrition component which included provision of healthy food and beverage in the school vending machines, cafeteria, snack bar, school stores, fundraising events and classroom celebration; ii) physical activity component was developed to engage the students in moderate to vigorous physical activities which were sufficient to raise the heart rate to minimum of 130 beats/minute and; iii) behaviour change component was conducted through classroom learning activity by self-monitoring on the food habit. Randomized cluster design study was conducted to examine the effect of the intervention. After three years of the intervention, the prevalence of the overweight and obesity decreased in both intervention and control schools although the difference was not significant in the school groups. However, the reduction of BMI z score, obesity prevalence and percentage of children with waist circumference in the 90^{th} percentile or higher was significantly reduced in the intervention schools compared to the control (The HEALTHY Study Group, 2010).

Another pilot intervention was conducted in two first nation schools in Northern Ontario among the conveniently selected students of grade 6 to 8. The intervention included provision of school snack program in the Kashechewan First Nation school and adding of milk and milk alternatives in an existing school snacks program in Attawapiskat First Nation school. Following the Canada Food Guide, in the first school, at least one serving of the fruits, vegetables, milk and milk alternatives were served among the selected students whereas at least one serving of the milk and its alternatives were added in the existing snack program in the second school. Prior to the intervention, a web-based eating behaviour questionnaire (WEB-Q) was administered among the children to collect information on intake of milk and milk alternatives, vitamin D and calcium intake by 24-hour recall. After one week of the serving the milk and its alternatives, the WEB-Q was administered again to assess the short-term impact of the program. The result revealed that calcium intake was increased in the Kashechewan

(805.9±552.0 to 1027.6±603.7mg, p=.04). On the other hand, there was significant increase in the consumption of milk and milk alternatives (1.7±1.7 servings to 2.1±1.4 servings, p=.03) and vitamin D in Attawapiskat (2.5±2.6 to 3.5±3.4 μg, p=.02) (Gates, Hanning, Gates, McCarthy, & Tsuji, 2013).

A two-year pilot intervention "Healthier Options for Public School Children (HOPS)" was conducted in the United States in six elementary schools among the students of age 6-13 years. The goal of this intervention was to improve the overall health status and academic achievement. The three components of the intervention included; i) dietary intervention which included modification of the school provided food by adding more high fibre item such as fruits and vegetables and lower the high sugar and fat containing food; ii) curriculum component taught students about healthy lifestyle management and daily physical activity; iii) in the fun and creative component, students involved in the school based wellness activity such as fruits and vegetable gardening, and iv) in the physical activity component, students daily conducted 10-15 minutes classroom desk-side physical activity. A quasi-experimental study was conducted after two years of the intervention to assess the effect. The intervention school students remained within the normal BMI percentiles range (p=.02) than the control group. BMI percentile decreased more among the obese students of the intervention schools (4.4%) compared to the control (2.5%) although the result is not significant (p=.27). However, students of the intervention schools scored significantly high in math exam (p<.001) (Hollar et al., 2010).

"Healthy Buddies" was a pilot intervention conducted in the two elementary schools in the British Columbia, Canada. It was a peer-led health promotion program where younger student paired with the older students and learnt about the healthy lifestyle from their buddy. At the beginning, the students of 4th to 7th grade received healthy living lesson from teachers. The students then paired with the kindergarten to 3rd grade students as "Buddy" for the whole school year. Older buddies delivered the lesson to the younger buddies by games, art activity, presentation etc. The "Healthy Buddies" program had three components: i) Healthy Eating: *"Go Fuel!"* component where they learnt about the healthy diet along with showing the example of nutritious food, ii) Regular Physical Activity: *"Go Move!"* included involvement of the buddies in 30 minutes exercise session at gymnasium per week, and iii) Healthy Body Image, Self-esteem, and Social Responsibility: *"Go Feel Good!"* component included lessons on healthy body image, healthy growth and development, increase self-esteem and social responsibilities and media literacy. They also learnt about the challenges to live a healthy life

and how to overcome the challenges. Evaluation of this pilot intervention showed that, height and weight was significantly increased (p<.001) among the younger students (kindergarten to 3rd grade) in both intervention and control group; however, height increase was greater in the intervention school students compared to the control. Change in BMI was not significant after the intervention. Similar result for height and weight was found among the older students (4th to 7th grade) although body weight and BMI increase were smaller compared to the control. Health knowledge, behaviour and attitude were significantly increased in both younger and older students of the intervention schools (p<.001) (Stock et al., 2007b).

An after-school nutrition intervention was conducted targeting the 4th and 5th grade school students in the United States with the aim of increasing fruit and vegetable consumption in order to developing healthy eating behaviour. The students received a total of twelve 2-hour session where they learnt about the nutrition, media literacy and development of media campaign. After the session, the students developed media campaign in the form of slogan, logo, brand name, key messages by using the knowledge and skill that they received from the sessions. The student and their parents were then invited to participate in two family fun nights at the schools where messages on increase consumption of fruit and vegetables were delivered to the parents through the media campaigns created by the students. The evaluation of the intervention showed that both parents and children's knowledge on the importance of eating fruits and vegetables had increased. Moreover, the intervention encouraged and motivated children to increase consumption and try and eat new fruits and vegetables. However, no significant difference was found in parental support and motivation and in the consumption of fruits and vegetables (mean intake: 1.94 servings [intervention] vs. 2.06 servings [control]) (Tanner, Duhe, Evans, & Condrasky, 2008).

Table 2. 1: Review matrix of School based Nutrition Interventions

Authors & year	Intervention Name	Length of the Intervention	Intervention component	Evaluation design	Target groups	Country	Evaluation findings
(Scherr et al., 2017, 2014)	Shaping Healthy Choice Program (SHCP)	Four years	i) Improve nutrition knowledge by classroom education ii) Garden-enhanced education and promotion by cooking and school gardening iii) Involvement of family and community by provision of family newsletter with the information of healthy eating and physical activity and conducting health fair at intervention schools, iv) Increase availability and consumption of fruits and vegetables by installing salad bar in the school lunchroom and v) Establishment of school wellness committee and development of policy	Clustered, randomized, controlled intervention	Fourth grade students (age 9-10 years) and parents	The United States	i) Improved knowledge on nutrition (2.2; $p<.001$) and vegetable identification (1.18; $p<.001$) along with significant decrease in BMI percentile (-6.08; $p<0.01$)
(Gates, Hanning, Gates, Isogai, et al., 2013)	-	One year (2009-2010 school years)	i) One 30 minutes education session at every week to improve students' knowledge ii) Food provision ensured by providing healthy breakfast and snacks containing fruit and vegetable, gain products, protein, milk and its alternative (MMI) according to the Canada's Food Guide iii) Parents involvement by regular receiving handouts from the students at home	Web-based 24-hour dietary recalls and Pre and post-program assessment	Six to eight grade students and parents	Canada	i) Significant improvement of students' knowledge ($p<.05$) and intention ($p<.01$) for taking milk and its alternative ii) Intake of MMI was remained inadequate before and after the intervention
(Saksvig et al., 2005)	Sandy Lake Health and Diabetes Prevention Intervention (SLHDP)	One year	i) Culturally appropriate 16-week education curriculum component focuses on adopting healthy eating behaviour by knowledge and skill development and information on food and physical activity	Pre-test/ post-test, single-sample design	Third, fourth and fifth grade student	Canada	i) Students' knowledge, self-efficacy, intention and preference for healthy eating significantly

			ii) Family Component included provision of information to the parents and family members on healthy eating and physical activity through weekly community radio show where parents were encouraged to prepare healthy food for their children iii) Children acted as a role model in Peer component. In this component, children had their video cooking club and participated in a radio show known as "Diabetes Kids" iv) Environmental component was developed to create an enabling environment for healthy eating at school. A school policy had been developed to ban high fat and sugar containing food from school v) Provision of school meal by providing low fat and sugar containing food in the school lunch				increased (p<.001) from the baseline ii) Significant association found between intervention exposure and increased knowledge on low fat containing food
(The Healthy Study Group, 2010)	HEALTHY	Three years	i) Nutrition component: Provision of healthy foods and beverages in the school vending machines, cafeteria, snack bar, school stores, fundraising events and classroom celebration ii) Physical activity component: Engage students in moderate to vigorous physical activities which were sufficient to raise the heart rate to minimum of 130 beats/minute iii) Behaviour change component: Classroom learning activity by self-monitoring on the food habit	Randomized cluster design	Sixth to eight grade students	The United States	i) Prevalence of overweight and obesity decreased in both intervention and control schools although the difference was not significant ii) Reduction of BMI z score, obesity prevalence and percentage of children with waist circumference in the 90^{th} percentile or higher was significantly reduced

							in the intervention schools
(Gates, Hanning, Gates, McCarthy, et al., 2013)	-	One year	Kashechewan First nation school and Attawapiskat First nation school were participated in the intervention. In the first school, one serving of the fruit, vegetable, milk and milk alternatives were served among the students. In the second school, at least one serving of the milk and its alternatives were added in the existing school snack program	Web-based 24-hour dietary recalls and Pre and post-program assessment	Sixth to eight grade students	Canada	i) Short term impact was assessed by WEB-Questionnaire. Calcium intake increased in the Kashechewan (805.9±552.0 to 1027.6±603.7mg, *p*=.04) ii) Significant increase in the consumption of milk and milk alternatives (1.7±1.7 servings to 2.1±1.4 servings, *p*=.03) and vitamin D in Attawapiskat (2.5±2.6 to 3.5±3.4 µg, *p*=.02)
(Hollar et al., 2010)	Healthier Options for Public School Children (HOPS)	Two years	i) Dietary intervention: Modification of the school provided food by adding more high fibre item such as fruits and vegetables and lower the high sugar and fat containing food ii) Curriculum component: Education on healthy lifestyle management and daily physical activity iii) Fun and creative component: Students involved in the school-based wellness activity such as fruits and vegetable gardening iv) Physical activity component: Daily 10-15 minutes classroom desk-side physical activity	Quasi-experimental study	Elementary school students of age 6-13 years	The United States	i) Intervention school students remained within the normal BMI percentiles range (*p*=.02) than the control group ii) BMI percentile decreased (*p*=.27) more among the obese students of the intervention schools (4.4%) compared to the control (2.5%) iii) Students of the intervention schools scored significantly high in math exam (*p*<.001)

(Stock et al., 2007b)	Healthy Buddies	Two years	i) Healthy Eating: *"Go Fuel!"*: Lessons provided on healthy diet along with showing the example of nutritious food ii) Regular Physical Activity: *"Go Move!"*: Buddies involved in 30 minutes exercise session at gymnasium per week iii) Healthy Body Image, Self-esteem, and Social Responsibility: *"Go Feel Good!"*: Lessons on healthy body image, healthy growth and development, increase self -esteem and social responsibilities and media literacy, challenges to living a healthy life and how to overcome the challenges	Randomized control trial	Kindergarten to seventh grade students	Canada	A. Height and weight: i) Significant increase (p<.001) in both younger (kindergarten to 3rd grade) and older (4th to 7th grades) students in both intervention and control group ii) Height increase was greater in the intervention school students than the control B. BMI & Body weight: i) BMI change was not significant among younger students ii) Among older students, body weight and BMI increase were smaller compared to the control C. Health knowledge, behave and attitude: i) Significantly increased in both younger and older students of the intervention schools (p<.001)
(Tanner et al., 2008)	After school nutrition intervention with the aim of increasing fruit and	Six weeks	i) Students received a total of twelve 2-hour session on nutrition, media literacy and development of media campaign ii) Students developed slogan, logo, brand name and key messages on	Quasi-experimental study design and focus group discussion	Fourth and fifth grade students and parents	The United States	i) Children's knowledge on the importance of eating fruits and vegetables increased

	vegetable consumption		healthy eating behaviour and consumption of fruit and vegetable based on the learning sessions iii) Parents were exposed with those media campaign in two family fun night events				ii) Children were encouraged and motivated to increase consumption and try and eat new fruit and vegetables after the intervention iii) Parents learned about the importance of fruits and vegetables consumption iv) No significant difference in parental support and motivation on fruits and vegetables consumption v) No significant changes in the consumption of fruits and vegetable (mean intake: 1.94 servings [intervention] vs. 2.06 servings [control])

2.9 Pulses Make Perfect Sense (PMPS) Intervention

Pulse Make Perfect Sense (PMPS) is an educational resources designed to increase awareness and consumption by integrating pulses into elementary schools and sought to extend and enhance the previous work `"Starting Young with Pulses: Integrating Pulses into the Menus of Childcare Centres" (2015-2017) (Henry et al., 2016), funded by Saskatchewan Pulse Growers. PMPS is a multi-component nutrition education resource that was used to deliver an educational campaign to elementary students in grades 4-8. The impact of the intervention on awareness (changes in knowledge, attitude and practice) among elementary school children and their caregivers was evaluated post intervention. The baseline data described in this thesis helped to fine-tune the nutrition intervention and post-intervention data collection.

3. METHODOLOGY

3.1 Study design

This was a cross-sectional study that gathered data from the students of grade 4-8 of elementary schools in Saskatoon during March 2019. This study also served as the baseline survey of a study that aims to evaluate a school-based intervention.

3.2 School Selection

The study was conducted in four elementary schools across Saskatoon, Saskatchewan. These schools were selected from the list of schools to which CHEP (Children Hunger and Education Program) Good Food Inc. provides lunch through their "Centralized Kitchen" program. To identify these four schools, a research team at the University of Saskatchewan led by Dr. Henry and her team at the College of Pharmacy and Nutrition made contact with CHEP to collect the list of the schools where CHEP operates their centralized kitchen program.

Before making contact with the schools, the research team and I applied to the Saskatoon School Division for permission to conduct the study in the schools. After getting the approval, the research team made contact with all those schools where CHEP provides lunch by informing the schools the objective and purpose of the study along with the Saskatoon School Division approval letter. Schools which responded within one week were short listed. From that short list, we finally purposively selected four schools for data collection taking into account the geographical location. The research team decided to choose four schools due to resource limitation.

3.3 Sample Size Calculation

As mentioned, this study represents the baseline of a pre-post evaluation design with a control group. Following assumptions were made in estimating the sample size in each round of data collection.

The major objective of the PMPS intervention was to increase demand for pulse consumption. This study collected information on knowledge, attitude, and practice (KAP) related to pulse consumption which served as the proxy or intermediary outcomes for increased demand for pulse. However, no previous information on KAP related to pulse consumption among this age group was available. To obtain the highest number of samples, I therefore assumed that 50% of the students had positive knowledge of pulse at baseline.

Assuming that the intervention will have a positive change in all components of KAP and will increase at least by ~30% point after the intervention, I used a one-sided test sample. Sample size calculation was done considering equal number of samples in each group and using the following formula and assumptions.

$$n = \frac{2(\bar{p})(1-\bar{p})(Z_{\beta} + Z_{\alpha})^2}{(p_1 - p_2)^2}$$

$\bar{p}$ = Estimated/assumed proportion (50%)

$Z\beta$= 0.84, corresponding to power (β=80%)

$Z\alpha/2$= 1.645, corresponding to one-tailed significance level (α=0.5)

P1-P2 = Expected difference between baseline and endline (50% to 80%)

Thus, a minimum sample size of 35 per group and a total of 140 was estimated. Possible lost to follow up was adjusted by incrementing 20% to the sample. The final sample size per group was therefore 42 students per group and 168 in total. However, it was not feasible to select only a certain number of students from a class as the excluded students may feel alienated. Furthermore, the number of samples was limited by the availability of students within the four schools selected by the research team from a list of all schools utilizing the CHEP school feeding program. Also, one out of those four schools were selected as the control school. Therefore, I attempted to include all students within these schools. Although not all the students and their parents consented to participate in the study, I was still able to obtain the required number of students from both control and intervention schools.

3.4 Participant selection

Participants of this study were students of grade 4-8 (aged 9-13). This age group was selected under the assumption that they are matured enough to provide the information asked for and are able to think independently (Sylvetsky et al., 2013), which implies that they will be able to complete the questionnaire independently. This age group is also the window period between the late childhood and early adolescence. At this age, rapid physical growth creates an increased demand for energy and nutrients (Spear, 2002). Therefore, it is a critical phase of life where children are in high nutritional risk (World Health Organization, 2005). Studies suggested that behavior pattern including food habit development in this age eventually sustain and continue into the adulthood (Day, Strange, McKay, & Naylor, 2008; Stock et al., 2007a; Veugelers & Fitzgerald, 2005). Therefore, this study selected this age group to develop a healthy eating practice among the young people in order to decrease the risk of future health problems.

To select the participant of this study, the research team contacted with the selected four schools for an appointment to meet the principals and teachers. Prior to the meeting, principals of all four schools were requested to inform the teachers of grade 4-8 of their schools about the study. On the given date determined by the schools, the research team and I visited the schools and met the principals and those teachers of grade 4-8 who showed their interest to support to conduct the survey in their classrooms. During the day of the meeting, the teachers were provided assent forms and consent forms along with a letter for the parents (includes the information of the research objectives and the method of survey among the children) to distribute among the students. We requested the teachers to inform their students about this study, distribute the consent and assent forms to them and ask the students to have the consent forms signed by their parents and bring back after one week if they want to participate in this study. After one week, I visited all four schools to collect the consent and assent forms. However, the percentage of signed assent and consent forms that I collected from schools were very low (50%). One of the reasons could be students forgot to give their parents the from; therefore, the response rate was low on first attempt. With the suggestion of the research team, we gave one more week to the students to bring back the consent forms. Within this week, we regularly made contact with the teachers to request them to remind the students about the consent forms. After one week, we found higher response rate than the first time. There was a total of 357 students of grade 4-8 in the selected four schools. Among the 357 students, 247 students and their parents finally gave their consent to participate in this study.

3.5 Questionnaire Development

The questionnaire was developed in three steps. Step one was conducted between April 2018 and July 2018 through a literature review on KAP and barrier questionnaire from similar studies. In step two, development of draft questionnaire and pre-testing of the questionnaire on target population was done in September 2018. Finally, under step three, changes were made suggested by the pre-test to finalize the questionnaire. The final research questionnaire was a paper-based, self-administered questionnaire with appropriate response options. Both the draft and final research questionnaire had four sections related to the objectives of the research with a cover page captured the demographic data (age, sex, grade, school name and homeroom name of each participants). Part one of the questionnaire addressed nutrition knowledge on pulses, part two captured pulses consumption patterns, part three addressed attitude, and part four was barrier to pulses consumption.

To develop the draft questionnaire, I conducted literature review to explore the similar studies with KAP and barrier questionnaire. The draft questionnaire includes questions adapted from three earlier studies that addressed similar construct and had questionnaires on KAP and barriers to pulse consumption directed to parents, educators, and children aged two to five years. The actual questionnaires were examined to extract all questions relevant to this study that would be able to address the research questions. The questions were then sorted in logical sequence of compilation and as applicable to the study participant, i.e., children aged 9-13 years. In absence of similar pulses consumption questionnaire that may be applied to this age group of children; additional questions were included to build similar construct. To assess knowledge, attitude, barrier and pulse consumption practice, questionnaires were adapted from studies conducted by Phillips, 2011 (Phillips, 2011) and Froehlich Chow et al., 2015 (Froehlich Chow, Leis, Humbert, Engler-Stringer, & Muhajarine, 2015), and Ramikie, 2018 (Ramikie, 2018). A summary of these three studies has been provided below.

Phillips (2011) conducted the study to determine perceived benefits and barriers to lentil consumption and how they relate to the demographics and nutritional knowledge of caregivers and consumption habits in families with children 3–11 years of age. The study was conducted in six schools in Saskatoon, Saskatchewan and participants were the caregivers of children aged 3 to 11 years of age. Self-administered questionnaires were used to measure the nutritional knowledge and perceived benefits and barriers to the consumption of lentils among 401 caregivers.

Froehlich Chow et al., 2015 conducted the study to evaluate a pulse crop intervention on increasing educators' knowledge and awareness about pulse crops and supporting educators in incorporating pulse crops into centers' menus. A pre and post 28-week intervention design was used to evaluate the pulse crop pilot intervention in one childcare center located in the province of Saskatchewan. The participants included female educators aged 35 to 50 years old and approximately 25 children 2 and 5 years of age who were exposed to the intervention. Self-administered questionnaires were used for data collection. One-on-one interviews were also conducted with the childcare center staff to determine their experiences with implementing the pulse crop intervention.

Ramikie (2018) conducted her study to evaluate the acceptability and feasibility of a pilot pulse-based nutrition education curriculum among children aged two to five. The pilot study was conducted in two childcare centers in Saskatoon over a three-month period. The evaluation of the intervention was conducted by sensory evaluations of pulse recipes with

children, lesson plan evaluations, semi-structured interviews with teachers, interviews with the cooks, and individual plate waste measurements.

3.5.1 Knowledge, Attitude, Barrier and Pulse Consumption practice Survey Questionnaire:

Knowledge component of the survey questionnaire was created to assess the knowledge on nutrient content of pulses, types of pulses and recommendation of Canada Food Guide for pulse consumption. A total of fifteen close-ended nutrition knowledge questions were included in the pre-tested questionnaire. Questions on assessment of nutrient content of pulses and recommendation of Canada Food Guide for pulse consumption were adopted from the studies of Phillips, 2011 (Phillips, 2011) and Froehlich Chow et al., 2015 (Froehlich Chow et al., 2015). Questions on identifying pulses (pictorial questions) were adopted from Ramikie, 2018 study (Ramikie, 2018). The knowledge component did not include questions on new Canada's Food Guide as it was not published until the time of questionnaire development. By the time the new Canada's Food Guide came out in January 2019, the study had already received ethical approval from the Behavioral Research Ethics Board (Beh-REB) of University of Saskatchewan. We received the Saskatoon Public School Division Approval on the February 2019 after which we had only 12 weeks left before summer vacation to initiate and complete the survey followed by implementation of the intervention. Therefore, the survey needed to be implemented as early as possible. Considering the time constrains, we were unable to revise the questionnaire to include questions on updated Canada's Food Guide.

Practice component was developed to assess pulse consumption practice of children using a Pulse Consumption Screener (PCS) adapted from a pulse frequency questionnaire (PFQ) from the study by Phillips, 2011. Phillips adapted her PFQ from a short food frequency questionnaire (SFFQ) which was created by Papadaki & Scott to assess the legume consumption in the population of Scotland. However, the SFFQ of Papadaki & Scott contained both legume and soy foods commonly consumed in Scotland (Papadaki & Scott, 2007). Therefore, Phillips included commonly eaten pulse-based dishes in Canada in her adapted PFQ as the original SFFQ did not contain any foods those are commonly eaten in Canada. In our Pulse Consumption Screener (PCS), we added more foods following recommendations from the research team along with the foods included in Phillips FFQ. These include bread and baked food made with beans, peas or lentils (e.g., cookies, brownies, muffins, pasta, pizza, puff patties), pulses eaten as side dish, beverage made with beans, peas or lentils (e.g., smoothies) and pulse-rich energy/protein bar. The possible responses to items in the PCS were never/rarely, 1 time in past month, 2-3 times in past month, 1 time per week, 2 times per week,

3-4 times per week, 5-6 times per week, 1 time per day, and 2 or more times per day. The possible responses to items in the PCS had been adapted from Phillips study and paper based Diet History Questionnaire of National institutes of health (National Cancer Institute, 2018). The PCS also included a section for participants to indicate usual serving size (categorized as low, medium and high) adapted from Philips study. With the recommendation from the research team, two other questions were included in the practice component to get information whether or not children eat pulses and if they eat pulses, what kind of pulses they eat; and what type of pulse-based food product they would like to be available in the market.

Attitude and barrier questions were adapted from Phillips, 2011 (Phillips, 2011) and Froehlich Chow et al., 2015 (Froehlich Chow et al., 2015) studies. Socio-demographic questions was limited to age, sex, and grade of the children. We could not add other socio-demographic information in the questionnaire such as information on parent's income and ethnicity, vegetarianism information of participants as it was assumed that children of 9-13 years age would not be able answer these questions.

3.5.2 Pre-testing:

Pre-test was done to understand whether participant understood the questions in a way that the researchers intended and to ensure that the responses were mutually exclusive and exhaustive (Collins, 2003; Fink, 2003). To pre-test the draft questionnaire, at first, we approached to a school which was not in the list of CHEP food service. However, I was unable to run the pre-test in any school as neither the ethical approval from the Behavioral Research Ethics Board (Beh-REB) of University of Saskatchewan nor the permission from Saskatoon Public School Division were issued by then. Therefore, with the consultation of the research team, finally the questionnaire was pre-tested among the fellow colleagues' children who are students of Grade 4-8. A total of 6 children of grade 4-8 participated in the pre-testing. We sent the questions to the parents and requested them to ask their children to fill out the questions on their own. We requested the parents to keep a note on how long the children took to fill up the complete questionnaire and provide us further suggestions to improve it.

Based on the pre-test, it was found that the average time to complete the full questionnaire was 35 to 40 minutes. Several amendments were made to the draft questionnaire based on the pre-test. For instance, in Knowledge section, "don't know" option was added in question number 1, 3 and 8 based on the suggestion we received from the pre-test. "Don't know" option was also added into the question number 18 in Practice section. In PSC, we made the instruction clear to fill up the boxes by adding "Please check (√)" with the main question.

Some questions were re-worded to make the language more child friendly. For example, the question in knowledge section 'Which of the following does not belong in the Meat and Alternative groups in Canada Food Guide" was changed to "Which of the following is not part of the Meat and Alternative groups in Canada Food Guide". From the suggestions we receive, we added a line within the parenthesis "Pictures contain same pulses" for each of the pulse identifying picture questions to make it easy for the children to understand; for example, "What is the name of these pulses? (Picture contains same pulses)". One of the pulse-identifying questions was re-worded from "Which one of these pictures are bean" to "Which one of these pictures contain bean". In the attitude section, one of the statements "Pulses are healthy food for growth and development of body" was changed to "Pulses are healthy food for growth and development of your body". Some minor grammatical and formatting changes were also occurred. The changes made from the pre-test then reviewed by the research team and the questionnaire was finalized to implement in the main survey of this study.

3.6 Interviewer training

Graduate students from College of Pharmacy and Nutrition were recruited for data collection (n=6). Each student attended 1 hour long mandatory training that covered explanation of each questions and become familiar with the full questionnaire, survey procedures, interviewer's role and responsibilities, ethics and confidentiality. A presentation on the instructions to fill up the survey questionnaire were made to the interviewers during the training. A copy of the presentation was also provided to the data collectors for their reference to administer the survey in the classes.

3.7 Survey procedure

We contacted the schools and the teachers of grade 4- 8 to get their convenient time and date to conduct the survey. One school was surveyed per day on the date given by that school. All grades of a specific school were surveyed simultaneously on that day. During the day of the survey, each data collector was provided a bag which included list of the students who provided consent, nine sample packet of pulses, measuring cups and spoons (2 cups of 250 ml and 150 ml, and one 15 ml spoon), and pictures of pulse-made food.

Each school had four data collectors (including myself) assigned for each class. On the day of the survey, data collectors and myself reached to the school 15 minutes before the survey time in order to organize and set up the class for survey. After reaching the school, the data

collectors and I went to our assigned classrooms. Before starting the survey, with the permission of the teacher, we gave a brief introduction of ourselves, informed the procedure to filling up the survey questionnaire, and the estimated time of the survey to the students. We knew from our previous contact with the teachers and schools that the classrooms have projector and during survey, we used the projector to display the questionnaire in the classroom with the help of the class teacher. We requested the class teachers to help us to manage the class during the survey. With the help of the class teacher, we distributed the survey copies among the students who have their name in our student list. The teacher assigned other activities to those students who didn't participate in the survey but remain in the classroom. In order to make sure that every student was filling up the same section and same questions at the same time, we were reading out every question one by one and gave some time to the students to fill out the questions within that time. While the students were filling up the questions, we were moving around to quickly check if all the students were in the same page and filling out the same questions. We requested the students to ask questions if they had any difficulty to understand or filling out the survey. We moved to the next question once we confirmed that the previous question was filled out by every student. Sample of pulses were used when the students were filling up the pictorial questions. We displayed the sample pulses for each pictorial question without mentioning the pulse's name to make sure that they see the same pulses in reality what they were seeing in the picture. While filling up the pulse consumption screener (PCS), we displayed the cups, spoons and food pictures to give them an idea for estimation of their serving size for each of those ten dishes mentioned in the PSC. The whole survey took 40-45 minutes to complete. Once the survey completed, the survey copies were collected from the students and checked quickly to make sure that everyone had filled out their information on the cover page.

3.8 Data Analysis

Once all data were received after completion of the survey, the data were checked for its consistency using logics, and frequencies to check valid entry of the data by students in the questionnaire. The data were then rechecked, coded and entered into SPSS software version 25. A unique identification number (UIN) was created for each the participant. The UIN was created by using the variables- School, Grade, Home room Number and the assigned code for the students. The reason to create the UIN was to ensure their identity are confidential in the dataset.

During analysis the distribution of the continuous variables was checked for normality. All variables in all grades were found to be normally distributed. All variables for grade 8 however was found skewed. The major reason was assumed to be the smaller sample size of grade 8 (n=15). Therefore, grade 7 and grade 8 were collapsed to have a sample size more than 30 to achieve a normal distribution (Kwak & Kim, 2017). Using this assumption, grade 7 and 8 were used as one unit in the analysis stratified by grades (Two way ANOVA to see the difference in mean knowledge, attitude, and barrier scores between grades, t- test to see the difference in mean knowledge score, mean attitude score, and mean barrier score between male and female students in each grade, chi-square test to see the difference in eating pulses between grades). Similarly, age 13 year (n=28) and 14 year (n=7) had a sample size less than 30. Therefore, age 13 & 14 were collapsed and used as one unit in all analysis stratified by age (Two way ANOVA to see the difference in mean knowledge, attitude, and barrier scores between age groups, chi-square test to see the difference in eating pulses between age groups).

Knowledge on Pulses: Correct responses were coded as '1' and all other responses were recoded to '0' for the purpose of calculating a composite knowledge score by adding all the knowledge variables. The score ranged from 0 to 15 where higher score indicated higher number of correct answers for an individual.

Pulses Consumption: Pulse consumption was measured using the PCS and three close ended questions. The PCS had a total of 10 dishes made of pulses. Frequency of consumption of these pulse-made dishes in the pulse consumption screener were coded into nine categories (never or rarely=0; 1 time in past month=1; 2-3 times in past month=2; 1 time per week=3; 2 times per week=4; 3-4 times per week=5; 5-6 times per week=6; once a day=7; and two or more times a day=8). Serving size was coded as one for small, two for medium and three for large. If participants checked that they "never or rarely" ate any of the pulse-made dishes in the PCS, serving size of that specific dish for that participant was coded as "0" during data entry regardless of which serving size was checked in the questionnaire.

Consumption data of pulses asked by a close ended question was coded as 1 if they said they eat pulses and 0 if they said that they do not eat pulses. Students who checked "yes" for this question were asked to proceed to answer the next question where they were asked the type of pulses they eat most often. Multiple answers were provided for this question. All checked answer options were coded as "1". Any unchecked option was coded as "0". If students said that they do not eat pulses, they were asked to skip this question.

Multiple answers were provided to a question asked to get information on the type of pulse-based food product participants would like to see available in the market. All checked

answer options were coded as “1”. Any unchecked option was coded as “0”. “Don’t know” was coded as “99”. Name of foods written under the “other” option was first checked if they were pulse-based. A list of all pulse-based foods written by the students was created. A new variable was then created for each of those pulse-based foods and code ’1’ was entered for the students who mentioned them. Descriptive statistics were used for this question to describe frequency of the different type of pulse-based foods students would like to see available in the market.

Attitude and Barrier to Pulses Consumption: Attitude questions were coded 1 through 5 with a higher score indicating a more positive response. For example, the question “Pulses are healthy food for growth and development of your body” would score 5 for a “strongly agree” response and 1 for “strongly disagree”. Barrier questions were also coded 1 through 5 with a higher score indicating higher agreement with barrier to pulse consumption. For example, the statement “Pulse based dishes upset my stomach, so I choose not to eat them” would score a 5 for “strongly agree” and a 1 for “strongly disagree”. All “not sure” responses coded as 3 for both barrier and attitude questions. To calculate a composite score, all the attitude and barrier questions were recoded as 1 for “agree” responses, and 0 for “disagree” and “not sure” responses. The responses were then added to get the total scores for both attitude and barrier.

Descriptive statistics were used to describe the demography, knowledge results, consumption report of 10 pulse-based dishes in PCS, attitude towards and barrier to pulses consumption. Frequencies of responses to the questionnaire items were measured and cross-tabulated (Chi-square ($\chi 2$) test of statistical significance) between knowledge and pulse consumption.

Cronbach’s alpha was used to test the internal consistency of the items of the attitude and barrier questions. A good measure should have a Cronbach’s alpha of at least 0.60 and anything over 0.90 is very good (Aron, Aron, & Coups, 2006). Factor analysis of both attitude and barrier questions were done to identify if all questions represented the same theme based on the factor loading.

Inferential statistics were also conducted. Pearson Correlation analysis was conducted between knowledge, and attitude to pulses consumption. Correlation analysis was also done to test the relation between pulse consumption and total knowledge score; and eating pulses and attitude towards pulses consumption. ANOVA test was done to see if there are any differences in mean knowledge, attitude, and barrier scores between schools, between grades, and between

age. Independent sample t-test was conducted to find out the differences in mean knowledge, attitude, and barrier scores between male and female students within each grade.

On top of the other analysis, Linear and Logistic regressions were conducted as multivariate analysis. The output variable for linear regression was 'Total knowledge score'. This analysis was conducted to identify whether knowledge has any relationship with being in certain school, grade and sex of the students. The following model was used for linear regression analysis:

Total knowledge score = β0 (Constant) + β1 (School) + β2 (Grade) + β3 (Sex)

The output variable for logistic regression was 'Pulses consumption'. Logistic regression was conducted to determine whether knowledge, grade, sex, attitude, and barrier had any relationship with pulses consumption and the following model was used to logistic regression:

Pulses consumption = β0 (Constant) + β1 (Knowledge) + β2 (Grade) + β3 (Sex) + β4 (Attitude) + β5 (Barrier)

3.9 Ethical approval

Ethical approval was obtained from the Behavioral Research Ethics Board (Beh-REB) of University of Saskatchewan. Approval was also obtained from Saskatoon Public School Division prior to collecting the data from schools. The school principals of the selected schools were provided a letter which contains the information on the study purpose and the approval letter from the Saskatoon Public School Division. An envelop was provided to each of the parents through students which contains a letter to parents informing the study purpose, survey procedure and benefits derived from this study, a written informed consent form for parents and assent form for students. We included those students in this study who could provided us both the signed consent forms from their parents and the signed assent form. Students who could not provide any of these forms were excluded from this study. All participants were informed that their participation in this study was voluntary and that they had the right to withdraw up to the point of handing the questionnaire in without any consequence from the teachers or the school. Although information would be reported, participants were assured that all information would be presented solely in summative form. At the end of the survey, all the participants were provided a copy of their signed consent form and assent form with the signature of the researcher on the copies.

4. RESULTS

4.1 Participants

More than two thirds (69%) of the 357 students of grades 4 to 8 signed the consent forms in the four participating schools. One hundred and ten participants did not provide their consent to participate in this study. Among the participating 247 students, 42 (17%) belonged to School A, 59 (24%) from School B, 57 (23%) from School C, and 89 (36%) participated from school D (Table 4.1). The total number of participating students in grade 4 was 41, 65 in grade 5, 61 in grade 6, 65 in grade 7, and 15 in grade 8 in four schools.

Out of the 247 participating students, approximately 48% were female and 47% were male. A very small proportion (5%) of students did not want to report their sex. The age range of the participating students were 9 to 14 years. The majority of the students' age fall between 10 to 12 years. However, the number of the student aged 13 and 14 years were small. Participation of grade 8 was also relatively low compared to other grades. Therefore, age 13 and 14 years were collapsed, and grade 7 & 8 were collapsed for all type of stratified analysis.

The number of enrolled students per schools ranged from 143 to 502 according to City of Saskatoon, 2018 data. Each school receives support from the CHEP program with bag lunches provided to children who needed them. Other than CHEP service, School A offers "Fresh Fruit Fridays" program where the school receives seasonal fruits and vegetables as donation from the local business. Under this program, students and staffs deliver fresh fruits to every classroom on Fridays. The schools are located in neighborhoods that have more or less similar ethnic diversity except for school B which has a higher ethnically diverse population. The median personal income of all four schools' neighborhoods is similar. Compared to the other neighborhoods, the residents of school C neighborhood are more educated in terms of having university degree/diploma. On the other hand, the number of the university degree or diploma holder is lower in the neighborhood of school B resident compared to the other three (City of Saskatoon, 2018). The medium of instruction was English in all four schools except for School D which also has French immersion programs. Details of school-wise participation is as follows:

School A: School A had a total of 53 students in grade 4 to 8 during the time of data collection among which a total of 42 students (79%) participated. All students from grade 4, 82% students from grade 5, and 75% students from grade 6, and 60% students from both grade 7 & 8 participated from this school. A total of 6 students from Grade 4, 5 and 6 of this school did not want to disclose their sex while all the students in Grade 7 & 8 reported their sex.

School B: A total of 59 students (52%) out of 113 from grade 4 to 8 participated from school B. About 60% students from grade 4, 58% students from grade 5, 68% students from grade 6, 45% students from grade 7, and 33% student from grade 8 participated from this school. Only 2 students from grade 4 and 1 student in grade 7 did not report their sex in School B.

School C: A total of 57 students (76%) out of 75 from grade 4 to 8 participated from school C. About 88% students from grade 4, 84% students from grade 5, 67% students from grade 6, and 74% students from grade 7 participated in the survey from this school. None of the students from grade 8 of this school consented to participate in the survey.

School D: A total of 89 students (77%) out of 116 from grade 4 to 8 participated from school C. About 91% students from grade 4, 76% students from grade 5, and 75% students from both grade 6 and 7 participated in the survey from this school. Students from grade 8 did not participate in the survey. Among the participating students, a total of 4 students from grade 5, 6 and 7 did not report their sex.

A summary of the distribution of students across schools by number and gender is found in Table 4.1 and Table 4.2 describes the age distribution of the participating students.

Table 4. 1: Distribution of students across schools by number and gender

	School A	**School B**	**School C**	**School D**
Grade 4				
- Number of students in participating class	15	15	8	11
- Number of students surveyed (%)	15 (100%)	9 (60%)	7 (88%)	10 (91%)
- Male (%)	5 (33%)	4 (44%)	5 (71%)	6 (60%)
- Female (%)	8 (53%)	3 (33%)	2 (29%)	4 (40%)
- Did not report gender (%)	2 (13%)	2 (22%)	0 (0%)	0 (0%)
Grade 5				
- Number of students in participating class	11	26	19	33
- Number of students surveyed (%)	9 (82%)	15 (58%)	16 (84%)	25 (76%)
- Male (%)	4 (44%)	7 (47%)	7 (44%)	9 (36%)
- Female (%)	3 (33%)	8 (53%)	9 (56%)	14 (56%)
- Did not report gender (%)	2 (22%)	0 (0%)	0 (0%)	2 (8%)
Grade 6				
- Number of students in participating class	12	25	21	28
- Number of students surveyed (%)	9 (75%)	17 (68%)	14 (67%)	21 (75%)
- Male (%)	5 (56%)	8 (47%)	6 (43%)	7 (33%)
- Female (%)	2 (22%)	9 (53%)	8 (57%)	13 (62%)
- Did not report gender (%)	2 (22%)	0 (0%)	0 (0%)	1 (5%)

Grade 7 - Number of students in participating class - Number of students surveyed (%) - Male (%) - Female (%) - Did not report gender (%)	5 3 (60%) 1 (33%) 2 (67%) 0 (0%)	20 9 (45%) 4 (44%) 4 (44%) 1 (11%)	27 20 (74%) 11 (55%) 9 (45%) 0 (0%)	44 33 (75%) 15 (45%) 17 (52%) 1 (3%)
Grade 8 - Number of students in participating class - Number of students surveyed (%) - Male (%) - Female (%) - Did not report gender (%)	10 6 (60%) 3 (50%) 3 (50%) 0 (0%)	27 9 (33%) 8 (89%) 1 (11%) 0 (0%)		

Table 4. 2: Age distribution of participating students

Age in completed years	Number of the participants (%)
9	31 (12.6)
10	52 (21.1)
11	65 (26.3)
12	64 (25.9)
13	28 (11.3)
14	7 (2.8)

4.2 Students' knowledge on pulses consumption

Fifteen questions were included in the nutrition knowledge section among which 50% of the students correctly answered more than 10 questions. Overall, mean knowledge score of female students was higher than the male student and the difference was significant ($p<.001$). We found a significant difference in mean knowledge score between male and female students of grade 5 ($p<.001$) and 6 ($p=.03$). However, no difference had been seen in knowledge between male and female students of other grades (Table 4.3).

Table 4. 3: Differences in mean knowledge score between male and female students by grade (n=247)

Grades	Mean knowledge score		*p*-value
	Male (µ± SD)	Female (µ± SD)	
All grade	8.94±2.4	10.18±2.3	<.001
Grade 4	10.10±1.7	9.76±2.02	.58
Grade 5	7.81±2.35	10.65±2.39	<.001
Grade 6	9.12±2.75	10.63±2.32	.03
Grade 7 & 8	9.00±2.3	9.56±2.3	.29

Table 4.4 shows that mean knowledge score was also higher among the students aged 9 years compared to the other age and school D had higher knowledge score than other schools. Grade 6 student's mean knowledge score was 10 which is higher than other grades. However, ANOVA test revealed that there was no significant difference in knowledge score between age groups, between schools and between the grades.

Table 4. 4: **Differences in mean knowledge score by age, school and grades**

Age (n)	**Mean knowledge score (μ± SD)**	***p*-value**
9 year (31)	9.84±2.09	0.67
10 year (52)	9.56±2.41	
11 year (65)	9.77±2.69	
12 year (64)	9.55±2.50	
13 & 14 year (35)	9.06±2.22	
School (n)	**Mean knowledge score (μ± SD)**	***p*-value**
School A (42)	9.67±2.11	0.13
School B (59)	9.03±2.33	
School C (57)	9.44±2.41	
School D (89)	9.98±2.64	
Grades (n)	**Mean knowledge score (μ± SD)**	***p*-value**
Grade 4 (41)	9.73±1.91	0.35
Grade 5 (65)	9.40±2.73	
Grade 6 (61)	10.00±2.58	
Grade 7 & 8 (80)	9.31±2.33	

More than three quarters (77%) of the students were unable to correctly recognize that pulses are an example of meat and alternative food group and only 16% students were able to identify the correct serving size of cooked pulses according to Canada's Food Guide.

Most students (86.2%) knew that pulses are good source of protein. More than three quarters (76.1%) of the students knew that pulses are good source of fiber and 64% knew that pulses are good source of Iron. In addition, 73.3% students correctly recognized that pulses contain low fat.

Results from the pulses identifying pictorial questionnaire indicated that about one third of students (32%) correctly answered all pictorial questions. However, a substantial proportion of students ranging between 28% to 46% answered "Don't know" to Q2, Q3 and Q5 (Table

4.5). Chickpeas and beans were correctly identified by 61% and 83% of students respectively and almost all students (96.8%) could correctly distinguished beans from lentils.

Table 4. 5: Percentage of pictorial questions answered correctly (n=247)

*Questions	Proportion (n)		
	Correct	Incorrect	Don't know
Q1. Distinguishing Bean btw Lentils & Beans pictures	96.8 (239)	1.6 (4)	1.6 (4)
Q2. Identification of Chickpeas	61 (150)	9 (23)	30 (74)
Q3. Identification of Lentils	44 (108)	10 (25)	46 (114)
Q4. Identification of Beans	83 (205)	1 (2)	6 (40)
Q5. Identification of Peas	58.3 (114)	13.4 (33)	28.3 (70)
All questions correctly answered	31.6 (78)	N/A*	N/A*

*N/A- As this is a cumulative score, we reported only those respondents who had correctly answered all five questions. Those who responded correctly to four or less questions were partially correct; and therefore, could not be included as 'incorrect' or 'Don't know'

To identify the association between student's knowledge and pulses consumption, knowledge questions had been recoded as '1' for ten or more correct answers and '0' for nine or less correct answers. Pearson's Chi-square test exhibits that pulse consumption was not associated (x^2=0.609, p=.43) with better knowledge on pulses as defined by above or median knowledge score (Table 4.6). In addition, Pearson correlation analysis also exhibits that there is no relation between pulse consumption and total knowledge score (r=0.067, p=.29).

Significant association (p=.02) had been found between the pulse consumption and pulses identification. Results from the pulses identifying questionnaire indicated that 50% of the students correctly answered 4 or more pictorial questions. Pulses identifying variable then recoded as one for four or more correct answer and zero for three or less correct answer. Pearson's Chi-square test revealed that the ability to identify pulses was significantly higher (x^2= 5.26, p=.02) among the students who eat pulses than the students who don't eat (Table 4.6). Pearson correlation analysis also exhibits that *p*ulse consumption is significantly (r=0.170, p<.01) and positively correlated with the ability to correct pulse identification of students. No association had been found between the students who eat pulses and their knowledge on the information on pulses can be used in baking (Table 4.6).

Table 4. 6: Association between knowledge and pulse consumption of students (n=247)

Consumption	Knowledge	Chi-square co-efficient	*p*-value
Consumes pulse? (Yes)	Total knowledge score (10 or more correctly answered) 112 (53%)	0.609	.43
Consumes pulse? (Yes)	Identification of pulses (4 or more correctly identified) 117 (55.2%)	5.26	.02
Consumes baked beans? (Yes)	Pulses can be used in baking 102 (82%)	0.0303	.86

Linear regression analysis was used to determine whether school, grade and sex had any relationship with total knowledge score. The following model was used in this analysis:

Total knowledge score = β0 (Constant) + β1 (School) + β2 (Grade) + β3 (Sex)

The R-square values (0.075) in the result suggested that all relevant and non-correlated independent variables used in the model accounted for only 7.5% of the variation in total knowledge score. Only sex of the student had significant (β= -0.245, p<.001) correlation with knowledge score; being male negatively changes the relationship with total knowledge score. School and grade did not have any significant correlation with total knowledge score (Table 4.7).

Table 4. 7: Magnitude and direction of associations between total knowledge score and the independent variables

Independent Variables	Standardized co-efficient	*p*-value	95% Confidence interval	
			Lower	Upper
Constant		<.001	9.743	13.574
School	0.083	.19	-0.095	0.470
Grade	-0.068	.28	-0.402	0.120
Sex	-0.245	<.001	-1.817	-0.586

4.3 Pulses consumption

A total of 86% students reported that they consume pulses among which consumption by female students (87%) was higher than male (85%). When the students were asked question

regarding the type of pulses they eat most often, 48% said they eat bean, while 26%, 16% and 15% students said they eat chickpea, peas and lentils respectively.

On average, 80% students of all age group consumed pulses; however, there was no significant difference in pulse consumption between the age groups. Similar to age, no significant difference was found in pulse consumption between the grades. School B had the highest pulse consumption (90%) compared to the other schools; however, the difference in pulses consumption between the schools was also not significant (Table 4.8).

Table 4. 8: Pulse consumption by age, grade and school (n=247)

Age (n)	**Pulse consumption (%)**	**Chi-square co-efficient**	***p*-value**
9 year (31)	27 (87%)	2.724	.60
10 year (52)	46 (89%)		
11 year (65)	57 (88%)		
12 year (64)	51 (80%)		
13 & 14 year (35)	31 (89%)		
School (n)	**Pulse consumption (%)**	**Chi-square co-efficient**	***p*-value**
School A (42)	36 (86%)	1.078	.78
School B (59)	53 (90%)		
School C (57)	48 (84%)		
School D (89)	75 (84%)		
Grades (n)	**Pulse consumption (%)**	**Chi-square co-efficient**	***p*-value**
Grade 4 (41)	36 (88%)	1.282	.73
Grade 5 (65)	58 (89%)		
Grade 6 (61)	51 (84%)		
Grade 7 & 8 (80)	67 (84%)		

Logistic regression analysis was used to determine whether knowledge, grade, sex, attitude, and barrier had any relationship with pulses consumption. We did not use student's age in the model as it was found that the grade and age are highly significantly correlated ($p<.001$). Therefore, it was decided to include grade in the model over age. The following model was used in this analysis:

Pulses consumption = β0 (Constant) + β1 (Knowledge) + β2 (Grade) + β3 (Sex) + β4 (Attitude) + β5 (Barrier)

The result demonstrated that students' attitude towards pulses consumption had significant ($\beta= 0.347$, $p<.01$) positive relationship with eating pulses. Sex of the students also

had positive relationship with pulses consumption; however, the relationship was not significant. Students' knowledge, grade, and barrier to pulses consumption were negatively correlated with eating pulses; although not significantly (Table 4.9).

Table 4. 9: Magnitude and direction of associations between pulse consumption and the independent variables

Independent Variables	**Standardized co-efficient**	***p*-value**	**Odd Ratio**	**95% Confidence interval**	
				Lower	**Upper**
Total Knowledge Score	-0.030	.77	0.971	0.793	1.188
Grade	-0.259	.27	0.772	0.487	1.225
Sex	0.362	.50	1.436	0.498	4.134
Attitude	0.347	<.01	1.414	1.125	1.778
Barrier	-0.187	.84	0.829	0.131	5.230
Constant	1.425	.48	4.158		

The Pulse Consumption Screener (PCS) contained ten dishes made of pulses. To identify the most commonly consumed dishes of PCS, the responses were recoded as zero for "never or rarely' eaten response and one for the rest of the responses. Overall, mixed dishes made of pulses (74%) was found as the most commonly eaten pulse dishes while beverages such as smoothie (30%) was the least consumed dish. Rest of the dishes fall in-between the two, following the pattern as shown in Figure 4.1 which appears to be similar in both male and female.

Students of grade 5, 6, and 7 and 8 commonly ate mixed dishes (73%, 71%, and 79% respectively) whereas students of grade 4 commonly consumed both baked bean (71%) and chili (71%) compared to other dishes in PCS. Beverage was reported as the least consumed pulse-based food by all grades (Figure 4.2).

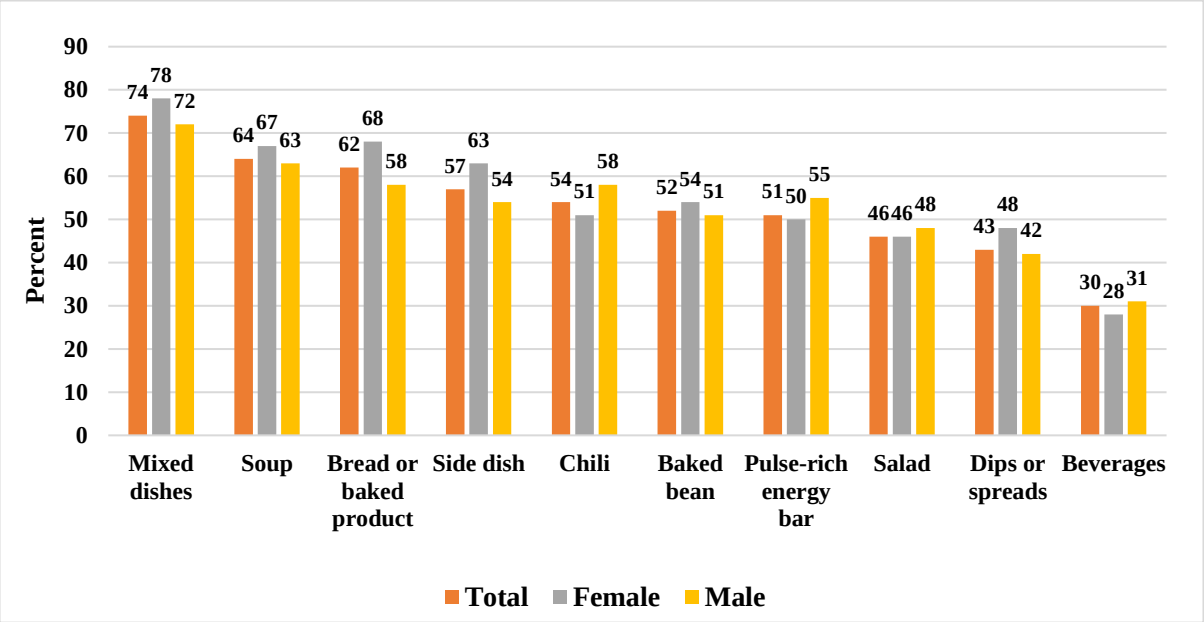

Figure 4. 1: Proportion of different type of dishes in PCS consumed by sex

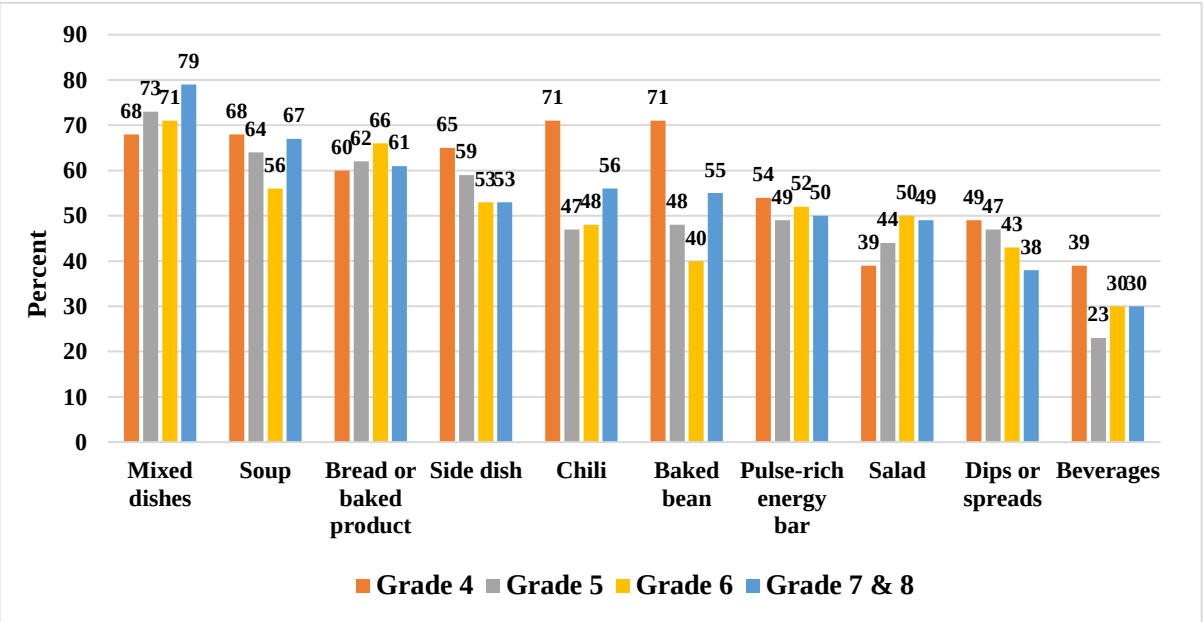

Figure 4. 2: Proportion of different type of dishes in PCS consumed across grade

About two thirds (63.2%) of all students reported that they ate at least one of the pulse-based dishes at least once a week or more often. No difference was found between male (63.5%) and female (63%) responses. “Never or rarely” was the most common response for eight out of 10 dishes, while “1-3 times in past month” was most commonly reported by students for soup and mixed dishes. The most commonly reported serving size for most of the

dishes was “Medium”, while “Small” serving size was reported only for the dips or spreads and pulse-rich energy/protein bar (Table 4.10).

Table 4. 10: Frequency of consumption of the ten pulse-based dishes in PCS

Pulse-based Dishes	Frequency of consumed dishes (%)					Most reported serving size (%)
	Never/rarely	1-3 times in past month	1 -4 times per week	5-7 times per week	2 or more times per day	
Baked bean (n=244)	48	36	13	3	0.8	M (44)
Soup (n=244)	37	43	18	1.2	0.8	M (56)
Chili (n=245)	46	36	15	2	1.2	M (42)
Dips or spreads (n=245)	57	28	11	2.9	0.8	S (56)
Mixed dish (n=245)	27	42	23	7	0.8	M (49)
Bread or baked product (n=244)	38	27	25	6	4	M (50)
Salad (n=243)	54	28	14	3	1	M (45)
Side dish (n=240)	43	37	15	3	1	M (48)
Beverage (n=244)	70	21	6	3	0.8	M (45)
Pulse-rich energy/protein bar (n=244)	49	30	10	7	3	S (48)

*S=Small, M= Medium, L= Large

When the students were asked, what type of pulse-based food product they would like to see available in the market, about 24% students reported that they want pulse-made bread product, 27% mentioned other baked product (e.g.: pizza crust) and 20% said they want pulse-made soup product available in the market. One third of the students (33%) students replied “don’t know” to respond to this question. Students mentioned a few other pulse-based food products such as salad, brownie, protein bar, hummus and muffins that they would want to find in the market.

4.4 Attitude towards pulses consumption

Attitude question had a total of nine items and using a five-point Likert scale (strongly agree to strongly disagree), statements were ranked eliciting information about students' attitude towards pulse consumption.

Factor analysis result showed that the nine attitude items fall under two principal components. Based on their characteristics, component 1 is more related to "health and nutrition benefits" and component 2 to "external factors that influence pulse consumption" (Table 4.11). Internal consistency of the attitude questionnaire was high (Cronbach's α =0.85).

Tables 4.12 provides a summary of the percentage of attitude statements reported by students. Majority of the students (74.9%) believed that pulses are healthy food for growth and development of body. About 64.4% students conceded that they will eat pulses if their parents serve them pulse-based dishes and about 63.2% students believe that parents' encouragement would make them eating pulses.

Table 4. 11: Components of attitude questions as derived by factor analysis

Component	Attitude questions	Factor loading
Component 1: Health and nutrition benefits	Pulses are healthy food for growth and development of your body	0.85
	Eating pulse-based food would give you more energy to work	0.86
Component 2: External factors that influence pulse consumption	You would eat pulses if your parents serve them	0.72
	You would eat pulses if your parents encourage you	0.82
	You would like to taste new pulse-based dishes that you haven't tried before	0.70
	You would eat pulses if your parents eat them too	0.72
	Pulse-based dishes are a tasty food	0.68
	You would eat pulses if they had a more attractive appearance	0.43
	You would eat pulses if your teachers encourage you	0.62

Table 4. 12: Attitude to pulse consumption reported by students

Attitude Question	% Agree
Pulses are healthy food for growth and development of your body	74.9
You would eat pulses if your parents serve them	64.4
You would eat pulses if your parents encourage you	63.2
Eating pulse-based food would give you more energy to work	59.5
You would like to taste new pulse-based dishes that you haven't tried before	53.8
You would eat pulses if your parents eat them too	51.0
Pulse-based dishes are a tasty food	45.3

You would eat pulses if they had a more attractive appearance	42.9
You would eat pulses if your teachers encourage you	38.9

Pearson correlation analysis was conducted to find out the relation between the knowledge & attitude, and pulse consumption practice with attitude. For this analysis, composite score was calculated for attitude questions. To calculate composite score, questions were recoded as one for "agree and strongly agree" statement. "disagree and strongly disagree", and "not sure" statements were recoded as zero. The questions then calculated to get a total score for attitude questions.

Pearson correlation demonstrated that knowledge on pulses significantly correlates (r=0.241, p<.001) with attitude towards pulse consumption. Pulse consumption also significantly (r=0.376, p<.001) correlates with the attitude (Table 4.13).

Table 4. 13: Relationship between knowledge and attitude, and pulse consumption practice and attitude

Variables	Pearson Correlation Coefficient	*p*-value
Between knowledge and attitude	0.241	<.001
Between pulse consumption and attitude	0.376	<.001

The mean attitude score of female students (5.07±2.51) was higher than that of the male students (4.83±2.67) but the difference was not significant. Also, no male-female difference in mean attitude score was found across grades except in grade 5 (Table 4.14).

Table 4. 14: Male-female comparison of mean attitude score (n=247)

Grades	Mean attitude score		*p*-value
	Male (μ± SD)	Female (μ± SD)	
All grade	4.83±2.67	5.07±2.51	.49
Grade 4	5.15±2.74	5.71±2.34	.51
Grade 5	4.37±2.68	5.74±2.37	.03
Grade 6	4.81±2.84	4.61±2.78	.79
Grade 7 & 8	5.00±2.57	4.53±2.36	.40

Table 4.15 shows that the mean attitude score of grade 4 students was higher than the other grades. Mean attitude score was also higher among the students aged 9 years compared to the other age. However, ANOVA test revealed that there was no significant difference in mean attitude score between age groups, between schools, and between the grades.

Table 4. 15: Difference in mean attitude score by age, school and grades

Age (n)	**Mean attitude score (μ± SD)**	***p*-value**
9 year (31)	5.74±2.28	.10
10 year (52)	5.04±2.86	
11 year (65)	5.06±2.62	
12 year (64)	4.27±2.48	
13 & 14 year (35)	5.23±2.66	
School (n)	**Mean attitude score (μ± SD)**	***p*-value**
School A (42)	4.67±2.96	.21
School B (59)	5.17±2.6	
School C (57)	5.47±2.34	
School D (89)	4.63±2.62	
Grades (n)	**Mean attitude score (μ± SD)**	***p*-value**
Grade 4 (41)	5.46±2.59	.22
Grade 5 (65)	5.14±2.63	
Grade 6 (61)	4.58±2.82	
Grade 7 & 8 (80)	4.84±2.47	

4.5 Barrier to pulses consumption

Barrier questions had a total of 8 statements and using a five-point Likert scale, ranging between strongly agree to strongly disagree, the statements were ranked eliciting information about students' barrier to pulse consumption. Factor analysis results showed that the eight barrier questions fall under only one component. Data reliability was also high for barrier questions (Cronbach's $\alpha = 0.85$). Tables 4.16 provides a summary of the percentage of barrier statements reported by students. Preference of other foods over pulses appeared as a barrier reported by most of the students (30.8%). On the other hand, feeling of greasiness in the hand due to eating pulses appeared as the least reported barrier (6.9%).

Table 4. 16: Barriers to pulse consumption as reported by students

Barrier Question	**% Agreed**
I do not eat pulse-based dishes because I want to eat something else (e.g., sweet, chocolate)	30.8
I do not eat pulses because my parents do not cook them	20.6
I am still hungry even after having pulse-based dishes, so I chose not to eat pulses	17.0
I do not like the taste of pulse-based dishes	15.8

I do not eat pulse-based dishes because it takes too much time to eat	9.7
Pulse-based dishes upset my stomach, so I choose not to eat them	8.5
I do not eat pulses because my parents do not eat them	7.7
I do not eat pulse-based dishes because it makes my hands greasy	6.9

Barrier score had a total of eight items. We created a composite score using those eight items to meaningfully use in the analysis. To calculate the composite score, response to each barrier question was recoded under either of the two options (i.e., '1' if agreed and strongly agreed, and '0' if disagreed, strongly disagreed, or unsure). Responses to all items were then added to calculate the composite score for the barrier module ranging between 0 to 8. The distribution of the composite score however was found to be non-normal (Skewness 1.704). The reason of having a skewed distribution of barrier score was that about 45% of the students reported having no barriers for pulse consumption. Therefore, log-transformations were used to normalize the data and subsequently used in the analysis.

Overall there was no difference in mean barrier score between male and female students. Similarly, no difference was found in mean barrier score between male and female students within the grades (Table 4.17). ANOVA test also revealed that there was no difference in mean barrier score between age group, between schools, or between the grades (Table 4.18).

Table 4. 17: Male-female comparison of mean barrier score (n=247)

Grades	**Mean barrier score (log-transformed)**		***p*-value**
	Male (μ± SD)	**Female (μ± SD)**	
All grade	0.26±0.26	0.21±0.27	.33
Grade 4	0.17±0.27	0.27±0.37	.57
Grade 5	0.19±0.27	0.19±0.28	.91
Grade 6	0.33±0.28	0.24±0.29	.37
Grade 7 & 8	0.28±0.24	0.16±0.19	.12

Table 4. 18: Difference in mean barrier score by age, school and grades

Age (n)	**Mean barrier score (log-transformed) (μ± SD)**	***p*-value**
9 year (14)	0.16±0.31	.40
10 year (28)	0.19±0.28	
11 year (41)	0.25±0.26	
12 year (33)	0.25±0.26	
13 & 14 year (20)	0.32±0.24	
School (n)	**Mean barrier score (log-transformed)**	***p*-value**

	(μ± SD)	
School A (22)	0.29±0.31	.19
School B (34)	0.24±0.26	
School C (34)	0.29±0.25	
School D (46)	0.18±0.25	
Grades (n)	**Mean barrier score (log-transformed) (μ± SD)**	***p*-value**
Grade 4 (20)	0.21±0.30	.44
Grade 5 (37)	0.20±0.28	
Grade 6 (38)	0.29±0.28	
Grade 7 & 8 (41)	0.23±0.23	

Pearson correlation analysis was conducted to find out the relation between the knowledge & barrier, and pulse consumption practice with barrier. A negative relation was found between the barrier and knowledge. Similarly, we found a negative relation between barrier and pulse consumption. However, none of the relations was significant (Table 4.19).

Table 4. 19: Relationship between knowledge and barrier, and pulse consumption practice and barrier

Variables	Pearson Correlation Coefficient	*p*-value
Between knowledge and barrier	- 0.126	.14
Between pulse consumption and barrier	-0.052	.54

5. DISCUSSION

Limited information was available in the literature around children's knowledge, practice, attitude, and barriers to pulse consumption although a few studies provided information on the similar indicators related to pulses consumption as reported by the parents. The intention of this cross-sectional survey was to fill that evidence gap by collecting the information from grades 4-8 students and also to serve as a baseline for an evaluation of an intervention. Given the lack of availability, another intention was to contribute to the development of the tools to measure knowledge, attitude, practice, and barrier to pulses consumption among the children grade 4-8.

The following sub-sections provides comparison of this study results with similar others and the likely interpretation of the results. This is followed by a few concluding remarks and recommendations made towards the end.

5.1 Students' knowledge on pulses consumption

Half of the students correctly answered 10 out of 15 knowledge questions indicating that they have considerable knowledge on pulses; however, with a room for improvement. Interventions focusing this age group; therefore, would make meaningful contribution. Similar to other studies, present study found that the mean knowledge score of female students was significantly higher than male students. A study conducted among elementary school students by Choi et al. shows that female students correctly answered questions on nutrition and diet more than the males did (Choi et al., 2008). However, the difference in knowledge score between male and female students was not significant in that study which is different from the present study result. Another study was conducted on knowledge, attitudes, and practices related to fruit and vegetable consumption of high school students reported similar results where female students' had higher knowledge than male students and the difference was significant (Beech, Rice, Myers, Johnson, & Nicklas, 1999). In general, women are more likely to be interested in diet, nutrition, body weight and they make more healthful food choice than men (von Bothmer & Fridlund, 2005; Yahia, El-Ghazale, Achkar, & Rizk, 2011). Furthermore, studies suggest that there is relationship between body image and adolescents eating behavior. Female students are more inclined to change their eating habit than male as they want to have a smart weight and slender body shape (Lai Yeung, 2010). The result of the present study also reflects that female students appear to have better knowledge and dietary habit than male students.

ANOVA test revealed no significant difference in knowledge score between the schools in present study. Health education is a required area of study in Saskatchewan's core education curriculum developed by Saskatchewan Ministry of Education. Health education aims to develop confident and competent students who understand, appreciate, and apply health knowledge, skills, and strategies throughout their lifetime. Each grade has separate health education curriculum with grade-specific goal, objective and learning outcome (Lu & Mclean, 2011). All the schools in Saskatchewan teaches health education following the curriculum of learning set out by the Saskatchewan Ministry of Education which could be a possible reason for not having any difference in knowledge score between the schools.

The study found no association between higher knowledge score and pulse consumption. However, contrary to that, a study conducted by Asakura et al. to explore the relationship between nutrition knowledge and dietary intake among the students of grade 1-6 reported that higher knowledge score has been associated with healthy dietary habits of children (Asakura, Todoriki, & Sasaki, 2017). Similar to the present study result, another study conducted among the students of grade six, seven, and eight in US did not find any correlation between the nutrition knowledge and eating behavior of the students (Pirouznia, 2001).

Results from the pictorial questions to identify pulses shows that about 32% of students correctly answered all pictorial questions. Chickpeas and beans were correctly identified by most students (61% and 83% respectively). Majority of the students (96.8%) also correctly distinguished beans from the pictures of beans and lentil. Similar questions applied in another study conducted by Ramikie among the preschool children; however yielded results different from the present study. It showed that majority of the students (91%) were unable to correctly identify chickpeas. Also, about two-thirds (62%) of the students were unable to identify beans from the picture of different pulses. However, 67% of the children could correctly distinguish between lentils and beans from the pictures (Ramikie, 2018) . The possible explanation of having the different result of these two studies could be that the participants of the present study were older and more matured than the participants of the previous study conducted by Ramikie, 2018; therefore, the ability to correctly identify pulses were more among the participants of the current study.

Participants of the present study exhibited good knowledge on the nutrient value of pulses as most of the students correctly answered that pulses are a good source of protein (86.2%) and, fibre (76.1%) and low in fat (73.3%). However, students did not demonstrate good knowledge while answering the questions regarding the Canada's Food Guide. More than three quarters (77%) of the students were unable to identify pulses as a 'meat and alternative

food group' and 87% could not identify the correct serving size of cooked pulses as per Canada's Food Guide. These findings correspond to the results reported by Phillips (2011) although questions on pulses were applied on the parents and caregivers of the 3-11 years age children. Majority of the participants in Phillips's study also correctly recognized the nutrient value of pulses while 55% of the parents were unable to identify pulses as a 'meat and alternative food group'. Almost none (98%) of the participants knew about the proper serving size according to the guideline of the Canada's Food Guide (Phillips, 2011). Furthermore, Phillips's study did not find any correlation between knowledge and pulse consumption which corresponds with the result of the present study. Despite having two different participants groups, these two studies demonstrated similar results. The parents and the children of these two studies were unrelated and therefore, parents' knowledge may not be conveyed among students. However, several studies established a positive relationship between parents' and children's nutrition knowledge. Studies suggest that children's nutrition knowledge can be influenced by parent's knowledge as parents are the main source of nutrition information, followed by school teachers, television and doctors (Bellisle & Rolland-Cachera, 2000; Gibson, Wardle, & Watts, 1998; Zarnowiecki, Sinn, Petkov, & Dollman, 2012). Therefore, we can assume that children exhibited good knowledge as they learnt these from their parents. Parents' nutrition knowledge also influences children's food habit by their food purchasing decision and availability of healthy food at home (Cluss et al., 2013). Therefore, food choice is often guided by children's nutrition knowledge which is related with parents' food preference as well (Patrick & Nicklas, 2005).

5.2 Pulses consumption

As mentioned in the previous section regarding female students being more likely to have better dietary habit than male, present study also supports that pulse consumption of the female students is higher than the male students. Choi et al. also reported that girls' dietary behavior was slightly higher than boys (Choi et al., 2008). Majority (48%) of the students reported consuming beans in the present study while chickpea, pea, and lentil consumption has been limited into 25%, 16% and 15% of the students respectively. Similar trend in pulses consumption has been found in the Pulse Canada Report where bean was reported as commonly consumed variety of pulses. Also similar to the present study, chickpea, pea and lentil were found as less commonly consumed pulses in that report (IPSOS REID, 2010).

The study found no difference in pulses consumption between grades. Contrary to that however, a study conducted among the students of grade 4, 5 and 6 of elementary school to investigate nutrition knowledge, nutrition attitude, and dietary behavior, reported significant difference ($p<.05$) in dietary behavior between grades (Choi et al., 2008). Similar to grade, present study also found no difference in pulses consumption between age groups. This appears to be due to the fact that each grade includes a certain range of age and most of the children in the same grade fall within that range. The present study also shows that grade and age to be statistically highly correlated ($p<.001$).

Majority of the students (86%) of the present study reported eating pulses when they simply asked if they eat pulses or not. In terms of frequency of consumption; however, more than one third (37%) of the students reported consuming pulses at least once a week. This shows that, students may consume pulses, but not in a very frequent manner. Pulse consumption screener (PCS) used in this study revealed that, mixed dishes were the most commonly consumed pulse-made food by the students. This finding corresponds to the result from Phillips study where participants reported mixed dishes as the most commonly eaten dish among other pulse-based food as assessed using a pulse frequency questionnaire (Phillips, 2011). This may be due to the fact that compared to the other pulse-based dishes mentioned in PCS, mixed dishes made of pulses are more commonly cooked at home which made the children more familiar to these dishes, resulting in high consumption compared to other dishes mentioned in the PCS. The least consumed dish among the 10 pulse-based food in PCS in present study was beverage made of pulses such as smoothie. A possible reason for that could be beverages made of pulses are not very common and are unavailable in the market. Also, the parents are less likely to prepare pulse-based beverage at home as they are also unaware of this kind of innovative drinks. Therefore, pulse-based beverage is the least consumed dish reported by the students.

Majority of the students reported that they want pulse-made bread or baked product such as pizza crust to see available in the market. Other name of the foods that students wanted in the market are salad, brownie, protein bar, hummus and muffin. This information may contribute in the development of marketing strategies for pulse-based food products in order to attract children because they are an important market segment as they are the future consumers of pulses.

Children's food choice is most often influenced by the product marketing (Scaglioni et al., 2018; Taylor et al., 2005). To develop interventions targeting this age group, it is important to know what type of pulse-based food product children would want to eat or want to see

available in the market. According to the WHO, unhealthy food marketing has impact on increase consumption of high fat and high sugar containing food among children (World Health Organization, 2016). Therefore, marketing of pulse-based food product as desired by the children will encourage them to buy those healthier foods from the market and potentially prevent children from buying unhealthy snacks and food. Production and marketing of innovative pulse-based food product can increase demand of pulses consumption among children as children often request their parents to buy those food that they want to eat.

The present study did not find any difference in pulses consumption between the schools. Similarity in school neighborhoods could have explained this result to certain extent. We found no differences between the neighborhoods except for school B where ethnic diversity was higher compared to the neighborhoods (City of Saskatoon, 2018)(City of Saskatoon, 2018)of the other three schools (City of Saskatoon, 2018). Regardless of the neighborhood characteristics, we would be unable to infer that school neighborhood would have any relationship with student's pulse consumption as students enrolled in a particular school may not necessarily have been residing in the same neighborhood. During data collection, we observed that all participating schools had immigrant and multicultural students among whom consumption of pulses is reportedly higher (IPSOS REID, 2010; Mudryj, 2011). However, I was unable to factor in such variables in the analysis due to the lack of socio-demographic data at the individual or household level.

5.3 Attitude towards pulses consumption

Our study shows that the girls have better attitude towards pulses consumption than boys. This result was similar to those reported in the studies on elementary school students by Choi et al. (2008) and Lin et al. (2007) in which nutrition attitude score was found higher in girls than boys (Choi et al., 2008; Lin, Yang Bs, Hang, & Pan, 2007). However, present study did not find any significant difference (p=.49) in attitude between male and female students. This result is consistent with the study conducted among elementary school students by Park et al. (2000) and Lin et al. (2007), and the study on middle school students by Lee at al. (2000) in which nutrition attitude was also not significantly different depending on gender (Lee, Sung, Kim, & Kim, 2000; Lin et al., 2007; Park, Kim, Chi, & Kwak, 2000). However, contrary to the present study result, a study conducted by Choi et al. showed significant difference (p<.05) in attitude between male and female students (Choi et al., 2008).

The current study showed that younger students and students in lower grade expressed more positive attitude towards pulse consumption compared to the older students and upper grade students. Similar finding was reported in a study conducted by Choi et al. (2008) where attitude towards nutrition was better in the students of lower grades in the order of 6th grade (7.24 points), 5th grade (7.35 points), and 4th grade (7.77 points). However, as opposed to the present study, Choi et al. found a significant difference in nutrition attitude between grades (Choi et al., 2008).

Overall, the elementary school students expressed favorable attitudes toward pulse consumption. Majority of the students (74.9%) in present study believe that pulses are healthy food for growth and development of body. Ipsos Reid (2010) also reported that people believe pulses are "healthy/good food for them" which was the second most common response for eating pulses by Canadian pulse consumers (IPSOS REID, 2010).

The present study shows that about two thirds (64.4%) of the students conceded that they would eat pulses had their parents served pulse-based dishes and about the same proportion (63.2%) of students believed that parents' encouragement would make them eating pulses. Phillips et al. reported in her study that parents also recognize that lentils are healthy food and therefore, considered them important for their child's health (Phillips et al., 2015). Findings from another study conducted to assess personal, social and environmental factors regarding fruit and vegetable intake among 11 to 12 year old children shows that half of the participants stated that their parents encouraged them to eat fruits and vegetables, and about one fourth of the children reported that their parents helped them to eat fruits and vegetables by cutting them up regularly (Sandvik et al., 2005). Another study conducted by Romanos-Nanclares et al. among parents of 287 pre-school children found positive association between parent's healthy eating attitude and children's dietary habit. The same study reported that pulses consumption is higher among children whose parents had higher healthy eating attitude score (Romanos-Nanclares et al., 2018). The results of these studies suggest that parents are the gatekeepers of food at household making decisions regarding which food to buy or cook at home.

Studies also suggest that children's healthy eating habit is driven by the availability of food at home (Patrick & Nicklas, 2005). Ranjit et al. further showed that the consumption of healthy food among children increases if healthy food is available at dinner (Ranjit et al., 2015). These results demonstrate that parental knowledge, attitude, and practice at home can play a key role in structuring children's positive attitude towards healthy food consumption. Parent's knowledge on the health benefits of pulses would; therefore, play a key role in increasing its consumption. As gatekeepers to the food choice in the household, they can create a healthy

food environment at home by preparing and serving healthy pulse-based dishes more often. More broadly, the aforementioned studies suggest that children's attitude for healthy eating is related to involvement of parents and caregivers, and is often shaped by their belief, food choice, preference, and purchasing capacity.

A significant positive correlation was found between pulse consumption and students' attitude in the present study (r=0.376, p<.001). A study conducted on elementary school students by Lin et al. also reported such positive correlation between nutrition attitude and dietary habit of the student (Lin et al., 2007). Current study also found significant positive correlation (r=0.241, p<.001) between knowledge and attitude of pulse consumption among students. Similarly, other studies reported that student's nutrition knowledge and attitude are significantly positively correlated (Barzegari, Ebrahimi, Azizi, & Ranjbar, 2011; Lin et al., 2007).

Given that we found significant positive correlation between 'knowledge and attitude' and 'attitude and pulse consumption', it may be assumed that students' knowledge would have a positive correlation with pulse consumption. However, we did not find any such relationship in our study. This may be explained by findings from Worsley's study which reported that it is complicated to describe the role of knowledge on behavior as there are other influencers that surround these two (Worsley, 2002).

Although present study did not find any significant relation between knowledge and pulse consumption, the value and impact of knowledge for shaping a healthy eating behavior cannot be ignored as many studies found strong evidence for an association between knowledge and healthy eating (Asakura et al., 2017; Wardle, Parmenter, & Waller, 2000). Therefore, it is prudent to include knowledge component in the interventions and health campaigning targeted for specific age group as suggested by different studies (Vereecken & Maes, 2010; Wardle et al., 2000).

5.4 Barrier to pulses consumption

The present study found that the preference of other food over pulses acts as the top barrier for not eating pulses by students. Ipsos Reid also reported several barriers for not consumption of pulses among which preference of other foods other than pulses were came out as one of the barriers reported by the participants (IPSOS REID, 2010). One of the possible explanations for wanting other foods could be that students perceive that pulses are not tasty enough. Other reasons for preferring other food over pulses could be the disproportionately

more availability of other foods and inadequate exposure to pulses and pulse-based foods. Study conducted by O'Dea (2003) which performed focus groups among the students of grade 2 to 11 found that the top barrier to healthful eating was inconvenience, unavailability, and difficulty in preparation of healthy food as opposed to other food (O'Dea, 2003). From this result, it is apparent that children want to eat those food which are easy to prepare, easily available, accessible and convenient to eat. Parents can also influence children's eating behavior. How and to what extent parents engage in children's eating habit play a key role for children to perceive barriers for healthy eating. Participants of the present study reported that they don't eat pulses as their parent do not cook them at home. Several studies also support the fact that parents' control over children's food preparation and serving are barriers for children for not having healthy food as children eat only those food which are allowable and available at home (O'Dea, 2003). Moreover, Phillips at el. (2011) reported that parents' perceived barriers for pulses consumption were not knowing how to cook or prepare them, not have enough time to cook them, and not thinking about them in meal planning. Lack of enabling environment at home for healthy eating, inadequate time for food preparation, and inability to provide healthy foods by parents were also reported as barriers in different studies. These results verify that challenges that children perceived for eating pulses or other healthy food depends on the type of challenges that parents face in providing healthy food (Nepper & Chai, 2016; O'Dea, 2003). While children's preference for other food, and parents' involvement and behavior for children's eating are found as barriers in this study; it has been reported in other studies that cost, influence of others, peer pressure, and children's own role modelling also inhibit healthy eating among children (Dwyer, Needham, Simpson, & Heeney, 2008; Ling, B. Robbins, & Hines-Martin, 2016; Pocock, Trivedi, Wills, Bunn, & Magnusson, 2010; Sonneville, La Pelle, Taveras, Gillman, & Prosser, 2009). In our study, we assessed children's perceived barrier for not eating pulses. Future studies should target parents and children together to determine the challenges and problems that parents and children face for pulse consumption. Furthermore, while developing any intervention, it is necessary to distinguish and understand the factors that may influences eating pulses; therefore, effective strategies should attempt to overcome those barriers.

5.5 Limitation

There are some limitations in this research. This was a cross-sectional survey that only captured information of a specific time point. Therefore, we could only examine the association

between variables and were unable to examine the causal relationship between variables. Also, it is entirely possible that the survey would have provided different results had it been conducted during another time-period. Therefore, the results should be interpreted with caution.

Limited time and logistic resources restricted us from collecting parents' or household socio-demographic data. We were unable to collect this information from the children either as we assumed that they will not be able to provide this information. Many studies suggested that socio-demography has influence on food choice and healthy eating. Evidence suggests that individuals with higher level of education and from a higher income households tend to make healthier food choices as compared to the individuals with lower level of education and from a lower income household (Ree, Riediger, & Moghadasian, 2008). Garriguet analyzed the 2004 Canadian Community Health Survey data and showed that vegetable and fruit consumption is high in the high-income household as compared to the low income households (Garriguet, 2007). Pulse Canada also reported that high pulse consumption, and a positive attitude towards pulses and healthy eating was found among the south Asian immigrants. A strong relationship was also found between being vegetarian and pulse consumption (IPSOS REID, 2010). However, as we did not have any household level information or parent's socio-demographic information of each participants, we could not analyze the data factoring in the individual socio-demographic status and were unable to infer if there has been any influence on the results due to cultural or immigrant related factors.

The PCS used in this study was an effort to gather data on children's pulse intake as much and as accurately as possible. However, as this was a child reported questionnaire, we had to keep the PCS simple to make sure children can understand and fill it up easily. Therefore, the intake of the students could not be measured in detail. Instead, the information that we collected through PCS was limited only to frequency and intake of 10 pulse-based dishes. Furthermore, as it was a child-reported study and that we asked participants to recall their intakes, we cannot confirm that the children can remember their pulses intake in past month absolutely correctly. Thus, it is difficult to determine whether the pulses intake recall was truly representation of children's diet, as participants may over or under report their pulses consumption.

We approached all the students of grade 4-8 from the selected four schools; however, included only those who provided consent to participate in this study. There was a possibility that the students who did not participate were characteristically different from the ones who participated. This difference may have had the potential to bias the results of the study.

5.6 Conclusion and future implication

The purpose of this study was to gather information on knowledge, attitude, practice and barrier from children on pulses consumption which also served as a baseline survey of an intervention. This study was important because, to our knowledge, limited information has been found in the literature to date on child-reported knowledge, attitude, practice, and barrier to pulses consumption. Furthermore, this study captured variations of information by including students of five grades and age groups.

Considering the nutrient value of pulses and having the opportunity of the largest pulse growing industry in Saskatchewan, researcher and policy makers can utilize this versatile food to develop future interventions and strategies to potentially reduce the obesity burden. While developing any interventions and strategies for children; however, it is important to target parents and caregivers as they are the decision influencers of what children would eat at home. Food and Agriculture Organization (FAO) also stated that, "The nutrition knowledge acquired throughout school life is a factor of interaction between the school curriculum, school environment, the family and community" (FAO, 2005). Therefore, to achieve the maximum benefit from an intervention, the strategies should develop in a way that it can target all the stakeholders and decision makers who play important role for developing children's eating behavior.

Considering the findings and interpretation of the results, the research provides the following recommendations to develop future interventions and strategies to increase demand for pulses consumption and to sensitize relevant stakeholders on the benefit of pulses:

1. Steps should be taken to build awareness among consumers regarding the health values of pulses and promote the use of pulses in variety of tasty, delicious recipes
2. Future studies should consider collecting data from parent–child dyads to retrieve comprehensive information to help better designing of such interventions
3. The gender differences in the KAP and barrier to pulses consumption should be factored in designing such school-based interventions

We conclude by making the following statements. Students have considerable knowledge on pulses; majority of the students consume pulses although not in very frequent manner; and students expressed favorable attitude towards eating pulses. We also acknowledge that the findings of this study reflect what children reported based on their best of understanding. Literatures support that there are studies which targeted parents and caregivers to measure their knowledge, attitude, practice, and barrier to pulses consumption. However, to

our knowledge, no study was found in the literature targeting both the parents and children together. Therefore, prospective research can contribute by targeting both groups - parents and children, to establish relationship between their knowledge, attitude, practice, and barrier to identify the factors affecting pulses consumption among children. Such studies will also have the potential to triangulate the child-reported questionnaire for its margin of error, if any at all. The questionnaire developed for this study could serve as the basis for designing future research tools. Also, the information generated from this study may contribute in designing of interventions to promote healthy eating practice among children.

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APPENDIX A: KNOWLEDGE, PRACTICE, ATTITUDE, AND BARRIER QUESTIONNAIRE FOR STUDENT

Dear Student,

As a student of Grade 4-8 of elementary school, you are invited to participate in a research study entitled ***Pulse Positive: An educational campaign to increase awareness and consumption by integrating pulses into Elementary Schools***. Please read this form carefully and respond to the questions on the space provided below and in the pages 1-8.

Please fill out the following boxes (Except box 7):

1	**Name of the student filling the questionnaire**	
2	**Your Age**	
3	**Your Sex (Please check (√) in the box)**	☐ **Male** ☐ **Female**
4	**Name of your School**	
5	**Grade**	
6	**Home room teacher's name**	
7	**Code for the student**	

PART ONE: Knowledge questions

The term pulses refer to:

- Beans (e.g., kidney beans, black beans, navy beans)
- Chickpeas
- Peas (e.g., split peas)
- Lentils (e.g., red, yellow and green)

The following section is regarding your knowledge of Pulse-based food. If you are unsure, do your best in picking what you believe to be the best answer.

1. According to Canada's Food Guide, pulses are an example of a food in the (please check (√) one):

   a. Vegetable and Fruit Group
   b. Grain Products Group
   c. Milk and Alternatives Group
   d. Meat and Alternatives Group
   e. Don't know

2. Eating pulse-based food is beneficial for weight management and obesity related certain type of diseases:

   a. True
   b. False

3. One serving of cooked pulses according to Canada's Food Guide equals (please check (√) one):

   a. ¼ cup (60 ml)
   b. ½ cup (125 ml)
   c. ¾ cup (175 ml)
   d. 1 cup (250 ml)
   e. Don't know

4. Pulses are a good source of protein:

   a. True
   b. False

5. Pulses are a good source of fibre:

   a. True
   b. False

6. Pulses are a poor source of iron:

   a. True
   b. False

7. Pulses are high in saturated fat:

   a. True
   b. False

8. Which of the following is not part of the Meat and Alternatives Group in Canada's Food Guide (please check (√) one):

a. Eggs
b. Kidney Beans
c. Tofu
d. Peanut Butter
e. Cottage Cheese

9. Saskatchewan is a leading producer of pulses:

a. True
b. False

10. Pulses can be used in baking:

a. True
b. False

11. Which one of these pictures contains bean? (Please check (√) one)

12. What is the name of these pulses? (Pictures contain same pulses)_____

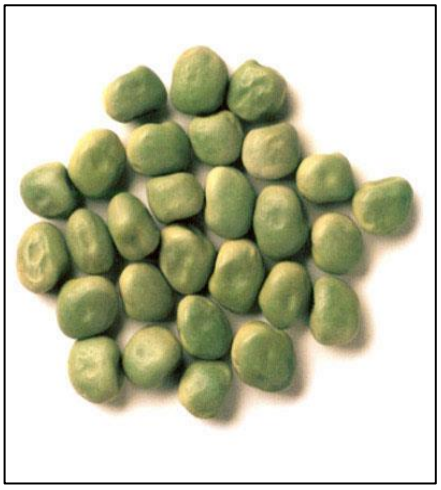
13. What is the name of these pulses? (Pictures contain same pulses) _____



14. What is the name of these pulses? (Pictures contain same pulses) _____




15. What is the name of these pulses? (Pictures contain same pulses) _____



PART TWO: Practice question

These questions are designed to record your pulses consumption:

16. Please answer both A and B in the chart below

A. How often do you eat **each** of the following foods? (Please check (√)											B. How big is your **usual serving** size?		
FOOD CHOICES	Never/ rarely	1 time in past month	2-3 times in past month	1 time per week	2 times per week	3-4 times per week	5-6 times per week	1 time per day	2 or more times per day	MEDIUM SERVING EQUALS	Small	Medium	Large
Baked beans										1 cup beans			
Soup with beans, peas, lentils or chickpeas										1 cup soup			
Chili with beans, peas, lentils or chickpeas										1 cup chili			
Dips or spreads made with beans, peas, lentils or chickpeas (hummus, bean dip, etc.)										2 table-spoons dips			
Mixed dishes with beans, peas, lentils or chickpeas (curries, stew, taco, casserole, pasta, lasagna, veg roll, vegetable burger etc.)										1 cup			
Bread or baked product made with beans, peas, lentils or chickpeas (cookies, brownies,										1 piece			

muffins, pizza, puff patties etc.)													
Salad with beans, peas, lentils or chickpeas										½ cup cooked beans			
Pulses such as beans, peas, lentils or chickpeas eaten as side dishes										1 cup			
Beverages made with beans, peas, lentils or chickpeas (e.g., smoothies)										1 glass			
Pulse-rich energy/ protein bars										1 bar			

17. A) Do you eat any kind of pulses?
    a. Yes
    b. No

17. B) If you have said you eat pulses, which one do you eat most often? Please check (√)

    a. Split peas
    b. Beans
    c. Chickpeas
    d. Lentils

18. Please check (√) the type of food product which contains pulse that you would like to be available in the market:

    a. Bread products
    b. Other baked products (e.g. pizza crust)
    c. Soup
    d. Others: Specify _____
    e. Don't know

PART THREE: Attitude questions

Please choose one response for each question in regard to pulses consumption:

	Strongly Disagree	Disagree	Not Sure	Agree	Strongly Agree
1. Pulses are healthy food for growth and development of your body					
2. You would eat pulses if your parents serve them					
3. You would eat pulses if your parents eat them too					
4. Pulse-based dishes are a tasty food					
5. Eating pulse-based food would give you more energy to work					
6. You would eat pulses if your parents encourage you					
7. You would eat pulses if your teachers encourage you					
8. You would like to taste new pulse-based dishes that you haven't tried before					
9. You would eat pulses if they had a more attractive appearance					

PART FOUR: Barrier questions

Please choose one response for each question in regard to pulses consumptions:

	Strongly Disagree	Disagree	Not Sure	Agree	Strongly Agree
1. Pulse-based dishes upset my stomach, so I choose not to eat them					
2. I do not like the taste of pulse-based dishes					
3. I do not eat pulse-based dishes because it takes too much time to eat					
4. I do not eat pulse-based dishes because I want to eat something else (e.g., sweet, chocolate)					
5. I am still hungry even after having pulse-based dishes, so I chose not to eat pulses					
6. I do not eat pulses because my parents do not eat them					
7. I do not eat pulses because my parents do not cook them					
8. I do not eat pulse-based dishes because it makes my hands greasy					

APPENDIX B: SASKATOON PUBLIC SCHOOL DIVISION APPROVAL

Saskatoon Public Schools
Inspiring Learning

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Barry MacDougall, Director of Education

February 1, 2019

Dr. Carol Henry
104 Clinic Place
University of Saskatchewan
Saskatoon, Saskatchewan
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Dear Dr. Henry:

The Research Review Committee has reviewed your study entitled, *"Pulse Positive: An educational campaign to increase awareness and consumption by integrating pulses into elementary and high schools"* and concluded that it meets the criteria to conduct research within our division. The study promises to provide interesting and relevant information.

Please contact principals directly and provide them with the written details of your study and a copy of this letter when seeking permission to conduct research in the school.

Our staff voluntarily participate in research and are free to withdraw from the research at any time.

Upon completion of your research, we request that you submit a copy of your study to our office. We wish you all the best as you move forward with this study.

Thank you for your interest in conducting research with Saskatoon Public Schools.

Yours truly,

Superintendent of Education

PJ/tm

Copy to: Superintendents of Education
Research Committee Members