Eating Habits of Nova Scotia Preschoolers Registered Full-Time in Regulated Child Care

By

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The development of healthy eating habits established in early childhood is crucial for growth, development, and health outcomes, both short- and long-term. The connection of lower quality diets high in sugar, sodium, and fats to negative health outcomes of obesity, heart disease, diabetes, and some cancers is well-established. National survey results and recent studies indicate that Canadian children may not be meeting the current *Eating Well with Canada's Food Guide* (CFG) recommendations. Further to this, data indicate that diets of most Canadian children are high in sugar and sodium. To support the development of healthy eating behaviours in early childhood, the *Standards for Food and Nutrition in Regulated Child Care Settings* were implemented in Nova Scotia in 2011. This thesis is embedded in the larger Nutrition Standards in Child Care Project (NSCCP), which explored the impact of these *Standards* on preschooler eating habits in the child care and home. This study examined preschooler diets to determine if Nova Scotia children registered full time in licensed child care centres meet CFG recommendations, and to compare home and child care environments. Four-day food records of 79 children ages 3 to 5 years old were examined for quantity and quality using The Classification of Foods in the Canadian Nutrient File According to *Eating Well with Canada's Food Guide* (CNF/CFG). Results indicate that many preschoolers are not meeting CFG recommendations for quantity and quality for the four main food groups and their directional statements. Overall, 55.7%, 82.3%, 65.8%, and 74.7% of children met recommendations for vegetables and fruits, grains, milk and alternatives, and meat and alternatives, respectively. Findings also identified that substantially fewer 4 and 5 year old preschoolers met recommendations for the vegetables and fruits group (30.3%) compared to the 3 year old preschoolers (60.9%), and fewer 4 and 5 year olds met grain recommendations on days at home (48.4%) compared to days including child care (83.3%). Additionally, vegetable and fruit intakes, as well as grain intakes are mostly in line with CFG guidance for quality; however, milk and alternatives intakes and meat and alternatives intakes are lower in quality. Children also consumed higher mean intakes of sugar-sweetened beverages and "other" foods on days at home ($p<0.001$). This study shows that food and beverage standards in the regulated child care environment do impact preschooler diets compared to CFG recommendations; however, many children in Nova Scotia are not meeting CFG recommendations for quantity and quality.

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LIST OF ABBREVIATIONS

AGHI	*Australian Guide to Healthy Eating*
AI	Adequate Intake
CCHS	Canadian Community Health Survey
CFG	*Eating Well with Canada's Food Guide*
CNF	Canadian Nutrient File
CNF/CFG	"The Classification of Foods in the Canadian Nutrient File According to *Eating Well with Canada's Food Guide*"
CNPP	Center for Nutrition Policy and Promotion
DQI	Diet Quality Index
HEI	Healthy Eating Index
HRM	Halifax Regional Municipality
IOM	Institute of Medicine
MDS	Mediterranean Diet Score
NCD	Noncommunicable Disease
NSCCP	Nutrition Standards in Child Care Project
OB	Obesity
ONQI	Overall Nutrition Quality Index
OW	Overweight
RA	Reference Amount
UL	Tolerable Upper Intake Level
USDA	United States Department of Agriculture
WHO	World Health Organization

INTRODUCTION

Early childhood is a crucial time for establishing healthy eating habits that can have both short and long term health impacts (Singh, Mulder, Twisk, van Mechelen, & Chinapaw, 2008). During the preschooler years, children ages 3 to 5 years old experience milestones in physical growth, fine and gross motor skills, and cognitive development that thrive with adequate nutrition. Malnutrition can result in physical growth issues, learning disabilities and cognitive and intellectual implications, and impaired immune system function that may have lifelong impacts (Blossner & de Onis, 2005; Fuglestad, 2010). Malnutrition can also present as over nutrition, potentially leading to overweight (OW) or obesity (OB). Nutrition-related noncommunicable diseases (NCDs) and risk factors such as type 2 diabetes, obesity, hypertension, and dyslipidemia that were previously and primarily seen in adult populations are now presenting in children at increasing rates (Steinberger & Daniels, 2003). Development of these health issues early in life are likely to persist into adulthood and increase the risk for further health complications (Steinberger et al., 2003). Moreover, Nova Scotian children had significantly higher rates of overweight (OW) and obesity (OB) (32%) compared to the Canadian national average of 26% (Shields, 2006; Vanasse, Demers, Hemiari, & Courteau, 2005). These rates reflect a national trending increase in childhood OW and OB from 15% in 1978 to 26% in 2004 (Roberts, Shields, de Groh, Aziz, & Gilbert, 2012).

Eating habits and diet related health outcomes are well established. A number of studies have investigated eating habits and health outcomes in school aged children and adolescents; however; there is limited information about eating habits of preschoolers. The early developmental stage, learning environments, and the influence of nutrition policy may have a unique impact on this younger population. The last national survey conducted in 2004 indicated

that a substantial number of children were not meeting nutrition recommendations established by Health Canada (Garriguet, 2004). More recent observations in regions of Canada outside of the Atlantic provinces suggest that this trend in dietary intake has continued in the preschooler population (Pabayo, Spence, Casey, & Storey, 2012).

Diet quality and diet quality measures are established as important indicators of nutrition adequacy and disease risk prediction (Patterson, Haines, & Popkin, 1994). Although the definition of diet quality remains subject to the context of its application, several tools are available to measure quantitative and qualitative aspects of a diet known to characterize it as 'healthful'. Nutrition surveillance tools have been investigating eating habits of populations and are further connecting diets and patterns to health outcomes. Indices such as the Healthy Eating Index (HEI) and alternate Mediterranean Diet Index (aMED) have been successfully applied to dietary data and shown to identify that those who consumed higher quality diets had a lower risk of cardiovascular disease and some cancers suggesting to the extent that higher quality diets may be protective against some chronic diseases (Reedy, Krebs-Smith, Miller, Liese, Kahle, Park, & Subar, 2014). Health Canada has recently released a new population nutrition surveillance tool that is relevant to recommendations put forth by the Canadian government. The Canadian Nutrient File-*Eating Well with Canada's Food Guide* Classification System (CNF/CFG) evaluates the diet by determining if individuals meet recommendations from *Eating Well with Canada's Food Guide* (CFG) (Health Canada, 2014). Like other diet quality indices, the CNF/CFG takes into consideration components of the diet that are associated with lower disease risk, including variety of food choices as recommended by the four main food groups, as well as sugar, sodium, and fats content (Heath Canada, 2014; Katamay et al., 2007). This study is one of the first to apply this new tool in research, particularly to investigate the diet quality of the preschooler population in

Nova Scotia. The knowledge collected and interpreted by these diet quality indices has the potential to inform families, early childhood educators, and policy makers in making healthful decisions, and to provide evidence for guiding policies and support initiatives within communities.

LITERATURE REVIEW

Nutrition During Early Childhood

Nutrition and development. Each stage of the life cycle requires attention to nutrition for health promotion and disease prevention or management. Early childhood is a particularly sensitive period for nutrition needs due to the rapid physical growth, cognitive development, and activity increase. The preschooler years, which usually includes children ages 3 to 5 years old, contain a variety of developmental milestones that mark the transition from toddler to school-aged childhood. Milestone areas include physical growth, fine and gross motor skills development and coordination, language skills progression, cognitive development including increased memory, and neural specialization and plasticity. Inadequate nutrition can have detrimental and lasting impacts on growth, development, and health (Centers for Disease Control, 2017). Numerous studies examining nutrition impacts, particularly studies investigating populations in developing countries, have documented the outcomes of inadequate nutrition (Engle et al., 2007; Walker et al., 2007).

Diet-related outcomes. There is a wealth of information documenting the impact of nutrition status on children's health and overall well-being. A primary focus for nutrition-related outcomes is on children's health. In recent years, the prevalence rates of childhood OW and OB conditions have increased substantially, both nationally and internationally. The resultant weight status of OW and OB is an energy imbalance that results in excess body fat and mass. There are many complex contributing factors including genetics and environment (Gillis & Bar-Or, 2003; Katamay et a., 2006; Shields, 2006). Although the diet-weight relationship has been documented in the literature primarily in the adult population, emerging evidence indicates that similar low quality eating patterns are associated with childhood weight status. Sugar-sweetened beverage

consumption patterns, low vegetable and fruit intakes, increased frequency of consumption of prepared foods away from home, and energy-dense, high fat intakes, and decreased fibre intakes are dietary factors associated with increased weight status and adverse health-outcomes documented in the paediatric population (Garriguet, 2006; Harrington, 2008; Johnson, Mander, Jones, Emmett, & Jebb, 2008; O'Connor, Yang, & Nicklas, 2006; Shields, 2006).

In 2013, the World Health Organization reported that 42 million children and infants globally have OW or OB (World Health Organization, 2015). Canada is not immune from this phenomenon. Between 1978/1979 and the CCHS cycle 2.2 in 2004, the prevalence of people with OW and OB in Canada almost doubled from 15% to 26% in the pediatric population of ages 2 to 17 years old (Shields, 2006). Currently, one in three children meets criteria for OW or OB (Levy, Zambo, Edell, &Borys, 2015). Marginalized populations are often at greater risk for OW and OB in Canada. The prevalence of OW and OB in Aboriginal youths is 41% (Public Health Agency of Canada, 2012). This shift in increased rates of childhood OB translates to increased comorbidities in the childhood population previously usually only observed in adult populations (Klish, Kirkland, & Motil, 2015; Steinberger et al., 2003). Evidence shows that carrying excess weight puts children at risk of developing physical growth issues in bones and joints, dyslipidemia, endocrinopathy, decreased lung function, hypertension, insulin resistance, and type 2 diabetes (Government of Canada, 2016; Klish et al., 2015; McCrindle, 2015; Davidson, Mackenzie-Rife, Witmans, Montgomery, Ball, Egbogah, & Eves, 2014; Klingensmith et al., 2015). Mental health can also be impacted. Children who have OW or OB are at an increased risk for low self-esteem, negative body image, depression, social stigma, anxiety, and social challenges such as bullying (Puhl & Heuer, 2009; Government of Canada, 2016; Lau, Douketis, Morrison, Hrmaiak, Sharma, Ur, & Obesity Canada Clinical Practice Guidelines Expert Panel, 2006). Children and adolescents

with OW and OB are more likely to experience discrimination from peers and adults (Puhl & Hueuer, 2009). Even as early as preschool, children are able to demonstrate prejudice against those with OB, giving more negative labels such as 'ugly' to an obese doll compared to comments from normal weight peers (Dunkeld Turnbull, Heaslip, & McLeod, 2000). Data and literature documenting the impact of weight status in the preschooler population are limited; however, a Swedish team recently used the Child Behaviour Checklist for ages 1.5-5 and the Beck Depression Inventory, Second Edition to examine the impact of weight status of 4 to 6 year olds behaviour (Ek, Hedman, Marcus, & Nowicka, 2014). Obese children were found to have higher scores indicating issues with social interaction, anxiety, depression, sleep, and attention when compared to normal weight children. These findings are significant and identify the presence of weight-related mental health issues in a young population.

Further evidence shows that children with OB are likely to continue having OB into adolescence and adulthood with continued risk for comorbidities of cardiovascular disease, insulin resistance, type 2 diabetes, metabolic syndrome, infertility, respiratory complications, and some cancers (Chikvaidze, Kristesashvili, & Gegechkori, 2014; Singh, Mulder, Twisk, van Mechelen, & Chinapw, 2008; Lau et al., 2006). Not only does OW and OB increase the risk for these chronic diseases, but increased weight status, even in childhood, is associated with a higher risk for all-cause mortality in adulthood (Flegal, Kit, Orphana, & Graubard, 2013; Must, Jacques, Dallal, Bajema, & Dietz, 1992; Mossberg, 1989). Although more recent national survey data suggests that the trend in childhood OW and OB has remained relatively stable since the CCHS cycle 2.2 in 2004, OW and OB remains a public health crisis (Roberts, Shields, de Groh, Aziz, & Gilbert, 2012; WHO, 2015). Currently in Canada, 59% of adults have OW or OB, and 25% of this group of adults has OB (Bancej, Jayabalasingham, Wall, Rao, Do, de Groh, & Jayaraman, 2015). Nova

Scotia is among the regions with the highest rates of childhood OW and OB in Canada (32%) compared to the national average of 26% (Roberts et al., 2012; Statistics Canada, 2011). These rates of adult OB are projected to continue to increase as OW and OB children and adolescents become adults (Levy et al., 2015).

Further to this, it is evident that childhood nutrition and hydration can impact education and cognitive development. Although more focus has been placed on school-aged children in the literature on diet and academic performance, several studies have identified a significant association between having an adequate diet and indicators of performance in school (Florence, Asbridge, & Veugelers, 2008; Jukes, 2005; Taras, 2005). A common finding in reviewed studies revealed that dietary habits and associated outcomes, including health and academic measures, are often already established by the time children reach school age. These findings further prompt investigation into dietary habits of preschool-aged children.

Eating Habits of Preschoolers

Development of eating habits in early childhood. Early childhood years are marked with frequent growth and developmental milestones. These milestones range from increased independence and social play with peers, to improved coordination and fine motor skills, and an increase in awareness and critical thought processes (Eliassen, 2011). During this period of significant growth and change, children are also developing eating habits and behaviours as they experience their food environment and are exposed to a variety of influencers (Sigman-Grant, 1992). Eating behaviours are food and meal time related behaviours that shape habits, attitudes, and relationships with food and eating, influence diet patterns, and can ultimately impact overall health (Koplan, Liverman, Kraak, & Wisham, 2006; Savage, Fisher, & Birch, 2007). Eating

behaviours and habits are established during early childhood years and can persist into adulthood (Koplan et al., 2007). Numerous studies have identified connections of adults eating habits, food choice, and diet-related coping mechanisms with childhood food memories and parenting strategies (Brink, Ferguson, & Sharma, 1999; Puhl &Schwartz, 2003; Savage et al., 2007). The introduction of children to food and meal times impacts dietary intake and eating habits (Sigman-Grant, 1992, Savage et. Al, 2007). Children observe and model the eating behaviours of adults, as well as peers. Additional influences impacting food intake include genetics, environment, social determinants of health, branding and marketing, and other health behaviours (Gillis et al., 2003; Sigman-Grant, 1992).

Current Diet of Canadian Preschoolers. Eating habits, behaviours, and taste preferences developed during the preschool period continue into adulthood and can shape lasting relationships with food (Maier-Noth, Schaal, Leathwood, & Issanchou, 2016; Puhl & Schwartz, 2003). Undesirable eating habits including overconsumption of sugar-sweetened beverages (SSBs), energy dense-nutrient poor foods, higher fats and salt intakes, and lower vegetable, fruit, and fibre intakes are considered to be nutritional contributions to childhood OW and OB (Dubois, Farmer, Girard, & Peterson, 2007; O'Connor et al., 2006; Dubois, Farmer, Girard, Peterson, & Tatone-Tokuda, 2007; Veuglers, Fitzgerald, & Johnston, 2005; Lau et al., 2006; Kaczorowski, Campbell, Duhaney, Mang, & Gelfer, 2016). Having OW and OB are complex health issues and nutrition is accepted as fundamental in prevention and treatment strategies (Veugelers & Fitzgerald, 2005; Lau et al., 2006; Government of Canada, 2016). Current data about the Canadian preschooler population and their diets is limited, and available information is dated. The last national survey of Canadian's diets that included the early childhood population was the Canadian Community Health Survey, Cycle 2.2 in 2004 (CCHS 2.2). This was also the most recent survey that included

young children from Nova Scotia and collected dietary data from this population (Health Canada, 2012). The CCHS 2.2 and subsequent studies suggest that a substantial percentage of Canadian preschoolers may not be meeting CFG diet recommendations.

In the CCHS 2.2 national survey, two 24-hour recalls were collected from participants across all Canadian provinces. The first pass was completed by 35 107 participants and the second pass was completed by a representative subsample of 10 150 people 3 to 10 days after the first pass (Health Canada, 2012; Black & Billette, 2013). Food and beverage intakes for children 5 years or younger were collected from parents or caregivers. Dietary data was interpreted using the 1992 version of CFG the most recent version of national diet recommendations available at that time. The CFG is discussed further in subsequent sections. However, of note, an updated version of the CFG released in 2007 contained recommendations for the 2 to 3 year old population, which were not provided in previous versions.

Initial findings from the CCHS 2.2 reported that, based on the 1992 CFG recommendations, 70% of children ages 4 to 9 were not consuming the minimum five servings of vegetables and fruits per day (Garriguet, 2004). The mean daily intake was 4.5 servings of vegetables and fruits for this age group. Children were more likely to meet the recommended five to 12 daily servings of grains with 27% not meeting the minimum recommendation. Of the same sample, 37% did not meet the recommended two servings of dairy and alternatives.

In 2013, Black and Billette re-evaluated the vegetable and fruit intakes for all ages groups based on the CCHS 2.2 information. Over half of children ages 2 to 3 years (54%) were more likely to meet fruit and vegetable recommendations than any other group. In the group of 4 to 8 year old children, 31.2% were likely to meet CFG recommendations of 5 servings; this is a statistically significant difference compared to the 2 to 3 year old group. Black and Billette (2013)

reported that their findings were similar when intakes were compared to both the 1992 and 2007 versions of CFG. Since there were not recommendations for children under 4 years of age, no comparison can be made for the vegetable and fruit intakes of the 2 to 3 year old population. Within the vegetable and fruits food group, CFG recommends at least one serving each per day of dark green vegetable and dark orange vegetable or fruit (Health Canada, 2011). This directional statement encourages a variety of foods that is more likely to ensure that the population meets nutrient needs. Both age groups consumed a mean of 0.34 servings of dark green vegetables (95% CI: 0.23-0.46 for 2 to 3 years olds; 95% CI: 0.28-041 for 4 to 8 year olds). The mean servings of orange fruits and vegetables were 0.28 (95% CI: 0.17-0.38) for 2 to 3 year olds, and 0.27 servings (95% CI: 0.20-0.35) for 4 to 8 year olds. No significant difference in takes was detected between age groups for the dark green vegetables, nor the orange fruits and vegetables.

Black et al. (2013) also included information on juice intake. The CFG suggests fewer than half of the servings consumed in the vegetable and fruit group should be sourced from juice. Juices often contain higher concentrations of sugar or salt, and lower levels of nutrients like fibre compared to their whole food versions. On average, 2 to 3 year olds consumed 1.74 servings of juice (95% CI: 1.26-2.21) and 4 to 8 year olds consumed 1.57 servings of juice (95% CI: 1.40-1.75).

A similar Canadian study found that preschoolers were not meeting CFG recommendations. Between 2005 and 2007 a dietary intake study was conducted in Edmonton, Alberta, by Pabayo, Spence, Casey, and Storey (2012), with 2015 children ages 4 to 5 years old. Parents were asked to recall their child's usual food and beverage intake over the course of one day or one week in order to complete a 20-item food frequency questionnaire. Results were tabulated by CFG food group and foods consumed that could not be placed in one of these

traditional groups were categorized as “other”. This “other” group was further stratified by specific food types such as chips, fries, candies, chocolate, and cakes and cookies. In this group of 2015 children, 29.6% met the CFG recommendation for vegetables and fruits; 23.5% met grain recommendations; 90.9% met the milk and alternatives recommendation; and 94.2% met the meat and alternatives recommendations. This study further suggests that preschooler diets in Canada may not be meeting recommendations from CFG. The recommendations are designed to promote variety and balance in the diet, whereby increasing the likelihood that adequate nutrition can be achieved while potentially decreasing chronic disease risk (Katamay et al., 2007). Usual dietary intake that does not meet CFG recommendations may increase the risk of inadequate nutrient intakes (Katamay et al., 2007).

Diet Quality

For the purposes of this study, ‘diet quality’ will be discussed in the context of nutrition epidemiology and diet analyses. The following sections introduce the ‘diet quality’ concept as it applies to nutrition research, and a brief outline of tools used in measuring diet quality.

Diet quality conundrum. In recent years increased attention has been placed on investigating the diet as a whole, particularly given that people rarely consume single nutrients in isolation. Diet quality is a concept that considers the complexity of eating habits, dietary patterns, and nutritional value of foods, appreciating the combined impact of the diet on health. The term ‘diet quality’ is widely used, yet poorly defined. Often, quality will be characterized as good or bad, healthy or unhealthy or even poor; however, these labels remain undefined and unquantified. In its simplest form, diet quality refers to the nutrient density of foods or the diet as a whole. ‘High quality diets’ emphasize foods that are nutritious such as vegetables, fruits, whole grains, lean

sources of protein, lower in saturated fats, sodium, and sugar, and linked to better health. 'Low quality diets' include foods that are processed, high in fat, sodium, and sugar, and are often lower in nutrient density and nutrient adequacy while being high in calories.

Diet quality is a multidimensional construct that has evolved to also reflect changes including social ideals for food and diet. Alkerwi (2014) discusses the improved standards of living and how this influenced a shift in focus from consuming adequate calories to survive, to food diversity and nutritious choices that maintain health and prevent disease. More recent research focuses on the nutritional value of foods and whole diets, and investigates the relationship between consumption and health maintenance or disease risk. More specifically, literature has well-established the relationship between diet and risk for cardiovascular disease, hypertension, diabetes, some cancers, and obesity by applying these nutrient and diet focused methods (McCullough et al., 2002; Fung, Rimm, Spiegelman, Rifai, Tofler, Willett, & Hu, 2001; Maghsoudi & Azadbakht, 2012; Fitzgerald, Dewar, & Veugelers, 2002). These studies, and others like them, further define and quantify the qualitative aspects of the diet, which can be translated to applicable population and individual recommendations. Whether in research or practical daily application, an operational and applicable definition of diet quality is needed to study the diet and its relationship to health, and to ultimately navigate food choices. Currently, there is emphasis on sugar, sodium, and fat intakes due to the increased levels of consumption by the population and the substantial impact higher intakes can have on health outcomes.

Sugar. Of late, there has been more interest on the contribution of sugar and added sugar to the diet and the impact of sugar to diet quality and to health outcomes. Sugar, a carbohydrate, occurs naturally in foods and is also added to foods and beverages during preparation and processing. The body metabolizes sugars for energy and a diet pattern that adheres to CFG

is likely to be adequate in sugar and total carbohydrates (Health Canada, 2011; Katamay et al., 2007; Langlois & Garriguet, 2011). Although there are no current recommendations from Health Canada regarding sugar sourced from added sources in the diet, this category of foods contributes a significant proportion of sugar to the preschooler diet (Langlois et al., 2011). Langlois et al. (2011) report that in Canada, 16.5% of calories consumed by 1 to 3 year olds and 27.0% of calories consumed by 4 to 8 year olds is sourced from added sugar. The CCHS 2.2 data reported that overall, Canadians consume 21.4% of their daily caloric intake as added sugars, which is equivalent to 26 teaspoons of sugar (Langlois et al., 2011). The Institute of Medicine (IOM) recommends to limit added sugar to 25% of total caloric intake, and the WHO recommends to further limit these sugars to 10% of daily caloric intake (World Health Organization, 2003; World Health Organization, 2015). There is evidence to support undesirable short-term and long-term outcomes related to increased sugar intakes in childhood. Higher intakes of foods and beverages containing sugars, particularly added sugars, may be energy-dense and nutrient-poor, and are connected to the displacement of more nutrient-dense foods (Kranz, Smiciklas-Wright, Siega-Riz, &Mitchell, 2005; Murphy & Johnson, 2003). Sugar-sweetened beverages, including fruit drinks, fruit juice, some milks, and sodas, are also associated with increased weight status and dental caries (Dubois, Farmer, Girard, & Peterson, 2007; Wang, Bleich, & Gortmaker, 2008; World Health organization, 2015). Currently, sugar is a macronutrient worthy of consideration as part of diet quality assessment due to higher intakes in the population and association with undesirable health outcomes. Higher intakes of sugar potentially compromise diet quality and nutrient adequacy in the diet.

Sodium. The CCHS Cycle 2.2 (2004) identifies that 1 to 8 year old children in Canada have median intakes of potassium significantly below the Adequate Intake (AI) and sodium intakes significantly exceeding the current recommended intake (Statistics Canada, 2017). Sodium is consumed as a salt and it is prevalent in the North American diet because it is a cost-effective flavor-enhancer and food preservative (Health Canada, 2017). Sodium is required in small amounts by the body for proper functioning of nerves and muscles, and to regulate blood volume and pressure (Martini & Nath, 2009). Health Canada recommends that Canadian adults need approximately 1500 mg and children need 1000 to 1500 mg daily (Health Canada, 2017). As reference, 1500 mg of sodium is approximately two thirds of a teaspoon of salt. The CFG diet pattern reflects these guidelines and recommends a diet that limits salt (sodium) to reduce the risk of associated health problems, yet meet adequate nutrient intakes (Health Canada, 2007). More specifically, Health Canada guidelines recommend that for one to three year olds and four to eight year olds, AI's of 1000 mg/day and 1200 mg/day, and UL's of 1500 mg/day and 1800 mg/day, respectively (Health Canada, 2017). Intakes that are higher than recommended can lead to hypertension in both children and adults, which is a risk factor for cardiovascular disease, stroke, and kidney disease (Health Canada, 2017). Figure 1 illustrates that almost every segment of the Canadian population has met or exceeded the UL for sodium, with 76.8% of one to three year olds and 92.7% of four to eight year olds exceeding recommendations as of national data published in 2004 (Statistics Canada, 2017).

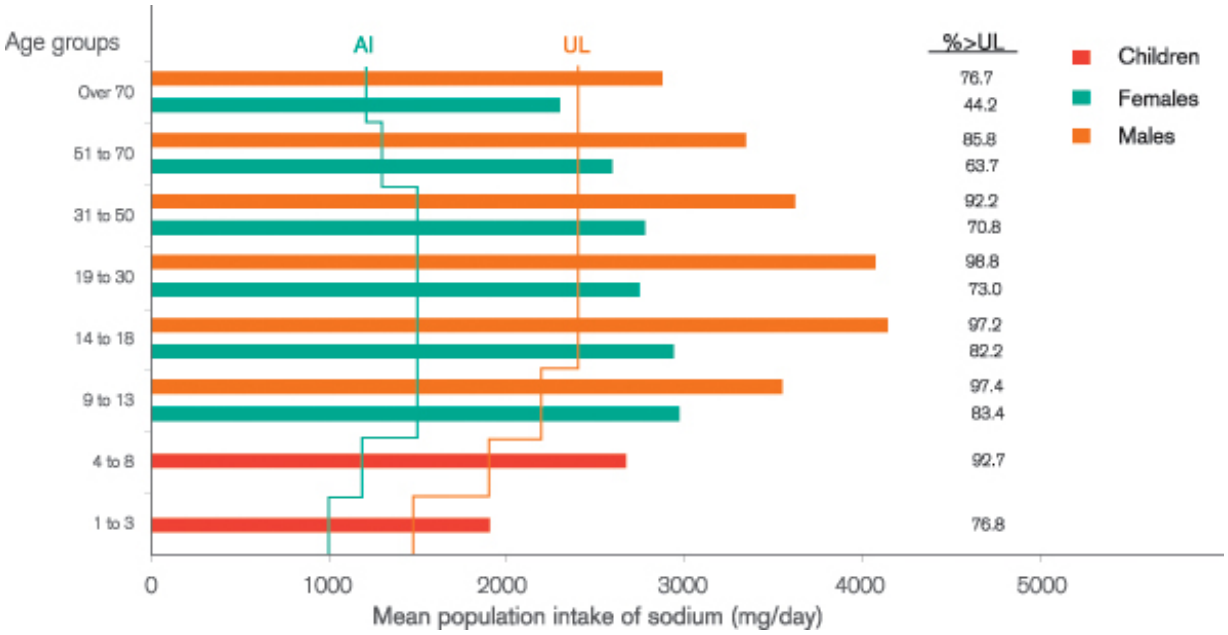

Figure 1. Canadian sodium intake by age bracket, CCHS 2.2 2004 (Statistics Canada, 2017)

Canadians, on average, are consuming 3400 mg of sodium daily, the equivalent to one and a half teaspoons of salt (Statistics Canada, 2017). Sodium is hidden in foods including vegetable juices, vegetable dishes, soups, and sauces that may seem to be in line with Health Canada sodium guidelines and CFG food group recommendations. The pervasiveness of salt in food processing, preservation, and flavour enhancement may lead to excessive daily sodium intakes. The leading sources of sodium in the diet of Canadians ages 1 to 8 years by percentage were breads (12.2%), processed meats (9.8%), and pasta dishes (8.3%) (Fischer, Vigneault, Huang, Arvaniti, & Roach, 2009). According to Fischer et al, bread is the leading source because it is consumed in large quantities, whereas processed meats are consumed in smaller quantities, but are sodium-dense (2009). Data specific to Nova Scotia preschoolers is unavailable; however, a large percentage of Canadian preschoolers have usual daily sodium intakes beyond the UL, intakes that are not in line with CFG (Statistics Canada, 2017).

Fats. Fats are an integral nutrient in the diet. This statement is particularly true for the

growth, development, and overall health of children. Fats, or lipids, are necessary for the absorption of fat-soluble vitamins and phytochemicals into the body; the creation and function of hormones; neurological structure and function; cellular structure and function; organ cushion; and for sources of dietary energy. They provide the highest amount of energy of all macronutrients at 9 kilocalories per gram. Both plants and animals are sources of various types of fats in the diet. A higher quality diet includes nutrient dense fat sources including nuts, seeds, fish and lean poultry, oils and fats, and some vegetables and fruits. A lower quality diet often includes highly processed items including fattier meats, processed meats, higher fat dairy, and snack foods that are not in line with the four main CFG food groups.

There is rising concern about the role of dietary fats in excess energy intakes, inflammation and immune functions, and its role in health and disease including obesity, cardiovascular disease, and cancer. In recent years, special focus has been concentrated on saturated fats, higher fat intakes, and lower overall diet quality being associated with increased risk factors and undesirable health outcomes such dyslipidemia, hypertension, obesity, type 2 diabetes, cardiovascular disease, stroke, and some cancers (Federal Interagency Forum on Child and Family Statistics, 2017; Katamay et al., 2012; Maskarinec et al., 2017). Currently, the Dietary Reference Intakes recommendation for fats in the diet is 30 – 40% of energy intake for 3 year olds and 25 – 35% for children ages 4 years and older (Health Canada, 2012). The CFG dietary pattern models for children suggest that the recommendations would yield an average of 8 – 9% saturated fat intake (Health Canada, 2012). There is no Dietary Reference Intake for saturated fats; however, it is recommended to have low intakes due to the established connection between higher saturated fats intakes and increased cardiovascular disease risk (Health Canada, 2012). The CCHS 2.2 (2004) results indicated that Canadian children ages 1 to 8 years old consume 12% of fat intakes as

saturated fats (Health Canada, 2012).

Measuring diet quality. Numerous tools have been created to measure diet quality, most of which have been developed to compare observed dietary information to healthy eating guidelines or to assess risk for nutrition related diseases. In a 2014 review to find the more commonly applied indices in research, Carvalho, Dutra, Pizato, Gruezo, and Ito found that there were four main indices that were used directly or modified for specific research objectives: Diet Quality Index (DQI) (Patterson, Haines, & Popkin, 1994), the HEI (Kennedy, Ohis, Carlson, & Fleming, 1995), Mediterranean Diet Score (MDS) (Trichopoulo et al., 1995), and Overall Nutrition Quality Index (ONQI) (Katz et al., 2009). These measurement tools were developed to tally scores assigned to components of an individual's diet that may indicate adherence to the current nutrition recommendations and predict risk for some chronic diseases. For example, the HEI, the surveillance tool developed by the United States Department of Agriculture (USDA) Center for Nutrition Policy and Promotion (CNPP) in 1995, assigns scores for adherence to healthy eating recommendations provided by the USDA *Food Guide Pyramid*, as well as percent of energy total fat intake, percent of energy saturated fat intake, total cholesterol, sodium, and variety in food choices (Kennedy et al., 1995). Together, these variables form 10 components of the HEI, each with a maximum score of 10 points, totalling a HEI score of 100. The higher an individual's score, the more likely they are meeting the USDA dietary recommendations. The components of this original index reflect what was valued at the time of development and considered to be parts of the definition of diet quality: meeting recommendations of an evidence-based food guide, fats content, sodium content, and diet variety. According to reviews conducted by the USDA, evidence supports that these components of the diet are related to chronic disease outcomes (Kennedy et al., 1995; McGrane, Fungwe, Essery, Obbagy, & Spahn, 2011). Since the development of the HEI,

the USDA has been able to monitor the eating habits of the American population, providing insight into dietary habits and their potential relationships to health outcomes.

A similar system for diet and diet quality assessment based on national food guide recommendations is the core and non-core categorization of foods based on the *Australian Guide to Healthy Eating* (AGHE). The AGHE is structured similarly to other national dietary guidelines and categorizes foods by group while providing guidelines to navigate foods and beverages, particularly those not considered nonessential to a health-promoting diet. The AGHE uses the terminology of 'core' to describe the nutritious foods found in the five food groups of grains; vegetables and legumes/beans; fruit; milk, yogurt, cheese, and other dairy alternatives; and lean meats, poultry, fish, eggs, nuts, seeds, and legumes/beans, as well as beverages such as water, tea, and coffee (A. G. Department of Health and Aging, 2017). 'Non-core' foods and beverages are those items not included in the core group such as items high in fat, added sodium, added sugar, and low in fibre, as well as sports drinks and alcoholic beverages. The AGHE labels these foods and beverages as "discretionary" foods, which would be like CFG's categorization of non-essential foods and beverages as "foods to limit" (A. G. Department of Health and Aging, 2017; Health Canada, 2011). Although this approach to categorizing foods and beverages as core and non-core appears simple in theory, and may be an effective quick reference approach for individuals to make more nutritious choice more often, the dichotomization of foods in this type of system can be challenging when assessing individual items in a dietary assessment. That is to say that not all foods can be easily or intuitively categorized solely based on whether or not they fit into a food group. For example, a whole grain slice of toast is a nutritious grain that is a source of many micro and macronutrients. A slice of chocolate cake contains grains, but perhaps also egg and dairy. It can be a source of nutrients that contribute to an individual's daily needs; however, due to the

higher added sugar content it would likely be considered non-core and an item to limit. Additionally, breakfast cereals are fortified to provide many nutrients, but several brands contain a substantial amount of added sugar. Breakfast cereals are still largely considered a core food and are categorized in the grains food group. The AGHE core and non-core approach to categorizing food does have limitations, particularly when specific criteria are not outlined to determine if an item belongs to a food group or if it should be considered a discretionary food to limit. This limitation is noted in much of the literature that uses this system in dietary assessment investigating diet quality (Bell, Kremer, Margarey, & Swinburn, 2005). This limitation is not unique to the AGHE, but is more apparent when applying the core and non-core system to dietary assessment and nutrition research. Approximately 10 years ago, collaboration began to create a validated Australian version of a Healthy Eating Index (Aust-HEI) to more effectively assess population diet quality and health outcomes (Australian Institute of Health and Welfare, 2007). The Healthy Eating Index for Australian Adults (HEIFA-2013) is a newer tool to assess the adherence of Australian adults to the AGHE by means of a multi-component points system that includes assessment of core and non-core food and beverage intakes (Roy, Hebden, Rangan, & Allman-Farinelli, 2016). Recent research has correlated findings that many Australian adults having lower quality diets, or lower adherence to the AGHE, from the HEIFA-2013 with demographic data indicating that lower quality diets were associated in some adult populations (Grech, Ying Sui, Zheng, Allman-Farinelli, Rangan, 2017). Some assessment tools solely measure dietary adherence to quantitative nutrition guidelines, whereas others assess the diet in relation to established risk factors for disease and other illnesses. The score- or point-based systems make results easier to interpret and to categorize individual and population diets according to adherence to nutrition recommendations and/or to risks associated with disease and illness. The additional benefit of

these tools and their assessment capabilities is the potential for stakeholders to identify people and communities who are at risk for lower quality diets, inadequate nutrition, and undesirable health outcomes, and to implement policy and programming to address existing disparities and barriers to nutrition.

Food Environments

Many variables can impact eating habits and diet. Eating behaviours, like other behaviours, are largely learned through observation and modelling. Different environments with their own role models combined with diverse food choices can create various learning opportunities for young children (Birch, 1999; Ventura & Birch, 2008; Savage et al., 2007). This study stratified observations by two main environments: the home environment, or any location outside of child care, and the regulated child care environment. This study did not investigate the details of each environment, but operated on the premise suggested by literature that each environment may have unique influences on learned eating habits and behaviours in young children.

Home food environment. The home food environment is one of the most influential factors in determining eating habits and behaviours and overall diet (Campbell & Crawford, 2001; Savage et al., 2007). Parents, as the usual primary provider, determine diet and eating patterns, meal style, role model behaviours and attitudes, and guide food preferences of the child (Savage et al., 2007; Campbell et al., 2001; Skinner, Carruth, Bounds, & Ziegler, 2002). A 2011 study of 396 parents in Australia identified significant parental influencers for preschooler fruit and vegetable intake (Wyse, Campbell, Nathan, & Wolfenden, 2011). Wyse and colleagues (2011) applied multiple validated questionnaires which determined that preschooler's fruit and vegetable intakes at home were positively associated with higher parental intakes; increased instances of

parental role modeling; availability and variety of fruits and vegetables at home; accessibility of prepared fruits and vegetables that are ready to eat; and limiting preschoolers to eat at set meal times. A study conducted by Skinner and colleagues (2002) identified that mothers and their children had significantly related food preferences and that mothers tended not to offer foods to their children that they did not enjoy themselves. Parenting styles and practices, and feeding styles are also influential determinants of a child's eating habits and relationship with food (Gubbels et al., 2009). For example, in a longitudinal study of maternal use of restrictive feeding practices with their 5 year old daughters, girls who were exposed to restrictive feeding practices had higher scores of eating in the absence of hunger when followed up with at ages 7 years and 9 years (Birch, Fisher, & Davison, 2013). Girls who were overweight at age 5 when the study began and had higher levels of food restriction also had the highest scores for eating in the absence of hunger and the highest increase in these scores from age 5 to age 9. The manner in which parents socialize children in the food environment can be a significant predictor for later diet and eating habits.

Although the home food environment was not investigated in depth beyond the contribution of dietary intake during this study, it is important to recognize the dynamics and variability of home environments and their possible impact on diet and socialization of food and meals during formative years. For example, there a number of barriers that limit the accessibility of nutritious foods to families in the community. Particularly in rural areas, reports have documented the challenges including the seasonal availability of foods, limited variety of nutritious options and affordable nutritious options, and increased selection of higher calorie, nutrient poor options at lower prices compared to the nutritious options (Hardin-Fanning, Rayens, 2014; Liese, Weis, Pluto, Smith, & Lawson, 2007). In Nova Scotia, ongoing research has reported on increasing food insecurity and associated social determinants impacting access to

affordable, nutritious food. Rural areas in Nova Scotia experience these challenges and basic nutritious foods were found to be significantly higher in cost in these areas compared to urban centres (Williams, & Nova Scotia Participatory Food Costing Project, 2011). These factors substantially impact the food environment for families and how parents navigate the food system to provide for their families. These early exposures begin to form the child's taste preference, familiarity and acceptance of food, and dietary patterns.

Child care centre food environment. Child care settings have a unique opportunity during formative years to create positive social learning environments to support healthy relationships with food while providing safe, nutritious snacks and meals. This is particularly important for children who spend a substantial amount of their day in child care. Children enrolled in full time child care can consume half to two-thirds of their dairy energy while at the child care centre (Dev, McBride, STRONG Kids Research Team, 2013). National surveys indicate that child care is changing in Canada with an increase of children being placed in some sort of child care arrangement, and more children being placed in a regulated child care centre (Bushnik, 2006). In Canada between 1967 and 1995, the number of children in a paid child care arrangement increased from 357,000 to 1.36 million (Johen, Forer, & Hertzman, 2006). In Nova Scotia, the percentage of parents accessing some child care arrangement is on par with the national average of 46% (Sinha, 2014). Licensed or regulated child care centres were the type of child care investigated in this current study. There are 390 regulated child care centres in Nova Scotia that are licensed by the provincial government. As of 2014, there were 10,290 children ages 2 to 4 years enrolled in these provincial centres, approximately 40% of this age bracket (Akbari & McCuaig, 2014). This number is estimated to be slightly higher when considering 5 year old preschoolers as part of the enrolled population. This shift in child care exposes children to new role models, social

interactions, and environments that can create new opportunities and influencers for the development of healthy eating habits (Amit et al., 2008). Early Childhood Educators (ECEs) serve as powerful role models for young children. Findings from Hughes and colleagues (2007) emphasizes that similar to parenting styles and feeding styles, ECE's approaches to role modelling of personal eating habits and feeding styles can impact a child's intake of novel and nutritious foods. Literature indicates that peer influence can also substantially impact a child's food preferences and increase acceptance of a food otherwise not preferred (Birch, 1980). Peer influence and social interaction during meal times can potentially affect a child's food intake and eating habits (Birch, 1980).

Nutrition Policy in Child Care

The Nova Scotia early childhood community has recognized the importance of healthy environments and the impact that child care environments can have in introducing young children to a positive, social food environment. Currently, in Canada, child care legislation is managed within each provincial jurisdiction. Within each provincial Child Care Act, there exists a piece addressing licensee nutrition and food service responsibilities while a child is in licensed child care. The depth of the guidelines and supports, criteria, and compulsory responsibilities of the child care centre varies between provinces and the territories. In recent years, recognizing the population-level health promotion opportunity through child care, provinces have been updating current food and beverage policies and implementing higher standards for nutrition to support facilities in creating a healthy eating environment. Nova Scotia implemented the first comprehensive food and nutrition standards in 2011 that are embedded in licensure, called the *Food and Nutrition Standards for Regulated Child Care Settings* (Standards) (Government of Nova Scotia, 2011). Other provinces have developed healthy eating guidelines, but have not made

the guidelines compulsory for licensure for the regulated child care centres. The Standards provide comprehensive criteria outlining child care requirements to provide a positive environment that facilitates healthy eating behaviours and habits (Government of Nova Scotia, 2011). The criteria are based on CFG food group recommendations and the Standards ensure that the child care centre menu adheres to CFG guidance; therefore, providing adequate, quality meals and healthy mealtime environments for children in provincially regulated child care centres (Government of Nova Scotia, 2011).

Population-level initiatives can be an effective response to changing health behaviours (Dev et al., 2013; Koplan et al., 2006). Studies have highlighted the positive impacts of nutrition policy in school-aged populations. In a study of 298 11 to 12 year olds, results showed that children who consumed school lunches complying with newly implemented food standards had lower intakes of saturated fat and sodium in their diets compared to children who consumed lunches from home (Spence, Delve, Stamp, Matthews, White, & Adamson, 2014). A comprehensive public nutrition policy for school-aged children in Nova Scotia was implemented between 2006 and 2009 in all provincial public schools. A study of effects of the school food and nutrition policy indicates that there were decreases in saturated fat and SSB intakes; however, there was a trending decrease in intakes of some micronutrients and fibre (Fung et al., 2013). Both studies cited acknowledge that there was an increase in diet quality and decrease in some intakes of lower quality foods and beverages, but that more effort needs to be made for compliance in schools and address diet quality outside of school.

A 2013 study compared the dietary intake of young children attending Nunavik child care (n=128) to children who did not attend child care (n-89) (Gagne, Blanchet, Vaissire, Lauziere, & Vezina, 2013). Researchers found that children who attended child care consumed significantly

more vegetables and fruits, grains, and milk and alternatives, and had higher intakes of a number of micronutrients. Most children who participated in the study did not meet CFG recommendations, regardless of the child care nutrition program. Authors also emphasized the importance of traditional diets in supporting proper nutrition for children in this community. As an increasingly diverse population, it is important for policy and organizations to consider culturally appropriate food options. A report by the same research group found that traditional foods significantly contributed to the nutrient contents of children's diets in the same study of children in Nunavik child care centres (Gagne et al., 2012).

Studies examining nutrition policy effects on diet and nutrient intakes of children report that nutrition policy has a positive effect; however, many children's diets continue to not meet government recommendations.

RESEARCH OBJECTIVES

This study was comprised of two main objectives.

Objective 1 (a): To compare the usual dietary intake of Nova Scotia preschoolers registered full time in licensed child care to the food group serving size and quantity recommendations of CFG, and to examine findings in the home and child care environments.

Objective 1 (b): To compare the usual dietary intake of Nova Scotia preschoolers registered full time in licensed child care to the quantifiable directional statements in CFG.

Objective 2: To examine the quality of usual dietary intake of Nova Scotia preschoolers registered full time in licensed child care with the Canadian Nutrient File/*Canada's Food Guide* Classification System, and to examine findings in the home and child care environments.

FRAMEWORKS FOR ANALYSES

Two complementary frameworks from Health Canada were applied during this study to examine the dietary data. The first framework is *Eating Well with Canada's Food Guide*, which is part of the Government of Canada's larger Healthy Eating Strategy (2016) to help create more healthful food environments for Canadians and to further promote a nutritious eating pattern. The Classification of Foods in the Canadian Nutrient File According to *Eating Well with Canada's Food Guide* is a new surveillance tool by Health Canada that categorizes and assesses adherence of the items in the diet to CFG's recommendations based on nutrient contents of foods found in the Canadian Nutrient File (Government of Canada, 2015). This second framework is the first diet and diet quality analysis tool from the Government of Canada, and this study is the first to apply this tool in dietary assessment of the Nova Scotia early childhood population.

Eating Well with Canada's Food Guide

The 2007 version of CFG is a well-established population level tool that provides evidence-based recommended eating habit information to Canadians based on age and sex (Table 1) (Health Canada, 2007). The CFG is part of the larger Healthy Eating Strategy from Health Canada (2016) that addresses the impact of the whole food environment and factors that deter or promote healthy lifestyles, including eating habits. The food guide component of the strategy provides recommendations for food, beverage, and meal preparation, as well as guidance for eating patterns that are based on four main food groups (Table 1). The four main food groups are vegetables and fruits, grains, milk and alternatives, and meat and alternatives. Outside of these categories, CFG also mentions recommendations for oils and fats, recognizing the place these items have in food preparation and meals of Canadians, and also recommends the consumption of water to satisfy

thirst. The CFG reference values indicate the quantity of food required from each food group to increase the likelihood of meeting nutrient and energy needs to support health maintenance (Katamay et al., 2007). Prior to the 2007 version, food group recommendations were not provided in CFG for children under the age of 4 years. Recent versions now include a category for children ages 2 to 3 years. The preschooler population includes children ages 3 to 5, therefore two reference ranges were used when comparing observed dietary data to CFG guidelines. Table 1 outlines the reference values for each food group that were used for diet intake comparison in this study of preschooler children.

Table 1

Eating Well with Canada's Food Guide (2007) population diet pattern recommendations

	Children			**Teens**		**Adults**			
	2-3	**4-8**	**9-13**	**14-18**		**19-50**		**51+**	
	Girls and Boys			**Female**	**Male**	**Female**	**Male**	**Female**	**Male**
Vegetables and Fruit	4	5	6	7	8	7-8	8-10	7	7
Grain Products	3	4	6	6	7	6-7	8	6	7
Milk & Alternatives	2	2	3-4	3-4	3-4	2	2	3	3
Meat & Alternatives	1	1	1-2	2	3	2	3	2	3

In addition, CFG provides directional statements to further support nutritious choices. Suggestions for the overall diet include choosing foods lower in sodium, sugars, and fats. Food group specific statements are structured to ensure food variety and increased nutrient coverage; such statements include 'consuming half of grain servings as whole grains', and 'choosing whole vegetables and fruits over juices'. Conversely, not all directional statements are quantified, leaving some CFG recommendations open to interpretation by the user. This vagueness poses a challenge to categorically determine if an individual or a population is meeting the recommendations. These

less well-defined statements include choosing leaner food options, and items lower in sodium, sugar, and fat. The CNF/CFG provides a framework to more effectively categorize foods and beverages according to CFG guidance using the nutrient contents of a serving size of these items.

The Classification of Foods in the Canadian Nutrient File According to *Eating Well with Canada's Food Guide*

In 2014, Health Canada released a population nutrition surveillance tool that quantifies the less well-defined directional statements. The Classification of Foods in the Canadian Nutrient File According to *Eating Well with Canada's Food Guide* (CNF/CFG) categorizes foods and beverages into Tiers within each food group according to fat, sodium, and sugar contents (Figure 2). By sorting items into these categories, the CNF/CFG quantifies and lends structure to the directional statements that recommend dietary choices be lower in sodium, sugar, and fat.

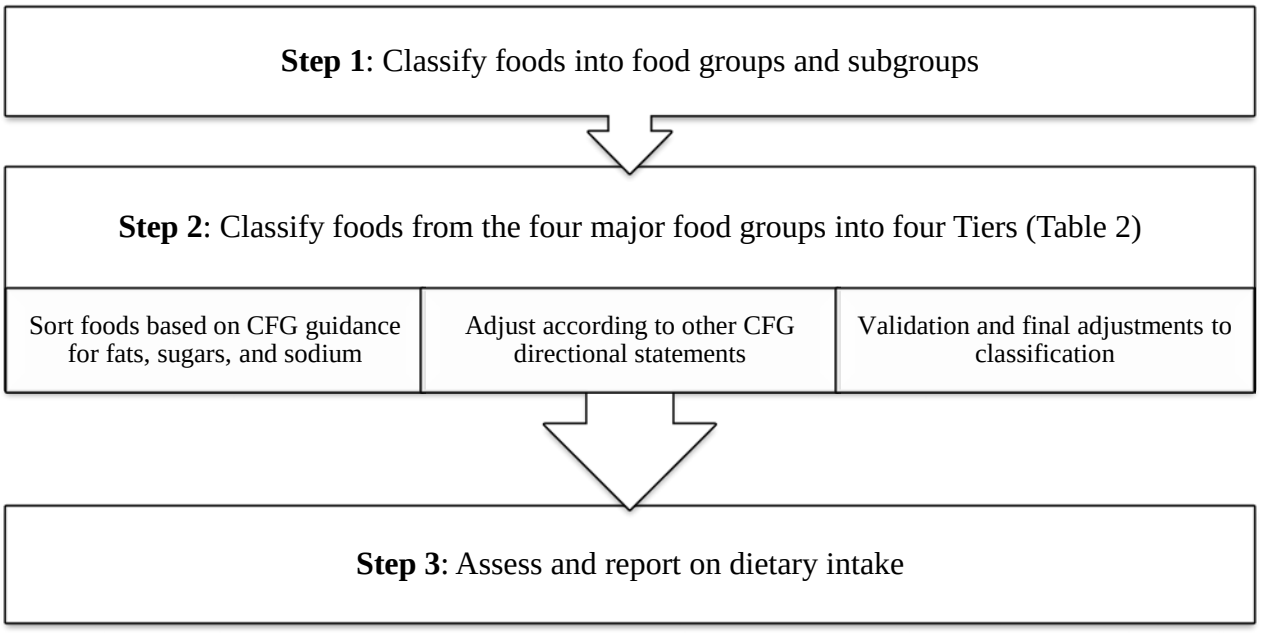

Figure 2. Categorization of foods and beverages into CNF/CFG Tiers (Health Canada, 2014).

The Tiers in this system are defined by criteria outlined in Table 2. Foods and beverages with lower amounts of fat, sugars, and sodium are found in Tiers 1 and 2, indicating that they are 'in line with CFG guidance'. Items found in Tier 3 are 'moderately in line with CFG guidance', and Tier 4 items are 'not in line with CFG guidance' (Health Canada, 2014).

In addition to this surveillance tool being a novel addition to Health Canada's population level monitoring programs, the CNF/CFG is the only tool that is framed with CFG and federal government nutrition recommendations. The significance of the CNF/CFG to this study is twofold: dietary data of preschoolers can be compared to government nutrition recommendations established in CFG, applying CFG as a benchmark for quantity and quality; and analyzing dietary data using CFG language to interpret findings makes the results of the study further relatable to the CFG-based *Standards* that govern food and beverage choices in licensed child care.

Table 2

Canadian Nutrient File/Canada's Food Guide Tier criteria

Tiers	Fats, sugars, and sodium content of foods		Thresholds
1	Foods that **do not exceed any of the three lower** thresholds for total fat, sugars and sodium		**Lower thresholds:** Total Fat: ≤ 3 g/RA** Sugars: ≤ 6 g/RA Sodium: ≤ 140mg/RA
2	Foods that **exceed one or two lower** thresholds for total fat, sugars or sodium, **without exceeding any upper** thresholds		
3	**Vegetables and Fruit and Grain Products** Foods that **exceed all three lower** thresholds **without exceeding any upper** thresholds for total fat, saturated fat, sugars or sodium **OR** Foods that **exceed only one upper** threshold for total fat, saturated fat, sugars or sodium	**Milk and Alternatives and Meat and Alternatives** Foods that **exceed all three lower** thresholds **without exceeding any upper** thresholds for total fat, sugars or sodium* **OR** Foods that **exceed only one upper threshold** for total fat, sugars or sodium* **OR** Foods that **only exceed the upper saturated fat threshold**	
4	**Vegetables and Fruit and Grain Products** Foods that **exceed at least two upper** thresholds for total fat, saturated fat, sugars or sodium	**Milk and Alternatives and Meat and Alternatives** Foods that **exceed at least two upper** thresholds for total fat, sugars or sodium*	**Upper thresholds:** Total Fat: >10 g/RA Sugars: >19 g/RA Sodium: >360 mg/RA Saturated fat: > 2 g/RA

Note. RA refers to the Reference Amount used by the Canadian Nutrient File

METHODS

Study Design

This thesis research is embedded within a larger study, the Nutrition Standards in Child Care Project (NSCCP). The NSCCP was formed in partnership with stakeholders from Mount Saint Vincent University (MSVU), Dalhousie University, and the Nova Scotia Departments of Community Services and Health and Wellness to investigate the outcomes related to the *Standards for Food and Nutrition in Regulated Child Care Settings* (The Standards) (Government of Nova Scotia, 2011). Data for this thesis study were collected as part of the quantitative phase of the NSCCP research. Study protocol for this thesis was approved by the MSVU Research Ethics Board in August 2014 (UREB# 2014-020).

A purposive sample of regulated child care centres were invited to participate in this study. Directors of the sample child care centres were contacted by the NSCCP. Upon Director approval, letters were distributed to the child care centre staff to inform them of the study and the presence of research assistants in the classrooms during the study, and invitations to participate in the NSCCP study were sent home to parents and caregivers of all preschoolers who met the study criteria. Invitation packages to the parents included background supporting the study, the parent's role in the NSCCP, informed consent forms, and a description of the incentives given to those who were able to participate. Incentives included a MSVU pen and tote bag at the start of the study, and a ballot for a draw for a $50 gift card to a local grocer. A draw for the gift card was held for each child care centre. Children were eligible to participate if they were between 3 and 5 years old and were registered full time in regulated child care in Nova Scotia.

From 2013-2014, four-day food records captured all food and beverage intake of 90 preschoolers over the course of three weekdays while in child care and one full day at home, which

was usually one weekend day. Trained research assistants observed and recorded dietary intake while participating preschoolers were in child care, and parents or guardians recorded all intake while preschoolers were outside of child care. Research assistants were undergraduate and graduate level students from the MSVU academic departments of Applied Human Nutrition and Child and Youth Studies. Each day during the study, research assistants sent the four-day food diary home with the preschooler to be completed by the parents or guardian. After all four days were recorded, the diaries were collected from the child care centre and the data was entered into software for analysis. This process is further outlined in following sections. The completed four-day food records were securely stored in a locked cabinet in the NSCCP office at MSVU. Each of these records was coded to maintain confidentiality and participant names were stored separately from the four-day food records.

NSCCP Four-Day Food and Drink Diary

All foods and beverages consumed by participating children were recorded in detail through the NSCCP Four-Day Food and Drink Diary. There are numerous dietary assessment methods available including the more commonly used food record, food frequency questionnaire (FFQ), and the 24-hour food recall. Strategically, the food diary assessment method for data collection was the most appropriate for the research objectives of this study. The assessment tool chosen is largely dependent upon the data that is required. The multiple day food diary captures variation in diet between days; details about food, beverage, and the meal time environment; items can be recorded by multiple observers at their convenience; and can report on eating patterns and the complexity of the whole diet compared to focusing on single nutrients or meals. Literature suggests that food records may more accurately report dietary intakes compared to the FFQ and

24-hour food recall, both of which have been shown to possibly overestimate or underestimate actual intake when adult proxies are involved (Baranowski, Sprague, Baranowksi, & Harrison, 1991; Wilson & Lewis, 2004)

The diary provided instructions, example diary forms, serving size approximations with diagrams and visual references to increase accuracy, and blank diary forms to record a child's 24-hour food and drink intake for the duration of the study. Observers were encouraged to include any available and applicable details about the items including brand name, cooking method, serving size versus size consumed, and whether an item was pre-packaged or prepared at home.

Dietary assessment is challenging in all populations; the early childhood group ability to independently and accurately report food and beverage intakes further adds to this challenge. Given that preschoolers are not yet able to record this information, parents or guardians completed the diary while the child was away from child care and research assistants completed the diary while the child was in child care. A parental proxy has been shown to provide accurate intakes of young children with exception to Eck, Hedman, Marcus, and Nowicka's (2014) finding that fathers under-report bread intake (-27%) and over-report fruit intake (>50%). However, in a more recent 2012 study, 3-day food records that were completed by parents to document young child dietary intakes accurately assessed energy and nutrient intake, with exception to linoleic acid ($p=0.001$) and retinol ($p=0.004$) (Eck et al, 2014). During each meal and snack time, observations about time, location, and eating environment were recorded in the allotted spaces.

Data Management, Coding, and Analyses

Data from the diaries were initially entered into Food Processor SQL (The Food Processor Nutrition Analysis Software, version 10.9, ESHA Research, Salem, Oregon) for nutrient and food

group analysis. Output was transferred to and coded in Microsoft Excel (Microsoft Office Professional, 2013) for statistical analysis. Descriptive statistics including mean, median, standard deviation, and percentages were calculated to determine the number of preschoolers meeting and adhering to CFG food group recommendations. Health Canada's surveillance tool, the CNF/CFG classification, was used to determine adherence to and diet quality of preschoolers' usual dietary intake. All food and beverage entries from the participant's food records were coded into Microsoft Excel by determining the number of servings of a food group consumed and this serving amount was placed in a tier category of the CNF/CFG. For example, one serving of a vegetable or fruit is one apple. If a participant consumed half an apple, they have consumed 0.5 CFG servings of a vegetable or fruit food group serving. Since the apple is a fresh, whole apple with no sugar, fat, or sodium added, it is 0.5 servings of a Tier 1 fruit (Table 3). Tables 3 to 6 show the codes used within the four main food groups, as well as examples for foods that are placed in each category. The CNF/CFG considers foods and beverages that are not within the four main food groups of CFG; tables outlining these codes and examples of items categorized outside of the four main food groups are found in Appendix A. These foods, including dried spices, candies, and soda, do not have serving size and serving number recommendations in CFG; in these instances, the Reference Amounts (RA) from Health Canada were used as serving size standards (Canadian Food Inspection Agency, 2016). The RAs, established by Health Canada, are serving size estimates that could be consumed by an individual in one meal and serve as the basis for establishing criteria for nutrient content analyses and health claims in the food industry (Canadian Food Inspection Agency, 2016).

Table 3

Vegetables and fruits: Examples of food groups and Tier codes

Food Group	Tier Code	Example Item
Fruit, whole	1121	Apple; fruit cocktail, water or juice packed; fruit sauce, unsweetened
	1122	Apple, fried; fruit sauce, sweetened; cranberries, dried, sweetened
	1123	Avocado, raw; canned fruit, heavy syrup
	1124	Plantain, fried; banana chips
Fruit Juice	1132	Apple juice, no vitamin C added; orange or grapefruit juice
	1133	Fruit juice, sugar added
Vegetables, Dark green	1211	Beans, snap, green/yellow; peas; peppers; raw or frozen
	1212	Beans, canned with liquid; peas, frozen, boiled with salt
	1213	Spinach, canned, solids and liquids
Vegetables, Orange	1221	Sweet potato; carrots; squash, winter, all varieties; raw or frozen
	1222	Carrots, canned, solids and liquids
	1223	Sweet potato, fried
Vegetables, Potatoes	1231	Potato, raw/boiled/baked
	1232	Potato, canned, liquid drained; potato, mashed with milk only
	1233	Potato, french-fry style, baked/fried in oil; potato, mashed with 2% milk
	1234	Potato, mashed, milk and butter; potato chips, light/plain/flavoured
Vegetables, Not otherwise specified	1241	Corn, on/off cob; onions; tomato, raw; tomato, sauce, low sodium
	1242	Corn, canned; tomato, canned, salt added
	1243	Corn, canned, cream-style; vegetable soup, canned
	1244	Onion rings, breaded, fried; tomato, fried
Vegetable Juice	1252	Vegetable juice, without salt added
	1253	Vegetable juice cocktail, canned, salt added

Table 4

Grains: Examples of food groups and Tier codes

Food Category	Tier Code	Example Item
Grains, Whole	2101	Cereal, oats/Shredded Wheat; popcorn, air-popped; rice, brown
	2102	Cheerios, multigrain; bread, whole wheat; rice cake, plain
	2103	Cocoa Puffs; Cheerios, frosted; pancakes, whole wheat
	2104	Popcorn, oil-popped; Quaker apples & cinnamon cereal
Grains, White, Enriched	2201	Pasta, white, enriched; English muffin
	2202	Corn Flakes; bread, white, commercial; cracker, low-sodium
	2203	Fruit Loops; animal crackers; cracker, soda (Premium Plus)
	2204	Timbit; chocolate chip cookie, commercial; pastries
Grains, White, Unenriched	2302	Cornstarch; rice flour; egg noodles; pasta, unenriched
	2303	Taco shell; Rice Krispies Square; granola bar, commercial
	2304	Snacks, corn-based, puffs/twists/chips; Doritos

Table 5

Milk and alternatives: Examples of food groups and Tier codes

Food Group	Tier Code	Example Item
Milks, Fluid	3101	Milk, skim or 1%; evaporated milk
	3102	Milk, 2%; soy milk, enriched;
	3103	Milk, whole; milk, chocolate; soy milk, unenriched; hot chocolate
	3104	Milkshake, homemade or fountain; condensed milk, sweetened
Milks, Non-Fluid Dairy	3201	Cottage cheese, dry; cheese, low fat, 0.5% MF
	3202	Yogurt, plain, <2% fat; pudding made with 2% milk
	3203	Most cow's milk cheeses; yogurt, plain 2-4% fruit bottom 0-4% MF; ice cream; soy cheese
	3204	Processed cheese; yogurt, fruit bottom, >4% MF; cream soup, canned

Table 6

Meat and alternatives: Examples of food groups and Tier codes

Food Group	Tier Code	Example Item
Beef, game, and organ meats	4101	Bison, roasted; snail; moose meat
	4102	Sirloin steak, 0” trim; goat, stewed; poultry organ meats
	4103	Ground beef, lean or medium; beef short rib; game sausage
	4104	Pate, any meat; beef, salted; breaded and fried meats
Other meats (pork, veal, lamb)	4201	Veal cutlet, raw or pan-fried
	4202	Pork tenderloin, lean; veal, lean; goat, fried
	4203	Pork rib, butt, shoulder, chop; lamb, rib, shank, leg
	4204	Pork chop, breaded and fried
Poultry	4301	Turkey or chicken, white meat, roasted or stewed
	4302	Turkey, with skin, roasted; chicken thigh, roasted
	4303	Chicken nuggets; chicken wings, fried, with or without batter
	4304	Chicken patty, battered, fried
Fish	4401	Atlantic salmon, cod, halibut, tuna, raw/baked/broiled
	4402	Tuna, canned in water, salt added; haddock, battered, fried
	4403	Smoked fish, dried; fish cakes, frozen, fried
	4404	Fish sticks, breaded, fried; oysters, battered, fried
Legumes	4501	Beans, red/black/white; hummus, homemade; lentils; tofu; chickpeas
	4502	Hummus, commercial; fermented soy; soy yogurt, all flavours
	4503	Peanut butter; Wow Butter; beans, canned, solids and liquids;
	4504	Baked beans, canned, vegetarian or with pork
Nuts and seeds	4601	Pumpkin seeds, raw
	4602	Almonds, blanched or unblanched; almond butter; flaxseeds;
	4603	Almonds, oil roasted; coconut meat; mixed nuts; sunflower seeds
	4604	Sunflower seeds, oil roasted, salt added
Eggs	4701	Chicken egg, whole, fresh, raw

	4702	Egg, whole, hard boiled/poached/pickled
	4703	Egg, fried/scrambled with whole milk and margarine
Processed meats	4802	Sausage, pork and beef, low fat, low sodium
	4803	Deli meat, ham, extra lean/regular; kielbasa; low fat wiener
	4804	Salami, dry/hard; bologna, beef/pork; canned meat
Shellfish	4901	Oyster; shrimp, canned; clam
	4902	Shrimp, boiled/steamed; crab, canned, drained
	4903	Crab, boiled/steamed; lobster, boiled/steamed; scallop
	4904	Scallops, breaded and fried; shrimp, battered and fried

Ethical Considerations

Data for this thesis study were collected as part of the quantitative phase of the NSCCP research. Study protocol for this thesis was approved by the MSVU Research Ethics Board in August 2014 (UREB# 2014-020). Informed consent was confirmed with directors of each child care facility and parents or caregivers of participating preschoolers. Assent for the preschooler to participate was obtained from the parents on behalf of the participating children who were 3 to 5 years old and, therefore, too young to provide consent.

The direct collection of information in this study required the dedicated involvement of research assistants. Each research assistant received orientation and training for data collection in child care centres. Training included briefing research assistants on the child care environment, sensitivity and professionalism when interacting with child care centre staff, families, and children. NSCCP protocol required that all research assistants sign non-disclosure agreements and obtain a criminal record check, vulnerable sectors check, and a Child Abuse Registry check.

Food records were kept confidential by using numerical codes and removing participant names from the records. All data, hard copies and electronic copies, were securely and separately stored from participant information. Hard copies of the 4-day food record were securely stored in the locked NSCCP office at MSVU with limited access to designated NSCCP team members. Electronic versions of the data were securely stored on password-protected USB drives also with limited access. For the purposes of this thesis project, coded data were stored on a designated password-protected NSCCP USB drive for data analysis.

Results

Summary of Participants

The participating preschoolers were registered full time in licensed child care during weekdays and were selected from a purposive sample of child care centres from the HRM and five child care centres throughout Nova Scotia outside of the HRM. The non-HRM communities included Cape Breton, South Shore, and the Annapolis Valley. Ninety-one children ages 3 to 5 years old from 13 child care centres participated in this study from 2013 to 2014. Eight children were excluded when dietary intake data was incomplete at child care or at home, one child was not enrolled full time in child care, and three children withdrew because the parents were unable to complete the food record. Therefore, completed records were analyzed from 79 preschoolers, including 46 3 year olds and 33 4 and 5 year olds. The 3 year old group was composed of 21 males and 25 females; the 4 and 5 year old group had 19 males and 14 females (Table 7). This overall group included those with completed food records for two, three, or four days. Table 7 summarizes demographic characteristics of the study participants.

Further, those who completed two to three of the three possible days of food records while at child care were analyzed for child care environment days. The home group included those children who had completed one full weekend day food record. In circumstances where two weekend days were provided, only the first full day was analyzed and the second day was disregarded.

Paired t-tests were conducted with 58 participant preschoolers who had complete dietary data in both meal time environments to compare dietary intakes on days when children were at home to days when children were in child care. Results were stratified by age group according to

CFG age categories and by meal environment to compare diets on days when children were at home to days that included full time child care.

Table 7

Summary of participant characteristics

Characteristic	Number of Children Included in Analysis
Age	
3 years	46
4 & 5 years	33
Environment	
Child care	
All	60
Preschoolers	
3 YO	36
4 & 5 YO	24
Home	
All	77
Preschoolers	
3 YO	46
4 & 5 YO	31

Note. Participants must have complete data to be considered for analysis.

Dietary Intake Analysis by CFG Food Group and Quantifiable Directional Statements

Table 8 summarizes the percentages of children meeting CFG food group recommendations during the overall study, by age, and by meal environment. Children were considered to have met a food group quantity recommendation if their daily mean intake was 0.5 servings below the recommended number of servings or higher. For example, if a child consumed 1.5 servings of milk and alternatives, they would be considered as having met the recommended 2 daily servings for this food group.

There is considerable variability in the number of children meeting CFG recommendations by food group, by age group, and by food environment. Of note, only slightly more than half (56%) of all children met the CFG recommendations for vegetables and fruits. When the age groups are considered, 61% of 3 year olds and half that number (30%) of 4 and 5 year olds met recommendations for the vegetables and fruits food group. The lower numbers of 4 and 5 year old children meeting vegetable and fruit intakes is similar on days when at home compared to days in child care, indicating that this is a recurring trend in both food environments. The percentage of children meeting food group recommendations and mean food group intakes is reported in subsequent corresponding sections.

Table 8

CFG food group recommendations overall, by age, and by eating environment (%)

Characteristic	n	Vegetables & Fruits	Grains	Milk & Alternatives	Meat & Alternatives
Overall	79	55.7	82.3	65.8	74.7
Age					
3 years	46	60.9	73.9	67.4	76.1
4&5 years	33	30.3	66.7	63.6	72.7
Child Care					
3 years	36	61.1	77.8	66.7	75.0
4&5 years	24	26.1	83.3	70.8	70.8
Home					
3 years	46	54.4	65.2	50.0	71.7
4&5 years	31	29.0	48.4	51.6	80.7

Note. n refers to the number of participants with complete data for this variable; not all participants had complete food diaries for each food environment.

Daily dietary intakes show that, based on group means, children are meeting or are close to meeting the CFG food group serving number recommendations, except for vegetables and fruits for 4 and 5 year olds (M = 4.37, SD = 1.82) (Table 2). In subsequent sections, results are reported as group daily means, but also as percentages of children meeting CFG recommendations to provide a more accurate picture of usual eating habits. Results are further reported according to food group.

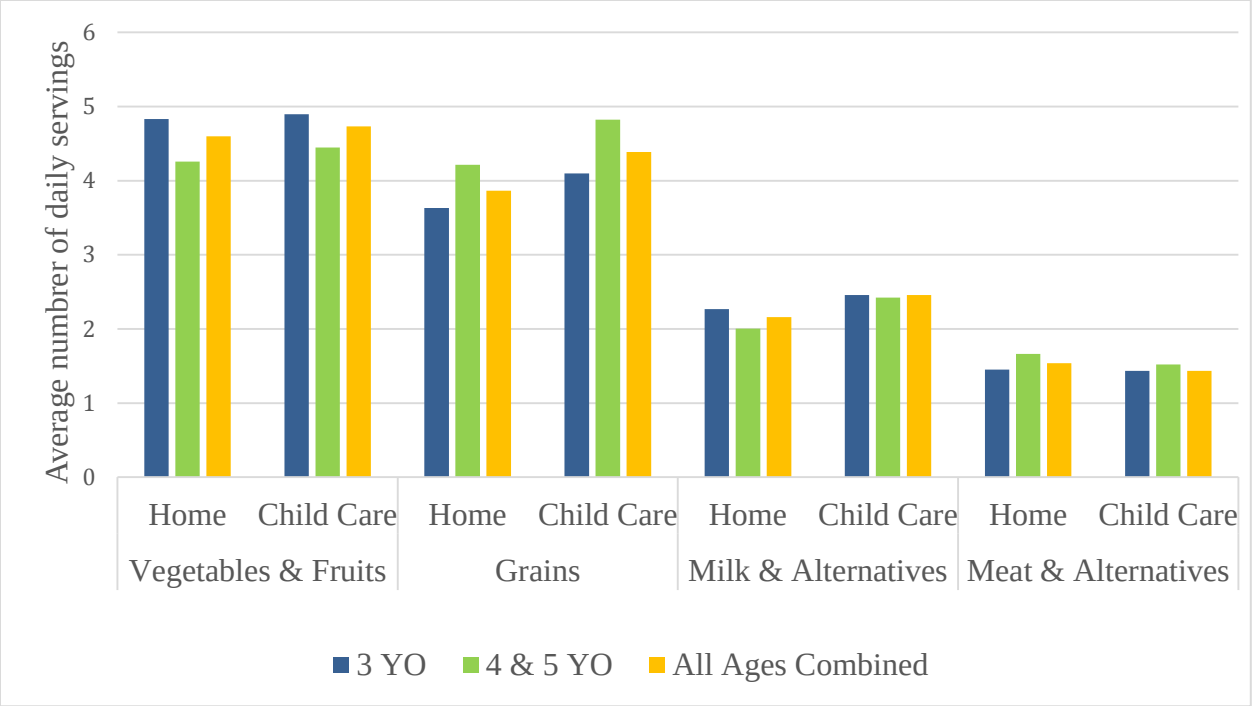

Figure 3. Mean daily intakes of CFG food groups overall, by age, and by environment

Dietary Intake Analysis with the Canadian Nutrient File-*Canada's Food Guide* Classification System

Dietary intake data for the children were examined using the CNF/CFG Classification System (CNF/CFG). This tool further investigates the types of foods consumed in the diet with particular attention to the quality of foods that can be categorized within the four main CFG food groups. Health Canada has four Tiers that categorize foods according to the amounts of sugar, sodium, and fat in the food or beverage. As food and beverages have increased contents of sugar, sodium and/or fat, they are placed in Tiers 3 or 4. Items in Tiers 1 and 2 are 'in line with CFG guidance'; items in Tier 3 are 'moderately in line with CFG guidance'; and items in Tier 4 are 'not in line with CFG guidance'. Descriptive statistics were used to report on the number of servings consumed in each Tier for each food group, and paired t-tests were applied to detect significant differences in mean daily intakes of Tiers in the home food environment compared to intakes on days including attendance at child care centres. Overall, a substantial amount of children's diets are sourced from Tiers 1 and 2, particularly in the vegetables and fruits food group. Items consumed from Tiers 3 and 4 progressively increases with each food group. Higher amounts of Tiers 2, 3, and 4 are consumed in the grains, milk and alternatives, and meat and alternatives food groups. This trend reflects the amounts of sugar, sodium, and fats found in items belonging to these food groups. Further results on the food and overall diet quality are reported in corresponding food group sections.

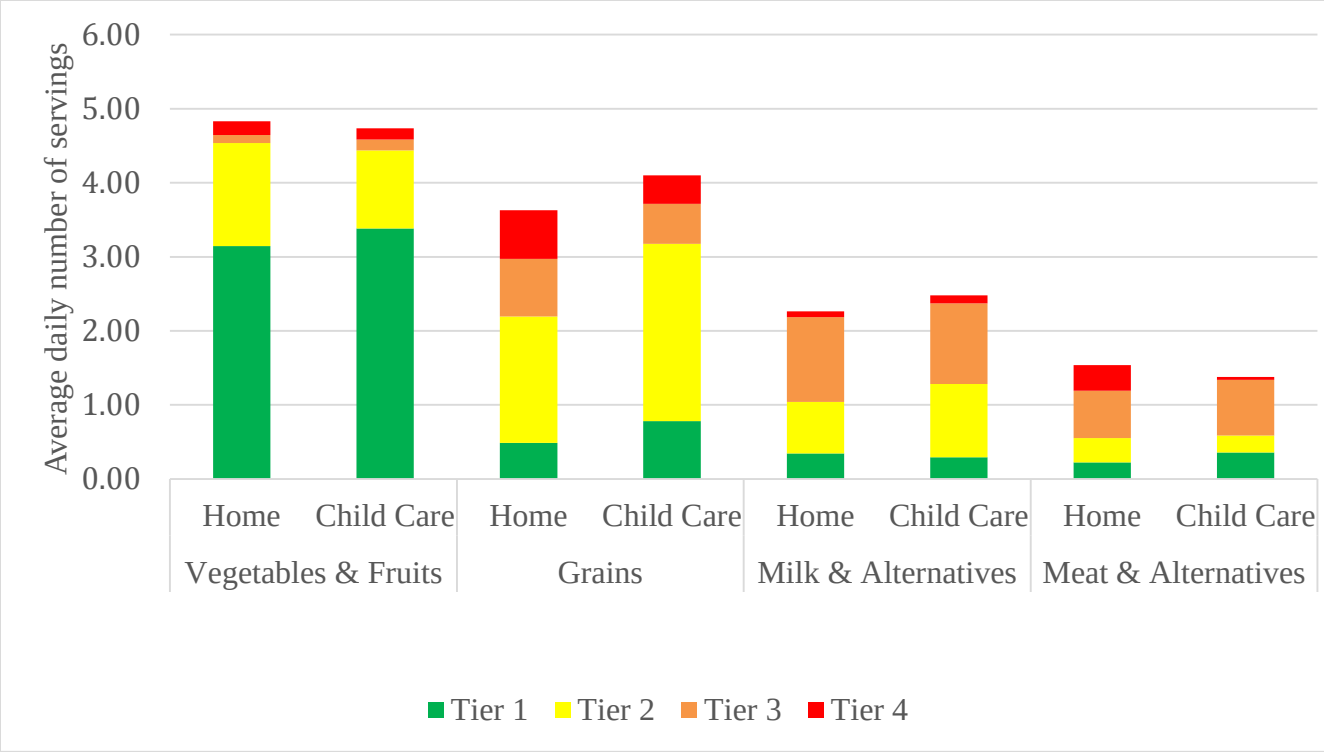

Figure 4. Mean daily food group intakes by Tier and environment for 3 YO.

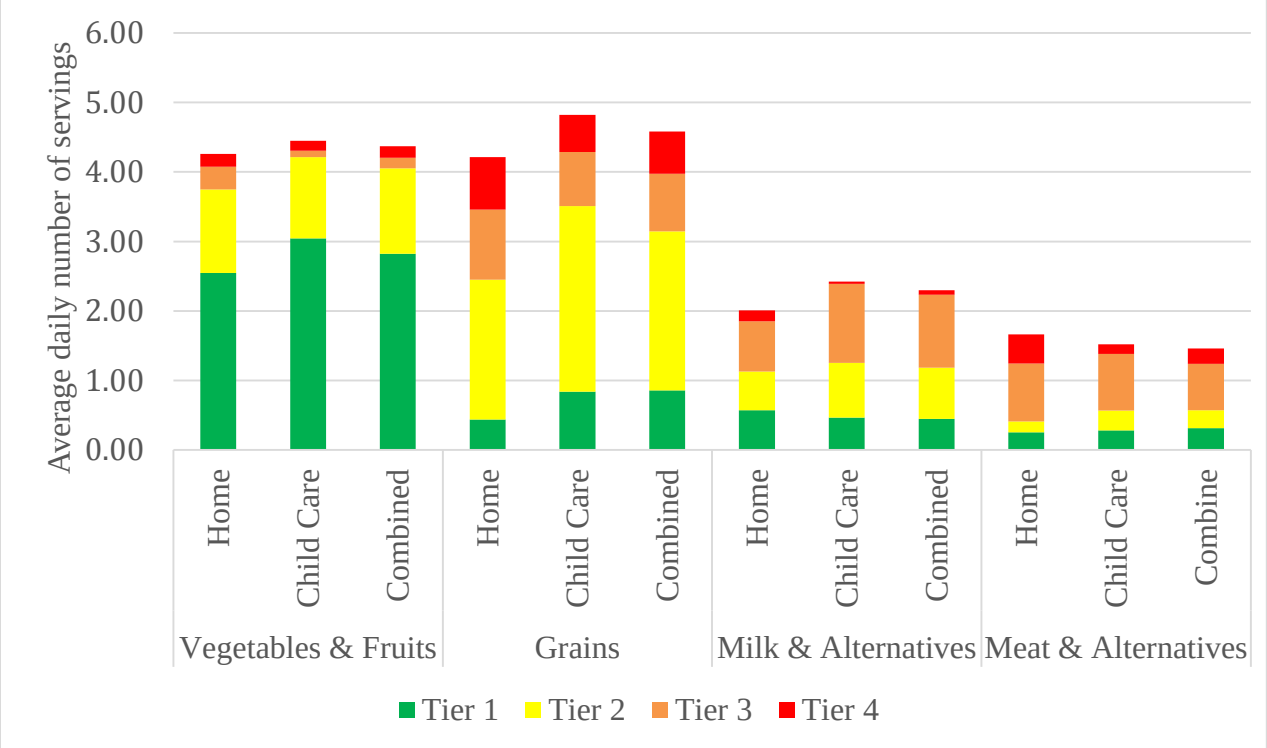

Figure 5. Mean daily food group intakes by Tier and environment for 4 & 5 YO

Vegetables and Fruits

Eating Well with Canada's Food Guide recommends 4 servings of vegetables and fruits for 3 year olds and 5 servings for 4 and 5 year olds. Generally, one serving of this food group equals one piece of whole fruit, one cup of leafy raw vegetables, one half cup of fresh or frozen 100% fruit or vegetable juice (Health Canada, 2007). Table 9 summarizes the descriptive statistics for the mean daily intakes of vegetables and fruits servings. The mean daily intake for all preschoolers (n=79) was 4.7 (*SD* = 1.7) servings of vegetables and fruits per day with a substantial range of 0.6 servings to 13.7 servings. Mean intakes for 3 year olds indicated that the group was meeting the recommended 4 servings (*M* = 4.6, *SD* = 2.2), whereas 4 and 5 year olds had a mean intake slightly below the CFG recommendation of 5 servings (*M* = 4.1, *SD* = 2.3). As noted from Table 8 though, the intakes of participating children varied, with 44% of children not meeting the recommendations for their age group. There was a notable difference between age groups for vegetable and fruit intakes, with considerably fewer 4 and 5 year old children meeting CFG recommendations (30%) compared to 3 year olds (61%). The ranges shown in Table 9 highlight the variability in the mean number of servings children consumed per day.

Vegetable and fruit directional statements. The vegetable and fruits food group has directional statements to ensure a variety of foods are consumed to better meet micronutrient requirements without excessive intakes of sugar, sodium, and fat. The first statement recommends to choose at least one dark leafy green vegetable and one orange vegetable each day (Health Canada, 2007). Mean intakes of these types of vegetables were low for the preschooler group. The mean daily intake of green vegetables for the children was 0.2 servings, as well as for each age group and in each meal time environment. The mean daily intake for orange vegetables was 0.3 servings for all preschoolers and for each age group. The intakes were similar on days when

the children were at home (*M*=0.2) compared to days that included full time child care (*M*=0.3). The largest mean intake was found in the 4 and 5 year old group at 0.4 servings per day on days that included full time child care. The largest variation between mean intakes of orange vegetables was a difference of 0.2 servings; therefore, mean daily intakes of orange vegetables was consistent when age group and meal time environment were considered.

Much of the usual intakes in this food group were sourced from fruit and fruit juice than vegetables for both age groups. For the 3 YO group, fruit juice composed 20% of vegetable and fruit servings, ranging from 0 to 73% of servings consumed. When all fruit and fruit juice are combined, 3 YO preschoolers consumed 65% of their servings from fruit and fruit juice. Mean individual intakes of fruit and fruit juice ranged from 23% to 100% of total vegetable and fruit food group intakes. Results for the 4 and 5 YO group show similar mean intakes of fruit and fruit juice. Mean fruit juice intake was 21% of total vegetable and fruit servings, ranging from 0 to 62% of servings consumed in this food group. Combined fruit and fruit juice intakes indicated a mean intake of 64% with individual mean intakes ranging from 32% to 96% of servings.

Vegetable and fruit intake by meal environment. Results were stratified to examine the preschooler average vegetable and fruit intakes based on days that included when the child was in full time child care and days spent at home. Paired t-tests were used to determine that there was no significant difference between mean total intakes of vegetables and fruits for this preschooler group when analyzing intakes by food environment. Overall, intakes were similar on days when children were at regulated child care compared to the days when they were only at home, $t(57) = 1.09$, $p=0.28$.

Table 9

Vegetable and fruits CFG food group servings: Daily mean intake overall, by age, and by environment

Characteristic		Mean	Range		
	n	*M* (*SD*)	Minimum	Median	Maximum
Overall	79	4.68 (1.74)	2.01	4.51	11.32
Age					
3 years	46	4.93 (1.73)	2.58	4.68	9.86
4&5 years	33	4.37 (1.82)	2.01	3.92	11.32
Child Care					
3 years	36	4.9 (1.9)	2.3	4.6	11.4
4&5 years	22	4.4 (2.5)	1.7	4.0	13.7
Home					
3 years	36	4.5 (2.5)	0.6	4.1	11.0
4&5 years	22	4.1 (2.1)	0.9	4.0	8.6

Note. 'Overall' is data from participants who completed food records both at home and while in child care. Not all participants completed both environments, hence why not all n have the same number of participants.

Vegetable and fruit intake by Tier. In the CNF/CFG classification system, the vegetables and fruits are separated and divided into different categories to yield a detailed picture of population intakes of this food group by the type of vegetable and fruit, as well as by quality within each category. The categories within this food group are as follows: fruits, whole; fruit juices; dark green vegetables; orange vegetables; potatoes; other vegetables; and vegetable juices (Health Canada, 2014). Based on group daily average consumption, most servings were found in Tiers 1 and 2, indicating that most of the vegetables and fruits consumed by preschoolers were 'in line with CFG guidance'. Fewer servings were being sourced from Tiers 3 and 4. These lower Tiers included foods and beverages such as sweetened fruits sauces, fried vegetables, and sweetened juices. Table 3 illustrates the types of foods and beverages that can be found in each Tier of the vegetable and fruits food group. On average, 3 year olds sourced 3.4 (70%) servings from Tier 1, 1.2 (26%) servings from Tier 2, 0.2 (4%) servings from Tier 3, and 0.2 (4%) servings from Tier 4 vegetables and fruits (Table 10). This distribution is similar on days when the child is at home and

days when he or she is in child care (Table 10). The 4 and 5 year old group consumed approximately 0.5 servings less than their younger counterparts (*M*=4.37). The Tier distribution of vegetable and fruit intake was similar in this age group. Mean intakes of vegetables and fruits were 2.8 (65%) servings from Tier 1, 1.2 (28%) servings from Tier 2, 0.2 (3%) from Tier 3, and 0.2 (3%) from Tier 4. The majority of vegetables and fruits sourced from Tiers 1 and 2 indicate that young children are consuming options in line with CFG that contain lower sugar, salt, and fat. Figures 5 and 6 illustrate that both age groups consumed more fruits and fruit juices than vegetables and vegetable juices.

Table 10

Vegetable and fruits CNF/CFG Tier servings: Daily mean intake overall, by age, and by environment

Characteristic			Tier			
	n	Total	1	2	3	4
Overall	79	4.68	3.14	1.22	0.15	0.18
Age						
3 years	46	4.93	3.37	1.22	0.15	0.18
4&5 years	33	4.37	2.82	1.23	0.15	0.17
Child Care						
3 years	36	4.90	3.57	0.99	0.18	0.16
4&5 years	24	4.45	3.05	1.17	0.09	0.14
Home						
3 years	46	4.83	3.15	1.39	0.11	0.19
4&5 years	31	4.26	2.55	1.20	0.32	0.18

Note. 'Overall' is data from participants who completed food records both at home and while in child care. Not all participants completed both environments, hence why not all n have the same number of participants.

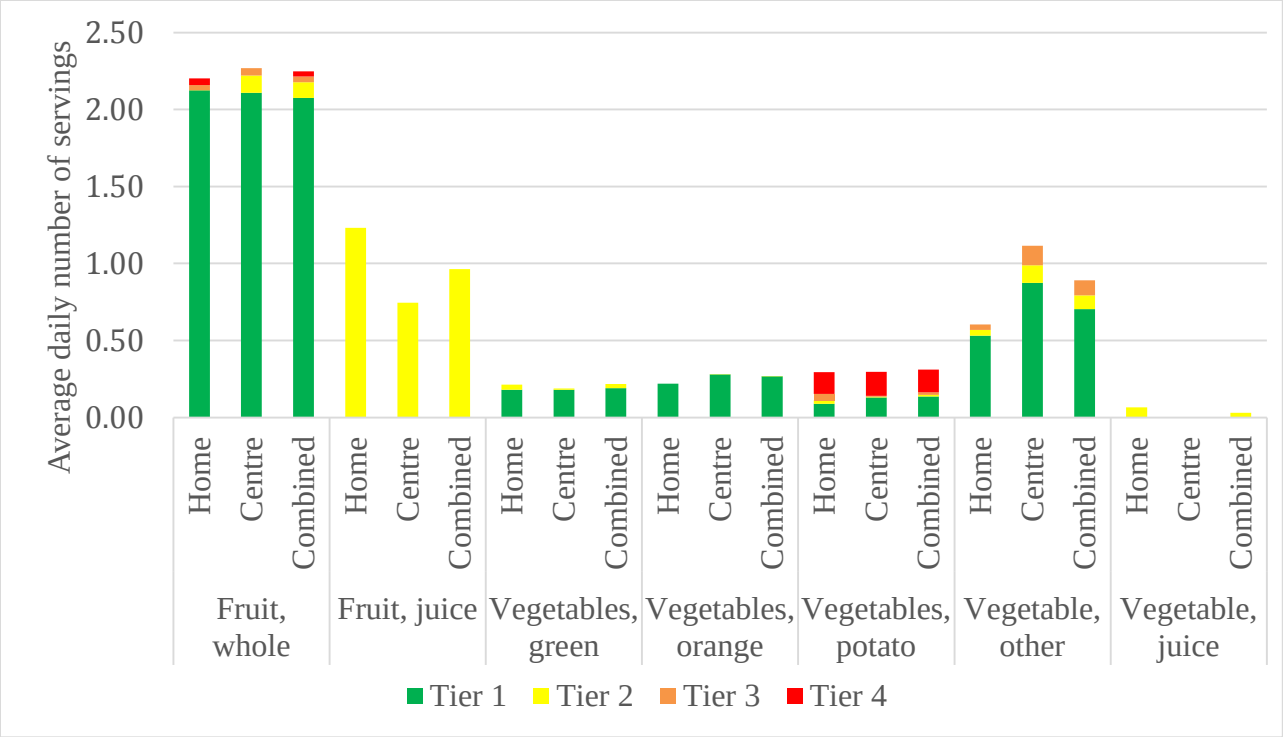

Figure 6. Mean daily vegetable and fruit intakes by Tier and environment for 3 YO

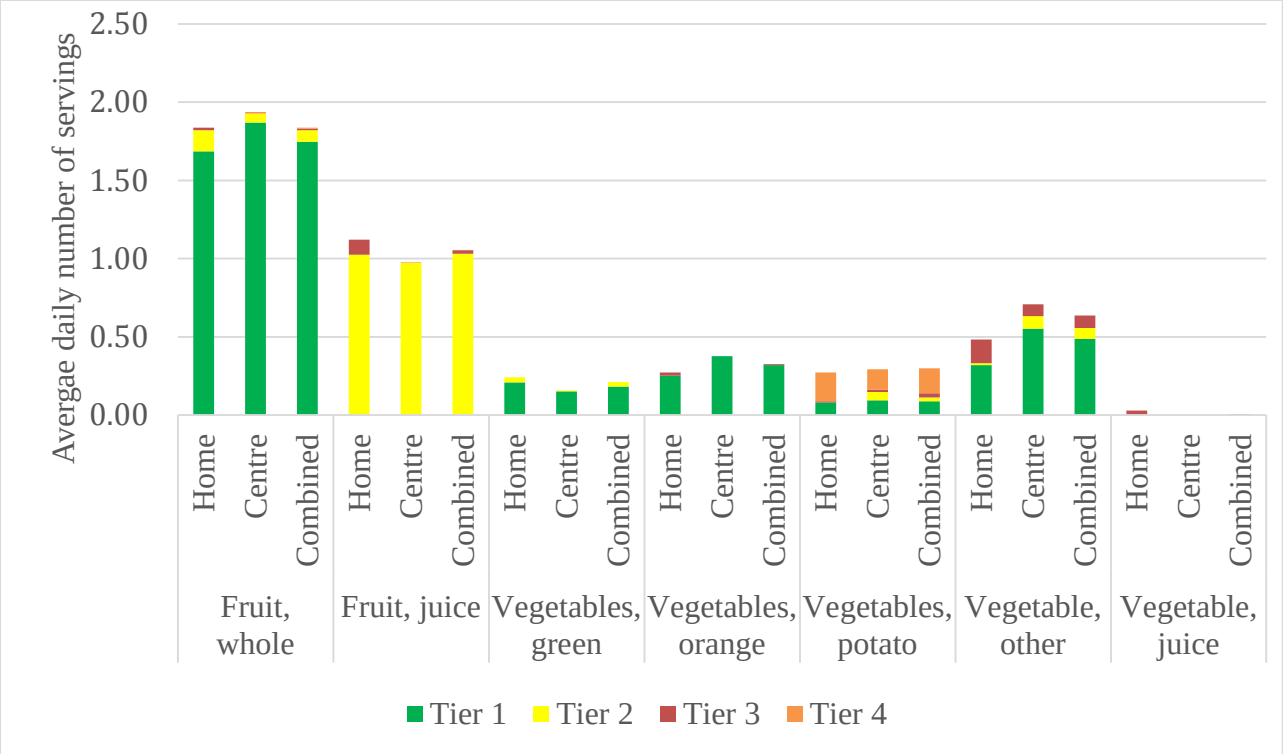

Figure 7. Mean daily vegetable and fruit intakes by Tier and environment for 4 & 5 YO

Grains

One serving of grains equals one slice of bread, one half bagel, 30 grams of cold cereal, which is often three quarter cups, one half cup of cooked pasta, or one half cup of cooked rice (Health Canada, 2007). This group of children consumed a mean of 4.2 (*SD* = 1.3) servings of grains per day, ranging from 1.9 to 8.7 mean servings daily (Table 11). During the study, 82% of children met grain recommendations for their age group (Table 8). Mean daily intakes for each age group met CFG recommendations of three servings for 3 year olds (*M* = 3.9, *SD* = 1.1) and four servings for 4 and 5 year olds (*M* = 4.6, *SD* = 1.4) (Table 4). During the study, 74% of 3 year olds and 67% of 4 and 5 year olds met their respective CFG recommendations.

Grain intakes by directional statement. Directional statements for this food group include sourcing half of grains from whole grain sources, enjoying a variety of sources, and choosing options lower in sugar, salt, and fats (Health Canada, 2007). Three year olds who consumed 1.5 or more servings of whole grains met this recommendation; 4 and 5 year olds who consumed 2 or more servings of whole grains met this recommendation. As summarized in table 10, the mean intake for 3 year olds was 3.9 servings (n=46), 4.1 servings for days while in child care, and 3.6 servings during a full day at home (Table 11). The 4 and 5 year old group had a mean daily intake of 4.6 servings for all days at home and in child care combined, 4.8 servings on child care days, and 4.2 servings during a full day at home (Table 12). For each age group, the majority of grain servings were sourced from enriched sources, whether white or whole grain, and less than half of mean servings were sourced from unenriched sources.

Grain intakes by meal environment. Table 8 outlines the percentage of children who met daily grain serving recommendations stratified by meal time environment. In the 3 year old group, 65% of children met the grain intake recommendation on days when at home (*M*=3.6, *SD*=1.4)

compared to 78% on days that included full time in child care (*M*=4.1, *SD*=1.3) (Table 11). The older preschooler group had a larger difference between the meal environments. On days spent at home, 49% of 4 and 5 year olds mean grain intakes met the four recommended daily servings (*M*=4.2, *SD*=2.2), and upwards of 83% of children met the same recommendation on days that included full time child care (*M*=4.8, *SD*=1.1).

Paired sample t-tests were conducted to determine if there was a difference between mean intakes of grains between the two meal time environments for when children were at home, or alternatively, on days when the child was not in child care, and on days when children were in child care full time. Statistically significant differences were detected for the overall grain intakes of all preschoolers included in this analysis, $t(57)=3.25$, $p=0.002$, as well as in the 3 year old group, $t(35)=2.05$, $p=0.048$, and in the 4 and 5 year old group $t(21)=2.56$, $p=0.018$. These results suggest that for each age group, fewer servings of grains are consumed by preschoolers on days when at home compared to days that include full time child care.

Table 11

Grain CFG food group servings: Daily mean intake overall, by age, and by environment

Characteristic		Mean	Range		
	n	*M* (*SD*)	Minimum	Median	Maximum
Overall	79	4.20 (1.27)	1.94	4.12	8.68
Age					
3 years	46	3.92 (1.14)	2.11	3.79	6.34
4&5 years	33	4.58 (1.35)	1.94	4.28	8.68
Child Care					
3 years	36	4.10 (1.31)	1.26	3.73	6.45
4&5 years	22	4.82 (1.05)	3.11	4.86	8.08
Home					
3 years	36	3.63 (1.35)	1.94	3.44	8.68
4&5 years	22	4.21 (2.20)	1.94	3.98	8.68

Note. 'Overall' is data from participants who completed food records both at home and while in child care. Not all participants completed both environments, hence why not all n have the same number of participants.

Grain intakes by Tier. The CNF/CFG classification system separates grain products into three categories: whole grain, enriched white, and unenriched white (Health Canada, 2014). Table 4 illustrates the types of foods found in each category and the Tiers within each category. Figures 7 and 8 show the distribution of grain intakes by Tier consumed in each meal environment. Fewer servings of grains were being sourced from Tier 1 (18%) with most servings of grains being sourced from Tier 2 grains (52%), and an increase in servings from Tiers 3 (17%) and 4 (13%) (Table 12). Although most of the grains being consumed were 'in line with CFG guidance', the average consumption indicates that over 1 serving was from Tiers 3 and 4 for each age group. This distribution pattern was similar when results were stratified by CFG age group. The intakes from Tiers 3 and 4 appeared slightly lower while at child care than at home for both age groups. Since grain intakes were mostly Tiers 1 and 2, preschooler's grain servings are mostly 'in line with CFG

recommendations' and generally are nutritious sources such as whole grains that are lower in sugar, sodium, and fats.

Table 12

Grains CNF/CFG Tier servings: Daily mean intake overall, by age, and by environment

Characteristic			Tier			
	n	Total	1	2	3	4
Overall	79	4.20	0.75	2.18	0.71	0.56
Age						
3 years	46	3.92	0.67	2.10	0.63	0.53
4&5 years	33	4.58	0.86	2.29	0.83	0.61
Child Care						
3 years	36	4.10	0.78	2.39	0.54	0.39
4&5 years	24	4.82	0.84	2.67	0.78	0.53
Home						
3 years	46	3.63	0.49	1.70	0.78	0.66
4&5 years	31	4.21	0.44	2.01	1.01	0.76

Note. 'Overall' is data from participants who completed food records both at home and while in child care. Not all participants completed both environments, hence why not all n have the same number of participants.

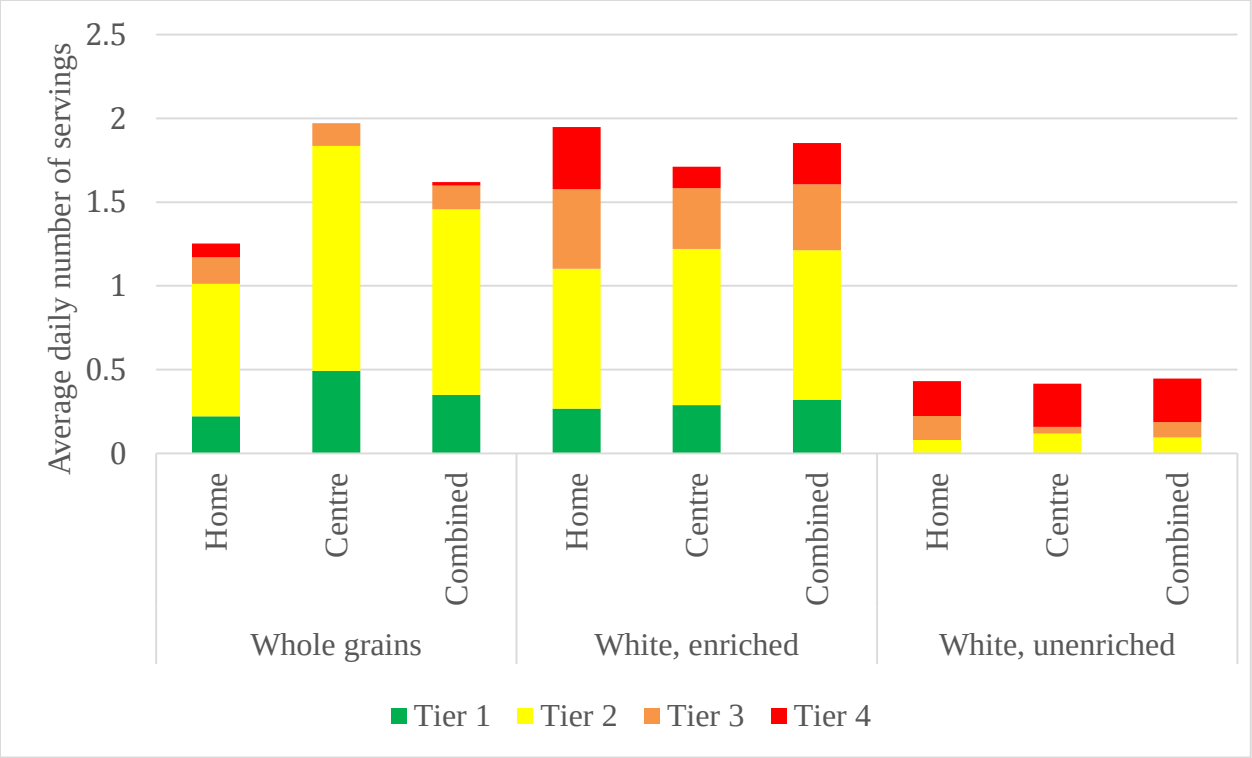

Figure 8. Mean daily grain intakes by Tier and environment for 3 YO

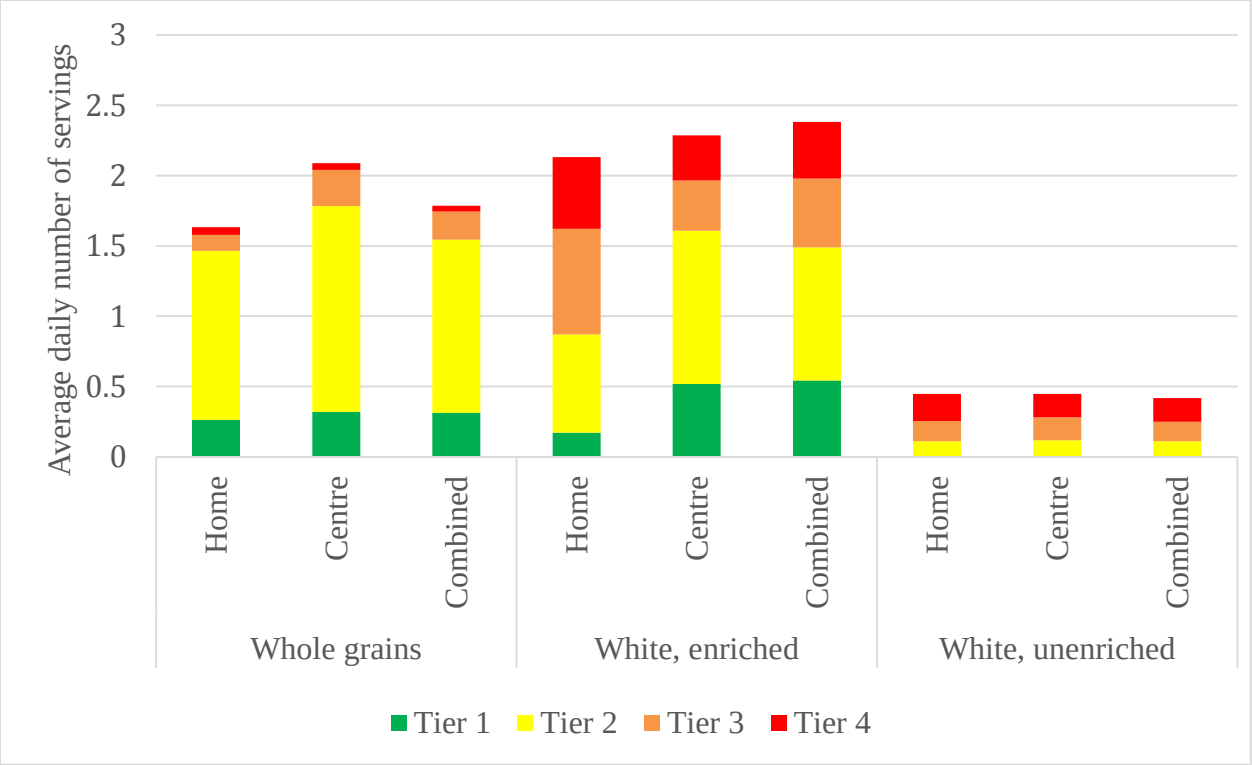

Figure 9. Mean daily grain intakes by Tier and environment for 4 & 5 YO

Milk and Alternatives

Eating Well with Canada's Food Guide recommends two milk and alternatives servings daily for both age groups and the mean intakes were higher than this recommendation. One serving equals one cup of fluid milk or fortified soy beverage, one and a half ounces of cheese, or three-quarter cups of yogurt (Health Canada, 2007). Assessment of individual mean intakes shows that one third of children did not meet the recommended two servings (Table 8). The mean number of daily milk and alternatives servings was similar for both age groups; 3 year olds consumed an average of 2.4 (*SD* = 0.9) servings per day and 4 and 5 year olds consumed an average of 2.3 (*SD* = 0.8) servings per day (Table 13).

Milk and alternatives intakes by directional statements. The CFG directional statements for the milk and alternatives group are not quantified and give vague guidelines including to drink fluid milks and fortified soy alternatives that contain 2% or less milk fat every day, and to select lower fat milk alternatives such as lower fat yogurts, reduced fat cheeses, and to limit higher fat foods in this food group. For young children, moderate fat intake is recommended due to nutrient and energy needs during growth. To how many servings of milk and alternatives were consumed that were 2% milk fat or lower, the number of servings sourced that met this directional statement was calculated. The total mean intake of all dairy for this early childhood group was 2.4 daily servings. Approximately 1.2 servings, or just over half of milk and alternatives servings, were sourced from products containing 2% milk fat or less. Eighty percent of products that were 2% milk fat or less were fluid milks compared to less that 20% being from low fat non-fluid dairy such as yogurt and cheeses. Each age group had similar mean lower fat milk and alternatives intakes of 1.2 daily servings of 2% milk fat or lower, indicating that approximately half of all foods consumed from this food group were lower in fat.

Milk and alternatives intakes by meal environment. Table 8 illustrates that overall, approximately two thirds of preschool children met the recommended 2 daily servings of milk and alternatives during this study. The percentage of children who met CFG recommendations varied upwards of 20% between days that included a full day of child care compared to the days not spent in child care. No significant difference was detected between home and child care environments for mean number of servings for 3 year olds, $t(78) = -0.73$, p=0.468, or 4 and 5 year olds, $t(47) = -1.54$, p=0.129. Commonly consumed items in this food group included fluid milks, both white and chocolate or strawberry flavoured, yogurt, and some cheeses.

Table 13

Milk and alternates CFG food group servings: Daily mean intake overall, by age, and by environment

Characteristic		Mean	Range		
	n	*M*(SD)	Minimum	Median	Maximum
Overall	79	2.36 (0.89)	0.61	0.30	4.84
Age					
3 years	46	2.39 (0.94)	0.64	2.44	4.84
4&5 years	33	2.30 (0.83)	0.61	2.21	4.18
Child Care					
3 years	36	2.48 (1.06)	0.65	2.53	4.62
4&5 years	24	2.42 (0.57)	1.07	0.37	3.81
Home					
3 years	46	2.27 (1.59)	0.00	1.93	6.28
4&5 years	31	2.01 (1.30)	0.00	2.00	5.67

Note. 'Overall' is data from participants who completed food records both at home and while in child care. Not all participants completed both environments, hence why not all n have the same number of participants.

Milk and alternative intakes by Tier. Milk and alternatives are separated into two categories of fluid milks and non-fluid milks (Health Canada, 2007). The mean intakes of milks and alternatives show that most servings were being sourced from Tiers 2 and 3 for both ages and

both eating environments (Table 14). Recommendations for these age groups encourage nutritious food choices that may contain slightly higher fat contents such as 2% milk instead of skim or 1% milks. Lower intakes of Tier 1 foods and beverages show that fewer items with lower sugar and fat content were being consumed in this food group. Tier 2 includes 2% milk, lower milk fat yogurts with little sugar added. Tier 3 includes homogenized milk, chocolate milk of all fat contents, and many cheeses. Table 5 provides examples of milk and alternatives in each Tier. Although the average preschooler intakes for milk and alternatives were 'in line' to 'moderately in line with CFG guidance', having more servings from Tier 3 indicates that these servings were higher in fat and added sugar.

Table 14

Milk and alternates CNF/CFG Tier servings: Daily mean intake overall, by age, and by environment

Characteristic			Tier			
	n	Total	1	2	3	4
Overall	79	2.36	0.35	0.86	1.07	0.08
Age						
3 years	46	2.40	0.28	0.95	1.09	0.09
4&5 years	33	2.30	0.45	0.74	1.05	0.06
Child Care						
3 years	36	2.48	0.29	0.99	1.09	0.11
4&5 years	24	2.42	0.47	0.79	1.14	0.03
Home						
3 years	46	2.27	0.34	0.70	1.14	0.08
4&5 years	31	2.01	0.57	0.56	0.72	0.16

Note. 'Overall' is data from participants who completed food records both at home and while in child care. Not all participants completed both environments, hence why not all n have the same number of participants.

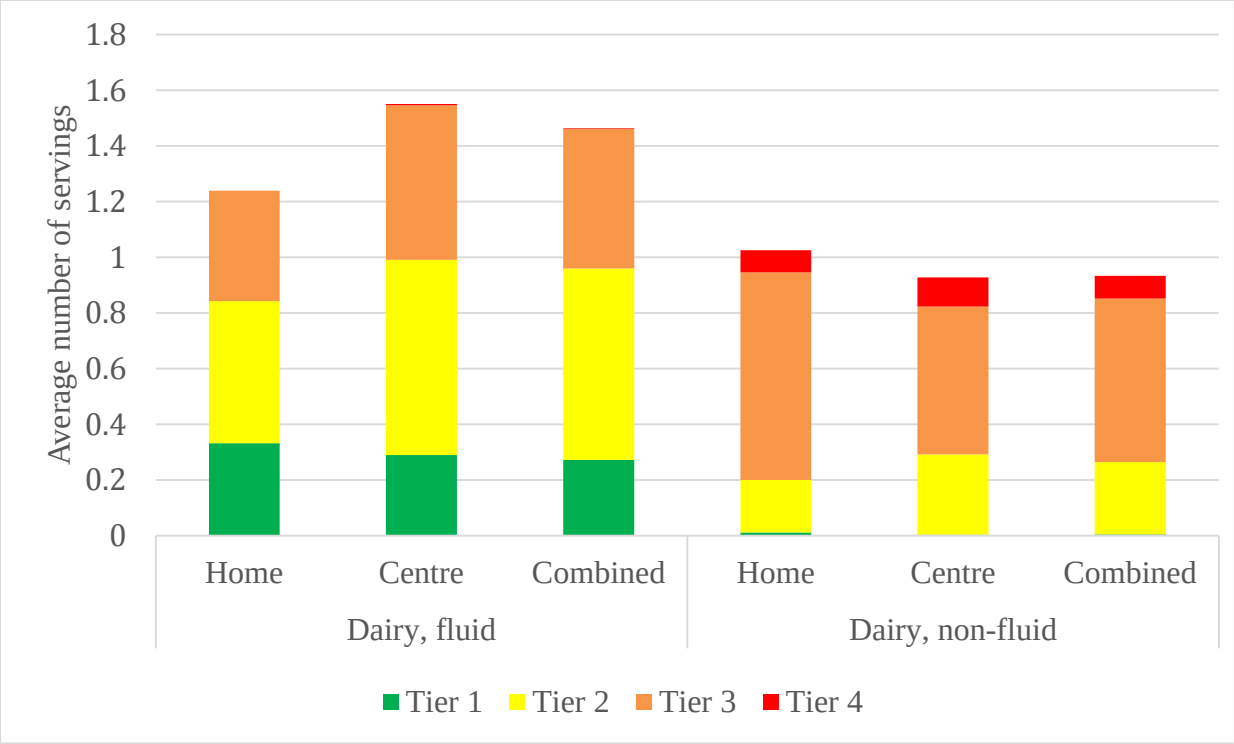

Figure 10. Mean daily intakes of milk & alternatives by Tier and environment for 3 YO

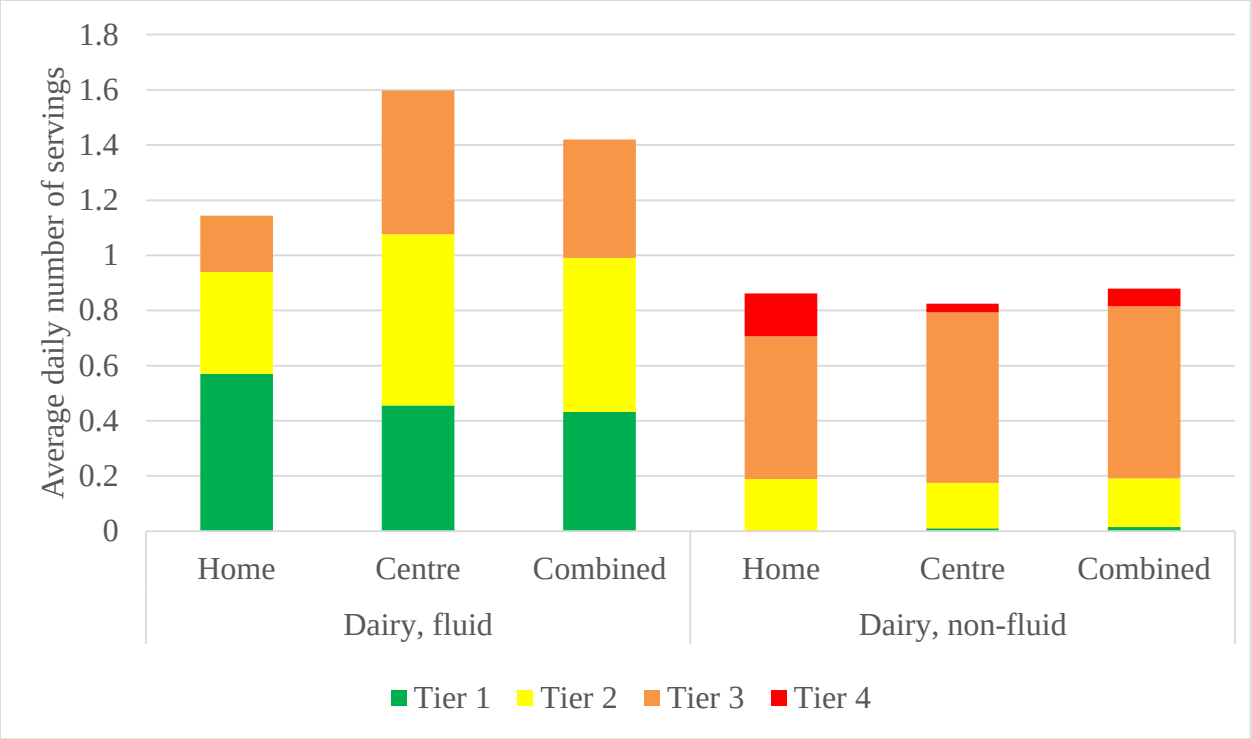

Figure 11. Mean daily intakes of milk & alternatives by Tier and environment for 4 & 5 YO

Meat and Alternatives

Canada's Food Guide recommends one serving of meat and alternatives daily for each of the preschooler age categories (Health Canada, 2007). This food group encompasses a large range of foods, including red meat, poultry, organ meats, legumes, nuts and nut butters, fish and shellfish. Table 15 outlines results of preschooler's meat and alternatives average daily intakes for the duration of this study. For all 79 children, the average daily intake was 1.39 (*SD* = 0.74) servings, ranging from 0.06 to 5.81 servings. Three year olds had an overall mean intake of 1.34 (*SD* = 0.59) servings with individual intakes ranging from a mean 0.06 servings to 2.86 servings per day. The 4 and 5 year old group consumed a mean of 1.46 (*SD* = 0.92) servings of meat and alternatives per day. Individual mean intakes ranged between 0.26 servings and 5.81 servings per day.

Meat and alternatives intakes by directional statement. *Canada's Food Guide* directional statements for the meat and alternatives group includes recommendations to choose plant-based options like beans and lentils and animal sources with lower fat and sodium contents. The sole quantifiable directional statement for this core food group provides guidance of two servings of fish per week. Since this study investigated a maximum of four days of food intakes, the results for consumption of fish were interpreted with caution. Throughout all days of the study, preschoolers consumed a mean of 0.2 servings of fish, ranging from a minimum of 0 servings to a maximum of 1 serving.

In the preschooler population studied, few servings were sourced from plant-based foods (*M* = 0.05, *SD* = 0.06), or legume, nuts, and seeds (*M* = 0.02, *SD* = 0.02). A mean of approximately 0.3 servings of processed or higher fat and sodium meats were consumed.

Meat and alternatives intakes by meal environment. For both age groups combined, a mean intake of 1.4 servings of meat and alternatives were consumed on days including full time

child care and 1.6 servings on days spent at home. A paired t-test indicated that mean intakes were likely similar between environments for the overall intakes of meat and alternatives for this group of preschoolers.

Three year olds consumed a mean of 1.4 (*SD* = 0.7) servings on days with time spent in child care and 1.5 (*SD* = 1.0) servings on days at home. Paired t-tests were calculated to determine if mean intakes of meat and alternatives were similar on days when children were in child care full time compared to days spent at home. There was no significant difference between environments for the total mean number of servings of meat and alternatives for the 3 year old group, $t(35) = -0.311$, $p=0.758$.

The 4 and 5 year old group consumed 1.6 mean servings of meat and alternatives on days including full time child care and 1.8 mean servings on days spent at home. A paired t-test determined there was no statistically significant difference detectable between intakes in the two environments for this age group.

Table 15

Meat and alternatives CFG food group servings: Daily mean intake overall, by age, and by environment

Characteristic		Mean	Range		
	n	*M*(SD)	Minimum	Median	Maximum
Overall	79	1.39 (0.74)	0.06	1.31	5.81
Age					
3 years	46	1.34 (0.59)	0.06	1.31	2.86
4&5 years	33	1.46 (0.92)	0.26	1.31	5.81
Child Care					
3 years	36	1.38 (0.71)	0.07	1.38	3.12
4&5 years	24	1.45 (1.02)	0.27	1.15	5.43
Home					
3 years	46	1.45 (0.98)	0.00	1.42	5.03
4&5 years	31	1.66 (0.95)	0.40	1.50	5.30

Note. 'Overall' is data from participants who completed food records both at home and while in child care. Not all participants completed both environments, hence why not all n have the same number of participants.

Meat and alternatives intakes by Tier. Children consumed slightly more Tier 3 meat and alternatives compared to other Tiers. The mean intake of meats and alternatives by Tier is outlined in table 16 and visually represented in figures 11 and 12. The foods covered in this food group vary substantially from wild game, red meats, poultry, and fish, to seeds, nuts, legumes, and nut butters (Table 6). The naturally occurring fats and sodium in many of the items found in this food group creates a challenge for finding lower Tier foods, particularly after sugar, salt, and fat may be added during processing. Tier 3 foods included peanut butter or Wow Butter, a soy-based alternative often served in place of peanut butter in child care, meats higher in fats or sodium, and some reduced sodium or reduced fat processed deli meats. Overall, preschoolers consumed a mean 1.4 servings daily of meat and alternatives with approximately 70% being sourced from Tiers 3 and 4, indicating that mean intakes are moderately in line with CFG to not in line with CFG

recommendations. The remaining 30% of servings are sourced from Tiers 1 and 2 and are in line with CFG guidance. Paired t-tests were conducted to determine if there was a statistically significant difference between the two environments in the quality of meat and alternatives being consumed by children. Mean intakes for the overall group included in paired t-test analyses showed that no statistically significant difference for Tiers 1, 2 or 3, however; intakes were found to not be similar between environments for Tier 4, $t(57) = 3.664$, $p=0.001$, and all processed meats, $t(57)=2.998$, $p=0.004$. This result suggests that higher sugar, fat, and sodium choices for meat and alternatives are being consumed on days when the children are at home versus days that include full time child care.

The meat and alternatives intake distribution appeared to be similar in each age group. Three year olds consumed approximately 40% of total mean meat and alternatives from Tier 1 and 2 sources that are in line with CFG recommendations. The remaining 60% is sourced from Tier 3 (49%) and Tier 4 (12%), which are moderately in line with and not in line with CFG guidance, respectively. Paired t-tests determined that mean intakes between meal environments were different for Tier 4, $t(35)=2.864$, $p=0.007$, and processed meat, $t(35)=2.548$, $p=0.0154$. Mean intakes of Tier 4 foods and processed foods were higher on days when children were at home versus days that included full time child care.

The 4 and 5 year old group had a similar distribution of meat and alternative intakes to the 3 year old group (Table 16). Approximately 39% of foods sourced from this group were from Tier 1 (21%) and Tier 2 (18%), and 61% sourced from Tier 3 (46%) and Tier 4 (15%). Like the 3 year old group, 4 and 5 year olds meat and alternatives intake is mostly in line with and moderately in line with CFG recommendations. No statistically significant differences were detected in mean intakes between the home and child care environments for this food group with exception to Tier

4 foods. The mean intakes of Tier 4 meat and alternatives on days at home were sufficiently higher to be significantly different than mean intakes on days including full time child care.

Table 16

Meat and alternatives CNF/CFG tier servings: Daily mean intake overall, by age, and by environment

Characteristic			Tier			
	n	Total	1	2	3	4
Overall	79	1.39	0.27	0.17	0.76	0.20
Age						
3 years	46	1.34	0.28	0.25	0.66	0.16
4&5 years	33	1.46	0.31	0.26	0.67	0.22
Child Care						
3 years	36	1.38	0.36	0.23	0.75	0.04
4&5 years	24	1.52	0.28	0.28	0.82	0.14
Home						
3 years	46	1.45	0.19	0.19	0.75	0.32
4&5 years	31	1.66	0.25	0.16	0.83	0.42

Note. 'Overall' is data from participants who completed food records both at home and while in child care. Not all participants completed both environments, hence why not all n have the same number of participants.

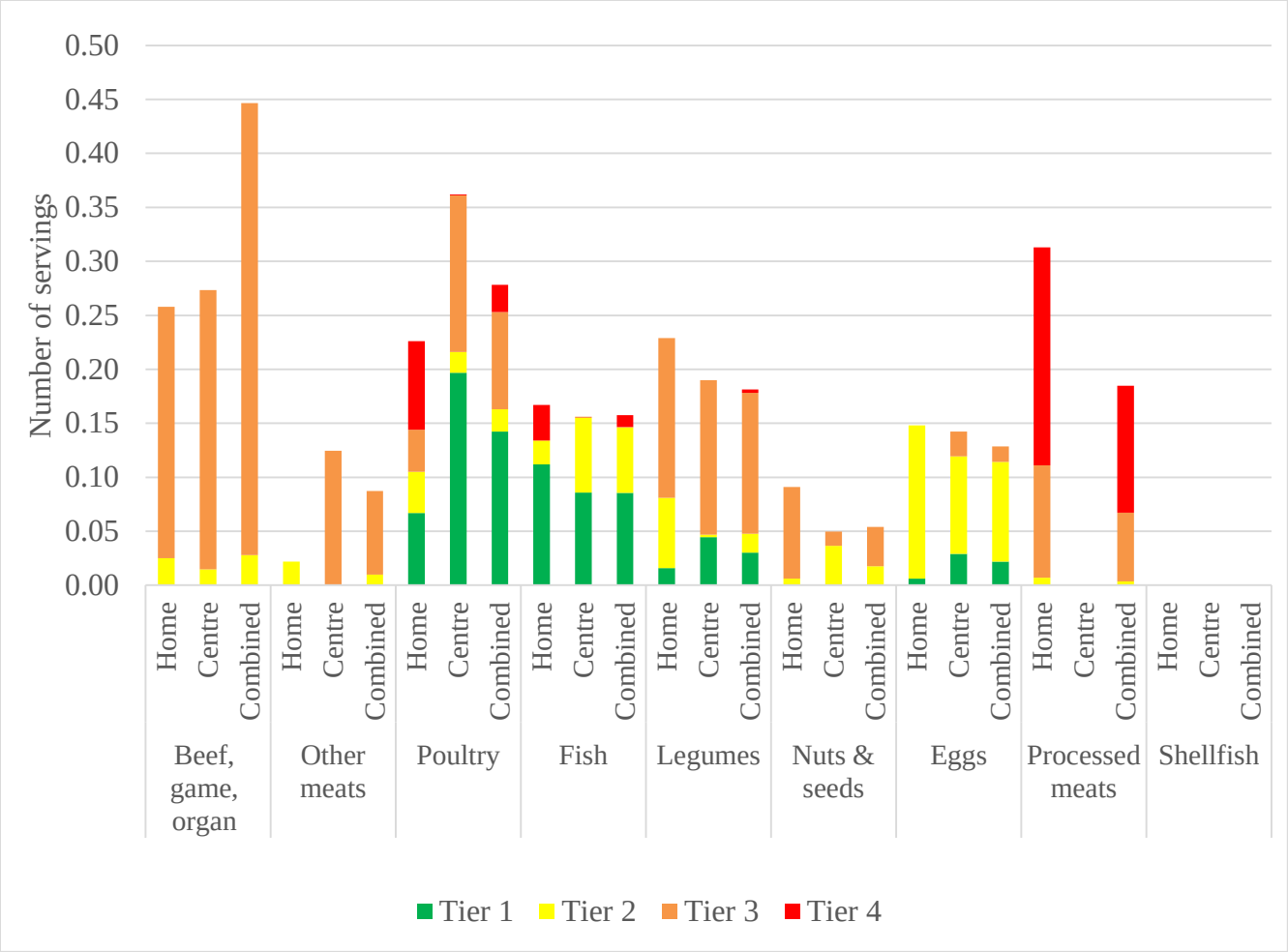

Figure 12. Mean daily intakes of meat & alternatives by Tier and environment for 3 YO

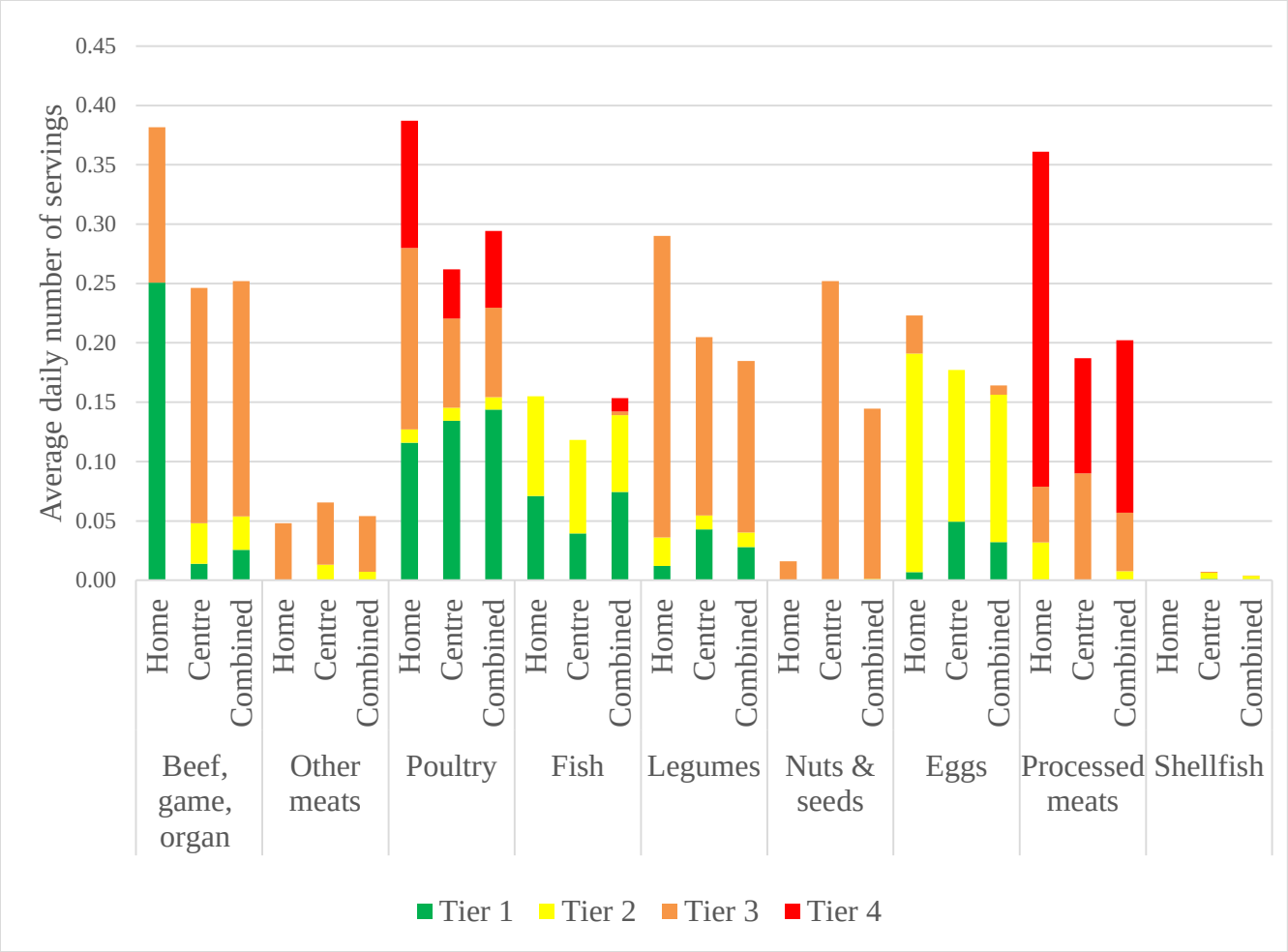

Figure 13. Mean daily intakes of meat & alternatives by Tier and environment for 4 & 5 YO

Summary of Findings for Basic Food Group Analysis

Group averages for both age groups indicated that children were meeting CFG recommendations for each of the four main food groups with exception to 4 and 5 year olds being one half serving short of meeting the recommendation for vegetables and fruits. Although group averages show that children were meeting recommendations, there was substantial variation in the range of participant intakes of each food group. As Table 2 illustrates, the number of children meeting the serving recommendations is lower than what the group averages may suggest.

Foods and Beverages Not Included in CFG Four Food Groups

The classification system includes codes to categorize foods and beverages not included in the core four food groups in CFG. These codes include foods and beverages still part of CFG recommendations such as water and added fats, and foods not included in the recommendations like confectionaries and manufactured foods. There are challenges with reporting intakes of these additional items due to the lack of quantified CFG recommendations. Statements from CFG regarding items that are labelled as "other" suggest to limit these types of foods and beverages with no definitive or prescriptive frequency, and no other serving sizes or serving numbers are defined (Health Canada, 2007). For application of the CNF/CFG to this category of items, the Canadian Food Inspection Agency (CFIA) Reference Amounts (RAs) were referenced to quantify serving sizes and to determine the sodium, sugar, and fats contents within the serving sizes for appropriate coding of the non-core CFG food group items consumed (Canadian Food Inspection Agency, 2016).

Water intake. During all study days, preschoolers consumed an approximate mean of 0.5 servings or 1 cup of water per day (*SD* = 0.3). Individual reported intakes of water per day ranged from 0 servings to 2.5 servings (5 cups). The CNF/CFG code for water included sources of municipal and well waters, as well as canned or bottled still or sparkling waters (Health Canada, 2014). The reported number of servings of water consumed is likely conservative due to the actual intake by children in this study. Water was liberally available in child care centres via water bottles, drinking fountains, and by request of the child. In the home environment, children also had access to water and potentially other beverages that were not recorded in the food and drink diary. Therefore, there is an increased likelihood that the reported amounts of water, and potentially all beverages, were lower than what was consumed.

Fats and oils. Added fats are considered part of guidance from Health Canada and were categorized into a single group in the CNF/CFG. Although serving sizes for this group are small in comparison to other CFG recommendations, there is still variation within the serving sizes. A serving size for fat-based salad dressings is 30 ml, whereas a serving of a vegetable oil is 10 ml (Canadian Food Inspection Agency, 2016). Preschoolers consumed a mean 0.5 servings per day (*SD* = 0.4), ranging from 0 to 1.7 servings per day throughout the course of the study.

Other foods. Several groups of foods and beverages are categorized as "other" food items and the CNF/CFG accounts for a number of foods in this category. Overall, preschoolers consumed a mean 2.8 (*SD* = 1.6) servings of foods and beverages not recommended by CFG, this figure includes items that can be found in the four core basic food groups, but have been cooked or processed to contain amounts of sugar, sodium, and fats that exceed guidance from CFG. Daily consumption averaged from a minimum of 0.4 servings to a maximum of 8.3 servings. Within the four foods groups, foods and beverages that are 'not in line' with CFG include deep fried foods such as French fries and fish sticks. When cooked using methods that do not add substantial amounts of sugar, sodium, and fats, potatoes and fish dishes are considered to be 'in line' or 'moderately in line' with CFG guidance. When Tier 4 foods are excluded from the analysis of "other" foods, preschoolers consumed a mean of 1.7 (*SD* = 1.3) servings from food sources that contained saturated and/or trans fats or foods that were high in fat and/or sugar, including syrups and chocolate bars.

Sugar-sweetened beverages. Another dietary component considered in this analysis was the consumptions of sugar-sweetened beverages (SSBs). This is a combination of beverages that could still be considered part of the four core CFG food groups, such as fruit juices and flavoured milks, and items not in CFG recommendations such as fruit drinks, sodas, and iced teas. Average

daily intakes of SSBs ranged from a minimum of 0.2 servings to a maximum of 6.6 servings, with individual serving numbers reaching a high of 7.2 (M = 1.6, SD = 1.1). Every child in this study consumed SSBs at some point during the investigation. A paired t-test determined there was a significant difference between mean intakes of SSBs on days at home (M = 1.5) versus days that included full time child care (M = 0.3), $t(57)=4.704$, $p<0.001$. On days when preschoolers were at home, they consumed significantly more servings of SSBs than they did on days that included time spent at child care.

Summary of Findings

The dietary intakes of preschoolers registered full-time in licensed child care in the province of Nova Scotia were recorded via a four-day food record and examined in the context of CFG and new policy introduced in 2011, which was in part to increase the quality of foods served in these food environments. The first research objective was to determine if preschoolers were meeting the serving quantity recommendations established by CFG and adhering to the directional statements that help to guide eating habits. Although group mean intakes of each food group indicated that preschoolers were meeting, or close to meeting the recommended serving numbers, the results indicated that a number of children sampled in this early childhood population were not meeting these guidelines individually. This disparity was particularly evident when reviewing vegetable and fruit and grain intakes in the 4 and 5 year old group. This older age group had lower mean food group intakes compared to 3 year olds, and fewer children met recommendations. This trend was similar in both home and child care food environments. Results suggest that there may be an impact on nutrition standards in regulated child care when mean daily intakes were compared for some food groups. More servings of grains were consumed on days including full time child care for the preschooler group and for each age group, and milk intakes were higher on child care days for the whole preschooler group.

For the second research objective, an examination of the diet quality was conducted using the CNF/CFG. This new classification system from Health Canada categorized the foods and beverages consumed into Tiers 1 through 4, each Tier indicating a higher level of sugar, sodium, and fat content. Overall, preschooler diets were mainly Tiers 1 and 2, or in line with CFG, and Tier 3, or moderately in line with CFG. Most vegetables and fruits consumed were from Tier 1 and 2, and both age groups consumed mostly whole fruit and fruit juice in this food group. Grains

and dairy were also primarily sourced from Tier 1 and 2 options. This group consumed Tier 3 dairy, including fluid homogenous milk and flavoured milks, and non-fluid items such as sweetened yogurts and regular fat cheeses. These children also consumed a variety of meat and alternatives ranging from Tier 1 to Tier 4. Both age groups ate mostly Tier 2 and 3 meat and alternatives, with a number of servings being sourced from Tier 4 foods, including processed meats.

Many servings of foods and beverages were sourced from outside of the four main food groups, some of which are recommended by CFG, such as water and added fats, and some items that are labeled as "other", such as soda, chocolate, and other confectionaries. The results indicate that preschoolers were eating and drinking a number of servings of "other" foods that CFG recommends to limit. Intakes of high fat and high sugar foods ranged from 0.4 to 8.3 servings (M = 2.8, SD = 1.6) per day during this study. It was also concluded that each preschooler consumed SSBs at some point during this study and the mean intakes of SSBs was higher than the mean intake of water.

This study provides insight into preschooler diets in Nova Scotia who are enrolled in full time child care and whose diets are impacted by institutional nutrition standards. Results suggest that not all children may be meeting CFG recommendations for the four main CFG food groups, nor are all directional statements being met to ensure food variety and, subsequently, nutrient requirements may not be met as a result. Overall, the preschooler diet is in line with or moderately in line with CFG recommendations for quality with exception to more lower quality servings being consumed in the meat and alternatives food group. There does also appear to be a difference in the quality of the diet on days when the children are in child care full time, suggesting that nutrition policy in this environment may ensure more nutritious options are a part of the diet.

DISCUSSION

There is limited information available about preschooler diets. This information is particularly limited within the context of Canadian preschoolers and nutrition policy in child care centres. This multidimensional study addresses research objectives to examine Nova Scotia preschooler diets on days when at home and days that included full time regulated child care, and how these eating habits, both in quantity and quality, compare to national recommendations by the Canadian government established in CFG (2007). The CFG was designed by Health Canada to meet nutrition needs of the population as well as potentially reduce the risk of diet-related diseases (Katamay et al., 2007). Guidelines like the CFG are particularly important to consider during sensitive periods of the lifecycle, for example, during the active growth and development periods throughout the preschool years. Although preschoolers are often referred to as a group of children ages 3 to 5 years old, CFG separates this group into two age categories: 2 to 3 year olds and 4 to 8 year olds (Health Canada, 2007). Results from this study were examined for each of the age groups and for the overall preschooler group. The application of a new surveillance tool, the CNF/CFG, from Health Canada presents a unique opportunity for an increasingly defined and more detailed analyses of the quality of preschooler diets (Health Canada, 2014). This study was also centered around the context of new policies promoting nutrition and health standards within regulated child care in the province of Nova Scotia. In 2011, the *Standards and Guidelines for Food and Nutrition in Regulated Child Care Setting* came into effect and the compliance is mandatory to maintain licensing as a regulated child care centre in Nova Scotia (Government of Nova Scotia, 2011). This is in contrast to non-regulated child care providers that are not bound by this policy and were excluded from this study. This policy contains thirteen evidence based components to support healthy eating behaviours and habits in the early childhood population enrolled in licensed child

care, including menu standards that ensure food and beverages of appropriate quantity and quality are served. Menu-specific contents are based on CFG recommendations which further support the application of CFG and CNF/CFG as analytical and translational frameworks for this study. The introduction of the *Standards* prompted the establishment of the NSCCP to investigate the impact of the *Standards* and to address the lack of knowledge around eating habits and dietary intake of the early childhood population. Findings of this thesis investigation embedded within the NSCCP mandate suggest that many preschoolers in Nova Scotia may not be meeting CFG recommendations in both quantity and quality, while consuming items that are higher in sugars, fats, and sodium, particularly in the home environment. Usual eating habits that do not meet CFG recommendations may place children at an increased risk of not meeting nutrient requirements and an additional increased risk for health problems, both short-term and long-term (Katamay et al., 2007).

Preschooler Dietary Intake by CFG Food Group

There is a paucity of literature that examines dietary intakes and patterns in the Canadian early childhood population and even fewer that examine the child care food environment contribution to the diet (Black et al., 2013; Garriguet, 2004; Pabayo, 2012; Sisson et al., 2017). Although there are recent studies available from Canadian cities, national dietary data is becoming increasingly dated. A 2015 study applied the newly developed CNF/CFG Classification System (2014) to re-analyze early childhood dietary data that was originally collected well over a decade ago during the CCHS 2.2 in 2004 (Jessri, Nishi, & L'Abbe, 2016). This dietary assessment was based on a 24-hour recall in children ages 2 to 18 years old. Jessri and colleagues found that many were not meeting CFG food group recommendations, were consuming poorer quality items, and upwards of 31% of energy intake was coming from foods outside of the four main food groups.

Additionally, the pattern of not meeting food group recommendations, consuming increasingly poor quality items, and sourcing more non-food group foods deteriorated further as children aged into adolescence.

The availability of information about preschooler diets may be due to the lack of guidance from CFG before 2007 for children under 4 years old, and therefore, no comparable quantified recommendations were available for all of the early childhood population (Health Canada, 2007). In the available literature, several studies compare dietary intakes to CFG food groups and some directional statement recommendations for this early childhood age group. The current study adds the novel dimension of the quality of foods consumed compared to CFG recommendations with the CNF/CFG. Vegetable and fruit intakes in this investigation were similar to findings from previous studies (Black et al., 2013; Garriguet, 2004; Jessri et al., 2016; Pabayo et al., 2012). Comparable literature for each of the remaining three food groups is somewhat limited in this age group. In this study, the proportion of children meeting recommendations for grains (82%), milk and alternatives (66%), and meat and alternatives (75%) servings were usually higher than the proportion meeting vegetable and fruit serving number recommendations. Regardless of findings in populations in other locales, this study shows that a number of preschoolers in Nova Scotia may not be meeting CFG recommendations on a regular basis.

Vegetables and fruits. A considerable number of preschoolers did not meet the CFG recommendations for quantity of vegetables and fruits during this study; however, results indicate that preschoolers are consuming mostly higher quality, nutritious options that are fresh or frozen, and have lower amounts of sugar, salt, and fat. Health Canada (2007) suggests 4 servings for 3 year olds and 5 servings for 4 and 5 year olds. As a group, approximately half of the children met the recommendations for their respective age groups. This finding of lower vegetable and fruit

intakes is consistent with results from previous population studies including young children in Canada and the United States (Black et al., 2013; Garriguet, 2004; Kim et al., 2014; and Pabayo et al., 2012). When results are stratified by CFG age categories, there is a considerable difference between age groups in the number of children meeting basic vegetable and fruit group recommendations. The percentage of preschoolers meeting respective serving numbers decreases by approximately half in the 4 and 5 year old group compared to the 3 year old group. This finding between the two age groups has not been documented in the reviewed literature. It may be argued that the smaller sample size of the 4 and 5 year old group (n=33) may have contributed to the finding; however, parents and caregivers stated that recorded diets were usual and this percentage of 4 and 5 year olds meeting dietary recommendations is an appropriate reflection of eating habits. The concern in this trend is as this population ages from early childhood to adulthood, the mean number of servings of vegetables and fruits consumed as well as the number of people meeting quantified recommendations continues to decline (Garriguet, 2004; Jessri et al., 2016). Eating habits of Canadians documented in CCHS data from 2000 to 2014 shows that one-third to one-half of Canadians 12 years old and older are consuming at least 5 servings of vegetables and daily on average (Statistics Canada, 2015). Further investigation into this finding may confirm that there is a decrease in mean vegetable and fruit intakes between these two age categories, as well as provide insight into an explanation for the change in this eating habit.

Grains. The second food group in CFG is the grains, which recommends 3 servings for 3 year olds and 4 servings for the 4 and 5 year olds in this study. Preschoolers as a group consumed a total daily mean of 4.4 (SD = 2.2) servings of grains, which suggests that each age group is meeting its respective three or four servings per day. The numbers of children meeting recommendations varied throughout the duration of the study, as well as when considering days

when they were at home and days spent in full time child care. An average of 82% of preschoolers were meeting recommendations when daily intakes were averaged; however, almost twice as many 4 and 5 year olds consumed the recommended number of servings on days when only at home versus days when they were in child care. In 2012, Pabayo et al. reported that of 2015 children 4 and 5 years old in Edmonton, Alberta, only 23.5% met the recommended 4 servings of grains per day, with the group mean daily consumption of 2.7 servings. Data reported by Pabayo and colleagues (2012) was collected via parental recall in a single interview and estimates were calculated for usual daily intake based on a single day or weekly intake. During the current study, multiple days of data were collected via food record reported by parents and research assistants to capture usual dietary intake, which may have more accurately captured the variability in usual dietary intakes. This finding is in addition to the lower numbers of 4 and 5 year olds meeting their vegetable and fruit intake. This decline in food group intakes between younger preschoolers and older preschoolers may be of significance in identifying a trend that continues into adolescence and may persist into eating habits in adulthood (Garriguet, 2004).

The grains food group contains one quantifiable directional statement that recommends to choose whole grain options for at least half of the recommended number of grains servings (Health Canada, 2007). To quantify this statement for study, 3 year olds had to consume at least 1.5 servings of whole grains and 4 and 5 year olds had to consume at least 2 servings of whole grains. The majority of preschoolers in this study met these criteria for consuming whole grains. It should be noted that as many as 52% of the preschoolers did not meet the recommended number of servings of total grains; thus, many of these children may have consumed more than half of their actual grain servings as whole grains.

Milk and alternatives. The recommended number of servings in the milk and alternatives group is the same for each age group. Approximately two thirds (64%) of children met the recommended two servings of milk and alternatives; however, results indicate that this proportion is higher by upwards of 30% on days when children were in child care (79%) compared to a full day at home (48%). In child care centres, policy dictates that every meal must include items from each of the four CFG food groups and snacks must include two food groups, one of which must be a vegetable or fruit (Government of Nova Scotia, 2011). Milk was served regularly at meals, and yogurt and cheese were regularly served as part of the meal or snack. The demand of dairy and alternatives in the child care environment may explain why more children are meeting the CFG recommendations on these days compared to days at home. There is also a higher number of SSBs consumed on days at home. There may be a relationship between lower milk and alternative consumption and higher SSB intake in the home environment. Overall, preschoolers consumed a mean 2.3 servings daily (*SD*=1.2) with intakes ranging from 0.0 servings to 6.0 servings over the course of this study. These figures are similar to the average number of servings consumed by Canadian children ages 4 to 8 years as reported with CCHS 2.2 results where approximately 63% of this age group met the CFG milk and alternatives recommendation for number of servings (Garriguet, 2004). In another study of 2015 children ages 4 and 5 years in Edmonton, Alberta, over 90% of children met the two-serving recommendation (Pabayo et al., 2012). Results from the Pabayo (2012) study showed that the proportion of children meeting milk recommendations was similar for those who were not in daycare (90.4%) compared to those who were in daycare (90.7%). The Nova Scotia preschoolers in this thesis study did appear to consume slightly more milk and alternatives on days while in child care compared to days when they were at home. Comparatively, fewer children consumed milk and alternatives while at home compared

to days that included time spent in child care in this study. These patterns between food environments were similar for both age groups. A study of 3 to 6 year olds enrolled in child care in a U.S. county also showed that fewer children met milk recommendations outside of child care (Robson, Khoury, Kalkwarf, & Copeland, 2015). Robson et al. (2015) found that only 9% of children met milk recommendations outside of child care, and on average, consumed one-third to one-half the recommended number of servings. Comparison of these findings suggests that more children are meeting milk and alternative recommendations in full time child care.

The CFG directional statements for this food group recommends choosing skim, 1%, or 2% fluid milk or fortified non-dairy alternatives like soy milk, and to choose lower fat options when consuming non-fluid items such as cheese and yogurt. For younger populations, Health Canada recommends not to limit nutritious foods due to fat content because these foods provide a primary energy source, a variety of nutrients, and support the absorption of fat soluble vitamins (Health Canada, 2011). There is an emphasis on fortified milk and alternative products because of the essential nutrient content for young children, particularly vitamin D and calcium. This nutrition is particularly important during physical growth and development in the preschooler population, and is relevant to the dietary fat that can be provided by milk and alternatives. However, food and beverage sources in this food group can also be a source of excess fat, added sugar and salt, including higher fat cheeses, flavoured milks, sweetened yogurts, and ice creams. Approximately half (52%) of preschooler milk and alternatives intakes were from Tiers 1 and 2, indicating that they were consuming half of their sources as lower in fat, added sugar and salt. The foods often found in these Tiers were 1% and 2% fluid milks, lower milk fat yogurts with little to no flavouring or added sugars, and occasionally lower fat cheeses. Children consumed more Tier 2 servings of milk and alternatives on days while in child care versus days when they were not in

child care. The remaining servings were sourced mainly from Tier 3 (40%), which included homogenized milk, flavoured milks like strawberry and chocolate milk, most regular fat cheeses, and flavoured yogurts with more than 1-2% milk fat. There is an inherent challenge when interpreting some results using the CNF/CFG due to types of foods included in one category code. For example, Tier 3 items in the milk and alternatives group includes homogenized milk, milks with added sugar-based syrups and flavourings, cheeses, and yogurts with added sugar or higher milk fat content. The challenge is when interpreting the nutritional contribution of a Tier or code that includes a broad variety of items, each with unique contributions to the diet, it is difficult to determine if an item is higher in sugar, sodium, and/or fats because they are categorized together. The number of servings from Tier 3 were similar for days in child care compared with days while at home. In child care, children often consumed flavoured yogurts such as vanilla or berry, cheese, and occasionally, homogenized milk in some centres where homogenized milk was available for younger groups, but was made available in the preschool aged rooms as well. At home, children sourced chocolate milk, sweetened yogurts, cheeses, and ice cream.

Each age group consumed similar mean intakes of milk and alternatives and two thirds of each group met the recommended two daily servings throughout the study. The 3 year old group had significantly more of Tier 2 items on days while at child care than they did on days at home. Tier 2 foods included 1-2% milk fat plain yogurts or made with low calorie sweetener, puddings made with lower fat milks, and 2% fluid milk. The results show for this age group that 50% of their milk and alternatives were Tier 1 and Tier 2, which increased to 96% when Tier 3 foods were added. These results suggest that intakes of milk and alternatives were mostly lower in added sugar, fat, and sodium for 3 year olds.

The 4 and 5 year old group had similar total mean intakes of milk and alternatives to the 3 year old group with 64% of this group meeting the daily recommended 2 servings. Intakes of milk and alternatives differed by one half serving on days at home compared to days when the older preschoolers were in child care, and was not found to be significantly different. Approximately 60% of intakes were sourced from Tiers 1 and 2, which was slightly higher than the 3 year old group, and this proportion increased to 96% when Tier 3 was included. In this older age group, the only difference found between intakes at home versus days spent in child care was in Tier 3. Older preschoolers consumed more Tier 3 milk and alternatives on days while in child care than during a full day at home. Overall, 4 and 5 year old preschoolers were consuming a diet that was mostly in line with CFG guidance, but still contained sources that were higher in added sugar, sodium, and fats. This does not necessarily reflect lower quality milk and alternatives being consumed at child care, but may reflect items consumed at home on those weekdays. Analysis of the days that include full time at child care includes the home food environment before and after child care; therefore, Tier 3 items may be consumed in either environment. This finding, although not unique to this food group, may reflect two potential situations. One situation includes items that are higher in sugar, sodium, or fat are being served in child care and this may be an opportunity to re-visit guiding policy for food quality choices in that environment. It is also important to emphasize that Tier 3 is not necessarily 'low quality' and should therefore be avoided because this category often includes sources of nutritious items in the diet; however, there is a higher content of sugar, sodium, and fats. Another potential situation is that milk and alternatives that are higher in milk fat, sugar, or sodium are consumed at home before and after a day spent in child care.

Meat and alternatives. Mean intakes of meat and alternatives suggest that approximately 90% of preschoolers are meeting the recommended one serving per day, which was similar for

days while in child care and days spent outside of child care. The meat and alternatives food group covers a broad range of foods that includes animal products like red meat, poultry, and game; fish, shellfish, and eggs; as well as plant-based sources such as nuts, nut butters, seeds, and legumes. This food group is particularly recognized for sources of dietary protein, but also contributes a variety of nutrients such as iron, B vitamins, zinc, magnesium, and potentially fibre (Health Canada, 2012). Within this food group, the directional statements continue to recommend a variety of meat and alternatives sources, as well as standard suggestions to limit sugar, sodium, and fat intakes. The recommendations include sourcing non-animal alternatives such as legumes often; consuming two servings of fish per week; and choosing leaner options with less fat and salt (Health Canada, 2007). Preschoolers in this study did consume a variety of meat and alternatives, primarily beef, chicken, and processed meats. Approximately three quarters of the meat and alternatives eaten were categorized as Tier 3, indicating that children ate foods higher in sugar, sodium, and fat. This food group contains many foods that are naturally higher in fat and sodium; therefore, it can be challenging to choose leaner options.

Other servings that were sourced include legumes, nuts and nut butters, particularly peanut butter, a soy-based Wow Butter, which is a peanut alternative used in place of peanut butter, and smaller portions of fish and eggs. Most children consumed a source of plant-based protein during this study (81%); however, the mean daily serving was smaller than half a CFG serving portion, and this intake was similar whether at home or on days that included time at child care. This intake was reflected in both age groups for both environments. Plant-based foods are nutrient dense sources of fibre, protein, numerous micronutrients, while often low in saturated fats and sodium depending on how the food is prepared. This plant-based portion of CFG may become increasingly important to a higher quality diet due to their nutrient density, particularly in the context of lower

vegetable intakes and possibly lower total grain intakes in this group. Additionally, meat alternatives are also often less costly compared to animal meats making this a more affordable option for both child care centres and families while still providing a high quality and nutritious option in this food group (Darmon & Drewnowski, 2015).

Since this study collected food diary information for two to four days, there is limited information about the fish intakes of preschoolers. Of the available data, most children did not consume fish during this study, and those who did consume fish ate a small fraction of a portion. The finding of lower meat alternatives and fish intakes may mean that children are consuming fewer nutrients often sourced from these foods including omega-3 fats, fibre, and protein, to name only a few. For example, omega-3 fats are found in abundance in some types of fish, seafood, seeds, and nuts. These fats contribute to neurogenesis, eye health, and other tissue development and maintenance. Lower intakes of these fats in young children have been associated with behavioural issues, psychological health, and other cognitive development concerns (Cording, 2015).

Preschooler Diet Quality

The CNF/CFG classification system addresses the vague CFG directional statements that recommend choosing options 'lower' in added sugar, salt, and fats. This classification system categorizes foods into Tiers by these nutrient contents and other dietary guidance using pre-determined thresholds, going beyond the basic four CFG food groups to identify the quality of foods being consumed to meet or not meet CFG recommendations. Similar food and dietary quality indices have been developed, but none directly based on specific recommendations by CFG, which makes this tool unique to Canadian dietary guidelines. The quality of food and

beverages consumed by the preschoolers in this study varied considerably when examined by food group, but many of the items consumed were ‘in line with’ or ‘moderately in line with CFG recommendations’. Conversely, this does not translate to mean that the children were consistently eating the quantities required to meet CFG recommendations. Food groups such as the vegetable and fruits group may have more options available that can be consumed raw or ‘as is’ without additions made through processing or cooking that would affect the final quality of the item. Groups such as the milk and alternatives or the meat and alternatives often have higher levels of naturally occurring fats, and the addition of salt or sugar through necessary processing and preparation increases the contents of these nutrients. These ‘inherent’ states of foods and beverages most commonly sourced from each food group contribute to the quality of the foods and the overall diet.

When comparing intake on days when children were at home all day versus being in child care full time, statistical significance was detected between these two environments in some food groups. Generally, it appears that when a difference was detected between mean intakes by meal time environment, preschoolers consumed fewer servings of items with higher added sugar, sodium, and fat on days that included time spent in child care. Vegetables and fruits consumed were largely Tier 1 and 2, indicating that when preschoolers ate these items, the foods were whole, fresh or frozen, and consumed raw or prepared without frying, batter, or deep frying, and with little or no added sugar or salt. It was frequently reported that children often consumed finger foods, particularly vegetable sticks or fruit slices, and occasionally served with a condiment for dipping such as ranch dressing for vegetables and a yogurt-based dip for fruits. Sources of lower quality in the vegetable and fruits food group were also consumed by this age group, including vegetables canned in a salt solution, prepared tomato sauces, and fruits packed in syrup; however, it appears

that this group largely consumed foods from Tiers 1 and 2, and had limited intakes of Tier 3 and 4 items. Of note is the higher intakes of fruit and fruit juice when children were consuming items from this food group. Vegetables were a substantially smaller portion of the diet compared to fruit and fruit juice. Average daily intakes showed that intakes from this food group are approximately 50% from fruit and upwards of 75% is fruit and fruit juice combined. Although fruits are a source of nutrients including carbohydrates, fibre, and a variety of micronutrients, the sugar contribution to the diet may be higher than is necessary. Fruit juice is, inarguably, a palatable option to meet vegetable and fruit recommendations; however, the same benefits provided by the whole fruit are often not available in the juice option. Juice often has a higher sugar content, lower or no dietary fibre, and is calorically dense while not being as nutrient dense as a whole fruit or vegetable. Most 100% fruit juices are still considered a moderate quality item due to the naturally occurring and added micronutrients. The Standards for regulated child care in Nova Scotia limits juice being served to no more than twice per week due to literature connecting higher juice and sugar intakes to overweight and obesity, tooth decay, and diarrhea (Government of Nova Scotia, 2011). At home, however, there is no guiding policy that translates evidence into mandatory practice. In many cases, more juice, more fruit, and fewer vegetables are being consumed at home compared to the child care environment. This raises multiple points for consideration about this food group. In other national guidelines, fruit and vegetables have been separated into their own respective food groups with recommendations for fruits independent to recommendations for vegetables (Australian Government Department of Health, 2017; United States Department of Agriculture, 2016). This messaging change in CFG may further clarify food choices for policy and for individuals and families. Further investigation may be required into the messaging around the

nutrient adequacy and quality of fruit juices and how parents and caregivers are interpreting juice as a part of a child's diet.

Foods and beverages consumed in the other food groups were increasingly sourced from Tiers 2, 3, and 4, particularly for the milk and alternatives and meat and alternatives groups. This lower quality rating is likely due to the inherent levels of sugar, salt, and fat in dairy products and meat and alternatives (Canadian Nutrient File as cited by Dietitians of Canada, 2014). Although there are higher naturally occurring levels of these nutrients in some foods, preschoolers still consumed a number of processed foods from the grains, milk and alternatives, and meat and alternatives groups that have sugar, salt, and fat added during processing and preparing. The increasing distributions in Tiers 2, 3, and 4 among the grains servings consumed during this study was a result of sugars present in bread, as well as consumption of cookies, granola bars, and cereals. Preschooler diets did include whole grains and most did meet the minimum recommendation of half of the grains servings being sourced from whole grains, even though not all met the total number of servings for grains. Marketing of whole grains and the release of products containing whole grains has increased in Canada over the last decade (Health Canada, 2015). Although there is no literature to support a relationship between preschooler whole grain intakes and the trending increase of products available in Canada, there is certainly a permeation of whole grain products available in the marketplace. Items made with whole grains that were common in the diet included breads, breakfast cereals, and crackers. Although many of these items are nutrient dense due to fortification and enrichment programs in Canada, there is a substantial amount of sugar added for palatability. The sugar content is a particular issue for breakfast cereals, which are a breakfast and snack staple for many children in Canada. The World Health Organization has stated that young children should have no more than four teaspoons of added

sugar per day (2015). Common breakfast cereals in Canada can have upwards of 20 grams of sugar per serving, which is five times the recommended limit. Granted, some sugar makes these nutrient-dense items palatable and more likely to be consumed; however, they drastically increase the overall sugar being consumed in the diet. This demonstrates a key opportunity for policy and manufacturers to address the overabundance of added sugar in products while simultaneously acknowledging the need for a food to be acceptable by consumers. The food group with the highest number of Tier 4 servings was the meat and alternatives, particularly poultry and processed meat products. These foods included battered and fried chicken fingers and chicken nuggets, as well as lunch meats in the processed meats category.

Assessing diet quality is challenging. It is well-established that early childhood nutrition is important and there are many elements of a diet to consider that impact growth, development, and overall health during these early years. Examining the diet through a tool like the CNF/CFG Classification System provides an assessment framework based on a model of eating that is known to provide adequate nutrients throughout the lifecycle while minimizing risk of diet-related chronic diseases. This study is one of the first to apply this tool to a dietary assessment in Canada and to a dietary assessment of preschoolers in Nova Scotia. It is apparent that much of preschooler's diets are in line with or moderately in line with CFG recommendations; however, evidence from this study indicates that there are opportunities to further increase the quality of foods being served to preschoolers. Further evidence suggests that there is an opportunity to learn more about the home environment, how parents and caregivers approach diet and diet quality at home, and how they can be further supported while providing adequate nutrition for children. As mentioned, the issue of diet quality must also be considered at the policy and manufacturing levels. Food variety and consumer choice freedoms are important variables to consider at these levels; however,

children are a vulnerable population and their health and development can be largely impacted by the quality of foods consumed. The connection between diet quality and undesirable health outcomes is well known (Blossner et al., 2005; Fuglestad, 2010; Shields, 2006; Steinberger et al., 2003; Vanasse et al., 2005). This study showed that there may be a positive effect of nutrition standards in child care on the diet quality of preschoolers. This connection between policy and diet quality is important to note and may be of benefit to future eating habits and health outcomes. In addition, there is increasing information that demonstrates that higher quality foods are costlier than less-nutrient dense foods, which can make high quality diets inaccessible to many families and place an increased burden of cost on child care centres when mandatory nutrition policy dictates that only high quality items be served (Darmon et al., 2015). In Nova Scotia, the medium income for families is below the national median income for all of Canada. Incidentally, Nova Scotian families may not be positioned to have access, or at least consistent access, to more nutritious options. Although income level and geographic information were not collected as part of this study to thoroughly report on accessibility of high quality foods and beverages, these variables are among many that should be considered in future research and in future strategies to address diet quality for children and families since they have been established as barriers to adequate nutrition in the literature.

Measuring diet quality. The CNF/CFG population level surveillance tool from Health Canada provides a thorough framework to categorize each food and beverage item consumed into a Tier system. This Tier system, levels 1 through 4, classifies items as 'in line with CFG guidance', 'moderately in line with CFG guidance, or 'not in line with CFG guidance'. Using this framework, this study determined that many children are not meeting CFG recommendations for quantity and quality. The detailed code system focuses on classifying foods and beverages based on the

presence of “negative” nutrients. This focus reflects the current population diet climate and emphasizes nutrients in the diet that are associated with undesirable health outcomes. Although the CNF/CFG does reflect CFG guidance, including directional statements to promote dietary variety and nutrient adequacy, the emphasis remains on the presence or absence of sugar, sodium, and fats to ultimately determine the quality of an item. In a 2005 article, Drewnoski highlights that diet quality and the nutrient density of food are not based on consistent criteria or standards. Alkerwi (2014) acknowledges that diet quality is a fluid concept that reflects social and cultural norms. This demonstrates the ongoing and inherent challenges of solidifying a definition of diet quality, and subsequently makes measuring diet quality increasingly difficult.

The unique claim of the CNF/CFG is that it is based on current diet guidance provided in the CFG and the categorization of items is based on nutrient content on foods available in Canada as found in the CNF. This reflects the current Canadian situation for food, diet, and nutrition. The inaugural version of the CNF/CFG does provide an adequate framework to categorize foods based on what is available in the CNF and report basic diet quality on these foods; however, there are many foods that could not be coded in the four food groups and did not contribute to the food groups intakes of the diets studied. For example, fresh herbs and lemon juice were items categorized in a general code group that also included canned soups or dried spices. Therefore, there may be items consumed that could have contributed to food group serving totals. Additionally, unlike other dietary quality indices, the CNF/CFG has not yet been validated to make statements associating claims of dietary quality and disease risk or health outcomes.

Food environment

Food environments have been established as a determinant of eating behaviours, and both the home and child care environments provide unique opportunities to support the development of healthy eating behaviours and habits in early childhood (Campbell & Crawford, 2001; Tysoe & Wilson, 2010). The meal time environment includes multiple factors such as the physical environment itself, who is present and the interaction between players, and the meal structure. There was substantial variability in food group intakes noted in the preschooler group, which may be attributed to the variety of possible permutations of influencing factors. The variability in diet was seen in both age groups, and on days that contained only the home environment as well as days that included the child care environment. Although no causal link was studied, it is apparent that there were some differences detected in the diet of these preschoolers when intake from days spent at home were compared to days spent in child care. A notable limitation of this study design is that days spent in child care include meals and snacks consumed at home; therefore, any noted differences between these days is inferred to potentially be a result of time spent in regulated child care.

Home food environment. The home is recognized as an important meal environment that contributes to the preschooler's overall diet and the development of eating behaviours and diet patterns; however, not all variables were measured, but they are acknowledged as factors that influence the variability in diet and impact on eating habits of children. Parents serve as primary role models for children's eating behaviours and habits, and they further shape a child's taste preferences with the foods made available to them and parent styles applied (Birch, 1999; Ventura & Birch, 2008; Savage, Fisher, & Birch, 2007). Beyond the parental influence, each home environment includes a broad range of influencers associated with eating behaviours and habits

including family relationships, meal time patterns, cultural associations, environment, income, and food security (Butler-Jones, 2008; Campbell & Crawford, 2001; Saelens, Sallis, Nader, Broyles, Berry, & Taras, 2002; Savage et al., 2008).

Generally, more options that contained higher sugar, salt, and fat contents were consumed at home than on days when children spent time in child care. For example, children consumed considerably more fruit on days at home compared to days that included time spent at child care. Even with higher intakes of fruit, total vegetable and fruit intake remained low, particularly for the 4 and 5 year old group. This was also evident in the remaining three food groups with consumption of items such as higher sugar cereals and granola bars, chocolate milk, flavoured yogurts, ice cream, and processed meats.

Child care centre food environment. On days when children were in child care, they consumed more servings of whole vegetables and fruits, grains, whole grains, and generally higher quality grains, more servings of milk and alternatives that were 2% milk fat or lower, and fewer servings of Tier 4 meat and alternatives and less processed meats. This study shows that there is potential for nutrition policy to provide a meal time environment that is supportive of a nutritious diet in the preschooler population. This finding is congruent to evidence from investigations of nutrition policy in child care settings (Bell, Hendrie, Hartley, & Golley, 2015; Gagne et al, 2013; Tysoe et al., 2010). In addition to meeting nutrition recommendations, other studies based on the 'Start Right Eat Right' program in Australia have found that parents of children enrolled in child care centres with this certification reported their children consumed more nutritious food options at home compared to children not enrolled in centres with this certification (Tysoe et al., 2010). These findings suggest that nutrition policy that sets a standard for quality of foods and beverages served in child care may ensure more nutritious items are consumed by preschoolers, which may

extend beyond the child care centre and impact eating behaviours and habits in the home environment. This further substantiates the benefits of nutrition policy in child care and is important to note as more children are being enrolled in child care and being exposed to a new meal environment (Bushnik, 2006; Sinha, 2015). Although the current study did not investigate the direct impact of the Standards on the home meal environment and eating habits at home, there is evidence to support that higher quality foods were consumed and more children met CFG recommendations for some food groups on days when in regulated child care compared to days when at home.

CONCLUSION

Considerations About the Current Investigation

Limitations. There are sources of limitation to consider in this study. The sample size of 79 children is satisfactory for statistical analyses; however, this sample size is small compared to the approximately 6,400 full time spaces in regulated child care for 3 to 5 year olds in Nova Scotia (Child Care in Canada, 2014). Although the findings show consistency in the numbers of children meeting CFG recommendations and in variability in diet quality in this study, and are similar to other studies reviewed, the smaller sample size comparative to the population size may limit the generalizability of these findings to the larger preschooler population in Nova Scotia. There is substantial diversity in the types of food environments available in communities throughout Nova Scotia, ranging from urbanized city centres like the HRM, which has an abundance of food service establishments and grocers with more selection often at lower prices, compared to more rural locales that do not have access to the same amenities. Further stratifying the dietary intake data according to food environments may provide another level of depth in understanding the diversity of food environments in Nova Scotia and how they impact diet quality.

Additionally, it is well-established that there is inherent error in dietary assessment research, particularly when using a food record tool to collect participant information. There are multiple points for error, including errors in accurately reporting how much food or beverage was consumed, errors due to inadvertent omission of items, and providing false information due to social desirability bias (Ortega, Perez-Rodrigo, & Lopez-Sobaler, 2015). To minimize the potential of these errors, participants were provided with a visual reference guide to increase accuracy of reporting the amounts of food and beverages consumed. Participants were also encouraged to include recipes, brand names, and restaurant information to help increase the accuracy of items being analyzed for this thesis study and other NSCCP dietary analyses. Research

assistants regularly engaged with early childhood educators and parents to discuss a participating child's activity and diet to help recall any items that may have been missed during the completion of the food diary. Finally, research assistants encouraged parents to feel comfortable completing the diary. It was important to let all caregivers know that this study was established to observe and document what children were consuming. Food diaries were coded for confidentiality and to protect the children from identification, but this practice of removing identifying information from the food and drink diaries may have provided a level of comfort for parents and caregivers recording dietary information with less concern about being judged about their food choices or their children's diet.

Moving forward. This study prompts a number of points for consideration of preschooler diets, influencing factors, dietary recommendations, nutrition policy, and beyond. Overall, preschoolers are not meeting CFG dietary recommendations for quantity and quality. These findings, particularly for lower intakes of vegetables and fruits, is consistent with other Canadian studies (Black et al., 2013; Garriguet, 2004; Pabayo et al., 2012). Further to findings of lower food group intakes, the substantial difference between the food group intakes of 3 year olds compared to 4 and 5 year olds justifies further investigation into this shift in eating habits between age groups. The identification of this shift may mark a moment in the lifecycle where a trend begins in the uptake of undesirable eating habits that is seen to continue beyond childhood into adulthood.

Evidence suggests that nutrition standards in regulated childcare may be of benefit to the diet quality of preschoolers, demonstrated by higher numbers of children meeting CFG food group recommendations on days including child care attendance, fewer children meeting the same recommendations on days only including the home environment, and higher numbers of servings of SSBs and non-CFG food group items while at home. In Nova Scotia, nutrition policy in

regulated child care makes it mandatory that nutritious options are available to children. This policy positions the child care environment as a key component of providing a large part of a child's diet. Findings in this phase of the NSCCP study support that on days when the child is in child care, children's diets meet, or are closer to meeting CFG recommendations for quantity and quality. The results also suggest that outside of child care, children are consuming lower quality items that are higher in fats, added sugar, and sodium.

There is a considerable variety to the diets children consume outside of child care. This study visited many different communities throughout the province of Nova Scotia, varying from urban to rural with a diverse population. This diversity creates a challenge to providing specific home-based results and recommendations; however, the overall recommendation going forward is to connect with parents and include them in learning about antecedents, attitudes, beliefs, and associated factors that drive food choices and eating habits for their young children. It would be beneficial to include detailed information about the home environment, such as geographic location, socioeconomic information, and demographic data that may contribute to a better understanding of the food choices that happen outside of child care and to better inform stakeholders who are in the position to work with parents to support a nutritious diet that is adequate for young children.

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Appendix 1
Introduction letter for Child Care Centre Director

INTRODUCTION LETTER
Nutrition **S**tandards in **C**hild **C**are **P**roject (NSCCP)

Dear Director:

This is a follow up letter to your recent telephone conversation with Kimberley Hernandez about the research study **"Nutrition Standards in Child Care Project"** (NSCCP). As you know, food and nutrition standards have been implemented in regulated child care centers across the province. NSCCP is exploring the eating behaviours of young children (aged 3-4 years) in both the regulated child care setting and the family environment. As well, parental perceptions of the eating behaviours of children in the home environment will be explored in connection with the food and nutrition standards.

We are engaging child care centers and families in the Halifax Regional Municipality to share their experiences since the introduction of the food and nutrition standards in regulated child care centers. We are also interested in learning more about the process of change and how directors, educators, staff, children and parents can be supported in terms of the nutrition and physical activity environment within child care centers.

The NSCCP study includes three components:

1. A 4 day food diary (to be completed by parents at home and a research assistant in the child care center);
2. A sub-set of the parents who complete the 4-day food diary will be recruited further for an interview;
3. A Nutrition and Physical Activity Questionnaire (to be completed by directors or assistant directors)

The following attachments are included:

a) Introduction Letter for Directors explaining the components and process of the study;
b) Classroom Teacher Information Letter introducing the study;
c) Nutrition and Physical Activity Questionnaire (NAP-Q) to be filled out;
d) Parent Information Letter explaining the study;
e) Informed Consent Form for parents to sign and return to the center.

The process for the study is outlined below:

NSCCP Project Coordinator has contacted your child care center to explain the study. Upon agreed participation, possible dates for data collection will be determined. We hope to collect data during **May and June** of this year. We ask for your help in the following areas:

1. Distribute the PARENT INFORMATION LETTER and INFORMED CONSENT FORM to parents of children aged 3-4 years. We will provide you with paper copies of these documents.
    - ✓ We ask parents to return the signed PARENT CONSENT FORM to the child care center within 2 days if they wish to participate.
    - ✓ The NSCCP Project Coordinator will follow up with your child care center to obtain the number of returned parent consent forms and schedule a time to pick up the forms and deliver the appropriate number of food diaries.

2. Distribute the CLASSROOM TEACHER INFORMATION LETTER introducing the study to your Early Childhood Educators and/or staff.

3. Fill out the Nutrition and Physical Activity Questionnaire (NAP-Q)
    - ✓ This short survey will take approximately 5-10 minutes of your time.
    - ✓ We will collect the completed NAP-Q when we return to the child care center or you may complete it and send it electronically to

4. Distribute 4-DAY FOOD DIARY packages to the participating families for data collection.
    - ✓ Research assistants will deliver the 4 DAY FOOD DIARY with parent instructions to the child care center during the week of the study.
    - ✓ We are asking parents to record everything their child eats and drinks at home for 4 days (specifically Wednesday, Thursday, Friday, and 1 weekend day). Parents will be asked to take the food diary home on Friday so they complete 1 weekend day. They are asked to return their child's food diary to the child care center the following Monday.
    - ✓ Classroom teachers will not be burdened with research tasks; the research assistants will record everything the child eats and drinks at the child care center on Wednesday, Thursday, and Friday (at a pre-arranged time scheduled by the child care center director or assistant director). Research assistants will be in the child care center to discretely observe the environment and record what the child eats throughout the day. All research assistants collecting data in your center will be mindful of the children's routine and become part of the everyday environment. As well, project staff will have a criminal record check and child abuse register on hand and will comply completely with any specific center policies.

5. Collect 4 DAY FOOD DIARY packages from the participating families.
    - ✓ Research assistants will return to the child care center the following week to pick up all returned 4 day food diaries.

Any participation in the NSCCP project is greatly appreciated. To acknowledge the time and involvement with this research each participating child care center will receive a gift. As well, each family that participates in the food diary will receive a small thank you gift and be included in a draw for a grocery store gift certificate. Families that are recruited further for an interview will receive an additional honorarium for their time.

If you have any questions or comments, please don't hesitate to contact myself (Principal Investigator) by

Sincerely,

Dr. Misty Rossiter, PDt
Principal Investigator, NSCCP
Assistant Professor
Applied Human Nutrition
Mount Saint Vincent University

Appendix 2
Introduction letter for Early Childhood Educator

INFORMATION LETTER
Nutrition **S**tandards in **C**hild **C**are **P**roject (NSCCP)

Hello Classroom Teacher,

We are a part of a research project at Mount Saint Vincent University called the **Nutrition Standards in Child Care Project (NSCCP)**.

It has been over a year since the 'Food and Nutrition Standards' were implemented in regulated child-care settings. We recognize that you have made changes in your classroom to accommodate these standards. We understand that some of these changes have been easy while others have been more difficult.

The reason we are doing this research is to better understand how the 'Food and Nutrition Standards' have affected the food environment of young children while in the child care setting and also at home.

While we are in your classroom we will be learning about what foods the participating children eat and how they function during mealtime. We will be with you during the AM snack, lunchtime, and the PM snack. In addition, their parents have agreed to write down what their children eat at home. This will give us a better understanding of how young children relate to food.

Rest assured that we are only here to learn from you. Please do not feel you need to change the way you do things in your classroom during meal and snack times. We appreciate the wonderful work you do and we value the care you provide to children.

We want to make sure that you feel informed about this project. If you have any questions about the research study please speak with us in person or contact Misty Rossiter by phone or email , or
or email

Sincerely,

Appendix 3
Introduction letter for Parent/Guardian

INTRODUCTION LETTER
Nutrition **S**tandards in **C**hild **C**are **P**roject (NSCCP)

Dear Parents/Guardians,

As you may know, food and nutrition standards have been in place in regulated child care centers across the province. The **Nutrition Standards in Child Care Project** (NSCCP) is a research project from Mount Saint Vincent University. We are interested in how young children (ages 3 and 4) eat while at day care and while at home with their families. We also want to learn about your understanding of how your child eats at home.

We are asking child care centers and families in the Halifax Regional Municipality to share their experiences since the introduction of the food and nutrition guidelines in regulated child care centers. We want to better understand how early childhood educators and staff, children and parents can be better supported to make sure the best nutrition and physical activity environments are available in child care centers.

We would like to invite you to take part in this study if you are a parent or primary care giver of a child 3 to 4 years of age who is at the child care centre 5 days a week (full-time). To participate you need to speak and understand English. If you volunteer, you will be asked to provide information about your child's eating behaviours. To do this we will ask you to fill out a food diary for 4 days. Rest assured that any information you give us will be kept private. If you participate you will receive a small gift and have your name placed in a draw for a $50 grocery gift card.

If you are interested in this project and wish to take part please sign the consent form and return it to your child care centre by:

Date: Friday, May 31st

Once we get your consent form we will send you the food diary along with instructions. We will also send you a few e-mail reminders to help make this experience as simple as possible.

If you have any questions or comments please contact myself by phone or email , or our Project Coordinator, Kimberley Hernandez, by phone or email .

Sincerely,

Dr. Misty Rossiter, PDt
Principal Investigator, NSCCP
Applied Human Nutrition
Mount Saint Vincent University

Appendix 4
Informed Consent Form

MOUNT SAINT VINCENT UNIVERSITY
Excellence • Innovation • Discovery

PARTICIPANT INFORMED CONSENT FORM

FOR

NUTRITION STANDARDS in CHILD CARE PROJECT

Principal Investigator:
Dr. Misty Rossiter
Mount Saint Vincent University

Telephone:
Fax:
Email:

Contact Person:
Kimberley Hernandez, MBA
Project Coordinator
Nutrition Standards in Child Care Project
Mount Saint Vincent University
Evaristus
Telephone:
Email:

Please feel free to contact Misty Rossiter or Kimberley Hernandez by phone or email if you have any questions, comments, or concerns regarding this research, or if you require further information.

Introduction

You are invited to take part in a research study being conducted by Dr Misty Rossiter at Mount Saint Vincent University. Participation in this study is completely voluntary; you do not have to answer any questions that you do not want to answer and you may withdraw from the study at any time. Please know that withdrawing from the study will not negatively affect your relationship with the child care centre or those regulating the child care centres.

Purpose of the Research

The purpose of this study is to explore the impact of the *Standards for Food and Nutrition in Regulated Child Care Settings*, released March 2011 in Nova Scotia. We are interested in the eating behaviours of young children in both the regulated childcare setting and the family environment. As well we want to explore parental perceptions of the eating behaviours of children in the home environment as a result of the Food and Nutrition Standards in child care centres.

What you will be asked to do

By volunteering to participate in this research study, you are being asked to provide information on your child's eating behaviours by completing a FOOD DIARY for 4 days. You will be asked to record what your child is eating for breakfast and for supper. A research assistant will record what your child is eating throughout the day at your childcare centre. For 3 days you will be asked to complete the food diary at home and then send it with your child to the childcare centre to be completed during the day. For the 4th day, we would like you to choose a weekend day and record what your child eats during that 24-hour period.

In addition, you may be asked to participate in a face-to-face interview. You will be asked questions about your perceptions of your child's eating behaviours in the home environment as a result of the new Food and Nutrition Standards in child care centres.

You will be given the opportunity to be contacted to discuss preliminary results and give feedback. You can also choose to receive a summary of the results from the study. Giving permission to be re-contacted is completely voluntary and not needed to participate in this research. You will also receive a copy of this consent form for your records.

Who Can Participate in the Study?

Parents (or primary care givers) who have a child 3 or 4 years of age attending the centre full-time, who are aware of the Food and Nutrition Standards, and can speak and understand English are invited to participate.

Possible Risks

There is minimal risk to taking part in this study. You do not have to answer any questions that you are not comfortable with. **Participants are only asked to provide information that they feel comfortable sharing.** If at any point you no longer wish to participate in the study you may simply withdraw.

Possible Benefits

Providing information on your child's eating behaviours as a result of the Food and Nutrition Standards in regulated child care centres may not directly benefit you. However, it may help to better understand how the Food and Nutrition Standards are perceived by parents and how centres can be supported in providing a healthy eating environment for children.

Compensation

Any participation in research is greatly appreciated, so you would be thanked for your time. Each participating family will receive a small gift and will be included in a draw for a grocery store gift certificate ($50 value). Each family who participates in the face-to-face interview will receive an additional honorarium ($25 value).

Confidentiality and Anonymity

All information that you provide will be kept confidential. All information will be stored in a secure file at Mount Saint Vincent University where only the research team will have access. All identifying information will be removed and replaced with a code number. You will not be identified by name in any reports, publications, or presentations of this study.

Questions

Please contact Dr. Misty Rossiter (Principal Investigator) by phone or email (Melissa.Rossiter@msvu.ca) or Kimberley Hernandez (Project Coordinator) by phone or email (Kimberley.Hernandez@msvu.ca) if you have any questions about this study.

Problems and Concerns

If you have any questions about how this study is being conducted and wish to speak with someone not involved in the study, you may contact the Chair of the University Research and Ethics Board (UREB) c/o MSVU Research Office, at or via email at research@msvu.ca.

NUTRITION STANDARDS in CHILD CARE PROJECT
Participant Informed Consent Signature Page

I, _____ (the participant), have read the explanation about this study. I have been given the opportunity to discuss it and my questions have been answered to my satisfaction. I hereby consent to take part in this study. I realize that my participation is **completely voluntary** and that I am free to withdraw from the study at any time without penalty. I understand that the information collected for this study will be retained unless I specifically contact the Project Coordinator to request the data be destroyed.

☐ Please check this box if you consent to participate in this survey.
Email:_____

☐ Please check this box if you consent to being contacted for an interview at a later date.
Email: _____

OR

Phone Number: _____

Are you aware that there are Food and Nutrition Standards in Regulated Child Care Centres?
☐Yes ☐No

☐ I would like the Project Coordinator to send me a summary of the final results.
Email: _____

OR

Mailing Address: _____

_____

_____

Child's Name (print) :_____

Child's Age: _____

Parent's name (print): _____

Parent's Signature: _____

Date: _____

Appendix 5

NSCCP Substitute Data Collection Form

NSCCP Substitute Data Collection Form

Recorded by: Date:

Child Care Center:

Name:				Name:				Name:			
Snack AM	Start:	Stop:		Snack AM	Start:	Stop:		Snack AM	Start:	Stop:	
	Typical:	Y	N		Typical:	Y	N		Typical:	Y	N
Food Item		Serv.	Intake	Food Item		Serv.	Intake	Food Item		Serv.	Intake
Lunch	Start:	Stop:		Lunch	Start:	Stop:		Lunch	Start:	Stop:	
	Typical:	Y	N		Typical:	Y	N		Typical:	Y	N
Food Item		Serv	Intake	Food Item		Serv	Intake	Food Item		Serv.	Intake
Snack PM	Start:	Stop:		Snack PM	Start:	Stop:		Snack PM	Start:	Stop:	
	Typical:	Y	N		Typical:	Y	N		Typical:	Y	N
Food Item		Serv.	Intake	Food Item		Serv.	Intake	Food Item		Serv.	Intake

NSCCP Substitute Data Collection Form

Recorded by: Date:

Questions:

Circle what meal was eaten 'family style'?	AM	Lunch	PM
ASK "Do you modify menus to accommodate cultural backgrounds?"	Y	N	
ASK "Do you get different requests for different foods not usually offered?"	Y	N	
Do the classroom teachers sit with children during snacks?	Y	N	
Do the classroom teachers sit with children during lunch?	Y	N	
Was there social interaction at the table?	Y	N	
Did teachers and children eat the same food?	Y	N	
Are snacks optional?	Y	N	
Are snacks 'open'? Time Frame:	Y	N	
List any recipes needed for Food Analysis			
Where were the snacks eaten?			
Where was the lunch eaten?			
Where is the kitchen?			
Who prepares the food?			
What foods did the child serve?			
What foods did the teachers serve?			

Additional Observations:

Appendix 6

Ethics Clearance

University Research Ethics Board

Certificate of Research Ethics Clearance

Effective Date	August 21, 2014	Expiry Date	August 20, 2015

File #:	2014-020
Title of project:	*Eating Habits of Nova Scotia Preschoolers Registered in Regulated Child Care*
Researcher(s):	Sarah Gatien
Supervisor (if applicable):	Misty Rossiter
Co-Investigators:	n/a
Version :	1

The University Research Ethics Board (UREB) has reviewed the above named research proposal and confirms that it respects the *Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans* and Mount Saint Vincent University's policies, procedures and guidelines regarding the ethics of research involving human participants. This certificate of research ethics clearance is valid for a period of **one year** from the date of issue.

Researchers are reminded of the following requirements:	
Changes to Protocol	Any changes to approved protocol must be reviewed and approved by the UREB **prior** to their implementation. **Form: REB.FORM.002** **Info: REB.SOP.113** **Policy: REB.POL.003**
Changes to Research Personnel	Any changes to approved persons with access to research data must be reported to the UREB immediately. **Form: REB.FORM.002** **Info: REB.SOP.113** **Policy: REB.POL.003**
Annual Renewal	Annual renewals are contingent upon an annual report submitted to the UREB **prior** to the expiry date as listed above. You may renew up to four times, at which point the file must be closed and a new application submitted for review. **Form: REB.FORM.003** **Info: REB.SOP.116** **Policy: REB.POL.003**
Final Report	A final report is due on or before the expiry date. **Form: REB.FORM.004** **Info: REB.SOP.116** **Policy: REB.POL.003**
Unanticipated Research Event	Researchers must inform the UREB immediately and submit a report to the UREB within seven (7) working days of the event. **Form: REB.FORM.008** **Info: REB.SOP.115** **Policy: REB.POL.003**
Adverse Research Event	Researchers must inform the UREB immediately and submit a report to the UREB within two (2) working days of the event. **Form: REB.FORM.007** **Info: REB.SOP.114** **Policy: REB.POL.003**

*For more information: http://www.msvu.ca/en/home/research/researchethics/policies/default.aspx

Dr. Derek Fisher, Chair
University Research Ethics Board

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