University of Alberta

The effect of school gardening and a healthy snack program on First Nations children's knowledge and attitudes about vegetables and fruit, and their consumption of these foods at home

by

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A thesis submitted to the Faculty of Graduate Studies and Research
in partial fulfillment of the requirements for the degree of

Master of Science
in
Nutrition & Metabolism

Department of Agricultural, Food and Nutritional Science

Spring 2013
Edmonton, Alberta

Abstract

Excess weight has a strong impact on First Nations children's health. Adequate vegetable and fruit consumption is one way to potentially prevent children from having excess weight. This study aimed to evaluate the effect of a 7-month school gardening and a 4-month healthy snack program on First Nations children's knowledge and attitudes about vegetables and fruit, and their consumption of these foods at home. Anthropometric measures were taken to determine weight status. Caregiver's food choices were documented.

Children in this study (n=76) significantly increased their overall vegetable and fruit attitude score from baseline. Children liked foods that were familiar, which were those frequently consumed at home. Of the 60 children for whom we had anthropometric data, overweight/obesity (60%) and abdominal obesity (28.3%) were high. Caregivers' diets indicated an integration of traditional and Western foods.

Future garden-based interventions should ensure family participation to promote healthy eating behaviours in Aboriginal children.

Acknowledgements

I wish to thank the First Nations community where the research project was carried out. I would like to thank the children for their participation and enthusiasm, as well as the teachers for their ongoing support. Special thanks to the members of the community research steering committee for their guidance. This research project would not have been possible without community support.

I would like to offer a sincere thank you to my academic supervisor Dr. Noreen Willows, for her valuable guidance and advice during my studies, for providing me with the opportunity to grow as a professional, and for allowing me to be part of this invaluable experience. Thank you to the members of my supervisory committee, Dr. Anna Farmer and Dr. Katerina Maximova, without whose knowledge and assistance this study would not have been successful. Thank you to Mr. David Dyck-Fehderau, Mrs. Daniela Berumen and Mrs. Hara Nikolopoulos for assisting with data collection.

I am especially grateful to my beloved partner Ignacio, who encouraged me to start this amazing journey with him. Thank you for all the support you gave me, even in the hardest times. Special thanks to my family. Words cannot express how grateful I am to my mother Alejandra, my father Patricio, my sister Emilia and Nonna Lina, for your unconditional love, inspiration, and belief in me.

Thank you to the Canadian Institutes of Health Research and a contribution agreement from Health Canada for financial support.

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List of Abbreviations

AANDC: Aboriginal Affairs and Northern Development Canada

BMI: Body Mass Index

CBPR: Community-Based Participatory Research

CCHS: Canadian Community Health Survey

CDC: Centers for Disease Control and Prevention

NCHS: National Center for Health Statistics

NHANES: National Health and Nutrition Examination Survey

RHS: Regional Health Survey

T2DM: Type 2 Diabetes Mellitus

VFAS: Vegetable and Fruit Attitudes Survey

VFKS: Vegetable and Fruit Knowledge Survey

WC: Waist Circumference

WHO: World Health Organization

1. Introduction

1.1 Aboriginal peoples of Canada

The term *Aboriginal peoples* is a collective name for the original inhabitants of North America and their descendants (AANDC, 2010). The Canadian Constitution recognizes three groups of Aboriginal peoples: Indians (commonly referred to as First Nations), Inuit and Métis. These groups are distinct from each other, and therefore, they have unique histories, cultural practices, spiritual beliefs and languages (Department of Justice of Canada, 1982). *First Nations* is a non-legal term that came into common usage in the 1970s to substitute for the word Indian and refers to the various Aboriginal peoples in Canada who are neither Inuit nor Métis, and generally live on land call reserves (Health Canada, 2003; AANDC, 2010). The *Inuit* are a group of Aboriginal peoples of Arctic Canada who live primarily in Nunavut, the Northwest Territories (NWT), Northern Quebec (Nunavik) and Labrador (Health Canada, 2003). *Métis* are Aboriginals of mixed First Nations and European descent. Their communities are generally located in the Prairie Provinces (Alberta, Saskatchewan and Manitoba) but also, to a lesser extent, in Ontario, British Columbia and the NWT (Health Canada, 2003; AANDC, 2010).

Canada's total population of Aboriginal peoples is on the rise. Data from the National 2006 census have shown that between 1996 and 2006 the population grew by 45%, which is approximately six times faster than the 8% increase reported for the non-Aboriginal population in the country (Statistics Canada, 2008). Accordingly, over one million people identified themselves as First Nations, Inuit or Métis in 2006, representing approximately 4% of the total population. In that year, First Nations people accounted for the majority (60%) of Aboriginal peoples, Métis accounted for around 33%, and Inuit represented 4%; the remaining 3% either identified with more than one Aboriginal group, or reported being a Registered Indian and/or Band member without reporting an Aboriginal identity (Statistics Canada, 2008).

Data available from the 2006 National Census have also indicated that Aboriginals are much younger than the non-Aboriginal population, with a median age of 27 years and 40 years, respectively. Specifically, children and youth aged 24 years and under made up almost one-half (48%) of all Aboriginal peoples, compared with 31% of the non-Aboriginal population (Statistics Canada, 2008). According to population projections, the Aboriginal population will continue to grow much faster than the rest of the inhabitants in the country (Statistics Canada, 2005). Given that the general health status of Canadian Aboriginal peoples, and of First Nations in particular, is poorer than that of the rest of the population of the country (Garner, Carrière, & Sanmartin, 2010), and considering the projected population growth, it is essential to develop effective interventions that address the health issues that affect Canadian Aboriginal peoples.

1.2 Health disparities between Aboriginals and the general Canadian population

Even though the health status of the general population has been improving over the last few decades, Aboriginals' health status is still lower than that of non-Aboriginal people (Frohlich, Ross & Richmond, 2006; Garner et al., 2010; Health Canada, 2003, Lix, Bruce, Sarkar & Young, 2009). There is strong evidence for significant health disparities between Aboriginal peoples and the rest of the Canadian population. As compared to the general population, Aboriginal peoples face higher rates of chronic diseases such as type 2 diabetes mellitus (T2DM) and heart disease, and higher rates of infectious diseases, such as tuberculosis and otitis media (Health Canada, 2003; Frohlich et al., 2006). Aboriginals are more likely than the non-Aboriginal population of Canada to face emotional stress, depression, anxiety, substance abuse, and suicide (King, Smith & Gracey, 2009), and have a shorter life expectancy (Health Canada, 2003). In addition, adult and childhood obesity is higher in Aboriginal populations (Canadian Institute for Health Information & Public Health Agency of Canada, 2011), creating major health concerns as obesity is associated with a number of

chronic diseases such as T2DM, several types of cancers and cardiovascular disease (Guh et al., 2009).

The factors that may have a direct impact on the health of Canadians are the living conditions they experience. These are known as 'the social determinants of health. These factors, which include Aboriginal status, education, employment and working conditions, food insecurity, gender, housing, income, and health services, have strong effects upon the health of Canadians (Mikkonen & Raphael, 2010). The reason for the health disparities between Canadian Aboriginal peoples and the non-Aboriginal population may be partially explained by the social determinants of health that many Aboriginals face, such as poverty, inadequate housing, unsanitary water supply and waste disposal, unemployment, alcohol and substance abuse, and family violence (Smylie, 2000; Statistics Canada 2008; Health Canada 2009). These determinants, when considered together with cultural, nutritional and historical transitions that Aboriginal peoples have experienced, help explain the health challenges facing this segment of the Canadian population (King et al., 2009; Smylie, 2000). Other factors adversely affecting Aboriginal health include colonization, globalization, migration, loss of language and culture, disconnection from the land, and the transition from a traditional way of life that has led to poor diets and sedentary lifestyles (King et al., 2009; Downs et al., 2009). For this reason, the factors that are usually associated with health in the general population, and the risk factors and behaviours that influence health and disease outcomes, may not have the same impact in Aboriginal populations if we compare them to the rest of the population of Canada (Frohlich et al., 2006).

1.3 First Nations health issues: A focus on childhood obesity

In regards to childhood obesity in Aboriginal communities across Canada, national data from 2004 showed that the prevalence of obesity in young people of Aboriginal origin (mostly First Nations people living off-reserve) was two and a half times higher than the national average (Shields, 2006). However, data from the 2002/03 and the 2008/10 First Nations Regional Longitudinal Health Surveys

(RHS) showed that the prevalence of obesity was even higher among First Nations youth living on-reserve (Assembly of First Nations, First Nations Information Governance Committee & First Nations Centre at the National Aboriginal Health Organization, 2005; First Nations Information Governance Centre, 2011). Childhood obesity tracks into adulthood and increases risk for developing chronic diseases such as T2DM and cardiovascular disease, which are associated with a higher probability of premature death and disability in adulthood (Guo, Wu, Chumlea & Roche, 2002; Harris et al., 2000; WHO, 2004).

It has been shown that Aboriginal peoples are generally diagnosed with diabetes at a younger age than non-Aboriginals, and complications of the disease are also more frequently seen among the Aboriginal population than in the rest of the population (Public Health Agency of Canada, 2011). The most recent national statistics on the burden and impact of diabetes revealed that the prevalence of diabetes in First Nations individuals living on-reserve was at least three times higher than the prevalence reported in the non-Aboriginal population (Public Health Agency of Canada, 2011). In First Nations children, it is likely that the number of cases of T2DM will continue to increase (Ho et al., 2008).

Until recently, type 1 diabetes mellitus (T1DM), previously called insulin dependent or juvenile diabetes, was the most common form of diabetes diagnosed in young people. However, new cases occurring in children and adolescents are predominantly T2DM, usually regarded as a disease of the middle-aged and elderly (Young et al., 2002; Fagot-Campagna, 2000; Bloomgarden, 2004). As evidence indicates, T2DM has already been reported among First Nations children as young as 12 years of age (Young, Reading, Elias & O'Neil, 2000).

1.4 Designing effective interventions for First Nations children at risk for obesity: Thesis contributions

Aboriginal peoples have undergone a significant nutritional transition where traditional diets and associated physical activities have been replaced with dietary patterns and physical activity that have increased the risk of developing chronic disease such as cardiovascular disease, T2DM and obesity (Earle & National Collaborating Centre for Aboriginal Health, 2011). Since traditional foods are key in promoting Aboriginal health and cultural identity (Elliot, Jayatilaka & Provincial Health Services Authority, 2011; Willows, 2005; Earle & National Collaborating Centre for Aboriginal Health, 2011), it is necessary to develop effective obesity prevention strategies that at the same time enhance traditional practices (Ferris, 2011).

It is known that some of the factors associated with childhood obesity can be modified to help reverse the upward trend. Eating more vegetables and fruits, increasing physical activity and devoting less time to sedentary activities may be key strategies to addressing this health issue (Shields, 2006; WHO, 2004). Increasingly, evidence has indicated that an adequate consumption of vegetables and fruit is associated with a lower risk of obesity and weight gain (He et al., 2004; Epstein et al., 2001; Slavin, 2005) and cardiovascular disease (Joshipura et al., 2001; He, Nowson, Lucas & MacGregor, 2007). Therefore, given the evidence that Aboriginal children consume less than the recommended number of daily servings of vegetables and fruits (Downs et al., 2009; Gates et al., 2012) as suggested by *Canada's Food Guide for First Nations, Inuit and Métis* (Health Canada, 2007), an effective and culturally relevant intervention promoting the consumption of these foods is needed (WHO, 2004).

Garden-based nutrition education programs are viewed by many as a promising strategy to improve children's knowledge about nutrition, and their preferences for and dietary intake of vegetables and fruits (O'Brien & Shoemaker, 2006; Morris, Briggs & Zidenberg-Cherr, 2000). However, there is limited information about the implementation of garden-based interventions in Aboriginal communities. Also, little is known about the link between garden-based programs

and dietary behaviour in Canadian Aboriginal children. Therefore, the research described in the present thesis aimed to address some of these research gaps by examining whether this approach can be effective in improving Aboriginal children's knowledge and attitudes about vegetables and fruit, and their consumption of these foods at home.

1.4.1 Project description

This thesis describes two of the research components of the Earthbox Kids study, which is a comprehensive school gardening program designed for First Nations Cree children living on-reserve in Central Alberta, supported by the Agriculture and Agri-Food Canada's Growing Forward program. Specifically, Earthbox Kids is a Community-Based Participatory Research (CBPR) project guided by a steering committee composed of Elders, parents and Departmental representatives from the Cree community, health practitioners and educators working in the community, and university researchers at the University of Alberta.

This research was conducted in the Province of Alberta, in a rural reserve community with a population of about 1000, located close to a small town and 60Km from a metropolitan city with a population exceeding one million people. This study was reviewed and approved by the Faculties of Physical Education & Recreation (PER), Agricultural, Life & Environmental Sciences (ALES), and Native Studies (NS) Research Ethics Board (REB) at the University of Alberta (Panel 2). The project was funded by the Canadian Institutes of Health Research in conjunction with a contribution agreement from Health Canada.

1.4.2 Thesis research goal

To accomplish the overall goal presented in this thesis, the following aims with their respective objectives were established:

Aim 1: Does a 7-month school gardening and a 4-month healthy snack program modify children's knowledge and attitudes about vegetables and fruit, and their consumption of these foods at home?

a) *Objective I*: To measure the prevalence of overweight and obesity in First Nations children, and evaluate changes in their knowledge and attitudes about vegetables and fruit, and their consumption of these foods at home, after a 7-month school gardening and a 4-month healthy snack program, in relation to their weight status and abdominal adiposity at baseline.

b) *Objective II*: To evaluate changes in First Nation children's knowledge and attitudes about vegetables and fruit, and their consumption of these foods at home, after a 7-month school gardening and a 4-month healthy snack program.

To accomplish *objective I,* baseline cross-sectional anthropometric data were collected to determine children's weight status. Height, weight and waist circumference were measured and entered on a data sheet at baseline in November 2010.

To determine if there was an association between children's weight status and their knowledge and attitudes about vegetables and fruit, and their consumption of these foods at home, the Vegetable and Fruit Knowledge Survey (VFKS) and the Vegetable and Fruit Attitudes Survey (VFAS) were used. In this study, with a pretest/post-test design, both self-administered, paper-and-pencil survey instruments were given to children to collect baseline data in November 2010. Data were collected again from the same children 7 months later, in June 2011. The same research tools and methodology were used to accomplish o*bjective II.*

Aim 2: What factors determine caregivers' food choices?

c) *Objective III*: To assess caregivers' perceptions of eating habits, self-ratings of current foods eaten and self-considerations guiding food choices.

To accomplish *objective III*, a questionnaire administered by university researchers in November 2010 and June 2011 was used to collect baseline, cross-sectional data about caregivers' perceptions of eating habits, self-ratings of current healthy foods eaten and self-considerations guiding food choices.

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2. Literature review

This literature review aims to provide an overview of childhood weight-related concepts in an effort to serve as the basis for informing the rationale for the objectives described in the present thesis. These objectives were designed to contribute to promoting healthy eating behaviours and preventing excess weight gain and obesity, particularly in First Nations children.

Obesity is one of the most serious public health challenges of the 21st century, described by some as having reached epidemic proportions (Reilly et al., 2005; Wang & Lobstein, 2006; Peterson & Fox, 2007). Even though the description of obesity as "epidemic" has been criticized (Campos, Saguy, Ernsberger, Oliver & Gaesser, 2005; Boero, 2007), this definition may be appropriate to describe obesity, as it is a global health issue (Wang & Lobstein, 2006) with a prevalence that has dramatically increased over the past two decades, exceeding all expectations (Flegal, 2006).

2.1 Defining and measuring overweight and obesity in children

The words *overweight* and *obesity* are frequently used by researchers to describe medical conditions caused by abnormal or excessive fat accumulation that may present a risk to health (WHO, 2006). There is no single index that researchers and health professionals can use to determine a child's weight status as his/her body undergoes a number of physiological changes during the growing years (WHO Multicentre Growth Reference Study Group, 2006). Numerous different measures of adiposity exist. For this reason, international and national trends are sometimes difficult to quantify and compare because a wide variety of definitions are currently in use (Cole, Bellizzi, Flegal & Dietz, 2000) and different methods to assess weight status are available (WHO Multicentre Growth Reference Study Group, 2006).

2.1.1 Body Mass Index

Body Mass Index (BMI) is used to classify who is overweight and who is obese in adults aged 18 years and older. BMI is derived from a person's weight in kilograms divided by the square of his or her height in meters (kg/m^2) (WHO, 2006). An adult who has a BMI greater than or equal to 25 is overweight, and a BMI greater than or equal to 30 is obese (WHO, 2006).

BMI is useful to describe adiposity at the population level, but is not necessarily accurate when describing the degree of fatness in individuals (Daniels et al., 2005). However, research suggests that BMI is a reliable alternative to direct measures of body fat in individuals (Mei et al., 2002; Sarría et al., 2001; Steinberger et al., 2005). BMI calculation requires only height and weight measures. For this reason, it is an inexpensive and easy-to-perform method to differentiate weight categories in individuals and does not rely on complex and expensive technologies or on highly trained personnel as other techniques may require (Lindsay et al., 2001).

BMI is commonly used in adults with a single cut-off value for all ages and both genders, but its use in children and adolescents is still controversial because the index itself does not measure body fat directly. Since children's and adolescents' bodies undergo a number of physiological changes as they grow, including changes in their body fat composition (Cole et al., 2000), the criteria used to classify weight categories is different from that in adults.

2.1.2 Centers for Disease Control and Prevention: 2000 Growth Reference

To ensure appropriate representation of infants, children and adolescents living in the United States, data to construct the 2000 Centers for Disease Control and Prevention (CDC) charts were derived from a number of different sources, including five cross-sectional national health examination surveys. These surveys consisted of a home interview and a standardized physical examination (Ogden et al., 2002; Kuczmarski et al., 2002).

The 2000 CDC charts provide BMI-for-age charts for children and adolescents aged 2 to 20 years. These charts are age- and gender-specific. Nutritional status is identified based on percentile curves (Ogden et al., 2002; Kuczmarski et al., 2002). The CDC 2000 growth reference charts define children as *normal weight* if their BMI is between the 5th and 84th percentiles; *at risk of overweight* if their BMI is between the 85th and 94th percentiles; and *overweight* if their BMI is greater than or equal to the 95th percentile (Kuczmarski et al., 2002).

Limitations of the CDC growth charts have been noted (Dietitians of Canada, Canadian Paediatric Society, College of Family Physicians of Canada & Community Health Nurses of Canada 2010). A major limitation of the charts is that they must be interpreted as growth "references" rather than "standards". The reason for this is that they describe how a sample population of children grew in the United States during a specific period of time, regardless of whether their rate of growth was optimal or not (Dietitians of Canada et al., 2010).

2.1.3 World Health Organization: Child Growth Standards

Dietitians of Canada, among other associations of health professionals who work with and care for children and youth in the country, has recommended that the growth of full-term infants, both breastfed and non-breastfed, and preschoolers should be evaluated using the 2006 WHO Growth Standards (birth to 5 years). As well, school-aged children and adolescents should be evaluated using growth charts from the WHO Growth Reference 2007 (5 to 19 years) (Dietitians of Canada et al., 2010). If these recommendations are followed, all practices involving growth monitoring will be more consistent among health professionals, leading to improvements in the assessment of the nutritional status and health outcomes of Canadian infants, children and adolescents (Dietitians of Canada et al., 2010).

It is important to mention that from the year 2012, the complete set of WHO growth charts were adapted for Canada, and are now recommended for monitoring and assessment of growth of Canadian infants and children. This

recommendation was developed collaboratively by Dietitians of Canada, Canadian Paediatric Society, The College of Family Physicians of Canada and Community Health Nurses of Canada (Dietitians of Canada, 2012). However, the re-evaluation and release of these new adapted growth charts were not available at the time of data collection and data analysis. For this reason, in the present study, school-aged children were evaluated using growth charts from the WHO Growth Reference 2007 (5 to 19 years) (Dietitians of Canada et al., 2010).

The World Health Organization (WHO) Multicentre Growth Reference Study (MGRS) was designed to collect data from children living in six different countries (Brazil, Ghana, India, Norway, Oman and United States) (de Onis et al., 2004) to identify and report how children should grow when provided optimal conditions. These charts were intended to provide internationally acceptable growth standards for infants, children and adolescents (de Onis et al., 2007). The WHO standards were constructed using longitudinal length and weight data measured by researchers at frequent intervals, based on healthy children living under conditions that were likely to promote favorable growth. For example, only children of mothers engaged in exclusive breastfeeding practices for the first four to six months of life were included (WHO Multicentre Growth Reference Study Group, 2006). Prior to data collection, researchers were trained in standardized measurement techniques, and all study sites used identical measuring equipment (de Onis et al., 2007).

Due to lack of growth standards charts to assess children's optimal growth, in 2006 the WHO released international growth charts for children up to 5 years old (WHO Multicentre Growth Reference Study Group, 2006). After the release of the 2006 WHO Child Growth Standards for preschool children, in 2007 the WHO released charts for monitoring the growth of older children and adolescents aged 5 to 19 years (de Onis et al., 2007).

BMI-for-age parameters are defined by standard deviations. Considering the 2007 WHO Child Growth Standards 5-19 years, age- and sex-specific BMI criteria (calculated as kg/m^2), weight status is classified as *normal weight* (BMI $\leq$ 85^{th} percentile); *overweight* (85th percentile < BMI $\leq$ 97^{th} percentile); *obese* (BMI

> 97th percentile) (de Onis et al., 2007). The +1 standard deviation (SD) in the WHO reference (equivalent to the 85th percentile) coincides at 19 years with the adults' cut-off of BMI ≥ 25 (kg/m^2), which is the cut-off for being considered overweight. Similarly, the +2 SD (equivalent to the 97th percentile) coincides at 19 years with the adults' cut-off of BMI ≥ 30 (kg/m^2) which is the recommended cut-off for obesity (de Onis et al., 2007).

2.1.4 Waist circumference

Waist Circumference (WC) is considered one of the most practical techniques for assessing abdominal fat (central adiposity) in individuals (National Heart, Lung, and Blood Institute, 1998). Specifically, abdominal obesity is associated with hypertension, dyslipidemia and insulin resistance, which usually occur together, increasing the risk for cardiovascular disease and type 2 diabetes mellitus (T2DM). This group of risk factors is known as *metabolic syndrome* (MetS) (Watts, Bell, Byrne, Jones & Davis, 2008; Riediger & Clara, 2011).

WC is generally measured at the trunk, located between the bottom of the lower rib and the iliac crest (top of pelvic bone), while the person is standing (Douketis, Paradis, Keller & Martineau, 2005). Measuring waist circumference helps identify possible health risks that are associated with overweight and obesity.

Evidence suggests that a WC measure can predict a greater variance in health risk than does BMI alone, and a combination of BMI and WC should be used to screen for overweight and obesity to assess health risk among children, adolescents and adults (Zhu et al., 2002; Janssen, Katzmarzyk & Ross, 2004; National Heart, Lung, and Blood Institute, 1998; Janssen et al., 2005; Douketis et al., 2005).

There is still no international reference available to assess children's waist circumference. For example, in Switzerland researchers have developed WC percentiles from a nationally representative sample of children aged 6 to 13 years, in the hope that results may be useful for clinical and epidemiological use in the country until official, validated references become available (Aeberli, Gut-

Knabenhans, Kusche-Ammann, Zimmermann & Molinari, 2011). In Canada, researchers developed age- and sex-specific WC reference data for Canadian youth ages 11 to 18 years to evaluate temporal trends in WC (Katzmarzyk, 2004). Similarly, country specific WC references were established by researchers in Australia with children aged 7 to 15 years (Eisenmann, 2005) and in Germany with children aged 3 to 11 years (Schwandt, Kelishadi & Haas, 2008).

In the United States, the National Health and Nutrition Examination Survey (NHANES) was conducted by the CDC and the NCHS on a periodic basis from 1960 to 1994, and became a continuous survey in 1999, to provide the primary source of body measurement and related health and nutrition data for the population of the country (McDowell, Fryar, Ogden & Flegal, 2008). Specifically, the NHANES III analyzed WC measures from African-American, European-American, and Mexican-American boys and girls from 2 years through 18 years, to provide age-, sex-, and ethnicity-specific WC percentiles for U.S. children and adolescents, which could also be used as an assessment tool for public health recommendations (Fernandez, Redden, Pietrobelli & Allison, 2004). Accordingly, the WC percentiles developed for children and adolescents from 2 to 18 years classify *abdominally obese* at a waist circumference (cm) > 85th percentile, and *not abdominally obese* at a waist circumference (cm) ≤ 85th percentile (McDowell et al, 2008).

2.1.5 Body Mass Index and Waist Circumference to assess overweight and obesity in Aboriginal peoples

Some authors have questioned whether the BMI cut-offs used to assess overweight and obesity for the general population are appropriate measures when used in Aboriginal populations (Lohman et al., 2000; Douketis et al., 2005; Lear, Humphries, Frohlich & Birmingham, 2007). This is because BMI does not necessarily indicate the same degree of fatness when applied in different populations, partly because individuals from different ethnic groups may be different in terms of body proportions (Daniels et al., 2005). For example, evidence has indicated that obesity among Aboriginal peoples is predominantly of

the central or abdominal type, as compared to Caucasians, which is associated with an increased risk for diabetes and heart disease (Young, Reading, Elias & O'Neil, 2000; Lohman et al., 2000). For this reason, although BMI is widely used to assess overweight and obesity, as this index seems to be influenced by ethnicity, it should be combined with a measure such as WC. This may help overcome some of the problems of using only BMI to assess health risk (Frankenfield, Rowe, Cooney, Smith & Becker, 2001; Douketis et al., 2005), such as underestimating obesity in First Nations populations based only on BMI reference data (Young et al., 2000; Lohman et al., 2000).

2.2 National data sources on overweight and obesity in Aboriginal peoples

The most recent national data surveys conducted for Aboriginal peoples include the Canadian Community Health Survey (CCHS) and the First Nations Regional Longitudinal Health Survey (RHS).

Canadian Community Health Survey (CCHS), Cycle 2.2, Nutrition Focus

The Canadian Community Health Survey (CCHS), which consists of a series of cross-sectional surveys, was initiated in the year 2000, and collects health-related data for the Canadian population aged 0 or above living in private dwellings (Health Canada, 2006). These surveys run every year rather than every two years as was the case prior to 2007, and cover the 10 provinces (Alberta, British Columbia, Manitoba, New Brunswick, Newfoundland and Labrador, Nova Scotia, Ontario, Prince Edward Island, Quebec, and Saskatchewan) and the 3 territories (Northwest Territories, Nunavut, and Yukon) that make up the country. Although the CCHS includes Aboriginal Canadians in its target population, one of the limitations of this survey is that people living on-reserves and in other Aboriginal settlements in the provinces are not included (Health Canada, 2006; Statistics Canada, 2011).

Specifically, the development and implementation of the CCHS 2.2 has been a joint initiative between Health Canada and Statistics Canada and provides information about the food and nutrient intakes of Canadians, physical activity, BMI, and household food security. Survey data were collected between 2004 and 2005 (Health Canada, 2006). To specifically determine weight status, height (cm) and weight (kg) measurements were obtained from participants aged 2 years or above. A subset of 10% of participants aged 18 years or above was asked to self-report their height and weight. These respondents also had their height and weight measured by researchers, allowing for the comparison of self-reported and measured values (Health Canada, 2006). Children's BMI was classified using age- and sex-specific international cut-off points for overweight and obesity based on percentile curves derived from nationally representative cross-sectional studies in Brazil, Great Britain, Hong Kong, the Netherlands, Singapore, and the United States (Cole et al., 2000). For example, the *overweight* cut-off (corresponding to an adult BMI of 25) for 8-year-old boys is 18.44, while the cut-off for *obesity* (corresponding to adult BMI of 30) is 21.60 (Cole et al., 2000).

First Nations Regional Longitudinal Health Survey (RHS)

The First Nations Regional Longitudinal Health Survey (RHS) is the only First Nations-governed national longitudinal health survey in Canada. So far, two phases have been conducted (2002-2003 and 2008-2010). This survey was developed to collect health-related data of First Nations adults, youth and children living on-reserve, as large numbers of their communities were excluded from major national health surveys. This survey provides information for First Nations individuals living on-reserve in all provinces and territories, except Nunavut, which has no First Nations communities (Assembly of First Nations, 2007; First Nations Information Governance Centre, 2011).

This survey provides estimates of overweight and obesity based on parent-reported data for children under the age of 12, and on self-reported data for youth aged 12 to 17 years (Assembly of First Nations, 2007). The cut-off points for BMI

were defined by an internationally accepted classification of *overweight* and *obese* for children and adolescents. These are the same definitions that the CCHS uses (Cole et al., 2000).

2.3 Prevalence of overweight and obesity in First Nations children based on survey data

Childhood overweight and obesity have a particularly strong impact on First Nations communities across Canada. Based on analyses of the 2004 CCHS, 41.3% of Aboriginal children and adolescents aged 2 to 17 years living off-reserve were either overweight or obese. The obesity prevalence itself was nearly 20%, two and a half times higher than the prevalence reported for the rest of the pediatric population in the country (8.2%) (Shields, 2006). However, data from the RHS suggest that children living on-reserve are at more risk for becoming overweight or developing obesity compared to those living off-reserve in Canada. Data from the 2002-03 RHS revealed that approximately 22.3% of First Nations children aged 3 to 12 years were overweight and 36.2% were obese (Assembly of First Nations, 2007). With further improvements in the sampling approach used in Phase I (2002-03) of the RHS, preliminary findings from Phase II (2008-10) have indicated that the number of children categorized as obese and overweight increased from 58.5% in 2002-03 to 62.3% in 2008/10 (First Nations Information Governance Centre, 2011).

Generally, national estimates of childhood obesity are useful to better understand the proportion of children who are at risk for lifelong health problems, which is fundamental to developing successful intervention programs and effective prevention strategies to tackle the disease. However, as Shields (2006) argues, data reported by parents and/or children, such as what is collected in the RHS, is not always accurate. Such information may affect estimates and associations with excess weight. For this reason, using measured data, such as what the CCHS collected to assess adiposity, is preferable for evaluating the prevalence of childhood overweight and obesity (Bélanger-Ducharme & Tremblay, 2005).

2.3.1 Etiology

Overweight and obesity are commonly caused by an imbalance between the calories consumed through food and drinks, and calories expended mainly through physical activity (WHO, 2006). Over the past few decades, the increasing global prevalence of overweight and obesity has been caused mainly by an increase in the consumption of foods especially high in fat, salt and sugars, but low in vitamins, minerals and other micronutrients. Together with this, a decrease in physical activity has occurred. This is mainly due to technology, increasing urbanization, and changing modes of transportation, which have led to more sedentary lifestyles (WHO, 2006). In addition to these changes, the etiology of obesity is multifactorial and complex: genetic, physiological, environmental, psychological, social, economic and even political factors all come into play, and these may interact in varying degrees among different individuals and populations (Wright & Aronne, 2012; Willows, Hanley & Delomier, 2012)

For Canadian Aboriginal peoples, the etiology of obesity can be more complex than that for non-Aboriginals. In the first place, Canadian Aboriginal peoples are one of the most economically vulnerable groups in the country. They are exposed to higher rates of individual and household food insecurity, which means that Aboriginal individuals and families are at greater risk of having limited or uncertain availability to sufficient, safe, nutritious, and personally acceptable foods to meet their dietary requirements for a healthy life (Tarasuk, 2005; Power, 2008; Willows, Veugelers, Raine & Kuhle, 2009).

Many studies related to food security for Aboriginal peoples have highlighted the essential role that traditional foods play in promoting Aboriginal health and cultural identity, and on the importance that these foods have in reducing the increasing burden of chronic disease (Willows, 2005; Receveur, Boulay & Kuhnlein, 1997).

Traditional diets consist of culturally acceptable foods, available from local natural resources recognized by Aboriginal peoples within their food systems. These foods have sociocultural meaning. Traditional procurement methods are used to obtain and process the food (Willows, 2005). In the past,

Aboriginal peoples subsisted by extracting and processing foods from the land and water around them using hunting, trapping, fishing, gathering and agriculture in different combinations. In that way they had fish, marine mammals, wild meats and plants as part of their traditional diets, while developing practices of their own culture and way of life. The Aboriginal diet was mainly based on animal protein; it was low in fat and carbohydrates, and provided sufficient energy, vitamins and minerals for good health (Willows, 2005; Doran 2004). But over the last decades many Aboriginal peoples have undergone a significant nutritional transition, where traditional diets and associated physical activities have been replaced with dietary patterns and physical activity that have increased the risk of developing chronic adverse conditions such as heart disease, T2DM and obesity (Earle & National Collaborating Centre for Aboriginal Health, 2011). The shift to more market foods has been rapid and the nutritional transition has therefore led to a "Westernization transition" of lifestyles and diets, implying reducing the consumption of foods accessed through traditional sources and leading to an increased reliance on a diet based on store-bought food, consisting primarily of processed foods and drinks high in sugars and fat (Uauy, Albala & Cain, 2001; Kuhnlein, Receveur, Soueida & Egeland, 2004).

2.3.2 Short- and long-term consequences

The most immediate consequences for children who are overweight and obese are psychosocial. In the short-term period, children and adolescents who are obese are often targets of discrimination, and therefore are more likely to develop lower levels of self-esteem than their non-obese peers (Strauss, 2000). This health outcome, which is usually linked to anxiety, stress, loneliness, and depression, may also lead to increased vulnerability to drug and alcohol abuse later in life (Wang, Wild, Kipp, Kuhle & Veugelers, 2009; Strauss, 2000; Franklin, Denyer, Steinbeck, Caterson & Hill, 2006). A systematic review conducted by Reilly et al. (2003) has indicated that children and adolescents who are obese are also more likely to experience orthopedic problems, particularly in the feet and hips; and

asthma symptoms. Adverse effects on the cardiovascular system including hypertension, dyslipidemia, insulin resistance, and T2DM, all of which have been traditionally observed in adulthood, are now reported in obese children and adolescents as well (Reilly et al., 2003; Sorof & Daniels, 2002; Bloomgarden, 2004).

Evidence suggests that adults who were overweight or obese during childhood and adolescence are more likely to report excess weight during adulthood, than are adults who had normal weight in childhood or adolescence (Reilly et al., 2003; Singh, Mulder, Twisk, van Mechelen & Chinapaw, 2008). As a consequence, the persistence of obesity will lead to an increased risk for premature mortality due to obesity-related complications including heart disease, certain cancers and liver disease (Grundy, 2000; Reilly et al., 2003; Adams et al., 2006).

2.4 Strategies to tackle childhood obesity in First Nations communities

It is known that some of the factors associated with childhood obesity can be modified to help reverse the upward trend. Eating more vegetables and fruits, increasing physical activity and devoting less time to sedentary activities may be key strategies to address this health issue (Shields, 2006; WHO, 2004).

Evidence has indicated that the majority of Aboriginal children has sedentary lifestyles and do not exercise enough (Ng, Marshall & Willows, 2006; Aboriginal Canada, 2006). In addition, their consumption of vegetables and fruits is below the daily recommendations according to the *Canada's Food Guide for First Nations, Inuit and Métis* (Health Canada, 2007; Downs et al., 2009). Their frequency of meals consumed at fast-food restaurants has increased, which means daily intakes of energy (mainly from fat and sweetened beverages) may be increasing as well (Downs et al., 2009; Willows et al., 2012).

On the other hand, several studies have indicated that an adequate consumption of vegetables and fruits is associated with a lower risk of obesity and weight gain (He et al., 2004; Epstein et al., 2001; Slavin, 2005) and heart disease

(Joshipura et al., 2001; He, Nowson, Lucas & MacGregor, 2007). Therefore, given the evidence that obesity is particularly high in Aboriginal children, that the majority of children do not eat enough servings of fruits and vegetables on a daily basis, and that an adequate consumption of this food group is key to helping to prevent obesity and its associated risk factors (WHO, 2004), an effective and culturally relevant intervention promoting vegetables and fruit intake is needed.

2.4.1 Promoting vegetables and fruit intake

The words *vegetables* and *fruits* usually refer to the edible parts of plants which can differ in their nutrient content, the way they are prepared and eaten, and the amounts in which they are eaten daily (Bazzano, 2005). In general, vegetables and fruits are important sources of fiber, water and essential nutrients, and are low-energy-dense foods that contribute to satiation and satiety (Newby, 2009). Specifically, satiation develops during a meal and brings the period of eating to an end by reducing the feeling of hunger. As a consequence, it may limit the amount of energy consumed during that meal. Satiety, on the other hand, develops after foods have been ingested, and delays the onset of the next meal. Consequently, it may reduce food consumption at the next eating occasion (Gerstein, Woodward-Lopez, Evans, Kelsey & Drewnowski, 2004).

Energy density is usually defined as the energy content in a given weight of a food (kcal/g or kJ/g). Water and fiber add weight to foods without increasing the caloric content (Rolls, Ello-Martin & Tohill, 2004). Consequently, if vegetables and fruits are often consumed, considering that they can also displace other high-energy-dense foods from the diet such as snacks or baked goods which are usually high in fat, sugars and salt, they may potentially lead to the consumption of meals with lower total calorie content but still high in essential nutrients (Wylie-Rosett, Segal-Isaacson & Segal-Isaacson, 2004; Newby, 2009). This evidence suggests that an adequate consumption of vegetables and fruit is an important component of a healthy diet which may play an important role in

weight management and in the prevention of chronic diseases such as cardiovascular disease and diabetes (Rolls et al., 2004; Bazzano, 2005).

For Aboriginal children, *Eating Well with Canada's Food Guide for First Nations, Inuit and Métis* recommends a daily intake of five to six servings of vegetables and fruit (Health Canada, 2007). Because the majority of Aboriginal children do not meet this dietary recommendation (Downs et al., 2009), there is a need to develop and implement effective programs that will increase the vegetables and fruit intake among Aboriginal children and youth.
More importantly, is that nutrition education can help children attain the knowledge and skills they need to make healthy food choices and develop lifelong healthy eating patterns (Story, Lytle, Birnbaum & Perry, 2002). Children's eating behaviours may be easier to modify than adults, because first, children can be reached in large numbers through school settings which provide opportunities to practice healthy eating (Story et al., 2002), and second, because children's dietary behaviours may be less fully formed than in adulthood (Moore, Braid, Falk & Klentrou, 2007). For these reasons, nutrition programs are likely to be more successful in contributing toward the education and modification of the eating habits when these kinds of interventions are carried out at schools reaching children in their early stages of life.

2.4.2 Garden-based nutrition education interventions

As Knai, Pomerleau, Lock and McKee (2006) argue, the great diversity in study designs, sample populations and outcome measures characteristic of interventions promoting children's vegetables and fruit intake, make it difficult to identify one specific program as being most effective. With much epidemiological evidence indicating the links between vegetables and fruit intake and reduced obesity, there are now many interventions designed to promote the consumption of these particular foods. The systematic review conducted by Knai et al. (2006) indicated that several school-based studies have been done. These have focused on interactive learning through skill-building and problem-solving exercises

designed to familiarize children with fruits and vegetables, and teach them to prepare and promote these foods at home (Auld, Romaniello, Heimendinger, Hambidge & Hambidge, 1998; Gortmaker et al., 1999; Reynolds et al., 2000). Several studies have included video projections during class hours to emphasize the intervention messages (Foerster et al., 1995; Baranowski et al., 2000). Other forms of activity included competitions in which students received prizes after correctly answering questions related to healthy eating behaviours (Perry et al., 1998). Certainly, in many parts of the world there is a wide range of interventions and programs promoting vegetable and fruit consumption for children.

When developing interventions to improve the health of Aboriginal children, to better design effective conditioned learning to promote a healthy diet, there is a need to first develop culturally-based strategies. This can only be done by taking into consideration the characteristics of each of the Aboriginal groups. It is known that many First Nations people have a special respect and connection to Mother Earth, which is the natural world and is considered a fundamental component of Aboriginal health (Bopp, Bopp, Brown & Lane, 2004). Evidence has indicated that younger generations of Aboriginal peoples are losing the knowledge about harvesting and preparing their traditional foods (Willows, 2005). Therefore, in order to develop culturally effective strategies to promote healthy eating behaviours in Aboriginal children, there is a need to design an intervention that not only promotes the consumption of healthy foods, but also enhances Aboriginal traditions that have been passed from generation to generation.

Garden-based nutrition education programs are viewed by many as a promising strategy to improve children's preferences for and dietary intake of vegetables and fruit (O'Brien & Shoemaker, 2006; Morris, Neustadter & Zidenberg-Cherr, 2001; Morris & Zidenberg-Cherr, 2002; Lineberger & Zajicek, 2000). Because schools provide an optimal setting to reach and have an impact on children with such a positive change (Kennedy & Goldberg, 1995), effective garden programs have been established at schools to teach children about and promote their consumption of vegetables and fruits (Story et al., 2002).

A systematic review conducted by Robinson-O'Brien, Story, & Heim (2009) has indicated that in the past few years, specifically from 1990 through 2007, many initiatives have included components to promote healthy eating behaviours through connections with gardens in the U.S. This study reviewed different gardening initiatives from *The National Farm-to-School Program* (National Farm to School Network, n.d.), *The Edible Schoolyard* (The Edible Schoolyard Project, n.d.), and *Kids Gardening Initiative* (The National Gardening Association, n.d.), among others. The aim was to provide an evaluation of garden-based programs and their impact on children's and adolescents' vegetables and fruit intake, their willingness to taste vegetables and fruits, their preferences for these foods, and other nutrition-related outcomes (Robinson-O'Brien et al., 2009). Overall, findings obtained in this review indicated that exposure to garden-based nutrition education was associated with increased fruit and vegetable intake among youth (McAleese & Rankin, 2007), increased preference for vegetables (Morris & Zidenberg-Cherr, 2002), children's willingness to taste vegetables and fruits (Cason, 1999), and increased nutrition knowledge (Morris & Zidenberg-Cherr, 2002; Cason, 1999; Koch, Waliczek & Zajicek, 2006).

Certainly, there is promising but relatively limited evidence for the effectiveness of garden-based nutrition education programs (Robinson-O'Brien et al., 2009). More importantly, is that there is limited information about the implementation of garden-based interventions promoting vegetable and fruit consumption for Aboriginal children in Canada. In the United States, Skelly & Zajicek (1998) integrated gardening components in the school curriculum to evaluate children's attitudes about environmental issues. Only a few Native American children participated in these curriculum programs. Hermann et al. (2006) evaluated the impact of an after-school garden program that catered to mostly Native American Aboriginal children in grades 3 to 8. The program resulted in an increased consumption of vegetables and fruit. Other than these studies, little formal evidence of garden-based interventions with Aboriginal children has been reported. In Canada, Aboriginal children are at a particularly high risk for becoming overweight and obese. For this reason, it is critical to

implement effective interventions that promote healthy eating behaviours that can also inform public health interventions adapted for Aboriginal communities across the country.

2.4.3 Snack programs to maximize children's exposure to vegetables and fruit

Interventions that aim to improve children's dietary behaviours need to first consider the determinants that guide their food choices to be successful (Brug, Oenema & Ferreira, 2005). Typically, there are personal and environmental factors that influence children's considerations guiding their food selection. The personal determinants include taste preference, outcome expectations (i.e. the perceived positive and negative consequences of food intake), self-efficacy and skills (i.e. the perceived confidence in the ability to engage in a particular behaviour), and knowledge (Blanchette & Brug, 2005). The environmental determinants include food availability and accessibility, parental dietary behaviours, peer influence, television viewing and advertisement, access to school snack bars, and food exposure (Blanchette & Brug, 2005).

Because there is a strong link between repeated food exposure and subsequent food acceptance (Cooke, 2007), several studies have been done to show how early introduction to foods during childhood is positively associated with a more varied diet later in life (Cooke, 2007; Cooke et al., 2004; Northstone, Emmett, Nethersole & ALSPAC Study Team, 2001). Increasingly, research suggests that food dislike can be transformed into liking if food exposure is maximized (Wardle et al., 2003; Cooke, 2007). The mechanism by which repeated food exposure increases liking may be known as 'learned safety' (Kalat & Rozin, 1973; Cooke, 2007), in which repeated consumption of unfamiliar foods followed by good feelings (i.e. satiety) and without negative gastro-intestinal consequences, may lead to increased acceptance of those foods (Birch, McPhee, Steinberg & Sullivan, 1990). In addition to this, increased food liking has also been related to increased familiarity of taste, in which even initially unpalatable tastes become acceptable with increasing experience (Rozin & Schiller, 1980).

Research suggests that only one exposure to the taste of novel foods may be necessary to increase infants' liking and further intake of those foods (Sullivan & Birch, 1994; Birch, Gunder, Grimm-Thomas & Laing, 1998). However, between five and twenty exposures may be required for older children and adults (Liem & de Graaf, 2004; Loewen & Pliner, 1999). These differences need to be considered carefully when designing strategies to increase children's exposure to foods. If exposure to a novel food is too frequent, this may result in children's reduced likeability because they were served it too often (Mennella & Beauchamp, 1999). On the other hand, other studies have indicated that infants tend to show a greater acceptance of flavours previously experienced through the amniotic fluid or breast milk (Mennella, Jagnow & Beauchamp, 2001). Nevertheless, despite variations in the time and duration needed to promote infants' and children's likeability toward novel foods and flavours, it seems that success can be achieved if actual tasting is involved (Cooke, 2007).

Over the past few years, several school-based interventions such as 'healthy snack programs' have been implemented to improve the food environment and maximize children's exposure to vegetables and fruits as a strategy to increase their consumption and tackle childhood obesity (Perry et al., 2004; Reynolds et al., 2000; Lakkakula, Geaghan, Zanovec, Pierce, & Tuuri, 2010; Tuuri et al., 2009). Children's exposure to vegetables and fruits has been defined as the number of different kinds of vegetables and fruits children have ever tasted, which can be positively related with their consumption (Resnicow et al., 1997). Because school gardening programs are a promising strategy to improve children's preferences for and dietary intake of vegetables and fruit (O'Brien & Shoemaker, 2006; Morris et al., 2001; Morris & Zidenberg-Cherr, 2002; Lineberger & Zajicek, 2000), it seems that the idea of complementing this kind of intervention with a healthy snack program, which will allow children to try and taste different vegetables and fruits, may lead to more encouraging results. If we know that success may be achieved if actual tasting is involved (Cooke, 2007), snack programs need to be designed in a way that encourages children's taste testing activities in order to maximize their exposure to healthy foods.

2.4.4 Community-based participatory research approach

There are concerns regarding the validity of studies conducted by researchers unfamiliar with Aboriginal culture and the setting in which the research is carried out. It is unknown whether findings from one setting can be applied to other situations, contexts, and populations (Schultz, Israel, Selig, Bayer & Griffin, 1998). For this reason, to develop effective strategies to address the health issues among Aboriginal peoples, there is a need to involve community members in all aspects of the research to build on strengths and resources within the community (Israel, Schulz, Parker & Becker, 1998; Israel, 2005).

CBPR is described as a "collaborative approach to research that equitably involves partnerships in all phases of the research and recognizes the unique strengths that each brings," with the aim of "combining knowledge and action for social change to improve community health and eliminate health disparities" (Israel, 2005). CBPR has evolved from "Community-Based Research and Evaluation (CBRE)." Due to increasing health disparities over the past years, CBRE has started to include participatory research as a tool to approach public health because of its potential to improve health and eliminate health disparities (Schultz et al., 1998). Accordingly, specific principles were set to bring together the key elements to engage all partnerships in the research. This included recognizing a community as a unit of identity (Israel et al., 1998).

Community is defined as a "sense of belonging," which involves identification and emotional connection to other members through common symbol systems, values, norms, shared interests and commitments to meeting mutual needs (Israel et al., 1998). For example, Aboriginal peoples have a special relationship, both spiritual and material, with the land and its resources. Harvesting traditional food is seen as one of the fundamental aspects of that relationship, as food obtained from the land represents a gift from Mother Earth (Royal Commission on Aboriginal Peoples, 1996). Harvesting traditional food retains significant symbolic and spiritual value that is central to personal identity and the maintenance of culture (Willows, 2005; Power, 2008).

Another example of identification with the community is the holistic perspective that Aboriginal peoples have about the concept of health (Mark & Lyons, 2010; Graham & Stamler, 2010). For example, for First Nations and Inuit, health and well-being are both a result of balance in a person's mental, physical, emotional and spiritual components (Mark & Lyons, 2010; Richmond & Ross, 2009). To connect and balance all these elements Aboriginal peoples use symbols that express and represent meaning. For example, the Medicine Wheel is an ancient symbol used by the majority of Aboriginal peoples in North America. It can be identified as the four grandfathers, the four winds, the four cardinal directions, and many other elements that can be expressed in sets of four. All these concepts show there are four aspects to nature: physical, mental, emotional, and spiritual (Bopp et al., 2004).

By adopting a CBPR approach, research will be more likely to improve health outcomes and reduce health disparities between Aboriginal peoples and the rest of the Canadian population. This is because CBPR interventions are strengthened by having insight into the community and incorporating community theories of etiology and change into the empirical science (Wallerstein & Duran, 2006). For example, the development of a steering committee composed of Elders, parents and Departmental representatives from the Cree community, and health practitioners and educators working in the community, was one of the strengthens of this study. The members of this committee and the university researchers at the University of Alberta met together on several occasions at the Cree reserve to discuss the research methodology of the intervention, among other subjects, before starting the Earthbox Kids study. During these meetings, all the members of the steering committee were encouraged to express their opinions and discuss any goal or objectives established in the program outline. For example, a copy of the survey used to assess children's knowledge and attitudes toward foods, and their consumption at home, was brought to one of the meetings to ask for the approval of all community members that were part of the steering committee, and ask for any suggestions regarding its format and the kind of questions addressed to children.

Once the program began, and the Earthboxes were already planted at the community school, the members of the steering committee were encouraged to communicate any concerns, ideas or suggestions to university researchers. Other ways of communication were also considered, such as e-mail and telephone. E-mail was used, for example, to send the caregiver's questionnaire to all members of the steering committee, when they were not able to meet. In this way, university researchers were able to continue with the intervention, after having the committee approval of the caregiver's questionnaire.

2.5 Conclusion

Relevant evidence, although still limited, has shown that school gardening and healthy snack programs have the potential to increase children's knowledge about nutrition, their willingness to taste vegetables and fruits, and their level of affinity for and consumption of these foods. Eating more vegetables and fruits is a key strategy to tackling childhood obesity, which is considered one of the most serious public health challenges of the 21st century, one that has reached epidemic proportions. For this reason, there is a growing interest among educators and researchers to include gardening and healthy snack programs as teaching tools to enhance learning opportunities for children. However, no formal research has been done to implement and/or evaluate these interventions for Aboriginal children in Canada. With high numbers of overweight and obese children, particularly among those First Nations children living on-reserve, it is imperative to investigate creative and effective nutrition intervention initiatives promoting healthy eating behaviours. In addition, considering all the short- and long-term risks of persistent excess weight during childhood, it is critical to act immediately. With this approach, school gardening will involve children planting and nurturing vegetables and fruits through hands-on experiences with their peers, by also providing more opportunities to try the produce grown, together with the foods provided in the school snack program. This will teach students how to plant,

grow, nurture and harvest their own vegetables and fruits, in the hope that this will also provide closer ties between First Nations children and their traditions.

In addition, future research will need to consider not only BMI anthropometric measures, but also a measure such as waist circumference to assess abdominal fat (central adiposity), to identify possible health risks that are associated with excess weight. This research will have to include the assessment of weight status, particularly in First Nations children who have a tendency to accumulate excess adipose tissue in the central region of the body.

2.6 References

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3. Objective I: Measuring the prevalence of overweight and obesity in First Nations children, and evaluating changes in their knowledge and attitudes about vegetables and fruit, and their consumption of these foods at home, after a 7-month school gardening and a 4-month healthy snack program, in relation to their weight status and abdominal adiposity at baseline

3.1 Introduction

Over the past few decades Canadian Aboriginal peoples (First Nations, Inuit, and Métis) have undergone a significant nutritional transition. Traditional diets and associated physical activities have been replaced with dietary patterns that have increased the risk of developing chronic obesity-related diseases such as type 2 diabetes mellitus (T2DM) and heart disease (Earle, & National Collaborating Centre for Aboriginal Health, 2011). The shift to more market foods has resulted in a reduced consumption of foods accessed through fishing, herding, hunting and gathering (i.e., fish, meat, vegetables and fruits), and increased reliance on store-bought food consisting primarily of processed foods and drinks, which are high in sugars and fat (Uauy, Albala & Cain, 2001; Kuhnlein, Receveur, Soueida & Egeland, 2004).

According to data from the Canadian Community Health Survey (CCHS) in 2004, approximately 26% of Canadian children aged 2 to 17 were overweight or obese, and young people of Aboriginal origin (mostly First Nations living off-reserve) had a significantly higher combined overweight and obesity rate (41%); their obesity rate was 20%, around two and a half times higher than the national average for children (8.2%) (Shields, 2006). Childhood obesity is also a concern among First Nations living on-reserve. Self-reported data from the 2002-03 First Nations Regional Longitudinal Health Survey (RHS) revealed that the prevalence of obesity (38.5%) was even higher among First Nations children living on-

reserve compared to those living off-reserve. The prevalence of obesity increased further to 40.5% according to 2008-2010 RHS findings (First Nations Information Governance Centre, 2011). Moreover, diabetes rates for the Aboriginal population living off-reserve were at least twice that for the rest of Canadians (Frohlich, Ross & Richmond, 2007). Evidence indicated that rates of the disease among First Nations people living on-reserve are three to five times higher than the general population in the country (Assembly of First Nations, 2007). Accordingly, one in four First Nations people living on-reserve over the age of 45 has T2DM. Higher rates occur in youth than in the general population (Assembly of First Nations, 2007).

Numerous studies have indicated that the causes of obesity in Aboriginal children are related to an inadequate intake of vegetables and fruit, a decrease in physical activity (Willows, Marshall & Ng, 2006; Pigford, Sanou, Ball, DyckFehderau & Willows, 2011), and an excessive daily intake of calories from foods consisting primarily of sugars and fat (Downs et al., 2009; Willows, Hanley & Delormier, 2012; Health Canada, 2007). For this reason, eating more vegetables and fruits, increasing physical activity and devoting less time to sedentary activities may be key strategies to address childhood obesity (Shields, 2006; WHO, 2004).

One of the factors that may influence children's consumption of vegetables and fruit is the acceptance of these foods (Dovey, Staples, Gibson & Halford, 2008). Children's feelings about vegetables and fruit are a primary predictor of whether they will eat these foods (Anzman-Frasca, Savage, Marini, Fisher & Birch, 2012). It would be of interest to explore if First Nations children's weight status is related to variations in their feelings about vegetables and fruit, as well as whether they consume vegetables and fruit at home. To our knowledge, no formal research had been done to explore the association between weight status and these factors in children. Therefore, *objective I* of the present thesis aimed to assess First Nations Cree children's weight status and evaluate the effect of school gardening and a healthy snack program on their knowledge and attitudes about vegetables and fruit, and their consumption of these foods at home.

3.2 Methodology

Objective I of the present thesis presents baseline cross-sectional anthropometric data collected in a school on a First Nations community located in Central Alberta. The data were collected as part of the Earthbox Kids school gardening program. All students in grades 1 to 6 (6-13 years old) who attended the community school (n=116) were eligible to participate in the research. Child assent and parental informed consent were received prior to baseline data collection (Appendix A) in November 2010. The study was reviewed by the Faculties of Physical Education & Recreation (PER) and Agricultural, Life & Environmental Sciences (ALES), and Native Studies (NS) Research Ethics Board (REB) at the University of Alberta (Panel 2). The study was approved in October 2010. The study was also reviewed and approved by the community steering committee.

Earthbox Planting

Earthboxes were first planted with vegetables and berries in the community at the Elder's Lodge courtyard in the summer of 2010. An example of a planted Earthbox and the produce that was grown at the Elder's Lodge in the Earthboxes was displayed at a community Harvest Fair that fall. Following this, the Earthbox Kids school gardening program was initiated at the community school in November 2010. The elementary school children planted the Earthboxes with celery, tomatoes, green peppers, and herbs as part of a school assembly. The growing boxes came complete with wheels, aeration screen, fertilizer, dolomite, mulch covers and a watering system (http://www.earthbox.com/). In total, 15 Earthboxes were set up and planted by children in the open cafeteria area with the collaboration of teachers, the school principal and vice-principal, university researchers, community members, and an agriculture education specialist with Alberta Agriculture and Rural Development. A ceremony was held after all Earthboxes were planted and an elder blessed the boxes. At this ceremony, a reporter from a nearby town took photographs and wrote a media story about the

planting of the Earthboxes at the school. This provided community members who were not present that day with information about the study. After the ceremony, two Earthboxes each were placed in the grades 1 to 6 classrooms, and three were placed in the school library. Children were encouraged to work with the soil and look after the plants. They spent the rest of the school year looking after the boxes. In this particular study, since Earthboxes were placed indoors, grow lights were installed in the classrooms and library.

During the school year, child caregivers were given the opportunity to see what children were growing by being shown Earthboxes at parent-teacher meetings. Throughout the school year, the project coordinator from the University of Alberta visited the school frequently to reinforce Earthbox usage and to help teachers. Since the Earthbox Kids study did not include a formal educational component, teachers decided how Earthboxes could be implemented as an educational tool in each classroom, adapting them to the school curriculum. No formal questionnaires were developed to evaluate educational activities carried out by teachers for their students. Instead, all the information that could be collected regarding the use of Earthboxes in each classroom was obtained by interviews carried out between teachers and university researchers (unpublished manuscript). One example that can be given of how EarthBoxes were used is that children from grade 5 prepared an act for Christmas holidays in which the Earthboxes were mentioned in a Christmas song. This segment of the song described how children were in charge of caring for the produce grown in their classroom. To our knowledge, children were divided into small groups and took turns to maintain the indoor plants by watering them on a daily basis, except for weekends and holiday breaks. No additional information describing who was in charge of maintaining the Earthboxes during these breaks was recorded.

When the vegetables were ready to be harvested, some teachers used them as part of the school curriculum program to develop taste testing activities with the students in each classroom. However, due to the limited amount of vegetables grown and the inability of staff to properly maintain the Earthboxes during holiday breaks, not many vegetables grew in the Earthboxes. For example,

insufficient water over the December school break was the main reason why tomatoes didn't grow properly, and therefore, they could not be included as part of the taste testing activity. For this reason, not all children were able to participate in the taste testing activities that had been planned using the Earthboxes. On the other hand, green peppers were successfully grown, and many children were able to try them in their classrooms.

School Snack Program

To maximize their exposure to vegetables and fruits, children were provided with a healthy afternoon snack from February to May 2011. The school chef was in charge of purchasing, preparing and providing the vegetables and fruits, which were purchased from nearby grocery stores. Mini carrots, grapes, bananas, celery, cucumbers, cauliflower, oranges, peas, cantaloupe, strawberries, watermelon, tomatoes, peppers and apricots were given to children from grades 1 to 6 on a weekly basis. One food was tried weekly. Children from grades 1 to 3 received one serving of the vegetable or fruit per week and children from grades 4 to 6 received two servings of the vegetable or fruit per week. All vegetables and fruits were served raw. In all, a different type of food was given once a week for 16 weeks.

After cutting and preparing all the food samples, the school chef presented the servings on separated containers (one for each classroom). These were carried to each teaching location on the same trolley used to distribute the school breakfast each morning. All children had the opportunity to try fresh vegetables and fruits as a healthy afternoon snack at school. Approximately fifteen minutes were necessary to provide the food to children in each classroom. On several occasions, children were able to have their snack while listening to their teacher explaining academic activities.

No formal questionnaires were used to collect information regarding strengthens and weaknesses of the snack program. The additional information that was used to describe how the snack program was delivered was obtained from interviews between university researchers and the school chef (unpublished

manuscript). One disadvantage of the snack program was its labour intensiveness coupled with the lack of school staff or volunteers available to help with the food purchasing, preparation and distribution. In addition, the school chef had a limited budget to purchase the snack foods. As a consequence, the foods that were purchased for the snack program were those frequently available at nearby grocery stores which also had an acceptable cost. This had a direct impact on the amount and variety of foods available for each weekly tasting activity.

3.2.1 Data collection tools

Anthropometric measures

Height, weight and waist circumference were measured and entered on a data sheet (Appendix D). Children were asked to remove their shoes, bulky clothing, glasses, and belt, empty their pockets, and unbraid their hair (to make sure the child was standing up straight), as this could have interfered with the accuracy of the measurement. All measurements were taken in private by researchers trained in standardized measurement techniques prior to data collection; a male researcher was responsible for measuring all male children and two female researchers measured all female children. A female community member was always present in order to provide a familiar environment for children while measurements were taken. Weight was recorded to the nearest 0.1kg using an electronic platform (Seca 769 digital column scale), and height was recorded to the nearest 0.1cm with a telescopic stadiometer (Seca 220). Waist circumference was recorded to the nearest 0.1cm with a non-stretch measuring tape between the bottom of the lower rib and the iliac crest.

Knowledge and attitudes towards vegetables and fruit and their home consumption

The Vegetable and Fruit Knowledge Survey (VFKS) (Appendix B) and the Vegetable and Fruit Attitudes Survey (VFAS) (Appendix C) were used to determine children's knowledge and attitudes about vegetables and fruit, and

home consumption. The VFKS, a self-report, paper-and-pencil survey, was designed to measure children's knowledge about vegetables and fruits. Children from grades 3 to 6 were asked to write down five fruits and vegetables that they knew. Because the writing skills of younger children in grades 1 and 2 were not fully developed, they were asked to draw five vegetables and fruits instead. University researchers collaborating with the data collection were in charge of asking each student what kind of food was drawn, so they could write the name next to each picture to facilitate data analysis.

After every child answered the knowledge survey, the VFAS was used. This self-administered, paper-and-pencil survey was adapted from previous work and has been validated to assess food preferences (Morris & Zidenberg-Cherr, 2002; Domel et al., 1996; Resnicow et al., 1997).

The VFAS included a Likert-type scale to assess children's level of affinity for 17 vegetables and fruits. The methodology to assess food attitudes took place after a taste testing activity where children had to taste and rate how much they liked 9 raw vegetables (broccoli, green pepper, carrot, tomato, celery, cauliflower, cucumber, radish, mushroom) and 8 raw fruits (kiwi, pear, grape, orange, apple, cantaloupe, grapefruit, banana), on a 6-point Likert-type scale provided on the survey. The scale's range was 6 = "*I really like* it"; 5 =*"I like it"*; 4 = "*It is OK"*; 3 = *"I do not like it"*; 2 = *"I really do not like it"*; 1 = "*I will never eat it again."* The 17 vegetables and fruits were chosen because they were readily available at grocery stores and could be served raw. The same food brands and portion sizes were used for both pre- and post-intervention taste testings.

Originally, the survey included strawberries. However, as strawberries were not available at grocery stores at the baseline taste testing, they were not included in the taste testing activity at that time. Strawberries were included at the 7-month follow up taste testing, although children's attitudes about and home consumption of strawberries could not be compared with baseline results.

After all students were sitting at their desks, university researchers presented the pre-cut vegetables and fruits individually, each one in its own container. Children were provided with hand sanitizer, disposable napkins, plastic

plates and toothpicks in order to pick one piece of vegetable or fruit at a time. After tasting a food, children rated how they felt about the food and reported whether they ate that food at home. After answering these questions for the first food offered to them, they tasted the second food presented in the survey, and so forth, with the rest of the foods. The VFAS was displayed, one question at a time, on a screen at the front of each classroom to better explain the activities and help students understand and complete the survey questions.

Children's fruit and vegetable consumption

In addition to the above data which was collected, a separate study was taking place to examine children's fruit and vegetable consumption. This data is not reported here, but is available elsewhere (Macias-Berumen, 2012).

3.2.2 Data Analyses

Adiposity

Body Mass Index (BMI) was calculated and weight status was determined according to the 2007 WHO Child Growth Standards using age and sex specific BMI criterion (de Onis et al., 2007). These standards are internationally recognized and have been recommended for use among Canadian children in clinical, community and research settings (Dietitians of Canada, Canadian Paediatric Society, College of Family Physicians of Canada, & Community Health Nurses of Canada, 2010). Accordingly, BMI (calculated as kg/m^2) was categorized as *normal weight* (BMI $\leq 85^{th}$ percentile); *overweight* (85th percentile $<$ BMI $\leq 97^{th}$ percentile); *obese* (BMI $> 97^{th}$ percentile).

Abdominal obesity status was classified at a waist circumference $>85^{th}$ percentile of sex-and-age matched children from the Third National Health and Nutrition Examination Survey (NHANES III) cohort. Accordingly, *abdominally obese* was classified at waist circumference (cm) $> 85^{th}$ percentile, and *not abdominally obese* at waist circumference (cm) $\leq 85^{th}$ percentile (McDowell, Fryar & Ogden, 2009).

Study Design

To determine if there was an association between children's weight status at baseline and changes in their knowledge and attitudes about vegetables and fruit, and their consumption of these foods at home, this study used a pretest/post-test design. Baseline data were collected in November 2010. Data were collected again from the same children 7 months later, in June 2011.

Data Analysis

Data were analyzed using the Statistics Package for the Social Sciences (SPSS) (Inc., Chicago, IL, USA), version 19.0. The AnthroPlus software from the WHO growth reference data 2007 was used to facilitate analysis of nutritional status according to normal weight, overweight and obese criteria in children and adolescents aged 5-19 years. The Chi-square test for independence was used to determine statistical differences between categorical variables. The McNemar's test was used to analyze nominal data according to dichotomous variables. Paired samples *t*-test was used to evaluate differences between continuous outcome data. Independent sample *t*-test (the unpaired form of the t-test) was used to evaluate two separate sets of independent samples for mean scores comparison. The strength of the Likert-type scale was determined by assuming equal distance between ordinal variables and considering children's intrapersonal variability. Eta squared statistic (η^2) was used to determine effect size for associations between variables based on small effect = .01, medium effect = .06, and large effect = .13 (Cohen, 1988). Statistical significance was set at $p < .05$.

3.3 Results

3.3.1 Weight status and abdominal adiposity

As **Table 3-1** describes, data were collected from 60 children from a total population of 116 students (51.7% participation rate) who attended grades 1 to 6 (aged 6-13 years) of which 32 were males (53.3% participation) and 28 were females (46.7% participation). All of these children participated in the taste testing activity at baseline and 7 months after the implementation of the gardening program, and their weight status was determined according to anthropometric measures taken at baseline. Based on the 2007 WHO Child Growth Standards age and sex specific BMI criteria (de Onis et al., 2007), 60% (n=36) of children who participated in the study were overweight (25%, n=15) or obese (35%, n=21). Of overweight and obese children, 55.6% (n=20) were males and 44.4% (n=16) were females. Of normal weight children, 50% (n=12) were males, and 50% (n=12) were females.

Considering abdominally obese status at a waist circumference >85th percentile of sex-and-age matched children from the Third National Health and Nutrition Examination Survey (NHANES III) cohort (McDowell et al., 2009), 28.3% (n=17) of the 60 participating students were abdominally obese.

Chi-square test for independence revealed that no statistically significant relationship was found between gender and weight status (p = .874), nor between gender and abdominally obese status (p = 1.0).

Table 3-1: Characteristics of children who participated in the taste testing activity at baseline and at 7-month follow up, and whose height, weight and waist circumference were measured at baseline

Characteristics	Total	Males	Females	P-value
Anthropometry total, n [%]	60 [100]	32 [53.3]	28 [46.7]	n/a
Age (y), mean ± SD	9.3 ± 1.8	9.1 ± 1.9	8.9 ± 1.6	.158
BMI (kg/m²), mean ± SD	20.1 ± 3.5	20.4 ± 3.4	19.8 ± 3.6	.557
Waist Circumference (cm), mean ± SD	71.1 ± 11.1	71.6 ± 10.9	70.5 ± 11.5	.706
Weight Status				.874
Normal weight, n [%]#	24 [40]	12 [50]	12 [50]	
Overweight and *obese*, n [%]#	36 [60]	20 [55.6]	16 [44.4]	
Abdominal obesity status				1.0
Abdominally obese, n [%]‡	17 [28.3]	9 [52.9]	8 [47.1]	
Not abdominally obese, n [%]‡	43 [71.7]	23 [53.5]	20 [46.5]	

n/a: Not applicable

WHO Child Growth Standards 5-19 years: *Normal* weight (BMI ≤ 85th percentile); *overweight* (85th percentile < BMI ≤ 97th percentile); *obese* (BMI > 97th percentile) (de Onis et al., 2007).

‡ CDC Abdominal obesity status criteria: *Abdominal obese* at WC > 85th percentile; *not abdominally obese* at WC ≤ 85th percentile (McDowell et al., 2009).

Table 3-2 indicates the relationship between anthropometric variables and abdominal adiposity. Of all children who had normal weight, none of them presented abdominal obesity. All abdominally obese children (n=17) were either overweight (11.8%, n=2) or obese (88.2%, n=15). For this reason, abdominally obese children had a statistically significantly higher BMI than non-abdominally obese children ($p < .001$). The mean difference in BMI between abdominally and not-abdominally obese children was 5.1 kg/m^2.

Table 3-2: Relationship between children's anthropometric variables and abdominal adiposity

Weight status	Measurements (n [%])		P-value
	Abdominally obese ‡	***Not abdominally obese*** ‡	
Normal weight #	0 [0.0]	24 [100]	
Overweight or obese #	17 [47.2]	19 [52.8]	
BMI (kg/m^2)	**Measurements (mean ± SD [n])**		
Males	23.7 ± 2.9 [9]	19.1 ± 2.7 [23]	<.001 †
Females	23.8 ± 3.5 [8]	18.2 ± 2.2 [20]	<.001 †
Total sample	23.8 ± 3.1 [17]	18.7 ± 2.5 [43]	<.001 †

For n=60. Chi-square test determined statistical differences between categorical variables.
WHO Child Growth Standards 5-19 years: *Normal* weight (BMI ≤ 85th percentile); *overweight* (85th percentile < BMI ≤ 97th percentile); *obese* (BMI > 97th percentile) (de Onis et al., 2007).
‡ CDC Abdominal obesity status criteria: *Abdominally obese* at WC > 85th percentile; *not abdominally obese* at WC ≤ 85th percentile (McDowell et al., 2009).
† Statistically significant difference in BMI between abdominally obese and non-abdominally obese categories (p<.05).

3.3.2 Knowledge about vegetables and fruit

3.3.2.1 Normal weight children

Table 3-3 shows results from the knowledge survey which revealed that out of 24 students with normal weight 75% (n=18) were able to list five fruits and vegetables required by the activity, increasing to 87.5% (n=21) at the 7-month follow up. Paired samples *t*-test revealed that changes in the number of foods listed from baseline to follow up were not statistically significant (p=.846).
Of these 24 children, 70.8% (n=17) listed five fruits and vegetables at both baseline and 7-month follow up. The remainder (n=7), as described on **Table 3-4**, differed in the amount of foods mentioned. Accordingly, between baseline and follow up, 16.7% (n=4) of children increased the number of foods listed, and 12.5% (n=3) decreased the number of foods listed. Paired samples *t*-test revealed that changes in the number of foods mentioned by these 7 children from baseline to follow up were not statistically significant (p=.859).

Table 3-3: Description of the lists completed by children with normal weight in response to the question "Please, write down five fruits and vegetables that you know"

Write down 5 fruits and vegetables that you know	Normal weight[#] children		
	Knowledge towards fruits and vegetables, n [%]		P-value
	Baseline	7-month follow up	
Listed 5 options	18 [75.0]	21 [87.5]	
Listed less than 5 options	6 [25.0]	3 [12.5]	
Total foods listed, mean ± SD	4.6 ± 0.7	4.7 ± 0.9	.846

For n=24. Mean score ± SD = standard deviation. Paired samples *t*-test was used to evaluate differences between continuous outcome data.
WHO Child Growth Standards 5-19 years: *Normal* weight (BMI ≤ 85th percentile) (de Onis et al., 2007).

Table 3-4: Changes observed in the number of foods listed by normal weight children from baseline to 7-month follow up

Student[†]	Normal weight[#] children			
	Write down five fruits and vegetables that you know		Change[‡] (No. of answers)	P-value
	Baseline	7-month follow up		
1	3	5	2	
2	3	5	2	
3	3	5	2	
4	4	5	1	
5	4	2	-2	
6	5	3	-2	
7	5	3	-2	
Total foods, listed ± SD	3.7 ± 0.7	3.8 ± 1.5	0.1 ± 2.0	.859

Mean score ± SD = standard deviation. Paired samples *t*-test was used to evaluate differences between continuous outcome data.
† Indicates number of children (out of n=24) that revealed a difference in number of foods listed.
‡ Absolute change number of answers at 7-month follow up.
# WHO Child Growth Standards 5-19 years: *Normal* weight (BMI ≤ 85th percentile) (de Onis et al., 2007).

3.3.2.2 Overweight/Obese children

Table 3-5 shows results of the knowledge survey from children with overweight and obesity. Of these 36 children, 91.7% (n=33) were able to list five fruits and vegetables required by the activity, decreasing to 86.1% (n=31) at the 7-month follow up. Paired samples *t*-test revealed that changes in the number of foods listed by overweight and obese children from baseline to follow up were not statistically significant (p=.597). Of these 36 children, 80.5% (n=29) listed five fruits and vegetables at both baseline and 7-month follow up. The remainder (n=7), as described on **Table 3-6**, differed in the number of foods mentioned. Accordingly, between baseline and follow up, 8.3% (n=3) of children increased the number of foods listed, and 11.1% (n=4) decreased the number of foods listed. Paired samples *t*-test revealed that changes in the number of vegetables and fruits mentioned by these 7 children from baseline to follow up were not statistically significant (p=.629).

Table 3-5: Description of the lists completed by children with overweight and obesity in response to the question "Please, write down five fruits and vegetables that you know"

Write down 5 fruits and vegetables that you know	**Overweight/obese[#] children**		
	Knowledge towards fruits and vegetables, n [%]		**P-value**
	Baseline	**7-month follow up**	
Listed 5 options	33 [91.7]	31 [86.1]	
Listed less than 5 options	3 [8.3]	5 [13.9]	
Total foods listed, mean ± SD	4.8 ± 0.7	4.7 ± 0.8	.597

For n=36. Mean score ± SD = standard deviation. Paired samples *t*-test was used to evaluate differences between continuous outcome data.

\# WHO Child Growth Standards 5-19 years: *Overweight* (85^{th} percentile $<$ BMI $\leq$ 97^{th} percentile); *obese* (BMI $>$ 97^{th} percentile) (de Onis et al., 2007).

Table 3-6: Changes observed in the number of foods listed by children with overweight and obesity from baseline to 7-month follow up

Student†	Overweight/obese# children			
	Write down five fruits and vegetables that you know		Change‡ (No. of answers)	P-value
	Baseline	7-month follow up		
1	2	3	1	
2	3	5	2	
3	3	5	2	
4	5	3	-2	
5	5	4	-1	
6	5	4	-1	
7	5	1	-4	
Total foods, listed ± SD	4.0 ± 1.3	3.6 ± 1.4	-0.4 ± 2.2	.629

Mean score ± SD = standard deviation. Paired samples *t*-test was used to evaluate differences between continuous outcome data.

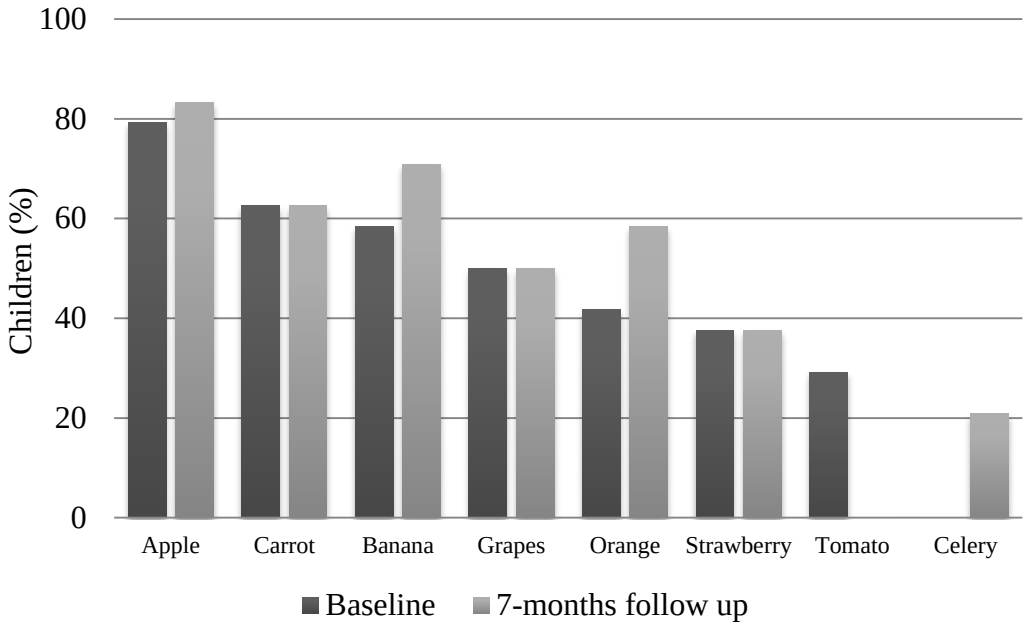
† For n=36. Indicates number of children that revealed a difference in number of foods listed from baseline to 7-month follow up.

‡ Absolute change number of answers at 7-month follow up.

WHO Child Growth Standards 5-19 years: *Overweight* (85^{th} percentile $< BMI \leq 97^{th}$ percentile); *obese* ($BMI > 97^{th}$ percentile) (de Onis et al., 2007).

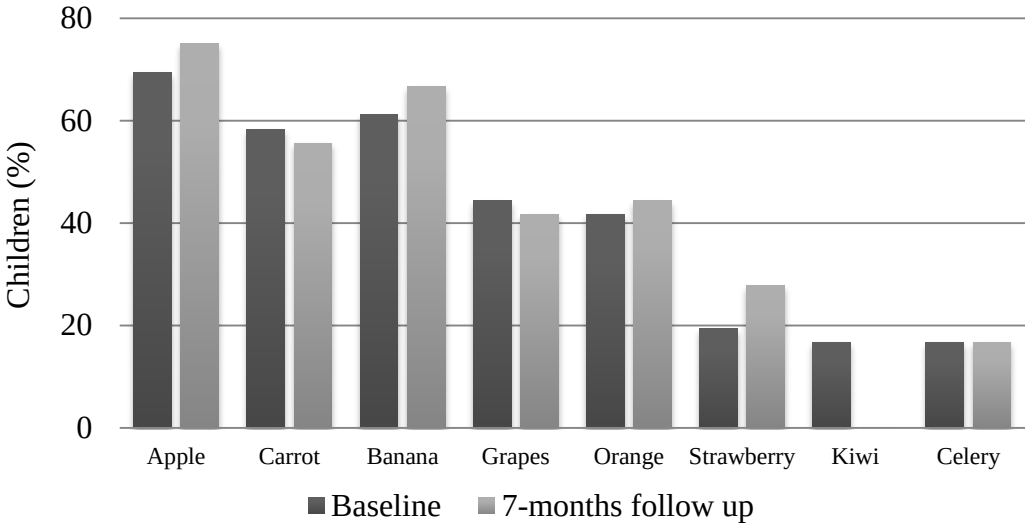
Figure 3-1 and **Figure 3-2** indicate the foods that were frequently mentioned by normal weight children and by overweight/obese children, respectively. At both baseline and follow up, these figures show that regardless of children's weight status, apple, carrot, banana, orange, grapes and strawberry, were consistently listed as the foods they were most knowledgeable about. At baseline, these foods were followed by tomato (for normal weight children), and by kiwi and celery (for overweight/obese children). At 7-month follow up, celery followed the top foods listed by both groups of children. On the other hand, foods such as grapefruit, mushroom, cauliflower, cantaloupe, radish, and cucumber were the foods that children, regardless of their weight status, mentioned the least.

Figure 3-1: Most frequently mentioned foods by children with normal weight at baseline and at 7-month follow up



Foods listed by n=24 children with normal weight.
WHO Child Growth Standards 5-19 years: *Normal* weight (BMI ≤ 85th percentile) (de Onis et al., 2007).

Figure 3-2: Most frequently mentioned foods by children with overweight and obesity at baseline and at 7-month follow up



Foods listed by n=36 children with overweight and obesity.
WHO Child Growth Standards 5-19 years: *Overweight* (85th percentile < BMI ≤ 97th percentile); *obese* (BMI > 97th percentile) (de Onis et al., 2007).

3.3.3 Attitudes about vegetables and fruit, and their home consumption

During the taste testing activity children answered questions using a 6-point Likert-type scale provided on the survey, with 6 = '*I really like* it'; 5 = *'I like it'*; 4 = *'It is OK'*; 3 = *'I do not like it'*; 2 = *'I really do not like it'*; 1 = '*I will never eat it again'.* Paired samples *t*-test was used to examine changes in children's attitudes about vegetables and fruit, and their consumption of these foods at home, between baseline and 7-month follow up, and considering their weight status at baseline. Based on the 17-item questionnaire and a 6-point Likert-type scale, the total likeability score of vegetables and fruits ranged from 17 to 102. After tasting and rating a food, each of the students answered if they ate that food at home. The McNemar's test was used to compare nominal data (vegetables and fruits) with dichotomous variables (Yes/No) considering children's responses at baseline and at 7-month follow up.

3.3.3.1 Normal weight children

Table 3-7 indicates likeability mean scores and home consumption of vegetables and fruits, reported at baseline and at 7-month follow up by children with normal weight. Overall, this group of children had significantly improved their food attitudes from baseline (M = 79.8, SD = 10.5) to 7-month follow up (M = 83.7, SD = 11.0), t (23) = 2.3, p <.05, showing a mean increase of 3.8. The eta squared statistic (.19) indicated a large effect size (Cohen, 1988).

With the exception of radishes, the score for every vegetable and fruit increased (banana, carrot, orange, pear, kiwi, celery, cantaloupe, cucumber, broccoli, green pepper, tomato, cauliflower, mushroom, grapefruit), or remained the same (grapes, apple). The only food that had a statistically significant increase in likeability was cauliflower.

Considering children's home food consumption, although no statistically significant differences were found from baseline to follow up, it can be observed there was a general increase in vegetable and fruit consumption. Specifically, 11 foods (grapes, carrot, pear, kiwi, celery, cantaloupe, cucumber, broccoli, green

pepper, mushroom and grapefruit) revealed an increase in their home consumption. At both interventions, banana and orange presented the same scores, and these were consumed by 91.7% and 95.8% of children, respectively. Only 4 foods presented a slight decrease in their consumption (apple, tomato, radish and cauliflower). Overall, results revealed that the foods that were mostly consumed at home were apple, orange, carrot, grapes and banana. In contrast, mushroom, radish and grapefruit were consumed to a lesser extent.

Additionally, Appendix F was included in this thesis to better describe the percentage distribution of attitude scores at baseline and at 7-month follow up, for the 6 values in the scale, and considering children with normal weight.

Table 3-7: Likeability mean scores and home consumption of vegetables and fruits, reported at baseline and at 7-month follow up by children with normal weight

Normal weight[#] children				
Foods	**Attitudes towards food (mean ± SD)[‡]**		**Home food consumption, Yes (n [%])***	
	Baseline	**7-months follow up**	**Baseline**	**7-months follow up**
Grapes	5.9 ± 0.3	5.9 ± 0.3	22 [91.7]	23 [95.8]
Banana	5.8 ± 0.7	6.0 ± 0.0	22 [91.7]	22 [91.7]
Apple	5.7 ± 0.8	5.7 ± 0.8	24 [100]	23 [95.9]
Carrot	5.7 ± 0.7	5.8 ± 0.5	22 [91.7]	23 [95.8]
Orange	5.6 ± 0.8	5.8 ± 0.5	23 [95.8]	23 [95.8]
Pear	5.6 ± 0.7	5.7 ± 0.6	15 [62.5]	19 [79.2]
Kiwi	5.5 ± 1.4	5.8 ± 0.6	15 [62.5]	17 [70.8]
Celery	5.2 ± 1.2	5.4 ± 1.1	15 [62.5]	19 [79.2]
Cantaloupe	5.0 ± 1.4	5.6 ± 1.0	10 [41.6]	12 [50.0]
Cucumber	4.8 ± 1.7	5.4 ± 1.5	13 [54.1]	17 [70.8]
Broccoli	4.2 ± 1.8	4.5 ± 1.7	14 [58.3]	18 [75.0]
Green Pepper	4.1 ± 1.9	4.7 ± 1.7	11 [45.8]	13 [54.2]
Tomato	3.6 ± 2.1	4.0 ± 2.0	13 [54.2]	11 [45.8]
Radish	3.5 ± 1.8	3.3 ± 2.0	6 [25.0]	3 [12.5]
Cauliflower	3.2 ± 1.8[A]	4.4 ± 1.8[B]	10 [41.6]	9 [37.5]
Mushroom	2.8 ± 2.0	3.0 ± 2.0	7 [29.1]	11 [45.8]
Grapefruit	2.8 ± 1.7	2.9 ± 2.0	4 [16.7]	5 [20.8]
Total Vegetables and Fruits §	79.8 ± 10.5[A]	83.7 ± 11.0[B]		

For n=24. Mean score ± SD = standard deviation. Paired samples *t*-test examined changes in attitudes. The McNemar's test compared nominal data with dichotomous variables.

[A] Numbers with different letters within the same row significantly different ($p<0.05$).

* Indicates number (and proportion) of children who eat each of the food at home.

‡ Likert-type scale was from 6 = 'I really like it' to 1 = 'I will never eat it again'.

\# WHO Child Growth Standards 5-19 years: *Normal* weight (BMI ≤ 85th percentile) (de Onis et al., 2007).

§ Based on a 17-item questionnaire and a 6-point scale, scores ranged from 17 to 102.

3.3.3.2 Overweight/Obese children

Table 3-8 presents results of the attitudes and home food consumption survey for the group of children who were overweight and obese (n=36).
With the exception cauliflower and celery, the score for every vegetable and fruit increased (banana, apple, orange, kiwi, cucumber, broccoli, cantaloupe, green pepper, tomato, grapefruit, mushroom), or remained the same (carrot, grapes, pear, radish). Specifically, a statistically significant increase ($p < 0.05$) was found for cantaloupe and green pepper.

Although no statistically significant differences were found from baseline to follow up for home food consumption in overweight/obese children, it can be observed that of 17 foods included in the taste testing, 6 of them presented an increase in their consumption (carrot, kiwi, cantaloupe, green pepper, tomato, grapefruit). There were 3 foods that remained the same (grapes, banana, orange), and the rest revealed a decrease in their consumption at follow up (pear, celery, apple, cucumber, broccoli, cauliflower, radish, mushroom).
Overall, the foods that were mostly consumed at home were banana, apple, celery, carrot and orange; while mushroom, grapefruit and radish were consumed to a lesser extent.

Table 3-8: Likeability mean scores and home consumption of vegetables and fruits, reported at baseline and at 7-month follow up by children with overweight and obesity

***Overweight*[#] and *Obese*[#] children**				
Foods	**Attitudes towards food (mean ± SD)[‡]**		**Home food consumption, Yes (n [%])***	
	Baseline	**7-months follow up**	**Baseline**	**7-months follow up**
Carrot	5.8 ± 0.9	5.8 ± 0.6	33 [91.7]	36 [100]
Grapes	5.8 ± 0.5	5.8 ± 0.6	32 [88.9]	32 [88.9]
Pear	5.8 ± 0.4	5.8 ± 0.6	31 [86.1]	27 [75.0]
Celery	5.8 ± 0.4	5.6 ± 1.1	34 [94.4]	32 [88.9]
Banana	5.7 ± 1.0	5.8 ± 0.5	34 [94.4]	34 [94.4]
Apple	5.6 ± 0.8	5.7 ± 0.6	34 [94.4]	31 [86.1]
Orange	5.6 ± 0.7	5.8 ± 0.5	33 [91.7]	33 [91.7]
Kiwi	5.5 ± 1.2	5.8 ± 0.6	23 [63.9]	26 [72.2]
Cucumber	4.9 ± 1.7	5.2 ± 1.3	24 [66.7]	23 [63.9]
Broccoli	4.9 ± 1.5	5.2 ± 1.3	26 [72.2]	24 [66.7]
Cauliflower	4.8 ± 1.6	4.7 ± 1.7	17 [47.2]	16 [44.4]
Cantaloupe	4.4 ± 1.9[A]	5.0 ± 1.6[B]	14 [38.9]	18 [50.0]
Green Pepper	4.2 ± 1.9[A]	4.6 ± 1.7[B]	18 [50.0]	19 [52.8]
Tomato	3.8 ± 1.9	4.3 ± 2.0	17 [47.3]	19 [52.8]
Radish	3.3 ± 2.1	3.3 ± 2.0	8 [22.2]	6 [16.7]
Grapefruit	3.0 ± 2.0	3.4 ± 2.1	8 [22.2]	12 [33.3]
Mushroom	2.8 ± 2.0	2.9 ± 2.0	12 [33.4]	11 [30.6]
Total Vegetables and Fruits[§]	81.6 ± 11.2	84.4 ± 11.0		

For n=36. Mean score ± SD = standard deviation. Paired samples *t*-test examined changes in attitudes. The McNemar's test compared nominal data with dichotomous variables.

[A] Numbers with different letters within the same row are significantly different ($p<0.05$).

* Indicates number (and proportion) of children who eat each of the food at home.

‡ Likert-type scale was from 6 = 'I really like it' to 1 = 'I will never eat it again'.

WHO Child Growth Standards 5-19 years: *Overweight* (85^{th} percentile < BMI ≤ 97^{th} percentile); *obese* (BMI > 97^{th} percentile) (de Onis et al., 2007).

§ Based on a 17-item questionnaire and a 6-point scale, scores ranged from 17 to 102.

Additionally, Appendix F was included in this thesis to better describe the percentage distribution of attitude scores at baseline and at 7-month follow up, for the 6 values in the scale, and considering children with overweight and obesity.

Overall, both groups of children, regardless of their weight status, showed an increase in their likeability scores for the total vegetables and fruits considered.

However, as likeability scores were measured with a 6-point Likert-type scale, of which three response options were positive (6 = '*I really like it*', 3 = '*I like it',* 4 = '*It is OK*') and three were negative (3 = '*I do not like it*', 2 = *'I really do not like it',* 1 = '*I will never eat it again*'), changes in absolute scores do not provide information about whether likability scores moved from a negative to a positive attitude across the 6-point Likert-type scale. For this reason, to better evaluate changes in children's attitudes about vegetables and fruit, the 6 ordinal variables that measure likeability scores for each of the 17 vegetables and fruits were merged into 2 groups considering positive attitudes from 6 = '*I really like it*' to 4 = '*It is OK*', and negative attitudes from 3 = '*I do not like it*' to 1 = '*I will never eat it again*'. The McNemar's test was used to analyze nominal data (vegetables and fruits) according to dichotomous variables (Positive/Negative).

Normal weight children

Table 3-9 shows the total amount of children with normal weight that presented a positive attitude (from 6 = '*I really like it*' to 4 = '*It is OK*') towards each of the vegetables and fruits included in the questionnaire. At baseline, the mean percentage of positive responses was 77.7%, and 4 foods (grapes, carrot, orange and pear) presented 100% of positive attitudes. After the intervention, the mean percentage of positive responses increased to 82.4%, and banana was added to the previous list presenting 100% of positive attitudes. Grapefruit and mushroom were the foods that presented a considerable low amount of positive responses at both points in time.

Overall, of 17 foods considered, 11 (64.7%) increased their number of positives responses from baseline, with the greatest magnitude of change presented for green pepper, tomato, cauliflower and mushroom. Radish was the only food that presented a decrease in its number of positive responses.

Table 3-9: Positive attitudes towards vegetables and fruits reported at baseline and at 7-month follow up by children with normal weight

What do you think of this food?‡	Positive attitude towards food*, n [%]		Change, n [%]†
	Baseline	7-month follow up	
Grapes	24 [100]	24 [100]	0 [0.0]
Carrot	24 [100]	24 [100]	0 [0.0]
Orange	24 [100]	24 [100]	0 [0.0]
Pear	24 [100]	24 [100]	0 [0.0]
Banana	23 [95.8]	24 [100]	1 [4.2]
Apple	23 [95.8]	23 [95.8]	0 [0.0]
Kiwi	22 [91.7]	23 [95.8]	1 [4.2]
Celery	22 [91.7]	23 [95.8]	1 [4.2]
Cucumber	20 [83.3]	22 [91.7]	2 [8.3]
Cantaloupe	20 [83.3]	21 [87.5]	1 [4.2]
Broccoli	17 [70.8]	18 [75.0]	1 [4.2]
Green Pepper	16 [66.7]	20 [83.3]	4 [16.7]
Tomato	14 [58.3]	17 [70.8]	3 [12.5]
Radish	14 [58.3]	12 [50.0]	- 2 [8.3]
Cauliflower	15 [62.5]	18 [75.0]	3 [12.5]
Grapefruit	8 [33.3]	9 [37.5]	1 [4.2]
Mushroom	7 [29.2]	10 [41.7]	3 [12.5]

For n=24. Mean score ± SD = standard deviation. The McNemar's test compared nominal data with dichotomous variables.
‡ Likert-type scale was from 6 = 'I really like it' to 1 = 'I will never eat it again'.
† Number (and proportion) of responses that changed from positive to negative, or negative to positive, from baseline to 7-month follow up.
* Indicates scores within the highest levels of the Likert-type scale (6 to 4).

Overweight/Obese children

Using the same methodology to evaluate changes in children's positive attitudes towards foods, **Table 3-10** describes positive attitudes towards vegetables and fruits of children with overweight and obesity.

At baseline, the mean percentage of positive responses was 79.2%, and 3 foods (grapes, pear and celery) presented 100% of positive attitudes. After the intervention, the mean percentage increased to 83.5%, and 6 foods (carrot, grapes, pear, banana, apple and orange) presented 100% of positive attitudes.

Radish, grapefruit and mushroom were the foods that presented a considerable

low amount of positive responses at both time points. Overall, of 17 foods considered, 11 (64.7%) increased their number of positives responses from baseline, with more significant changes presented for tomato, green pepper, cantaloupe and cucumber. A statistically significant increase ($p < 0.05$) was reported for tomato (19.4%, n=7). Celery and cauliflower were the foods that presented a decrease in their number of positive responses.

Table 3-10: Positive attitudes towards vegetables and fruits reported at baseline and at 7-month follow up by children with overweight and obesity

What do you think of this food? ‡	**Positive attitude towards food*, n [%]**		**Change, n [%]** †
	Baseline	**7-month follow up**	
Grapes	36 [100]	36 [100]	0 [0.0]
Pear	36 [100]	36 [100]	0 [0.0]
Celery	36 [100]	34 [94.4]	-2 [5.6]
Carrot	35 [97.2]	36 [100]	1 [2.8]
Banana	35 [97.2]	36 [100]	1 [2.8]
Orange	35 [97.2]	36 [100]	1 [2.8]
Apple	34 [94.4]	36 [100]	2 [5.6]
Kiwi	34 [94.4]	35 [97.2]	1 [2.8]
Broccoli	32 [88.9]	33 [91.7]	1 [2.8]
Cauliflower	31 [86.1]	29 [80.6]	-1 [2.8]
Cucumber	29 [80.6]	33 [91.7]	4 [11.1]
Cantaloupe	26 [72.2]	30 [83.3]	4 [11.1]
Green Pepper	26 [72.2]	30 [83.3]	4 [11.1]
Tomato	18 [50.0]**A**	25 [69.4]**B**	7 [19.4]
Radish	16 [44.4]	16 [44.4]	0 [0.0]
Grapefruit	14 [38.9]	16 [44.4]	2 [5.6]
Mushroom	12 [33.3]	14 [38.9]	2 [5.6]

For n=36. Mean score ± SD = standard deviation. The McNemar's test was used to analyze nominal data according to dichotomous variables.

‡ Likert-type scale was from 6 = 'I really like it' to 1 = 'I will never eat it again'.

* Indicates scores within the highest levels of the Likert-type scale (6 to 4).

† Number (and proportion) of responses that changed from positive to negative, or negative to positive, from baseline to 7-month follow up

A Numbers with different letters within the same row are significantly different ($p<0.05$).

As previously described, a statistically significant increase ($p < 0.05$) was found in likeability scores from baseline to follow up for the group of children who had normal weight, and no significant differences were found for overweight and obese children. But to better examine likeability scores considering children's weight status, **Table 3-11** compares changes in likeability mean scores between both groups at baseline and at follow up. Independent sample t-test (the unpaired form of the t-test) was used to evaluate statistical differences of continuous outcome data between both groups of children (normal weight and overweight/obese).

Although no statistically significant difference was found after comparing likeability scores between both groups of children at either time point, both normal weight and overweight/obese children improved their attitudes towards vegetables and fruit between baseline and follow-up.

Table 3-11: Comparison between children's weight status and attitudes towards vegetables and fruit at baseline and at 7-month follow up

***Do you like vegetables and fruits*?**‡	**Measurements (mean ± SD [n])**		
	***Normal* weight**#	***Overweight* and *Obese***#	**P-value**
Baseline	79.8 ± 10.5 [24]	81.6 ± 11.2 [36]	.538
7-month follow up	83.7 ± 11.0 [24]	84.4 ± 11.0 [36]	.785
P-value	.031†	.059	

For n=24 normal weight, and n=36 overweight/obese. Mean score ± SD = standard deviation. Independent sample t-test evaluated statistical differences of continuous outcome data between both groups of children (normal weight and overweight/obese).

WHO Child Growth Standards 5-19 years: *Normal* weight (BMI ≤ 85th percentile); *overweight* (85th percentile < BMI ≤ 97th percentile); *obese* (BMI > 97th percentile) (de Onis et al., 2007).

† Indicates statistically significant increase ($p < .05$) in food likeability scores from baseline to 7-month follow up.

‡ Based on a 17-item questionnaire and a 6-point scale, scores ranged from 17 to 102.

3.3.4 Knowledge, attitudes and home consumption of vegetables and fruit, considering children's abdominal adiposity

Of 60 children who had their waist circumference (WC) measured, 43 (71.7%) of them were not abdominally obese, and 17 (28.3%) had abdominal obesity. Of these 17 children, 15 (88.2%) were obese and 2 (11.8%) were overweight.

When children were asked to list/draw five vegetables and fruit that they knew, no differences were found considering their abdominal adiposity status. Specifically, the results that were obtained were similar to findings revealed when children's weight status was considered. Accordingly, apple, carrot, banana, grapes and orange, were the foods that children, regardless of their waist circumference measures, mentioned more frequently at both interventions.

Independent sample t-test (the unpaired form of the t-test) was used to evaluate statistical differences of continuous outcome data between both groups of children (abdominally obese and not abdominally obese). Accordingly, as **Table 3-12** shows, both group of children, regardless of their abdominal adiposity, increased their attitudes toward vegetables and fruits at 7-month follow up. Specifically, abdominally obese children revealed a statistically significant increase in their total likeability score from baseline (M = 82.1, SD = 10.8) to 7-month follow up (M = 86.1, SD = 9.3), t (16) = 2.9, $p < .05$, with a mean increase of 4.0. As well, children who were not abdominally obese revealed a statistically significant increase in their total likeability score from baseline (M = 80.4, SD = 10.9) to 7-month follow up (M = 83.4, SD = 11.2), t (42) = 2.1, $p < .05$, with a mean increase of 3.0.

Table 3-12: Comparison between children's abdominal adiposity and attitudes towards vegetables and fruit at baseline and at 7-month follow up

Do you like vegetables and fruits? ‡	**Measurements (mean ± SD [n])**		
	Abdominally obese #	***Not abdominally obese*** #	**P-value**
Baseline	82.1 ± 10.8 [17]	80.4 ± 10.9 [43]	.524
7-month follow up	86.1 ± 9.3 [17]	83.4 ± 11.2 [43]	.386
P-value	.010†	.046†	

For n= 17 abdominally obese, and n=43 not abdominally obese. Mean score ± SD = standard deviation. Independent sample t-test evaluated statistical differences of continuous outcome data between both groups of children (normal weight and overweight/obese).

CDC Abdominal obesity status criteria: *Abdominal obese* at WC > 85th percentile; *not abdominally obese* at WC ≤ 85th percentile (McDowell et al., 2009).

† Indicates statistically significant increase ($p < .05$) in food likeability scores from baseline to 7-month follow up.

‡ Based on a 17-item questionnaire and a 6-point scale, scores ranged from 17 to 102.

Table 3-13 shows changes in home consumption of vegetables and fruits from baseline to follow up, considering children's abdominal adiposity. The McNemar's test was used to compare nominal data (vegetables and fruits) with dichotomous variables (Yes/No). This table shows there were no statistically significant changes in children's home food consumption. Specifically, for (n=17) children who were abdominally obese, of 17 foods included in the questionnaire, 5 of them (orange, banana, carrot, kiwi, grapefruit) showed an increase from baseline, 7 foods (apple, celery, pear, broccoli, cucumber, cauliflower, radish) revealed an increase, and the remaining 5 foods (grapes, cantaloupe, tomato, green pepper, mushroom) didn't show any changes.

For (n=43) children who were not abdominally obese, 11 of them (carrot, celery, pear, grapes, broccoli, kiwi, cucumber, cantaloupe, green pepper, mushroom, grapefruit) presented an increase from baseline, 4 foods (apple, orange, banana, radish) revealed an increase, and the remaining 2 foods (cauliflower, tomato) didn't show any changes in their consumption.

Table 3-13: Home consumption of vegetables and fruit at baseline and at 7-month follow up, considering children's abdominal adiposity

Home food consumption, Yes (n [%])*				
Foods	**Abdominally obese#**		**Not abdominally obese#**	
	Baseline	**7-months follow up**	**Baseline**	**7-months follow up**
Apple	16 [94.1]	14 [82.4]	42 [97.7]	40 [93.0]
Orange	16 [94.1]	17 [100]	40 [93.0]	39 [90.7]
Banana	15 [88.2]	16 [94.1]	41 [95.3]	40 [93.0]
Carrot	15 [88.2]	17 [100]	40 [93.0]	42 [97.7]
Celery	15 [88.2]	14 [82.4]	34 [79.1]	37 [86.0]
Pear	15 [88.2]	11 [54.7]	31 [72.1]	35 [81.4]
Grapes	14 [82.4]	14 [82.4]	40 [93.0]	41 [95.3]
Broccoli	12 [70.6]	10 [58.8]	28 [65.1]	32 [74.4]
Kiwi	11 [64.7]	12 [70.6]	27 [62.8]	31 [72.1]
Cucumber	10 [58.8]	9 [52.9]	27 [62.8]	31 [72.1]
Cantaloupe	9 [52.9]	9 [52.9]	15 [34.9]	21 [48.8]
Cauliflower	9 [52.9]	7 [41.2]	18 [41.9]	18 [41.9]
Tomato	8 [47.1]	8 [47.1]	22 [51.2]	22 [51.2]
Green Pepper	7 [41.2]	7 [41.2]	22 [51.2]	25 [58.1]
Radish	4 [23.5]	2 [11.8]	10 [23.3]	7 [16.3]
Mushroom	4 [23.5]	4 [23.5]	15 [34.9]	18 [41.9]
Grapefruit	3 [17.6]	5 [29.4]	9 [20.9]	12 [27.9]

For n= 17 abdominally obese, and n=43 not abdominally obese.

The McNemar's test compared nominal data with dichotomous variables.

CDC Abdominal obesity status criteria: *Abdominal obese* at WC > 85th percentile; *not abdominally obese* at WC ≤ 85th percentile (McDowell et al., 2009).

* Indicates number (and proportion) of children who eat each of the food at home.

3.4 Discussion

The main purpose of the present report was to measure the prevalence of overweight and obesity in First Nations schoolchildren. Considering their weight status and their abdominal adiposity, this study aimed to examine changes in children's knowledge and attitudes about vegetables and fruit, and their consumption of these foods at home, after a 7-month school gardening intervention and a 4-month snack program.

This study has shown a high prevalence of obesity among First Nations Cree children living on-reserve. Anthropometric measurement results revealed that out of 60 students who participated in the study, 25% (n=15) were overweight and 35% (n=21) were obese. The prevalence of obesity was about four times higher than the prevalence reported for the rest of the pediatric population in Canada (8.2%) (Shields, 2006). The high obesity rate was similar to results revealed in the First Nations Regional Longitudinal Health Survey (RHS) 2008/10, where approximately 40.5% of First Nations children living on-reserve were obese (First Nations Information Governance Centre, 2011). High levels of obesity have also been reported in small community-based studies among First Nations children on the Pacific coast of British Columbia (33%) (Wahi, Zorzi, Macnab & Panagiotopoulos, 2009), Ojibwa-Cree children in Northern Manitoba (37%) (Young, Dean, Flett & Wood-Steiman, 2000), and Cree children in Northern Québec (34.3%) (Downs et al., 2009).

It has been suggested that measures of central adiposity such as waist circumference (WC), rather than Body Mass Index (BMI) alone, should be considered in all research studies concerning childhood obesity (Ardern, Katzmarzyk, Janssen & Ross, 2003). This is necessary to determine a range of cardiovascular risk factors such as high blood pressure, insulin resistance and dyslipidemia (Watts, Bell, Byrne, Jones & Davis, 2008; Colin-Ramirez et al., 2009). These factors comprise the metabolic syndrome (MetS), which considers central adiposity as the clustering of metabolic abnormalities that may predict increased risk for cardiovascular disease and T2DM (Downs, Willows, Marshall & Ng, 2008).

We found in this study that the majority (88.2%) of children with abdominal obesity were obese. Moreover, abdominally obese children had a significantly higher BMI than other children, which adds to the evidence that Aboriginal children tend to accumulate excess adipose tissue in and around the central region of the body (Ng, Marshall & Willows, 2006; Downs et al., 2008). Children with excess body weight combined with high WC are more likely to develop MetS compared to children with excess weight and low WC (Anderson et

al., 2010; Janssen et al., 2005; Shields, 2006; Johnson et al., 2010). For this reason, results of this report suggest that nearly one-third (n=17, 28.3%) of the children who participated in the study (n=60) may be at high risk of developing obesity-related diseases.

Longitudinal studies have reported that excess weight and obesity in childhood may be major contributors to the adult obesity epidemic. These studies have emphasized the need to identify factors that contribute to the onset and persistence of excess weight (Singh, Mulder, Twisk, van Mechelen & Chinapaw, 2008; Dietz, 2004).

Among Aboriginal populations in Canada, being overweight is more prevalent among men, and being obese is more prevalent among women (Assembly of First Nations, 2007; First Nations Information Governance Centre, 2011; Garriguet, 2008). Among First Nations children, no differences are apparent in BMI between boys and girls (Assembly of First Nations, 2007). In this study, the prevalence of childhood overweight and obesity was similar among boys and girls. A larger sample size would have been required to better examine the prevalence of overweight and obesity according to gender categories.

Based on results of the knowledge survey, children listed the same foods at both baseline and follow up, regardless of their weight status or abdominal adiposity. Considering the taste testing activity, the overall attitude score towards vegetables and fruits likeability increased from baseline to follow up regardless of children's weight status or abdominal adiposity. In addition, the home food environments of normal weight and overweight/obese children, and abdominally obese and not abdominally obese children, were also comparable and did not present significant changes as a result of the intervention. The foods that were most often consumed at home were the same ones they liked the most and were more knowledgeable about, including bananas, apples, celery, carrots, oranges and grapes.

The snack program provided 16 different foods, of which 10 (carrot, grapes, banana, celery, cucumber, cauliflower, orange, cantaloupe, tomato, green pepper) were included in the taste testing questionnaire. The vegetables grown in

the Earthboxes were 3 in total and all of them were included in the taste testing questionnaire (celery, tomato, green pepper). In total, 10 different foods were included in the snack program together with the produce grown in Earthboxes, which were also included in the taste testing questionnaire that evaluated likeability and home consumption.

Interestingly, considering normal weight children (n=24), of the 10 foods that were evaluated using the VFAS, 9 foods have shown an increase in their likeability score from baseline. In addition, of those 10 foods, 6 foods (grapes, carrot, celery, cantaloupe, cucumber, green pepper) have increased the proportion of children that ate them at home. Tomato and cauliflower were the only foods that showed a decrease in their consumption.

On the other hand, considering overweight/obese children (n=36), of the 10 foods previously mentioned, 6 foods (banana, orange, cucumber, cantaloupe, green pepper, tomato) presented an increase in their likeability score from baseline, and 2 foods (celery, cauliflower) have shown an increase in their likeability score. Of 10 foods, 4 (carrot, cantaloupe, green pepper, tomato) increased the proportion of children who ate them at home, and 3 foods (celery, cucumber, cauliflower) showed a decrease in their consumption.
In addition, similar results were obtained considering children's abdominal adiposity.

Research indicates that to successfully promote children's likeability toward foods, the number of food exposures may vary from one to twenty, and considering children's age (Sullivan & Birch, 1994; Birch et al, 1998; Liem & de Graaf, 2004; Loewen & Pliner, 1999). However, as Cooke (2007) suggests, if children actually taste a food there will be a greater chance of increased likeability. This may partially explain the effectiveness of the gardening intervention, together with the healthy snack program. Although the snack program didn't provide more than one exposure for each food included in the program, it did provide a variety of healthy foods and the opportunity for children to try them on a weekly basis. Together with this, both taste testing interventions and the produce grown in the Earthboxes provided more opportunities for

students to be exposed to these healthy foods.

Future research involving First Nations children's weight status or abdominal adiposity, and its relationship to the children's feelings about foods and home food consumption will need to consider a vegetable and fruit frequency questionnaire to better assess the relationship between food likeability and food intake, and to better interpret results based on current findings. However, children's cognitive abilities to self-report food intake are a key factor to consider because dietary surveys based on recall usually rely on memory, which is subject to a variety of errors. Therefore, as Livingstone & Robson (2000) suggest, if any method of dietary assessment is included in research, dietary reporting will be more effective in children aged 7 and older, as they will be more aware of their food intake and frequency of food consumption than younger children.

In Canada, studies involving Aboriginal children have been done to demonstrate how a culturally appropriate intervention would increase their nutritional knowledge and positively change their food choices (Saksvig et al., 2005). Other studies have been done to prevent obesity and the development of T2DM by assessing children's risk factors and measuring their physical activity and television viewing habits (Horn, Paradis, Potvin, Macaulay & Desrosiers, 2001; Smith, Burghardt, Gowanlock, Brown, & Collings, 2002; Hanley et al., 2000). Some studies have explored the relationship between children's diet quality, weight status and food environment (Downs et al., 2009) or evaluated their intentions to eat more vegetables and fruits (Gates et al., 2011). But unfortunately, results from the present report cannot be compared with these other studies due to differences in study design and objectives.

Certainly, the Earthbox Kids gardening intervention and the healthy snack program have been effective in examining changes in First Nations children's knowledge and attitudes about vegetables and fruits, and their consumption of these foods at home, in relation to the children's weight status and abdominal adiposity. In the future, similar studies promoting children's participation and parental involvement will help to achieve a larger sample size that will lead to a better understanding of the relationship between First Nations children's weight

status or abdominal adiposity, and the behaviours that guide their food choices. Accordingly, it will help to develop more effective nutrition intervention initiatives, especially in this population that continues to show a high prevalence of overweight and obesity.

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4. Objective II: Evaluating changes in First Nations children's knowledge and attitudes about vegetables and fruit, and their consumption of these foods at home, after a 7-month school gardening and a 4-month healthy snack program.

4.1 Introduction

Generally, a lack of food diversity in children's diets, and the replacement of fresh produce such as vegetables and fruits with unhealthy processed foods, may potentially lead to children becoming overweight and obese. One of the factors that may influence children's consumption of vegetables and fruits is the acceptance of these foods (Dovey, Staples, Gibson & Halford, 2008). Usually, this depends on the sensory attributes of the food such as taste, texture, smell and appearance, as well as learned acceptance based on repetitive exposures to food (Zandstra & El-Deredy, 2011). The development of eating behaviours can also be affected by factors such as home food availability, preference for particular foods, and family's beliefs and cultural practices (Patrick & Nicklas, 2005).

Children usually do not eat foods they do not like and tend to reject unfamiliar foods. In general, children have innate preferences for sweet and salty tastes and tend to reject bitter and sour tastes (Anzman-Frasca, Savage, Marini, Fisher & Birch, 2012; Dovey et al., 2008). Exposure to foods early in life is essential to developing children's feelings and preferences towards them (Harris, 2008). Children eat the foods that are served most often, which will shape their preferences and consumption. For example, when vegetables and fruits are available in the home environment, children will be more likely to eat them (Cullen, Baranowski, Rittenberry & Olvera, 2000). When foods are easily accessible (e.g., easy for the child to reach, appropriate sizes such as apple wedges or carrot sticks) and ready to be eaten, children will also be more likely to choose these kind of foods (Patrick & Nicklas, 2005).

Food preferences developed in childhood may be reflected in food choices later in life. The rejection of novel foods, termed "food neophobia," describes the avoidance of new foods and flavours often due to fear of a negative sensory experience (Dovey et al., 2008). Evidence suggests that children who tend to avoid trying new foods generally have lower intakes of vegetables and fruits (Wardle et al., 2003). Given that early eating habits may be predictive of those in adulthood, early exposure to healthy foods seems to be the most effective conditioned learning to promote a healthy diet, including children's early acceptance of vegetables and fruits (Harris, 2008). Children can learn to like foods and flavours which will then become familiar if their early environments are structured to promote exposure to healthier foods (Anzman-Frasca et al., 2012; Birch, 1999). Consequently, the more familiar the food, the greater the chance it will be liked (Cooke, 2007).

Increasingly evidence has indicated that an adequate consumption of vegetables and fruit is associated with a lower risk of obesity and weight gain (Epstein et al., 2001; Slavin, 2005) and heart disease (Joshipura et al., 2001; He, Nowson, Lucas & MacGregor, 2007). Even though over the past few years there has been much interest in school gardening initiatives in Canada, to our knowledge, until we began the program, a school gardening program had never been formally implemented in a First Nations community.

Given the evidence that the majority of children do not eat enough servings of vegetables and fruits on a daily basis, and that an adequate consumption of this food group helps prevent obesity and its associated risk factors (WHO, 2004), effective and culturally relevant interventions promoting vegetables and fruit are needed for First Nations children who are at high risk of becoming overweight and obese (Shields, 2006).

As reported in chapter 3, children improved their attitudes towards vegetables and fruit, and their home consumption, regardless of their weight status and abdominal adiposity. For this reason, *objective II* of the present chapter aimed to evaluate the effect of the Earthbox Kids school gardening intervention and the healthy snack program, by measuring changes in First Nations children's

knowledge and attitudes about vegetables and fruit, and their consumption of these foods at home, irrespective of weight status and abdominal adiposity.

4.2 Methodology

With the same methodology presented in chapter 3, *objective II* of the present thesis was designed to collect data about children's knowledge and attitudes about vegetables and fruit, and their consumption of these foods at home. Data was collected from a First Nations community school located in Central Alberta as part of the Earthbox Kids school gardening program. All students (n=116) from grades 1 to 6 (6-13 years old) who attended the school participated in the research, but only data from children who provided their assent and their parents' informed consent were analyzed.

The study was reviewed by the Faculties of Physical Education & Recreation (PER) and Agricultural, Life & Environmental Sciences (ALES), and the Native Studies (NS) Research Ethics Board (REB) at the University of Alberta (Panel 2). The study was approved in October 2010. It was reviewed and approved by the community steering committee. Parental consent and child assent were received prior to data collection (Appendix A)

Baseline data to assess children's knowledge and attitudes about vegetables and fruit, and home consumption, were collected in November 2010. Data were collected again from the same children 7 months later, in June 2011. Data were collected with two self-administered surveys, the Vegetable and Fruit Knowledge Survey (VFKS) and the Vegetable and Fruit Attitude Survey (VFAS).

The VFKS (Appendix B), a self-report, paper-and-pencil survey, was designed to measure children's knowledge about vegetables and fruits. Children were asked to list five vegetables and fruits that they knew. After this activity, the VFAS (Appendix C) was used. Both research tools and methodology to assess children's knowledge and attitudes about vegetables and fruit, and their consumption of these foods at home, were described in chapter 3.

The Statistics Package for the Social Sciences (SPSS) (Inc., Chicago, IL, USA), version 19.0, and Microsoft Excel 2010 were used to analyze data. Paired samples *t*-test was used to examine statistical differences between continuous outcome data. The strength of the Likert-type scale was determined by assuming equal distance between ordinal variables and considering children's intrapersonal variability. Eta squared statistic (η^2) was used to determine effect size for associations between variables based on small effect = .01, medium effect = .06, and large effect = .13 (Cohen, 1988). The McNemar's test was used to analyze nominal data according to dichotomous variables. Statistical significance was set at $p < .05$.

4.3 Results

Data about knowledge and attitudes about vegetables and fruit, and their consumption of these foods at home were collected from 76 children of a total population of 116 students (65.5% participation rate) who attended grades 1 to 6. There were 40 males (52.6%) and 36 females (47.4%), with ages ranging from 6 to 13 years, with a mean age of 9.0 ± 1.8 years. Sample retention was 100% with no data loss, so the same proportion of children who participated in the study at baseline also participated at 7-month follow up.

4.3.1 Knowledge about vegetables and fruit

Table 4-1 shows results from the knowledge survey which revealed that out of 76 students 81.6% (n=62) were able to list five fruits and vegetables required by the activity, increasing to 84.2% (n=64) at the 7-month follow up. Paired samples *t*-test was used to evaluate differences between continuous outcome data. The mean increase in the number of vegetables and fruits mentioned by children was 0.2 and was not statistically significant ($p = .167$).

Of 76 students, 72.4% (n=55) listed five fruits and vegetables at both baseline and 7-month follow up, while the remainder (n=21), as described in

Table 4-2, differed in the number of foods mentioned. Accordingly, between baseline and follow up, 18.4% (n=14) of children increased the number of foods listed, and 9.2% (n=7) decreased the number of foods listed. Paired samples *t*-test revealed that changes in the number of vegetables and fruits mentioned by these 21 children from baseline to follow up were not statistically significant (*p*=.171).

Table 4-1: Description of the lists completed by children in response to the question "Please, write down five fruits and vegetables that you know"

Write down 5 fruits and vegetables that you know	**Knowledge towards fruits and vegetables, n [%]**		**P-value**
	Baseline	**7-month follow up**	
Listed 5 options	62 [81.6]	64 [84.2]	
Listed less than 5 options	14 [18.4]	12 [15.8]	
Total foods listed, mean ± SD	4.6 ± 1.0	4.8 ± 0.7	.167

For n=76. Mean score ± SD = standard deviation. Paired samples *t*-test was used to evaluate differences between continuous outcome data.

Table 4-2: Changes observed in the number of foods listed by children from baseline to 7-month follow up

Student[#]	***Write down five fruits and vegetables that you know***		**Change**[‡] **(No. of answers)**	**P-value**
	Baseline	**7-month follow up**		
1	0	5	5	
2	0	5	5	
3	2	3	1	
4	3	5	2	
5	3	5	2	
6	3	5	2	
7	3	5	2	
8	3	5	2	
9	3	5	2	
10	3	5	2	
11	4	5	1	
12	4	5	1	
13	4	5	1	
14	4	5	1	
15	4	2	-2	
16	4	2	-2	
17	5	4	-1	
18	5	4	-1	
19	5	3	-2	

20	5	3	-2	
21	5	1	-4	
Total foods listed, mean ± SD	3.4 ± 1.4	4.1 ± 1.3	0.7 ± 2.3	.171

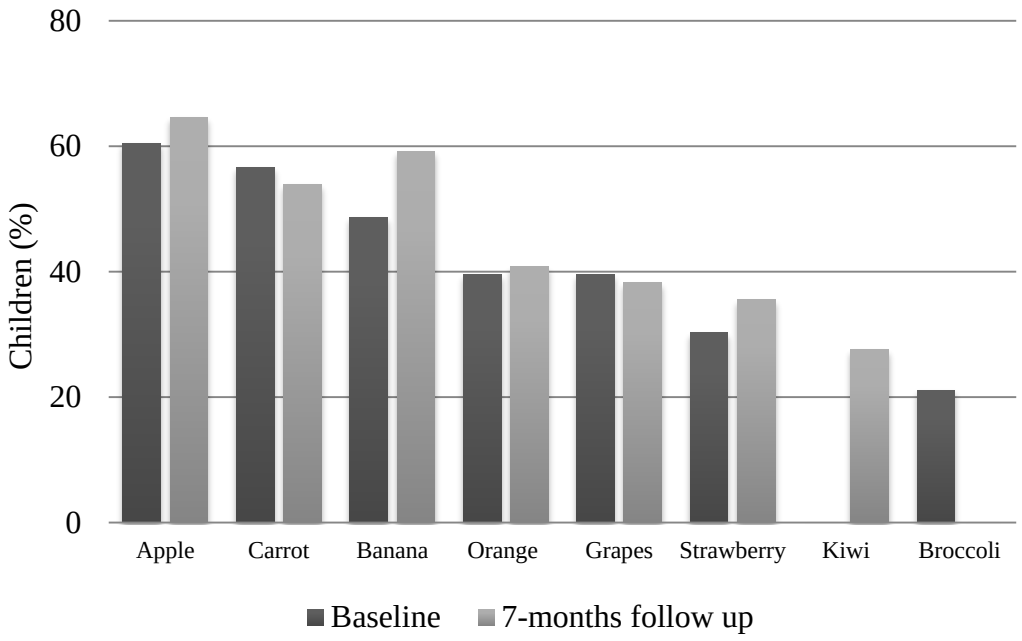
Mean score ± SD = standard deviation. Paired samples *t*-test was used to evaluate differences between continuous outcome data.

\# Indicates number of children (out of n=76) that revealed a difference in number of foods listed from baseline to 7-month follow up.

‡ Absolute change number of answers at 7-month follow up.

Figure 4-1 indicates the most frequently mentioned foods. At both baseline and at 7-month follow up, apple, carrot, banana, orange, grapes and strawberry were the foods that children were more knowledgeable about. These were followed by broccoli (at baseline) and by kiwi (at 7 month-follow up). It can be mentioned that grapefruit, mushroom, cauliflower, cantaloupe, radish, and cucumber were the foods that children mentioned the least.

Figure 4-1: Most frequently mentioned foods by children at baseline and at 7-month follow up



Foods listed by n=76 children.

4.3.2 Attitudes about vegetables and fruit, and their home consumption

For the VFAS children had to taste and rate each of the 17 foods based on a 6-point Likert-type scale with 6 = '*I really like* it'; 5 = *'I like it'*; 4 = *'It is OK'*; 3 = *'I do not like it'*; 2 = *'I really do not like it'*; 1 = '*I will never eat it again'.* Paired samples *t*-test was used to evaluate changes in children's likeability scores for each vegetable and fruit included in the taste testing. Accordingly, as **Table 4-3** shows, a statistically significant increase in likeability scores ($p < .05$) was revealed from baseline to 7-month follow up for 6 of 17 (35.3%) foods: cucumber, broccoli, cantaloupe, cauliflower, green pepper, and tomato.
As well, paired samples *t*-test was used to evaluate the impact of the Earthbox Kids gardening and the healthy snack program on children's attitudes towards all vegetables and fruits included in the taste testing activity. Based on the 17-item questionnaire and the 6-point Likert-type scale, the total likeability scores ranged from 17 to 102. There was a statistically significant increase in children's total likeability score from baseline (M = 79.6, SD = 11.3) to 7-month follow up (M = 82.6, SD = 11.8), t (75) = 3.0, $p < .01$, with a mean increase of 3.1. Eta squared statistic (.11) revealed a large effect size indicating considerable difference between children's likeability scores at baseline and at 7-month follow up (Cohen, 1988).

After the tasting activity children were asked if they ate each of the foods at home. The McNemar's test was used to compare nominal data (vegetables and fruits) with dichotomous variables (Yes/No) considering children's responses at baseline and at 7-month follow up. As **Table 4-3** shows, no statistically significant differences were found in home food consumption. However, of 17 foods, 10 (grapes, carrot, kiwi, celery, cucumber, broccoli, cauliflower, tomato, mushroom, grapefruit) showed an increase in the proportion of children who ate them at home. Apple, pear and radish showed a decrease in consumption. Overall, results revealed that the foods that were mostly consumed at home were apple, orange, banana, grapes and carrot, which were the same foods that children reported they liked the most. In contrast, foods such as mushroom, radish and

grapefruit were consumed to a lesser extent, and these were the foods that children liked the least.

Table 4-3: Children's likeability mean scores and consumption of vegetables and fruits, reported at baseline and at 7-month follow up

Foods	Attitudes towards food (mean ± SD)‡		Home food consumption, Yes (n [%])*	
	Baseline	7-months follow up	Baseline	7-months follow up
Grapes	5.8 ± 0.5	5.7 ± 0.7	70 [92.1]	71 [93.4]
Banana	5.7 ± 0.8	5.8 ± 0.6	72 [94.7]	72 [94.7]
Carrot	5.6 ± 0.9	5.7 ± 0.6	68 [89.5]	73 [96.1]
Orange	5.6 ± 0.8	5.7 ± 0.7	72 [94.7]	72 [94.7]
Apple	5.6 ± 0.8	5.6 ± 0.9	74 [97.4]	69 [90.8]
Pear	5.6 ± 0.7	5.6 ± 0.8	61 [80.3]	59 [77.6]
Kiwi	5.5 ± 1.2	5.7 ± 0.8	48 [63.2]	54 [71.1]
Celery	5.5 ± 1.1	5.4 ± 1.1	61 [80.3]	65 [85.5]
Cucumber	4.7 ± 1.7^{A}	5.1 ± 1.6^{B}	45 [59.2]	50 [65.8]
Broccoli	4.6 ± 1.7^{A}	4.9 ± 1.5^{B}	50 [65.8]	53 [69.7]
Cantaloupe	4.6 ± 1.7^{A}	5.0 ± 1.6^{B}	36 [47.4]	36 [47.4]
Cauliflower	4.4 ± 1.7^{A}	4.7 ± 1.7^{B}	32 [42.1]	36 [47.4]
Green Pepper	4.0 ± 1.9^{A}	4.4 ± 1.8^{B}	35 [46.1]	35 [46.1]
Tomato	3.4 ± 2.0^{A}	4.0 ± 2.0^{B}	34 [44.7]	38 [50.0]
Radish	3.4 ± 1.9	3.2 ± 2.0	18 [23.7]	13 [17.1]
Mushroom	2.8 ± 1.9	3.0 ± 2.0	25 [32.9]	29 [38.2]
Grapefruit	2.6 ± 1.8	3.0 ± 2.0	15 [19.7]	20 [26.3]
Total Vegetables and Fruits§	79.6 ± 11.3^{A}	82.6 ± 11.8^{B}		

For n=76. Mean score ± SD = standard deviation. Paired samples t-test evaluated changes in attitudes. The McNemar's test compared nominal data with dichotomous variables.

‡ Likert-type scale was from 6 = 'I really like it' to 1 = 'I will never eat it again'.

* Indicates number (and proportion) of children who eat each of the food at home.

A Numbers with different letters within the same row are significantly different ($p<.05$).

§ Based on a 17-item questionnaire and a 6-point scale, scores ranged from 17 to 102.

Additionally, Appendix F was included in this thesis to better describe the percentage distribution of attitude scores at baseline and at 7-month follow up for the 6 values in the scale.

Table 4-4 shows the frequency of children who presented a positive attitude (from 6 = '*I really like it*' to 4 = '*It is OK*') towards each of the vegetables and fruits included in the questionnaire. The methodology to assess positive and negative attitudes towards foods was described in chapter 3. The McNemar's test was used to analyze nominal data (vegetables and fruits) according to dichotomous variables (Positive/Negative).

At baseline, the mean percentage of positive responses was 77.0%, increasing to 81.4% at 7-month follow up. Grapes, pear, orange, banana, carrot, apple, celery, kiwi, broccoli, cucumber and cantaloupe, were the foods that presented a higher percentage of positive attitudes than the mean average considered for all foods. Mushroom and grapefruit were the foods that presented a considerable low amount of positive responses at both time points.

Overall, of 17 foods considered, 11 (64.7%) increased their number of positives responses from baseline, with the greatest magnitude of change presented for tomato, mushroom and green pepper. Accordingly, a statistically significant increase ($p < .05$) of positive attitudes was found for tomato (19.5%, n=15) and for mushroom (11.8%, n=9). Grapes and radish were the foods that presented a decrease in their number of positive responses.

Table 4-4: Positive attitudes towards vegetables and fruits reported by children at baseline and at 7-month follow up

What do you think of this food?‡	Positive attitude towards food*, n [%]		Change, n [%]†
	Baseline	**7-month follow up**	
Grapes	76 [100]	75 [98.7]	-1 [0.0]
Pear	75 [98.7]	75 [98.7]	0 [0.0]
Orange	75 [98.7]	75 [98.7]	0 [0.0]
Banana	74 [97.4]	75 [98.7]	1 [0.0]
Carrot	73 [96.7]	75 [98.7]	2 [2.6]
Apple	73 [96.7]	73 [96.7]	0 [0.0]
Celery	72 [94.7]	72 [94.7]	0 [0.0]
Kiwi	71 [93.4]	72 [94.7]	1 [1.3]
Broccoli	60 [78.9]	65 [85.5]	5 [6.6]
Cucumber	59 [77.6]	66 [86.8]	7 [9.2]
Cantaloupe	59 [77.6]	63 [82.9]	4 [5.3]
Cauliflower	57 [75.0]	61 [80.3]	4 [5.3]
Green Pepper	51 [67.1]	59 [77.6]	8 [10.5]
Radish	37 [48.7]	35 [46.1]	-2 [2.6]
Tomato	36 [47.4]^{A}	51 [67.1]^{B}	15 [19.7]
Mushroom	23 [30.3]^{A}	32 [42.1]^{B}	9 [11.8]
Grapefruit	23 [30.3]	27 [35.5]	4 [5.3]

For n=76. Mean score ± SD = standard deviation. The McNemar's test compared nominal data with dichotomous variables.

‡ Likert-type scale was from 6 = 'I really like it' to 1 = 'I will never eat it again'.

* Indicates scores within the highest levels of the Likert-type scale (6 to 4).

† Number (and proportion) of responses that changed from positive to negative, or negative to positive, from baseline to 7-month follow up.

A Numbers with different letters within the same row are significantly different (p<.05).

Finally, **Table 4-5** compares the total likeability mean scores between vegetables and fruits, reported at baseline and at 7-month follow up. Considering the vegetables first, the mean score was calculated using the 9 foods in the questionnaire and the 6-point scale that measured attitudes towards each of the foods. Accordingly, likeability scores could range from 9 to 54. There was a statistically significant increase in children's total likeability score for vegetables from baseline (M = 38.4, SD = 9.2) to 7-month follow up (M = 40.5, SD = 9.1), t (75) = 3.3, p < .001, with a mean increase of 2.1. Then, considering the fruits, the

mean score was calculated using the 8 foods in the questionnaire and the 6-point scale that measured food attitudes. Accordingly, likeability scores could range from 8 to 48. No statistically significant difference was found for fruit attitudes.

Table 4-5: Comparison of total likeability mean scores between vegetables and fruits, reported at baseline and at 7-month follow up

Attitudes towards foods‡	Measurements (mean ± SD)		
	Baseline	7-month follow up	P-value
Vegetables§	38.4 ± 9.2	40.5 ± 9.1	.001#
Fruits†	41.2 ± 4.2	42.1 ± 5.0	.117

For n=76. Mean score ± SD = standard deviation. Paired samples t-test evaluated changes in attitudes.
‡ Likert-type scale was from 6 = 'I really like it' to 1 = 'I will never eat it again'.
# Indicates significant difference (p<0.05) in total likeability mean score.
§ Based on a 9-item questionnaire and a 6-point scale, scores ranged from 9 to 54.
† Based on a 8-item questionnaire and a 6-point scale, scores ranged from 8 to 48.

4.4 Discussion

Baseline results revealed that the vegetables and fruits that children were more knowledgeable about were the same foods mentioned at 7-month follow up. Accordingly, apples, carrots, bananas, oranges, grapes, strawberries and, to a lesser extent, broccoli and kiwi, were the foods mentioned with most frequency. On the other hand, grapefruit, mushrooms, cauliflower, cantaloupe, radishes, and cucumbers were the foods that children mentioned the least. These findings are consistent with the concept of food familiarity, which refers to the idea of "knowing" and the "comfort" associated with knowing (Cooke, 2007; Aldridge, Halford, & Dovey, 2009). The most important determinant of a child's positive feelings for a particular food may be the extent to which it is familiar to him or her (Cooke, 2007). Results from the attitudes survey revealed that many of the foods that children reported they liked the most were the same foods that they knew the most about. Additionally, a statistically significant increase was

reported in the children's attitude scores for cucumbers, cauliflower, green peppers, and tomatoes.

Evidence has indicated that children like what they know and what has been previously introduced to them, which re-emphasizes the concept of food familiarity (Cooke, 2007). This approach is the antithesis of neophobia which, as previously mentioned, can be expressed by a rejection of new foods and flavours often due to the fear of a negative sensory experience. Children have innate preferences for sweet and salty tastes, and a tendency to reject bitter and sour tastes (Dovey et al., 2008; Anzman-Frasca et al., 2012) which may explain children's attitudes towards radishes, mushrooms and grapefruit. Nevertheless, children can show greater acceptance of novel foods when such foods are paired with familiar foods. When such acceptance occurs, the unfamiliar food will be more preferred and consumed (Pliner et al., 2000).

Overall, the gardening intervention and the healthy snack program seemed to be effective in promoting First Nations schoolchildren's positive attitudes towards vegetables and fruit. Fruits were more accepted than vegetables both pre- and post-intervention, showing higher likeability scores than vegetables. For this reason, the foods that garnered a significant increase in their likeability scores were mainly vegetables. Accordingly, a statistically significant increase was found in the total likeability mean score for vegetables but not fruits, from baseline to the 7-month follow up.

As previously mentioned, the snack program provided 16 different foods, of which 10 (carrot, grapes, banana, celery, cucumber, cauliflower, orange, cantaloupe, tomato, green pepper) were included in the taste testing questionnaire. The vegetables grown in the Earthboxes were 3 in total and all of them were included in the taste testing questionnaire (celery, tomato, green pepper). In total, 10 different foods were included in the snack program together with the produce grown in Earthboxes, which were also included in the taste testing questionnaire that evaluated likeability and home consumption.

Interestingly, of the mentioned 10 foods, the majority of the foods (banana, carrot, orange, cucumber, cantaloupe, cauliflower, green pepper,

tomato), revealed an increase in their likeability score from baseline. Grapes and celery were the foods that presented a decrease from baseline. On the other hand, 6 foods (grapes, carrot, celery, cucumber, cauliflower, tomato) revealed an increase in their home consumption.

The rest of the foods included in the questionnaire, such as broccoli, kiwi, mushroom and grapefruit, revealed an increase in their likeability scores at follow up. Specifically, broccoli showed a statistically significant increase. Radish presented a slight decrease in its likeability score at follow up.

These findings may be helpful to explain that the present intervention was effective in improving children's attitudes toward vegetables and fruits. Certainly, food dislike can be transformed into liking if food exposure is maximized (Wardle et al., 2003; Cooke, 2007). Accordingly, the gardening intervention, together with the healthy snack program maximized children's exposure to vegetables and fruits. Interestingly, the taste testing questionnaires used to evaluate children's attitudes toward specific vegetables and fruits, also worked as a tool for children to experience more taste testing activities. Each of these components certainly involved food taste testing, and as Cooke (2007) suggests, the probability of obtaining successful results can be higher if actual tasting is involved.

One of the disadvantages of the healthy snack program was that foods were only given to children once per week, and only exposed children to one type of food at a time. Also, not all Earthboxes were successful in properly growing their plants, because during weekends and holiday breaks these were not properly maintained. Foods such as celery and tomato require a lot of moisture to grow. For this reason, the amount of foods grown in Earthboxes was not always enough for children to try. Teachers in only a few classrooms were able to use the produce in taste testing activities.

Still, the effectiveness of the program in improving children's attitudes towards foods may be also explained by the fact that children are more willing to taste and like foods when these are offered in a familiar environment to them (Story, Neumark-Sztainer & French, 2002b). Since the intervention took place in the children's school, the probability of having a positive impact was higher. It is

possible that children and teachers may have created an environment full of positive expectations after the introduction to the Earthboxes (Story, Lytle, Birnbaum & Perry, 2002a). Repeated exposure to food often acts to increase familiarity and further acceptance of that item; in contrast, if a food is presented in a negative manner or context, children can easily reject it (Aldridge et al., 2009). For this reason, schools provide an optimal setting which reach and have an impact on children with such a positive change (Story et al., 2002a).

Teachers noted that it was important for the snack program to occur regularly throughout the year to maintain student interest and increase nutritional awareness. This could be a viable strategy to enhance children's consumption of vegetables and fruits (Cockroft, Durkin, Masding & Cade, 2005). Overall, the program was well received by children and it is possible that their excitement contributed to the teachers' support and interest in taking advantage of this educational opportunity for promoting better nutrition.

Overall, there was an increasing trend in children's responses regarding home food consumption, although no significant changes were observed. While children may improve their knowledge and attitudes about vegetables and fruit as a result of school garden-based programs and healthy snack programs, they may not be able to influence their consumption of these foods at home, as their food choices are not only the result of nutritional knowledge and food preferences. In general, children will eat what is available at home. One of the most influential factors in their food choices is food availability. Generally, parents or caregivers decide which foods to buy and when to serve them, leading to a direct impact on children's preferences and food consumption (Story et al., 2002b). If available healthy foods are in a form or location that facilitates their consumption, children will be more likely to eat such foods and, therefore, make healthy food choices (Story, Kaphingst, Robinson-O'Brien & Glanz, 2008).

Overall, findings from the home food environment question were consistent with results from the knowledge and attitudes surveys, as the foods that were mostly consumed at home were apples, oranges, bananas, grapes, carrots, celery, pears, broccoli, kiwi, cucumbers and tomatoes. Foods such as mushrooms,

radishes and grapefruit were consumed to a lesser extent. Since children usually like what they are familiar with, they will choose to eat what they already know and like. Accordingly, the foods to which they are usually exposed will shape their preferences and consumption habits (Patrick & Nicklas, 2005).

Most of the effective garden programs have been carried out at schools to involve children in planting and nurturing vegetables with multiple exposures through hands-on experiences with their peers, in the hope that this innovative approach can motivate children to develop life-long healthy eating habits (Morris, Neustadter, & Zidenberg-Cherr, 2001; Morris & Zidenberg-Cherr, 2002). However, one key limitation of the snack program was the lack of child involvement in this particular activity. For this reason, it will be important to consider having the child involved in preparing food at school. This involvement should be considered as a program component for future interventions in order to maximize exposure to food through hands-on experience. As Potter et al. (2011) argue, future vegetable and fruit distribution programs might consider including educational strategies as a core component as well. For example, children could be encouraged to obtain practical experience in food preparation at school (French & Stables, 2003). This would ensure that they are actively engaged in all stages of the intervention: planting, maintaining, harvesting, and preparing the vegetables grown in the Earthboxes, and helping to prepare the food purchased for the snack program.

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5. Objective III: Assessing caregivers' perceptions of eating habits, self-ratings of current foods eaten and self-considerations guiding food choices

5.1 Introduction

There has been lot of interest in achieving the most effective ways to provide food guidance to individuals and populations to improve their health by examining the determinants that affect their food choices (Larson & Story, 2009). Although the concept of health can be subjective and its meaning can vary from person to person, culture to culture, and society to society, Aboriginal peoples believe that good health is achieved through balancing the mind, body, spirit, family and land (Mark & Lyons, 2010; Graham & Stamler, 2010). Considerable evidence exists that many health problems that Aboriginal peoples face are related to the nutritional transition they have experienced over the past few decades (Uauy, Albala & Cain, 2001; Kuhnlein, Receveur, Soueida & Egeland, 2004). As a result, children and adolescents tend to consume more market foods and less traditional foods than adults, who in turn consume less traditional foods than elders (Morrison et al., 1995; Wolever et al., 1997; Kuhnlein et al., 2004). In addition, younger generations of Aboriginal communities are losing the knowledge of harvesting and preparing their traditional foods (Willows, 2005).

Parents shape their children's food preferences and activities in powerful ways. They are the primary providers of food, and also of opportunities for their children to be active (Ventura & Birch, 2008). In this report, the terms "parents" and "caregivers" are used interchangeably. This is because, particularly in Aboriginal populations, from early in life children spend time within the extended family where parents, grandparents, aunts and uncles, and brothers and sisters all share responsibility for protecting and nurturing them (Greenwood & Shawana, 2000; Assembly of First Nations, 2007). Children represent the heart of the family

and community, and traditions that manifest beliefs and values are passed on from generation to generation through parenting, which is considered sacred and a valued responsibility.

For many Aboriginal peoples, eating healthy is usually linked to the consumption of traditional foods, which contributes to nutrition through cultural expression (Willows, 2005). Therefore, *objective III* aimed to assess First Nations adults' considerations guiding food choices, to provide insight into their attitudes towards food that may influence children's dietary behaviours. Responses from parents and caregivers of children who attended the community school will provide context to the findings of Earthbox Kids and will help provide direction about how future community initiatives can help improve children's dietary habits.

5.2 Methodology

Objective III presents baseline, cross-sectional data collected in a rural Alberta Cree First Nations community, about parents' perceptions of eating habits, self-ratings of current healthy foods eaten, and self-considerations guiding food choices. Data were collected as part as of the Earthbox Kids program, a school gardening and a healthy snack intervention developed for First Nations children to assess their knowledge and attitudes about vegetables and fruit and home food consumption.

In the context of the community school, all parents and caregivers of children who attended kindergarten to grade 12 were eligible to participate in the research. The study was reviewed by the Faculties of Physical Education & Recreation (PER) and Agricultural, Life & Environmental Sciences (ALES), and the Native Studies (NS) Research Ethics Board (REB) at the University of Alberta (Panel 2). The study was approved in October 2010. It was also reviewed and approved by the community steering committee.

Using convenience sampling, data were collected during parent-teacher meetings at the community school, and during the "Harvest Fair" and "Health

Fair" events that were carried out in the community in November 2010 and June 2011, respectively.

Parent questionnaires were adapted from *The Learning Garden Program,* which was developed and run with two First Nations communities in northwest Ontario, to support a sustainable local food system. A sustainable local food system is particularly important to remote and Aboriginal communities, where extensive transportation usually means that food is more expensive and of poorer nutritional value (Stroink & Nelson, 2009) (Appendix E). *The Learning Garden Program* included workshops based on experiential activities such as cultivated garden planting, soil preparation, composting, weeding, and harvesting. Other program components were discussions on cultural values and food and health, and kitchen activities including the preparation of healthy meals and snacks. In addition, garden boxes were established in each community as experiential learning gardens. The foods that participants from *The Learning Garden Program* ate most frequently were included in the parent questionnaire (Stroink & Nelson 2009). Appendix E was included in this thesis to show how the questionnaire used in the Earthbox Kids study was adapted from *The Learning Garden Program* questionnaire. This appendix shows some of the questions included in the respective program. More information can be found in the study published by Stroink, Nelson and McLaren (2010).

Prior to data collection, all caregivers who participated in the study were informed of the research objective and were asked for their consent to continue with the study. All questionnaires were administered by two researchers who conducted in-person interviews with each of the participants. First, participants were asked how they felt about their eating habits. The 5-point scale provided on the survey was 5 = "*Very healthy*"; 4 = *"Healthy"*"; 3 = *"Average*"; 2 = *"Unhealthy";* and 1 = *"Very unhealthy."* Then, community members were asked to rate the frequency of consumption of the same market, garden and traditional foods that participants of *The Learning Garden program* reported consuming, using a 5-point scale: 5 = "*Very often*"; 4 = "*Often*"; 3 = "*Sometimes*"; 2 = "*Rarely*"; and 1 = "*Never*."

Finally, participants were asked to rate how important various considerations were in guiding their food choices. The considerations included healthiness, price, convenience, proximity to the source, taste, and cultural connectedness. The 5-point scale used was 5 = "*Very important*"; 4 = "*Important*"; 3 = "*Neither important nor unimportant*"; 2 = "*A little important*"; and 1 = "*Not at all important*."

A Statistics Package for the Social Sciences (SPSS) (Inc., Chicago, IL, USA), version 19.0, was used to analyze data.

5.3 Results

As **Table 5-1** shows, data about perceptions of eating habits, self-ratings of current foods eaten and self-considerations guiding food choices were collected from 58 participants of whom 48.3% (n=28) were mothers, 29.3% (n=17) were fathers, 15.5% (n=9) were grandmothers, and 6.9% (n=4) were grandparents. Of total questionnaires, nearly 75% (n=43) were completed during the fall season, while the remainder were completed during the spring season.

Table 5-1: Characteristics of the sample for First Nations children's caregivers

Characteristics	Respondent's care giving role, n [%]
Mother	28 [48.3]
Father	17 [29.3]
Grandmother	9 [15.5]
Grandfather	4 [6.9]
Total	58 [100]

For n=58 adults.

Results of perceptions about eating habits revealed that the majority of participants (58.6%, n=34) described their eating habits as *average*, followed by 34.5% (n=20) who considered that their eating habits were *healthy*, 6.9% (n=4) who indicated *unhealthy*, and 0% who mentioned having a *very healthy* diet.

Participants' frequencies of food consumption were assessed on a 5-point

scale from 5 = '*Very often*' to 1 = '*Never*'. Mean scores were described in **Table 5-2** in descending order. As a result, it can be observed that the foods that are eaten least often are mostly food from the land.

Table 5-2: Caregivers reported frequencies of food consumption ranked in descending order

***How often do you eat this food*?**	**Self-ratings of current foods eaten (mean ± SD)**
Bananas	4.3 ± 0.6
Potatoes (baked, boiled, or mashed, but not fried)	4.3 ± 0.7
Apples	4.2 ± 0.6
Beef	4.1 ± 0.7
Strawberries	4.1 ± 0.7
Corn	4.1 ± 0.8
Tomatoes	3.9 ± 0.7
Carrots	3.9 ± 0.7
Oranges	3.9 ± 0.7
Pork	3.8 ± 0.8
Raspberries	3.7 ± 0.8
Blueberries	3.5 ± 0.8
Chicken	3.5 ± 0.6
Saskatoon berries	3.1 ± 0.9
Broccoli	3.1 ± 0.8
Moose	2.8 ± 1.0
Fish	2.8 ± 1.0
Deer	2.5 ± 0.9
Duck	2.3 ± 0.9
Rabbit	2.3 ± 0.7
Beets	2.1 ± 1.1
Spinach or Swiss chard	2.1 ± 0.9
Sweet potatoes/yams	1.8 ± 0.9

Mean score ± SD = standard deviation. For n=58, the following scale was used: 5 = Very often; 4 = Often; 3 = Sometimes; 2 = Rarely; 1 = Never.

Participants' considerations guiding food choices were assessed on a 5-point scale where 5 was '*Very important'*; 4 was '*Important*'; 3 was '*Neither important nor unimportant*'; 2 was '*A little important'*; and 1 was '*Not at all important*'. **Table 5-3** describes mean scores in descending order.

Participants agreed mostly that taste, healthiness, and convenience were most important in guiding their food choices, with a combined mean of 4.33 on a 5-point scale of agreement. On the other hand, that food comes from the land nearby and that it is not highly processed were rated the lowest scores with 3.2 and 3.4, respectively.

Table 5-3: Caregivers self-considerations guiding food choices ranked in descending order

How important is that the food you eat…	**Self-considerations guiding food choices[‡] (mean ± SD)**
Tastes good?	4.6 ± 0.5
Is healthy?	4.3 ± 0.7
Is easy to prepare?	4.1 ± 1.0
Is familiar?	4.0 ± 0.9
Is natural?	3.9 ± 1.0
Does not cost too much?	3.6 ± 1.3
Is connected to your culture?	3.6 ± 1.0
Is available at a nearby grocery store?	3.5 ± 1.2
Was eaten by your ancestors?	3.5 ± 1.0
Is not highly processed?	3.4 ± 1.2
Comes from the land nearby?	3.2 ± 1.0

Mean score ± SD = standard deviation. For n=58 the following scale was used: 5 = Very important; 4 = Important; 3 = Neither important nor unimportant; 2 = A little important; 1 = Not at all important.

5.3.1 Comparison of responses between parents and grandparents

The following section of this study was developed to better evaluate responses considering participants' caregiver role. Accordingly, the sample of 58 adults who participated in this study was divided in two groups, n=45 parents (77.6%) and n=13 grandparents (22.4%).

First, considering caregivers' perceptions about eating habits, results revealed that of 45 parents, the majority (64.4%, n=29) described their eating habits as average, followed by 26.7% (n=12) who considered that their eating

habits were healthy, 8.9% (n=4) who indicated unhealthy, and 0% who mentioned having a very healthy diet. On the other hand, considering grandparents' responses, of 13 participants 61.5% (n=8) mentioned having a healthy diet, followed by 38.5% (n=5) who described their diet as average. None of the participants mentioned having a very healthy or unhealthy diet.

Table 5-4 shows the frequency of food consumption considering participants' caregiver role (parents/grandparents). Responses were assessed on a 5-point scale from 5 = '*Very often*' to 1 = '*Never*'. The 23 foods included in the questionnaire were divided in three groups to better assess their consumption. The first food group was composed of meats that are available year round at grocery stores (beef, pork and chicken). Second, the vegetables and fruit group was composed of foods that are commonly found at grocery stores (bananas, apples, strawberries, oranges, raspberries, blueberries, beets, spinach, sweet potatoes, potatoes, corn, tomatoes, carrots, and broccoli). Finally, the group of wild foods was composed of foods that are traditionally obtained by Aboriginals using hunting, trapping, fishing, gathering and agriculture in different combinations (Saskatoon berries, moose, fish, deer, duck, and rabbit).

Considering the first food group which was composed of 3 items, and taking into account the 5-point scale, the frequency of consumption score ranged from 3 to 15. Then, considering the same scale and 14 food items of the second group, scores ranged from 14 to 70. Finally, based on 6 wild foods and the 5-point scale, scores ranged from 6 to 30.

As **Table 5-4** shows, the group of beef, pork and chicken presented a high frequency of consumption in both caregivers' categories. Vegetables and fruit consumption presented similar frequencies in both categories, with grandparents' total mean score being slightly above the score reported by parents. Finally, grandparents reported eating more wild foods than parents, although this difference was not significant.

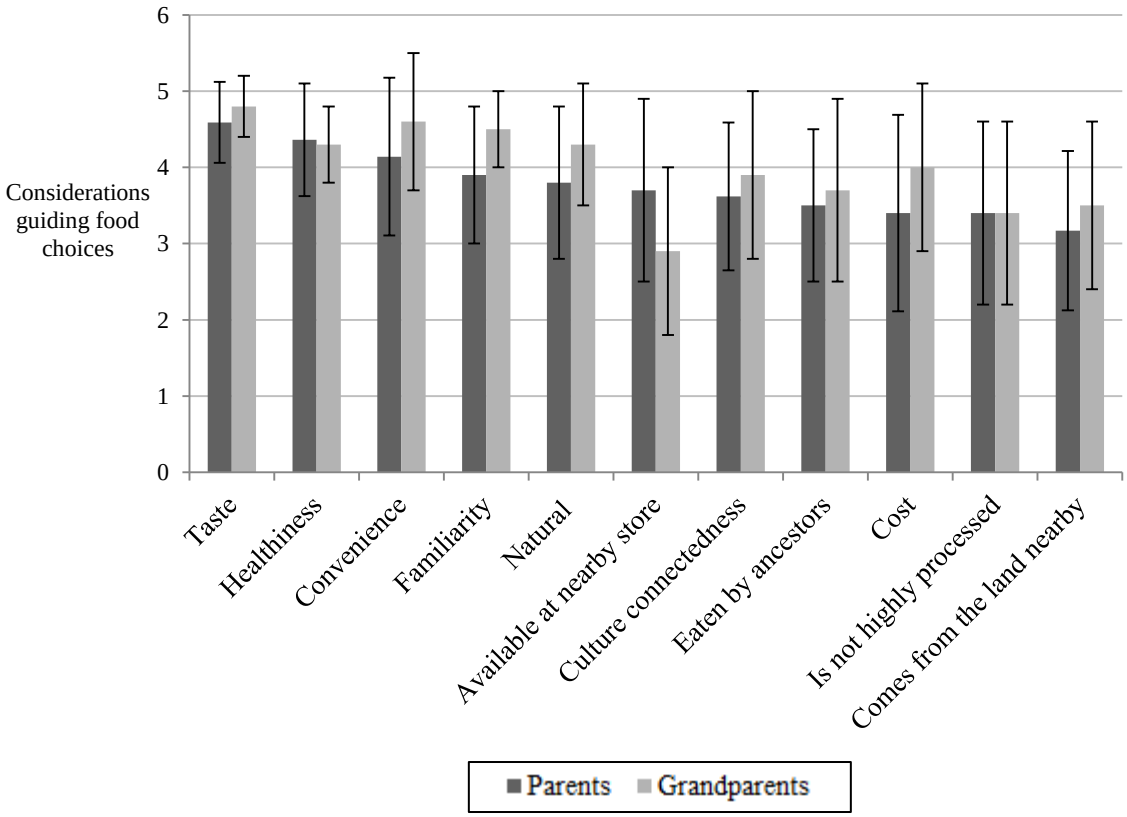
Table 5-4: Frequencies of food consumption considering caregivers' role

***How often do you eat this food*?**	**Self-ratings of current foods eaten (mean ± SD)**	
Food groups	**Parents**	**Grandparents**
Beef, pork, chicken*	11.4 ± 1.7	11.5 ± 1.0
Vegetables and fruits#	48.5 ± 5.9	50.5 ± 5.1
Wild foods‡	15.3 ± 3.5	17.8 ± 4.0

Mean score ± SD = standard deviation. For n=45 parents and n=13 grandparents, the following scale was used: 5 = Very often; 4 = Often; 3 = Sometimes; 2 = Rarely; 1 = Never.
* Based on 3 food items and a 5-point scale, scores ranged from 3 to 15.
# Based on 14 food items and a 5-point scale, scores ranged from 14 to 70.
‡ Based on 6 food items and a 5-point scale, scores ranged from 6 to 30.

Finally, **Figure 5-1** compares responses about considerations guiding food choices between parents and grandparents. Overall, regardless of their caregiver role, most of the participants agreed that taste and healthiness were two of the most important factors in guiding their food choices. Specifically, that the food was easy to prepare (convenience), and that the food was familiar and natural, were more important in guiding grandparents' food choices, as compared to parents' considerations. In addition, that the food connected them to their culture, that it was eaten by their ancestors, the cost and that it came from the land nearby was also more important to grandparents than to parents. On the other hand, that the food was available at nearby grocery stores was more important to parents than to grandparents. Overall, it can be observed there are many variations in participants' responses, which makes it difficult to consider these results as representative of the sample in study.

Figure 5-1: Comparison between parents' and grandparents' considerations guiding food choices



For n=45 parents and n=13 grandparents, the following scale was used: 5 = Very important; 4 = Important; 3 = Neither important nor unimportant; 2 = A little important; 1 = Not at all important.

5.4 Discussion

Objective III of the present thesis was included as one of the Earthbox Kids research components in order to provide an insight into parents' and caregivers' considerations guiding food choices. Data were collected from caregivers who attended parent-teacher meetings at school, as well as during the "Health Fair" and "Harvest Fair" events carried out in the community. In total, 58 First Nations adults with children or grandchildren participated in the study. The sample was composed mainly of parents, followed by grandparents.

First, considering the eating habits of all participants, the majority (58.6%) described their diets as average. Roughly one-third of participants reported that they had a healthy diet. The rest of the participants (6.9%) reported that their diet was unhealthy. Similar data from the 2002/03 RHS indicated that of First Nations adults aged 18 and older, around one-third (35.4%) reported always or almost always eating a nutritious diet, whereas the majority (52.7%) did not always; the remaining 11.9% either rarely (9.1%) or never (2.8%) reported eating a nutritious diet (Assembly of First Nations, 2007).

Second, considering caregivers' perceptions about eating habits, results revealed that the majority of parents (64.4%, n=29) described their eating habits as average, followed by 26.7% (n=12) who considered that their eating habits were healthy, and 8.9% (n=4) who indicated unhealthy. On the other hand, the majority of grandparents (61.5%, n=8) mentioned having a healthy diet, followed by 38.5% (n=5) who described their diet as average.

Considering the questionnaire about participants' eating habits, two limitations were noted. First, there was no additional data collected that could have been helpful to understand how participants viewed the concept of 'healthy' or 'unhealthy' diet. Second, some of the participants mentioned having diabetes together with hypertension (specifically three of them), which could have had a direct impact on their responses. For example, these three caregivers appeared to be more aware of the foods they needed to consume to feel better and have a better quality of life. As well, these participants knew they were required to consume more vegetables, fruits and grains, instead of high processed foods which are high in sodium and could also affect their hypertension.

Usually, for many Aboriginal peoples, eating healthy is usually linked to the consumption of traditional foods, which contributes to nutrition through cultural expression (Willows, 2005). For example, as Adelson (2000) describes, for the Whapmagoostui Cree of northern Quebec, Cree food is a fundamental and necessary basis for health, which is linked to a land-based heritage that contributes to the individual's physical and social well-being. However, over the past few decades research has indicated that First Nations people are more likely

to access food from convenience and grocery stores than from traditional sources (Stroink & Nelson, 2009).

This study has found that participants were more likely to eat bananas, apples and potatoes, which are widely and easily available year-round at grocery stores; and less likely to eat Saskatoon berries, which are abundant in the region and were traditionally obtained by being grown in a home garden, or being picked in the forest (Adelson, 2000). As well, participants were more likely to eat beef, chicken and pork, than moose meat, fish, deer, duck, and rabbit. This adds to the evidence that convenience stores may be the primary destination for regular food needs, which is consistent with findings of the *Learning Garden* program for First Nations communities (Stroink & Nelson, 2009).

This observation seems to reflect to a certain degree one of the consequences of the nutritional transition that Canadian Aboriginal peoples have faced. Certainly this transition has influenced people globally, but evidence has indicated that Canadian Aboriginal peoples are probably among the populations that have experienced the most extreme dietary change in the last few decades (Kuhnlein et al., 2004). For example, Inuit people from remote Arctic communities in Nunavut have identified as a key issue in their community the rapid shift from a nomadic way of life that included traditional practices such as hunting and gathering, to permanent settlements in communities in the 1950s (Mead, Gittelsohn, Kratzmann, Roache & Sharma, 2010). With the introduction to markets as a new food source, the shift from a highly active lifestyle to a more sedentary way of life also led to a decrease in the consumption of traditional foods influencing on their dietary practices (Mead et al., 2010). Changes in traditional food patterns have been also observed in remote Arctic Yukon First Nations communities. Before colonial contact in the Americas until the beginning of the 20th century, their dietary intake was based exclusively on traditional foods which were based on animal and plant species culturally identified within the local environment. In 2004, only 10-36% of adult dietary intake was derived from traditional foods (Kuhnlein et al., 2004).

In this study, beef, pork and chicken were frequently consumed by participants regardless of their caregiver role (parents/grandparents). As compared to parents, grandparents reported consuming with more frequency vegetables and fruits and wild foods. However, no differences were observed.

Although these results may not be entirely representative of the sample due to the variations in participant's responses, they do indicate that elders tend to consume more vegetables and fruits and wild foods than younger adults. These findings are similar to studies that indicate that adults tend to consume more market foods and less traditional foods than elders (Morrison et al., 1995; Wolever et al., 1997; Kuhnlein et al., 2004). Therefore, based on these findings and considering the evidence indicating that children and adolescents tend to consume more market foods and less traditional foods than adults (Uauy, Albala & Cain, 2001; Kuhnlein, Receveur, Soueida & Egeland, 2004), it may be expected that children in this community consume less traditional foods than their parents.

While many studies indicate an Arctic nutrition transition with children and adults consuming fewer traditional foods, who in turn consume less traditional foods than elders, there is a marked variability in the extent of traditional foods consumed by Aboriginal communities across the country (Johnson-Down & Egeland, 2010). For this reason, in order to better understand the findings of the present report, future research is needed to evaluate the frequency with which Aboriginal peoples access food from market and traditional sources.

It was observed that regardless of participants' caregiver role, most of them agreed that taste and healthiness were two of the most important factors in guiding their food choices. Specifically, grandparents indicated that convenience, familiarity and that the food was natural were more important factors as compared to parents' responses. As well, that the food connected them to their culture, that the food was eaten by their ancestors, the cost and that the food came from the land nearby, were more important to grandparents than to parents. On the other hand, that the food was available at nearby grocery stores was more important to parents than to grandparents.

Without considering participants' caregiver role, all adults reported that their food choices were guided more by the taste, healthiness, convenience and familiarity of the food, than by the degree to which it was processed and connected the individual with his or her ancestors or to the land nearby. Similar results were found in *The Learning Garden* program for First Nations communities (Stroink & Nelson, 2009). Although taste preferences are personal, they also reflect the individual's social and cultural origins (Wright, Nancarrow & Kwok, 2001).

Given the evidence that Aboriginal children and youth are losing the knowledge of harvesting and preparing their traditional foods (Willows, 2005), it seems essential to promote their healthy eating behaviours by developing activities that enhance traditional values and practices. This will result in traditions continuing to be passed down from one generation to another, while healthier food choices will be encouraged. For example, the school gardening intervention and the healthy snack program described in this thesis were designed to improve First Nations children's attitudes towards vegetables and fruit by involving the children with planting and nurturing vegetables, as well as maximizing their exposure to these healthy foods through weekly tastings. They were involved in these activities often, through hands-on experiences with their peers. This also allowed them to interact more closely with the land which is part of the concept of Aboriginal health. However, in this particular study, family participation in school gardening activities or in the snack program was not included as a research component during the intervention. Therefore, besides from evaluating children's and adults' attitudes towards food, future initiatives at the community school should also consider parents' and grandparents' involvement in vegetable-and-fruit-program activities such as food purchasing, preparation and snack distribution. In fact, including a caregiver component may help boost children's interest in vegetables and fruits, as well as boosting their affinity for and consumption of these foods. It may also address the issue of nutrition in the home environment (Potter et al., 2011).

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6. Conclusions and recommendations for future research

6.1 Summary of findings

Obesity particularly affects First Nations children living on-reserve (Assembly of First Nations, 2007; First Nations Information Governance Centre, 2011). Increasingly evidence indicates that adequate vegetable and fruit consumption is one way to potentially prevent children from having excess weight (Slavin, 2005; Epstein et al., 2001). For this reason, there is an urgent need to develop effective strategies to promote healthy eating behaviours for Aboriginal children.

Garden-based nutrition education interventions and healthy snack programs are a promising strategy to improve children's preferences towards, and dietary intake of, vegetables and fruit (O'Brien & Shoemaker, 2006; Morris, Neustadter & Zidenberg-Cherr, 2001). Because younger generations of Aboriginal peoples are losing the knowledge of harvesting and preparing their traditional foods (Willows, 2005), it is fundamental to develop a garden-based program for Aboriginal children promoting not only healthy dietary behaviours but also to enhance their traditional values and practices.

Objective I of the present thesis was designed to determine if changes in Cree First Nations children's knowledge about, attitudes towards, and home consumption of, vegetables and fruit varied after a 7-month school gardening and a 4-month healthy snack program, by their weight status and abdominal adiposity baseline. Data were collected from 76 of 116 children (65.5%), of whom 60 (51.8%) had BMI and waist circumference data. Based on findings from *Objective I*, 60% of children were either overweight or obese, with nearly half of them presenting excess adipose tissue in the central region of the body, which indicates an increased risk for diabetes and heart disease (Watts, Bell, Byrne, Jones & Davis, 2008; Riediger & Clara, 2011). Considering children's weight status, both normal weight and overweight/obese children had similar vegetable and fruit attitude scores at baseline and 7 months after the initiation of the

intervention. Also, considering children's abdominal adiposity, both abdominally obese and not abdominally obese children presented similar likeability scores toward vegetables and fruits, as well as they both increased their attitudes at follow up.

Similar results were also found for the foods that children, regardless of their weight and waist circumference listed as the ones they were more knowledgeable about. There was no evidence that weight category or abdominal adiposity category were associated with any differences in changes in home food consumption of any vegetable or fruit, and the foods children liked the most were the same ones consumed at home.

Objective II described in this thesis was to determine if changes in children's knowledge about, attitudes towards, and home consumption of vegetables and fruit varied after the initiation of a 7-month school gardening and a 4-month healthy snack program, regardless of their weight status and abdominal adiposity at baseline. Findings were that the school gardening and snack program significantly improved children's attitudes towards vegetables and fruit. The most significant changes were observed for an increase in positive attitudes towards vegetables, as most of the fruits already had high likeability scores at both pre- and post-intervention. In regards to children's knowledge about vegetables and fruits, no significant changes were found in the foods listed at baseline and 7-months following the initiation of the intervention. The vegetables and fruits that children were more knowledgeable about were the same ones they liked the most.

Objective III of this thesis was designed to assess caregivers' perceptions of eating habits, self-ratings of current foods eaten and self-considerations guiding food choices. This information was sought to provide an insight into caregiver's attitudes towards food that may influence children's dietary behaviours, in the hope that this information would provide context to study findings among children, and to better address future health-promotion initiatives in the community. Overall, findings from *Objective III* indicated that of 58 First Nations parents and caregivers of children living in the community, more than a half of them described their diet as average, followed by one-third who indicated having

a healthy diet. Caregivers' food choices were guided more by the taste, healthiness, convenience and familiarity of the food, than by the degree to which it was processed or connected the individual with their ancestors or to the land nearby.

Considering responses according to participants' caregiver role, it was observed that grandparents tend to consume more vegetables and fruits and wild foods than parents. To grandparents, the factors that were important in guiding their food choices included convenience, familiarity and culture connectedness, while parents considered it was more important that the food was available at nearby grocery stores.

6.2 Strength of the study

This study is novel because, to date, no formal research has been done to implement and/or evaluate garden-based interventions together with a healthy snack program for Aboriginal children in Canada. Results of this thesis are also novel because they provide data about First Nations children's weight status and abdominal adiposity in relation to their attitudes towards vegetables and fruits.

A dataset is longitudinal if it tracks the same type of information on the same subjects at multiple points in time. The primary advantage of longitudinal studies such as the one used in this thesis to address Objectives I and II is that change in the dependent variables can be measured. By comparison, cross-sectional data can only examine associations among variables and cannot prove causality. Given the adoption of a longitudinal study design, we were able to estimate the effect of the gardening and snack intervention on children's knowledge about, attitudes towards, and home food consumption of, vegetables and fruit.

For a school based study, a relatively high proportion of participants had data available both at baseline and seven months after the initiation of the intervention. Thus, non-response bias was not a major problem in our study.

6.3 Limitations and implications of the study

One limitation of this study was its small sample size. A larger sample size would have been required to better examine the prevalence of overweight and obesity according to gender categories, and to better explore attitudes toward foods considering children's weight status and abdominal adiposity. Also, caregivers and parents who responded to the questionnaire were not necessarily the caregivers or parents of children who participated in the study. It was not possible therefore to say anything about children's responses in relation to caregiver's responses. Also, the lack of a control group means that we were not able to determine if the intervention or some other factors were responsible for the findings.

Reviewers of research reports frequently criticize the choice of statistical methods when analyzing data from Likert scales with parametric methods. For example, as Jamieson (2004) states, "the response categories in Likert scales have a rank order, but the intervals between values cannot be presumed equal". Therefore, Likert scales fall within the ordinal level of measurement, and ordinal data should be measured with non-parametric statistics (Jamieson, 2004). Therefore, calculating the mean (and standard deviation) for ordinal data is not appropriate, and assuming that Likert-type scale categories have interval-type values is not correct (Cohen, Manion & Morrison, 2000). Blaikie (2003) also argues that the intervals between values cannot be presumed equal yet researchers frequently assume that they are.

In this study, the Likert scale was considered an interval level of measurement, and children's responses were analyzed using parametric methods such as paired *t*-test. First, the intervals between the 6-point values in the scale were assumed equal because in this particular intervention we measured changes in children's responses considering intrapersonal variability. Second, mean and standard deviation were calculated to compare the sum of attitudes scores as continuous outcome data between baseline and follow up. This methodology allowed the study to obtain more informative results when examining changes.

Appendix G was included in this thesis to show how data is sensitive to change considering parametric (paired-sample *t*-test) and non-parametric methods (Wilcoxon signed-rank test). To conclude, as Norman (2010) suggests, parametric statistics can be used with Likert data with no fear of ‘‘coming to the wrong conclusion’’.

6.4 Concluding remarks

The Earthbox Kids school gardening intervention and the healthy snack program described in this thesis were designed to contribute to the promotion of healthy eating behaviours and therefore the prevention of overweight and obesity in First Nations children. Due to limited information about the effectiveness of garden-based interventions with snack programs promoting vegetables and fruit consumption for Aboriginal children in Canada, the results of this study can be used to encourage future garden-based interventions together with healthy snack programs for Aboriginal children across the country.

Overall, the intervention described in this thesis was well received by children, teachers, principal and vice-principal, and school staff throughout the academic year (Willows, personal communication, unpublished qualitative data). A key component of the present research was the inclusion of a community-based participatory research approach (Israel, 2005). Elders, parents and Departmental representatives from the Cree community, health practitioners and educators working in the community, contributed to the development of the study.

6.5 Future directions

While children may improve their attitudes towards vegetable and fruit as a result of garden-based interventions and healthy snack programs, or improve their knowledge about healthy eating behaviours as a result of an educational component added to the school curriculum, they may not be able to influence their consumption at home as their food choices at home are not only the result of

nutrition knowledge and food preferences. Future obesity prevention strategies developed for Aboriginal children should focus on garden activities at school by also including an educational component about healthy eating behaviours. As well, children and parents should be encouraged to participate in school activities such as gardening and snack programs to increase their exposure to health promotion messages which may also contribute to address nutrition in the home environment, as well as to promote learning opportunities for the family through activities that enhance their traditional values and practices, such as planting, growing, nurturing, harvesting and sharing their own vegetables and fruits.

As previously stated, one cause of childhood obesity in Aboriginal populations is likely a calorically dense diet lacking in vegetables and fruit intake but high in foods containing sugars and fat. But, on the other hand, it is known that children's attitudes toward foods are a primary predictor of their consumption if those foods are made available to them. In this thesis, results indicated that the participating First Nations children, regardless of their weight status and abdominal adiposity, tended to like fruits over vegetables, and they are still capable of improving their attitudes toward vegetables as a result of a gardening intervention and a snack program. As well, children reported eating vegetables and fruits at home, but unfortunately, this study did not consider frequency of their consumption to build on findings of the present report. This leaves us a question mark for further research, as there is a need to study more in depth what are the factors that influence First Nations children's consumption of vegetables and fruits, particularly in their home environment.

Usually, parents or caregivers decide which foods to buy and when to serve them at home, leading to a direct impact on children's preferences and food consumption (Story, Neumark-Sztainer & French, 2002). Children will eat what is available at home. For this reason, studies related to food availability and accessibility will increase our understanding of what is available at home that may influence children's food choices. If the foods to which children are usually exposed can shape their preferences and consumption, it indicates that food preference may be learned through experience. Therefore, in order to improve

students' dietary practices there is also a need to involve the family and the community, which are essential settings for children to practice and share what they learn from nutrition interventions at school. With this, children will have the potential to promote health in an environment which families and community members may work together to create conditions that will allow the population to achieve healthier behaviours and therefore, to have a better quality of life.

It is difficult to simply attribute the improvement of children's attitudes towards vegetables and fruit to the implementation of the gardening and snack programs. Lack of formal implementations of garden-based programs designed for Aboriginal children in Canada makes it even more difficult to build on findings of this study. It is possible that children's excitement for this innovative approach at school contributed to promoting their interest in participating in the program throughout the year. Still, it is possible that the short term period that the program lasted contributed to the significant improvement that was observed, as it may be possible that children's excitement and interest may have declined over longer periods of time. For this reason, from these results, future research is being done to evaluate children's attitudes towards vegetables and fruit 18 months from baseline.

Based on findings revealed in the present study, evidence for the effectiveness of the Earthbox Kids school gardening and the healthy snack program is promising. This intervention may have the potential to lead to improvements in First Nations Cree children's vegetable and fruit intake, willingness to taste unfamiliar fresh produce, and increase preferences among children whose current intake of these foods are low. Future research is needed to investigate whether garden-based programs positively impact dietary outcomes in Aboriginal children. With high overweight and obesity rates especially in First Nations children, it is imperative to investigate creative and effective healthful eating initiatives.

6.6 References

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7. Appendices

7.1 Appendix A: Consent forms

UNIVERSITY OF ALBERTA

Earthbox Kids – A comprehensive school gardening program to improve the dietary practices of First Nation children

Evaluation of Children's Consumption, Attitudes, and Preferences For Fruits and Vegetables

Agreement to participate

TO BE COMPLETED BY THE CAREGIVER

	Yes	No
Have you read the attached Information Sheet?	☐	☐
Do you understand the benefits and risks in having your child take part in these evaluations	☐	☐
Do you understand that your child's participation in these evaluations is voluntary?	☐	☐
Do you understand that the evaluations will be used to write reports and manuscripts, and to make presentations?	☐	☐
Do you understand that your child's name will not appear in any reports, manuscripts, and presentations?	☐	☐
Do you understand that you can decide to withdraw your child from the evaluations up to the point where data have been collected?	☐	☐

I agree to have my child take part in these evaluations: YES ☐ NO ☐

SIGNATURE OF CAREGIVER _____

Date_____

(Printed Name of Caregiver) _____

PRINT NAME OF CHILD TAKING PART IN THE STUDY_____

UNIVERSITY OF ALBERTA

Earthbox Kids – A comprehensive school gardening program to improve the dietary practices of First Nation children

Evaluation of Children's Consumption, Attitudes, and Preferences For Fruits and Vegetables

(TO BE SIGNED BY THE CHILD)

It is important that children eat healthy foods. This year at school you will grow vegetables. You will eat fruits and vegetables as snacks. Your teacher will ask you questions about what you eat. You teacher will ask you questions about what you like to eat.

A study is being done to help boys and girls eat healthy food. Your parent or caregiver has agreed you can be in the study. If you also say yes, your answers will be used in the study.

It is okay if you say "no." You can change your mind. If you do, please tell your teacher before the study starts.

All information will be kept private. No one will know your name.

Please check (√) one of the following choices:

I **want to** participate in this study: _____

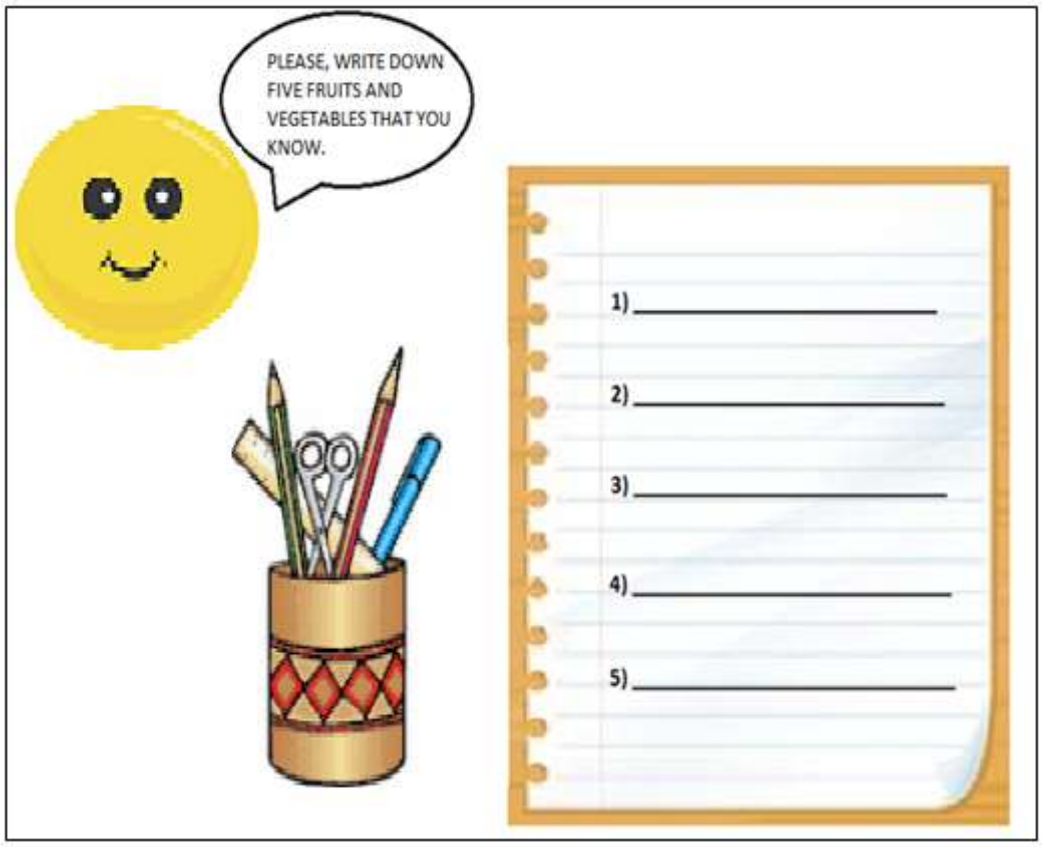
I **do not want to** participate in this study: _____

My name is: _____

7.2 Appendix B: Vegetables and fruit knowledge survey

DATE: _____ GRADE: _____

Vegetable and Fruit Knowledge Survey	Child ID	Male	Female	Age	Birthday	PRE	POST



7.3 Appendix C: Vegetables and fruit attitudes and home consumption survey

Vegetable and Fruit Attitudes Survey							CHILD ID	
	What do you think of this food?						**Do you eat this food at home?**	
Broccoli 	I really like it!	I like it.	It is OK.	I do not like it.	I really do not like it!	I will never eat it again.	YES	NO
Green pepper 	I really like it!	I like it.	It is OK.	I do not like it.	I really do not like it!	I will never eat it again.	YES	NO
Carrot 	I really like it!	I like it.	It is OK.	I do not like it.	I really do not like it!	I will never eat it again.	YES	NO
Tomato 	I really like it!	I like it.	It is OK.	I do not like it.	I really do not like it!	I will never eat it again.	YES	NO
Celery 	I really like it!	I like it.	It is OK.	I do not like it.	I really do not like it!	I will never eat it again.	YES	NO
Cauliflower 	I really like it!	I like it.	It is OK.	I do not like it.	I really do not like it!	I will never eat it again.	YES	NO

	What do you think of this food?						Do you eat this food at home?	
Cucumber 	I really like it!	I like it.	It is OK.	I do not like it.	I really do not like it!	I will never eat it again.	YES	NO
Radish 	I really like it!	I like it.	It is OK.	I do not like it.	I really do not like it!	I will never eat it again.	YES	NO
Mushroom 	I really like it!	I like it.	It is OK.	I do not like it.	I really do not like it!	I will never eat it again.	YES	NO
Kiwi 	I really like it!	I like it.	It is OK.	I do not like it.	I really do not like it!	I will never eat it again.	YES	NO
Pear 	I really like it!	I like it.	It is OK.	I do not like it.	I really do not like it!	I will never eat it again.	YES	NO
Grapes 	I really like it!	I like it.	It is OK.	I do not like it.	I really do not like it!	I will never eat it again.	YES	NO

Vegetable and Fruit Attitudes Survey							CHILD ID	
	What do you think of this food?						Do you eat this food at home?	
Orange 	I really like it!	I like it.	It is OK.	I do not like it.	I really do not like it!	I will never eat it again.	YES	NO
Apple 	I really like it!	I like it.	It is OK.	I do not like it.	I really do not like it!	I will never eat it again.	YES	NO
Cantaloupe 	I really like it!	I like it.	It is OK.	I do not like it.	I really do not like it!	I will never eat it again.	YES	NO
Grapefruit 	I really like it!	I like it.	It is OK.	I do not like it.	I really do not like it!	I will never eat it again.	YES	NO
Banana 	I really like it!	I like it.	It is OK.	I do not like it.	I really do not like it!	I will never eat it again.	YES	NO

7.4 Appendix D: Anthropometric measurements data sheet

ANTHROPOMETRIC MEASUREMENTS

DATA SHEET

Participant Information

ID | | | | | | Survey Date: _____

Sex: _____ Grade: _____

Measurements

Height (cm): 1st measurement = _____
2nd measurement = _____
3rd measurement = _____
(only when |1st - 2nd | ≥ 0.5 cm)

Weight (kg): 1st measurement = _____
2nd measurement = _____
3rd measurement = _____
(only when |1st - 2nd | ≥ 0.5 kg)

Waist circumference: 1st measurement = _____
2nd measurement = _____
3rd measurement = _____
(only when |1st - 2nd | ≥ 0.5 cm)

Measurer comments (if any) : _
_ _
_ _

Measurer: _____

7.5 Appendix E: Caregivers' questionnaire

7.5.1 'The Learning Garden Program' questionnaire

The following information is part of the questionnaire of *The Learning Garden Program,* developed and run with two First Nations communities in northwest Ontario (Stroink & Nelson, 2009).

A. BACKGROUND INFORMATION:

1. Sex: Male_____ Female_____ Other_____

2. Age: _____

B. Instructions: The next questions are about the foods you usually eat. Think about all the foods you eat, both meals and snacks, at home and away from home. Indicate how much you eat each of the following using the scale provided:

1 = Not at all; 2 = A little; 3 = Occasionally; 4 = Often; 5 = Very often.

1. ____ Potatoes (not counting potato chips)

2. ____ Carrots

3. ____ Turnips

4. ____ Lettuce

5. ____ Tomatoes

6. ____ Cucumbers

7. ____ Broccoli

8. ____ Squash

9. ____ Beans

10. ____ Fish

11. ____ Moose meat

12. ____ Caribou meat

13. ____ Beef

14. ____ Chicken

15. ____ Pork

16. ____ Apples

17. ____ Oranges

18. ____ Bananas

19. ____ Blueberries

20. ____ Raspberries

21. ____ Other vegetable (specify): _____

22. ____ Other meat (specify): _____

23. ____ Other fruit (specify): _____

C. Thinking about what you typically eat on a day to day basis, do you feel your eating habits are:

1 = Very Unhealthy; 2 = Average; 3 = Healthy; 4 = Very Unhealthy; 5 = Healthy.

D. Instructions: When choosing food, how important is each of the following to you in guiding your food choices? Think about the food you eat for your primary meals. Use the following scale to make your answers:

1 = Strongly Disagree; 2 = Neutral; 3 = Agree; 4 = Strongly Disagree;
5 = Agree

When choosing food to eat, it is important to me that the food…

____ 1. is affordable.

____ 2. is easy to prepare.

____ 3. does not require cooking.

____ 4. is familiar (you have eaten it before)

____ 5. is convenient.

____ 6. is eaten by other people I know.

____ 7. is accessible at the grocery or convenience store.

____ 8. tastes good.

____ 9. is healthy.

____ 10. has a unique flavour.

____ 11. connects me with my cultural heritage.

____ 12. was also eaten by my ancestors.

____ 13. is not overly processed.

____ 14. is not too salty.

____ 15. is not too sweet.

____ 16. comes from the land nearby.

7.5.2 Earthbox Kids questionnaire for caregivers adapted from 'The Learning Garden Program'

Date: _____ Questionnaire administrator's name: _____

Respondent's care giving role (mother, father, aunt, uncle, grandmother, grandfather, etc.): _____

INTRODUCTION STATEMENTS SAID TO POTENTIAL PARTICIPANTS

We would like to know about the decisions you make about purchasing, choosing and eating food. Your answers will be used as part of a project being done by [redacted] and the University of Alberta to increase children's access to healthy food. All responses will be kept confidential and your name will never be used in any reports or presentations. The questions will take about 15 minutes to answer. Do we have your permission to continue?

1. Thinking about what you typically eat on a day to day basis, do you feel your eating habits are:

Very Unhealthy	**Unhealthy**	**Average**	**Healthy**	**Very healthy**

2. For the following questions, please choose the option that best tells how often you eat different foods. For all questions, the choices are never, rarely, sometimes, often and very often. How often do you eat …..?

	Never	**Rarely**	**Sometimes**	**Often**	**Very Often**
Chicken					
Blueberries					
Rabbit					
Saskatoon berries					
Beef					
Pork					
Apples					
Fish					
Moose					
Bananas					
Potatoes (baked, boiled, or mashed, but not fried)					
Oranges					
Spinach or Swiss chard					
Duck					
Carrots					
Tomatoes					
Corn					
Strawberries					
Deer					
Raspberries					
Broccoli					
Sweet potatoes/yams					
Beets					

3. For the following questions, please choose the option that best tells how you make food choices. For all questions, the choices are not at all important, a little important, neither important nor unimportant, a little important, and very important. When choosing food to eat, how important is it to you that the food …

	Not at all important	**A little important**	**Neither important nor unimportant**	**Important**	**Very important**
Is healthy?					
Is available at a nearby grocery or convenience store?					
Is not highly processed?					
Does not cost too much?					
Is familiar (you have eaten it before)?					
Is natural?					
Is easy to prepare?					
Comes from the land nearby?					
Tastes good?					
Is connected to your culture?					
Was eaten by your ancestors?					

In the future, would you be willing to participate in a survey about whether your family has access to affordable healthy food? If yes, what is your name and how can we reach you? (Information to be written on a separate document; it should be a document that cannot be linked to this person's answers.)

7.6 Appendix F: Percentage distribution of children's attitudes towards vegetables and fruits

Table F-1: Percentage distribution of attitudes toward foods reported by normal weight children (n=24) at baseline

Foods	Attitudes toward foods, (%[n])					
	I really like it	I like it	It is OK	I do not like it	I really do not like it	I will never eat it again
Banana	91.7[22]	0[0]	4.2[1]	4.2[1]	0[0]	0[0]
Grapes	87.5[21]	12.5[3]	0[0]	0[0]	0[0]	0[0]
Kiwi	87.5[21]	4.2[1]	0[0]	0[0]	0[0]	8.3[2]
Carrot	83.3[20]	4.2[1]	12.5[3]	0[0]	0[0]	0[0]
Apple	79.2[19]	12.5[3]	4.2[1]	4.2[1]	0[0]	0[0]
Pear	75[18]	12.5[3]	12.5[3]	0[0]	0[0]	0[0]
Orange	75[18]	8.3[2]	16.7[4]	0[0]	0[0]	0[0]
Cantaloupe	58.3[14]	12.5[3]	12.5[3]	8.3[2]	8.3[2]	0[0]
Celery	54.2[13]	29.2[7]	8.3[2]	0[0]	8.3[2]	0[0]
Cucumber	50[12]	25[6]	8.3[2]	0[0]	8.3[2]	8.3[2]
Green Pepper	41.7[10]	0[0]	25[6]	12.5[3]	4.2[1]	16.7[4]
Tomato	29.2[7]	16.7[4]	12.5[3]	4.2[1]	4.2[1]	33.3[8]
Broccoli	25[6]	37.5[9]	8.3[2]	8.3[2]	4.2[1]	16.7[4]
Cauliflower	25[6]	16.7[4]	20.8[5]	16.7[4]	4.2[1]	16.7[4]
Radish	25[6]	0[0]	33.3[8]	8.3[2]	12.5[3]	20.8[5]
Mushroom	20.8[5]	4.2[1]	4.2[1]	8.3[2]	25[6]	37.5[9]
Grapefruit	12.5[3]	4.2[1]	16.7[4]	16.7[4]	16.7[4]	33.3[8]

Table F-2: Percentage distribution of attitudes toward foods reported by normal weight children (n=24) at 7-month follow up

Foods	Attitudes toward foods, (%[n])					
	I really like it	**I like it**	**It is OK**	**I do not like it**	**I really do not like it**	**I will never eat it again**
Banana	100[24]	0[0]	0[0]	0[0]	0[0]	0[0]
Grapes	91.7[22]	8.3[2]	0[0]	0[0]	0[0]	0[0]
Kiwi	91.7[22]	4.2[1]	0[0]	4.2[1]	0[0]	0[0]
Carrot	79.2[19]	16.7[4]	4.2[1]	0[0]	0[0]	0[0]
Apple	87.5[21]	0[0]	8.3[2]	4.2[1]	0[0]	0[0]
Pear	75[18]	20.8[5]	4.2[1]	0[0]	0[0]	0[0]
Orange	83.3[20]	12.5[3]	4.2[1]	0[0]	0[0]	0[0]
Cantaloupe	83.3[20]	4.2[1]	0[0]	12.5[3]	0[0]	0[0]
Celery	62.5[15]	25[6]	8.3[2]	0[0]	0[0]	4.2[1]
Cucumber	79.2[19]	4.2[1]	8.3[2]	0[0]	0[0]	8.3[2]
Green Pepper	41.7[10]	25[6]	16.7[4]	4.2[1]	0[0]	12.5[3]
Tomato	33.3[8]	12.5[3]	25[6]	4.2[1]	0[0]	25[6]
Broccoli	37.5[9]	20.8[5]	16.7[4]	8.3[2]	8.3[2]	8.3[2]
Cauliflower	41.7[10]	12.5[3]	20.8[5]	4.2[1]	8.3[2]	12.5[3]
Radish	25[6]	0[0]	25[6]	12.5[3]	0[0]	37.5[9]
Mushroom	16.7[4]	16.7[4]	8.3[2]	4.2[1]	16.7[4]	37.5[9]
Grapefruit	20.8[5]	0[0]	16.7[4]	12.5[3]	8.3[2]	41.7[10]

Table F-3: Percentage distribution of attitudes toward foods reported by overweight/obese children (n=36) at baseline

Foods	Attitudes toward foods, (%[n])					
	I really like it	**I like it**	**It is OK**	**I do not like it**	**I really do not like it**	**I will never eat it again**
Banana	86.1[31]	5.6[2]	5.6[2]	0[0]	0[0]	2.8[1]
Grapes	88.9[32]	5.6[2]	5.6[2]	0[0]	0[0]	0[0]
Kiwi	80.6[29]	5.6[2]	8.3[3]	0[0]	2.8[1]	2.8[1]
Carrot	88.9[32]	5.6[2]	2.8[1]	0[0]	0[0]	2.8[1]
Apple	80.6[29]	8.3[3]	5.6[2]	5.6[2]	0[0]	0[0]
Pear	77.8[28]	22.2[8]	0[0]	0[0]	0[0]	0[0]
Orange	72.2[26]	19.4[7]	5.6[2]	2.8[1]	0[0]	0[0]
Cantaloupe	47.2[17]	11.1[4]	13.9[5]	2.8[1]	11.1[4]	13.9[5]
Celery	77.8[28]	22.2[8]	0[0]	0[0]	0[0]	0[0]
Cucumber	58.3[21]	11.1[4]	11.1[4]	5.6[2]	5.6[2]	8.3[2]
Green Pepper	33.3[12]	22.2[8]	16.7[6]	5.6[2]	0[0]	22.2[8]
Tomato	33.3[12]	5.6[2]	11.1[4]	19.4[7]	16.7[6]	13.9[5]
Broccoli	52.8[19]	16.7[6]	19.4[7]	2.8[1]	0[0]	8.3[3]
Cauliflower	47.2[17]	19.4[7]	19.4[7]	0[0]	2.8[1]	11.1[4]
Radish	27.8[10]	8.3[3]	8.3[3]	11.1[4]	11.1[4]	33.3[12]
Mushroom	19.4[7]	5.6[2]	8.3[3]	8.3[3]	16.7[6]	41.7[15]
Grapefruit	22.2[8]	5.6[2]	11.1[4]	13.9[5]	8.3[3]	38.9[14]

Table F-4: Percentage distribution of attitudes toward foods reported by overweight/obese children (n=36) at 7-month follow up

Foods	Attitudes toward foods, (%[n])					
	I really like it	**I like it**	**It is OK**	**I do not like it**	**I really do not like it**	**I will never eat it again**
Banana	88.9[32]	5.6[2]	5.6[2]	0[0]	0[0]	0[0]
Grapes	86.1[31]	5.6[2]	8.3[3]	0[0]	0[0]	0[0]
Kiwi	86.1[31]	8.3[3]	2.8[1]	2.8[1]	0[0]	0[0]
Carrot	83.3[30]	13.9[5]	2.8[1]	0[0]	0[0]	0[0]
Apple	75[27]	16.7[6]	8.3[3]	0[0]	0[0]	0[0]
Pear	80.6[29]	13.9[5]	5.6[2]	0[0]	0[0]	0[0]
Orange	83.3[30]	11.1[4]	5.6[2]	0[0]	0[0]	0[0]
Cantaloupe	58.3[21]	8.3[3]	16.7[6]	5.6[2]	5.6[2]	5.6[2]
Celery	72.2[26]	13.9[5]	8.3[3]	2.8[1]	0[0]	2.8[1]
Cucumber	63.9[23]	13.9[5]	13.9[5]	2.8[1]	0[0]	5.6[2]
Green Pepper	50[18]	8.3[3]	25[9]	2.8[1]	0[0]	13.9[5]
Tomato	44.4[16]	11.1[4]	13.9[5]	5.6[2]	8.3[3]	16.7[6]
Broccoli	58.3[21]	16.7[6]	16.7[6]	2.8[1]	2.8[1]	2.8[1]
Cauliflower	52.8[19]	8.3[3]	19.4[7]	8.3[3]	0[0]	11.1[4]
Radish	25[9]	5.6[2]	13.9[5]	19.4[7]	2.8[1]	33.3[12]
Mushroom	16.7[6]	11.1[4]	11.1[4]	13.9[5]	5.6[2]	41.7[15]
Grapefruit	27.8[10]	11.1[4]	5.6[2]	13.9[5]	11.1[4]	30.6[11]

Table F-5: Percentage distribution of attitudes toward foods reported by n=76 children at baseline

Foods	Attitudes toward foods, (%[n])					
	I really like it	**I like it**	**It is OK**	**I do not like it**	**I really do not like it**	**I will never eat it again**
Banana	88.2[67]	2.6[2]	6.6[5]	1.3[1]	0[0]	1.3[1]
Grapes	86.8[66]	6.6[5]	6.6[5]	0[0]	0[0]	0[0]
Kiwi	82.9[63]	3.9[3]	6.6[5]	0[0]	2.6[2]	3.9[3]
Carrot	82.9[63]	5.3[4]	7.9[6]	2.6[2]	0[0]	1.3[1]
Apple	78.9[60]	9.2[7]	7.9[6]	3.9[3]	0[0]	0[0]
Pear	75[57]	17.1[13]	6.6[5]	0[0]	1.3[1]	0[0]
Orange	69.7[53]	17.1[13]	11.8[9]	1.3[1]	0[0]	0[0]
Cantaloupe	51.3[39]	10.5[8]	15.8[12]	5.3[4]	7.9[6]	9.2[7]
Celery	67.1[51]	22.4[17]	5.3[4]	0[0]	3.9[3]	1.3[1]
Cucumber	53.9[41]	13.2[10]	10.5[8]	6.6[5]	6.6[5]	9.2[7]
Green Pepper	32.9[25]	15.8[12]	18.4[14]	9.2[7]	1.3[1]	22.4[17]
Tomato	26.3[20]	9.2[7]	11.8[9]	13.2[10]	10.5[8]	28.9[22]
Broccoli	42.1[32]	21.1[16]	15.8[12]	6.6[5]	3.9[3]	10.5[8]
Cauliflower	36.8[28]	17.1[13]	21.1[16]	7.9[6]	3.9[3]	13.2[10]
Radish	26.3[20]	3.9[3]	18.4[14]	13.2[10]	11.8[9]	26.3[20]
Mushroom	19.7[15]	3.9[3]	6.6[5]	11.8[9]	17.1[13]	40.8[31]
Grapefruit	14.5[11]	3.9[3]	11.8[9]	14.5[11]	11.8[9]	43.4[33]

Table F-6: Percentage distribution of attitudes toward foods reported by n=76 children at 7-month follow up

Foods	Attitudes toward foods, (%[n])					
	I really like it	**I like it**	**It is OK**	**I do not like it**	**I really do not like it**	**I will never eat it again**
Banana	90.8[69]	5.3[4]	2.6[2]	0[0]	1.3[1]	0[0]
Grapes	84.2[64]	5.3[4]	9.2[7]	0[0]	0[0]	1.3[1]
Kiwi	86.8[66]	6.6[5]	1.3[1]	3.9[3]	0[0]	1.3[1]
Carrot	80.3[61]	13.2[10]	5.3[4]	1.3[1]	0[0]	0[0]
Apple	78.9[60]	7.9[6]	9.2[7]	2.6[2]	1.3[1]	0[0]
Pear	76.3[58]	14.5[11]	7.9[6]	0[0]	0[0]	1.3[1]
Orange	78.9[60]	13.2[10]	6.6[5]	0[0]	1.3[1]	0[0]
Cantaloupe	63.2[48]	7.9[6]	11.8[9]	6.6[5]	3.9[3]	6.6[5]
Celery	67.1[51]	19.7[15]	7.9[6]	1.3[1]	0[0]	3.9[3]
Cucumber	67.1[51]	7.9[6]	11.8[9]	2.6[2]	1.3[1]	9.2[7]
Green Pepper	42.1[32]	13.2[10]	22.4[17]	5.3[4]	0[0]	17.1[13]
Tomato	36.8[28]	10.5[8]	19.7[15]	6.6[5]	3.9[3]	22.4[17]
Broccoli	50[38]	14.5[11]	21.1[16]	5.3[4]	3.9[3]	5.3[4]
Cauliflower	50[38]	13.2[10]	17.1[13]	6.6[5]	2.6[2]	10.5[8]
Radish	25[19]	2.6[2]	18.4[14]	15.8[12]	1.3[1]	36.8[28]
Mushroom	17.1[13]	13.2[10]	11.8[9]	10.5[8]	7.9[6]	39.5[30]
Grapefruit	21.1[16]	5.3[4]	9.2[7]	14.5[11]	9.2[7]	40.8[31]

7.7 Appendix G: Data analysis using Parametric vs. Non-parametric statistics

Table G-1: Statistically significant differences of children's food attitudes scores between baseline and 7-month follow up considering parametric and non-parametric statistic methods

Attitudes toward food	Parametric statistics: Paired sample t-test	Non-parametric statistics: Wilcoxon signed-rank test
Grapes		
Banana		
Carrot		
Orange		
Apple		
Pear		
Kiwi		
Celery		
Cucumber	**X**	
Broccoli	**X**	
Cantaloupe	**X**	**X**
Cauliflower	**X**	**X**
Green Pepper	**X**	
Tomato	**X**	**X**
Radish		
Mushroom		
Grapefruit		
Total Vegetables and Fruits	**X**	**X**

X: Statistically significant difference ($p<0.05$) found in attitudes scores from baseline to 7-month follow up