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Investigating Elementary School Food Programs: Impacts on Child Knowledge and Dietary Behaviours

Paige Colley, *The University of Western Ontario*

Supervisor: Gilliland, Jason, *The University of Western Ontario*
: Miller, Linda, *The University of Western Ontario*

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Abstract

Good nutrition is an important part of maintaining a healthy lifestyle. A balanced diet can promote positive health outcomes, protecting against health problems caused by nutritional deficiencies. Canada has reported poor diet quality and high rates of overweight and obesity among children. Obesity has been linked to several non-communicable diseases including type 2 diabetes, heart disease, and some forms of cancer. Efforts to improve lifelong, healthy eating behaviours must be implemented.

This dissertation investigated the impacts of school food programming on child nutrition. A Centrally Procured School Food Program (CPSFP) was implemented at 30 elementary schools in Southwestern Ontario, Canada. This program delivered free, locally-sourced food to schools in an effort to improve child nutrition. A food literacy resource was designed and delivered to families as part of this food program.

A cross-sectional study involving 2,431 children assessed participant knowledge of food. Children's total knowledge scores were on average 29.2 out of 46 (63.5% correct responses). Participants demonstrated nutrition competency and food skills; although, awareness of food guide recommendations and local foods were limited. Female gender, high household income, and rurality were associated with higher knowledge scores.

A randomized controlled trial including 1,836 child participants evaluated changes in food-related knowledge associated with a food literacy resource. The results presented non-significant differences in mean total knowledge scores ($F = 2.7$, $p = .10$) between intervention and control groups pre- to post-intervention. Limited increases in healthy eating efficacy, food selection, identification of local produce, and nutrition knowledge were reported.

A qualitative study involving focus groups with 208 children explored perceptions of and suggestions for the CPSFP. Results from the child focus groups indicated that the program's food provision curbed hunger, promoted greater fruit and vegetable consumption at school and home, and enabled children to try various healthy foods. Participants recommended

adding educational activities, a greater variety of foods, and increased child involvement with the program.

This dissertation identified current strengths and gaps in children's food-related knowledge. Results from two elementary school food interventions can be used to improve current practices and develop innovative programs to promote healthy dietary habits among children.

Keywords

school food; nutrition education; food literacy; food provision; elementary school; child nutrition; dietary habits; health promotion

Summary for Lay Audience

This dissertation examined the impacts of school food programs on children's nutrition and health in Southwestern Ontario, Canada. Three studies were conducted: 1) an assessment of children's food and nutrition knowledge; 2) an evaluation of children's food-related knowledge associated with a take-home food literacy resource; and 3) children's perceptions of and suggestions for a Centrally Procured School Food Program (CPSFP).

Measurements of children's food-related knowledge revealed somewhat low total knowledge scores (63.5% correct responses). Participants demonstrated some nutrition competency and food skills; although, awareness of food guide recommendations and local foods were limited. Several sociodemographic factors, including female gender, high household income, and rurality were associated with higher knowledge scores. These findings can be used to design strategic food education interventions that address gaps in children's knowledge.

Food literacy can be defined as the capacity to understand basic information about food and nutrition as well as the competence to use that information to make appropriate health decisions. An evaluation of a food literacy resource involving eight weeks of fruit and vegetable (F/V) information sheets, maps of local farms, parent and child-friendly recipes, and weekly educational games and activities, presented predominantly non-significant effects on children's total food-related knowledge. Future food literacy interventions should incorporate experiential learning and be provided over a longer period of time with consistent methods of delivery. Additional long-term evaluations of food literacy interventions are recommended.

Elementary school children had positive impressions of the CPSFP. This program offers daily fruit, vegetable, and supplementary food group snacks at schools. Results from child focus groups indicated that the program's food provision curbed hunger, promoted greater F/V consumption at school and home, and enabled children to try various healthy foods. Participants recommended adding educational activities, a greater variety of foods, and increased child involvement with the program. These suggestions can be used to design future multi-component programs that cater to children's interests and needs.

Studies presented in this dissertation offer rich, data-driven research to support the development and sustainability of food programming regionally and beyond. In addition, this research aids in supporting school nutrition policies and practices in Canada.

Co-Authorship Statement

Studies in this dissertation have been or will be submitted for publication in peer-reviewed journals. Paige Colley was the primary author for each article and performed data collection, analysis, and writing. The systematic review of food literacy was co-authored by Dr. Linda Miller, Dr. Patricia Tucker, Dr. Paula Dworatzek, Emily Thomson, and Dr. Jason Gilliland. The three empirical studies were co-authored by Dr. Jamie Seabrook, Dr. Sarah J. Woodruff, Dr. Linda Miller, and Dr. Jason Gilliland. Co-authors were involved in the development of study design, methods, procedures, and analyses of each respective article. Feedback and comments on all versions were provided by co-authors, along with final approval of each article.

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Preface

Overview

Concerns about the quality of children's diets have received considerable attention in recent decades (Colley et al., 2018). Many children are consuming foods of low-nutritional value, leading to dietary excess and nutritional inadequacies (Taylor et al., 2005). Only 10% of Canadian youth are meeting Canada's 2007 Food Guide recommended intake of fruit and vegetable (F/V) servings (Minaker & Hammond, 2016). Similar trends can be found across many food groups, with few children meeting basic nutrition standards (Martorell, 1999). Children are frequently consuming foods with excess fat, sugar, and sodium, often not recommended by national guidelines (Krebs-Smith et al., 2010; Moreno et al., 2014). In 2017, UNICEF ranked Canada 37 out of a list of 41 wealthy countries for children having access to enough nutritious food (United Nations Children's Fund [UNICEF], 2017).

Children with poor diets are prone to immediate and long-term health consequences (Martorell, 1999). Nearly one-third of Canadian children live with overweight or obesity (Peirson et al., 2015), which increases the risk of developing type 2 diabetes, heart disease, and some forms of cancer (Calle & Kaaks, 2004; Daniels et al., 2005; Dietz, 2004). Inadequate nutrition can also impact brain development, leading to a variety of psychosocial and behavioural problems (Benton, 2008; Pollitt et al., 1996; Rao et al., 2008). It is therefore important to identify effective nutrition interventions that promote healthy eating and reduce the risk of debilitating health problems (Colley et al., 2018).

School food programs – including lunch, breakfast or snacks served in the school environment with or without the integration of curriculum – offer a promising method to support child nutrition and lifelong healthy eating habits (Colley et al., 2018). Students participating in school food programs demonstrate increased nutritional knowledge, preferences for healthy foods, and a higher intake of nutrient-dense foods (Fung et al., 2012; He et al., 2009). With increased access to healthy foods, children are also less likely to consume non-nutritious foods (Drapeau et al., 2016). Improved dietary behaviours can offset risks for health-related problems associated with poor eating patterns and nutritional deficiencies (Dalen & Devries, 2014; World Health Organization [WHO], 2002).

This doctoral dissertation follows an integrated article format to investigate the impacts of school food programs on children's nutrition and health. This introductory chapter presents necessary background information regarding the state of child nutrition in Canada, in order to set a foundation for the three primary studies included herein. Research pertaining to child nutrition in Canada is initially presented, followed by health consequences associated with poor dietary patterns. An overview of the current landscape of school nutrition programming in Canada is provided.

Research Objectives and Hypotheses

The objectives of this dissertation were to:

1) assess what children currently know about food and nutrition;

2) evaluate changes in children's food-related knowledge associated with an innovative food literacy resource; and

3) investigate children's perceptions of and recommendations for a Centrally Procured School Food Program (CPSFP).

These objectives were met through three inter-related studies conducted with elementary school children ages 9 to 14 years in Southwestern Ontario (SWO), Canada. The overarching aim of assessing children's food and nutrition knowledge is to offer insight regarding current strengths and gaps, to hopefully inform the design of future food programs that cater to children's nutrition and educational needs.

A food literacy intervention was provided to elementary school children; the intervention included a take-home resource with F/V information sheets, maps to show where food from the Ontario Student Nutrition Program (OSNP) are produced, parent- and child-friendly recipes, and weekly educational activities for children. It was hypothesized that this resource would increase children's knowledge related to Canada's 2007 Food Guide, efficacy for healthy eating, food selection, local F/V, nutrition content, and food preparation.

OSNP offers a network of funding and support for elementary schools across the province to implement nutritious breakfasts, snacks, or meals for students. OSNP, in partnership with the

Victorian Order of Nurses, implemented an innovative CPSFP in SWO. The intervention included the provision of daily, high-nutrient quality foods (i.e., fruit, vegetables, whole grains, dairy products, meat alternatives) directly to participating schools. It was hypothesized that the CPSFP intervention would positively influence children's dietary behaviours.

Rationale

Canada is the only nation among the G8 (i.e., the group of 8 highly industrialized nations, including France, Germany, Italy, Japan, Russia, the United Kingdom, and the United States), without a national school food program (Colley et al., 2018). In the absence of such a program, there are many regional and provincial food programs with different funding systems, intervention components, and delivery methods that vary greatly by region and school. Among these regional and provincial programs are nine elementary-school food programs that have been formally evaluated and reported in academic journals (Colley et al., 2018). This presents a timely opportunity to investigate the impacts of novel food programs using rigorous research designs.

Research presented in this dissertation can be used to explore what Canadian children currently know about food and nutrition. This information can inform future health curricula development in Ontario, as well as the creation of innovative food education programs that address current gaps in food-related knowledge. An evaluation of a novel take-home food literacy resource will add to the current, limited body of literature on food literacy. Results from this research can be used to inform educational practices to improve children's food literacy and associated dietary practices. This research also investigates the impacts of an innovative CPSFP, which offers daily healthy snacks (i.e., fruit, vegetables, dairy, whole grains, and meat alternatives) directly to elementary school children in SWO. Children's perceptions of this program can be used to improve this existing initiative and set a foundation for establishing additional, locally-sourced food provision programs to support healthy dietary behaviours. Collectively, results from these studies can offer evidence-based practice to guide the development of a nation-wide school food program.

Organization of Dissertation

This dissertation follows an integrated article format consisting of a systematic review and three primary studies. *Chapter 1* presents a systematic review of global food literacy interventions and their impacts on child knowledge, determinants of behaviour, and intake of healthy foods. This comprehensive and exhaustive summary of current literature will offer key background information to address the dissertation objectives. *Chapter 2* reports on a quantitative study measuring children's food and nutrition knowledge in SWO. *Chapter 3* involves a quantitative evaluation of a novel take-home food literacy resource. Participant knowledge pertaining to Canada's 2007 Food Guide, efficacy for healthy eating, food selection, local F/V, nutrition and food preparation, was assessed between intervention and control groups pre- to post-intervention. *Chapter 4* includes a qualitative study reporting on children's perceptions of and recommendations for the CPSFP in SWO. *Chapter 5* provides a synthesis and discussion of findings from each of the three primary studies. Implications for policy and practice, suggestions for future studies, and concluding remarks are presented.

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Chapter 1

1 A Systematic Review of Food Literacy Interventions - Impacts on Child Knowledge, Determinants of Behaviour, and Intake

1.1 Introduction

Food provides essential nutrients to support the growth, development, and maintenance of body functioning. It plays a critical role in sustaining a healthy quality of life, as well as preventing and managing chronic disease and conditions (World Health Organization [WHO], 2003). Eating a wide variety of nutrient-dense foods in sufficient quantities is vital to achieve adequate nutrition. Although, maintaining a balanced, quality diet has become an increasing challenge within today's complex global food system (Vidgen & Gallegos, 2014). Modern food culture has been shaped by declining food and cooking skills (Condrasky & Hegler, 2010; Seabrook et al., 2019), frequent consumption of low-cost convenience foods, and increased reliance on processed or packaged foods that are often energy dense and nutrient poor (Baraldi et al., 2018).

Growing concerns about the quality of children's diets have been reported (Colley et al., 2018). Many children are not meeting dietary recommendations set forth by national guidelines (Health Government, 2015; Moreno et al., 2014; Ronto et al., 2018). Regular consumption of foods lacking essential nutrients and in excess quantities have been associated with adverse health consequences (Kearney, 2010). Rates of overweight and obesity have risen to one in six children in developed countries (Organization for Economic Co-operation and Development [OECD], 2017). Childhood obesity has increased risk for developing lifelong health complications and illnesses, including type 2 diabetes, cardiovascular disease, musculoskeletal disorders, psychosocial and behavioural problems, and some forms of cancer (Calle & Kaaks, 2004; Daniels et al., 2005; Dietz, 2004; Pi-Sunyer, 2009).

Accessibility to sufficient, safe and good quality food is needed to establish well-nourished populations; although, focusing solely on food security is unlikely to solve issues of malnutrition caused by excess dietary consumption and micronutrient deficiencies (Food and Agriculture Organization [FAO], 2011). Educating young people about consuming healthy food in appropriate quantities is needed to improve nutritional status (FAO, 2011). The capability to make healthy food choices in different contexts has been identified as food literacy (Poelman et al., 2018). Food literacy can be further defined as the capacity to obtain, process, and understand basic information about food and nutrition as well as the competence to use that information to make appropriate health decisions (Kolasa et al., 2001). Becoming food literate is a critical life skill that enhances resiliency in today's modern food culture, particularly among high risk populations (Food Secure Canada, 2013).

Attention to food literacy programming and research has grown in recent years (Poelman et al., 2018). Food education organizations have been established around the world to foster healthy eating behaviours, food literacy, culinary skills, and education about the broader environmental, social, and health influences of food choice (Food Tank, 2016). Many of these initiatives have surfaced to fill current gaps in school curricula (Perera et al., 2015; Schmitt et al., 2019). For example, in the Unites States, the median length of time for teaching nutrition and dietary behaviour in elementary school was 3.4 hours per year in 2006, well below the number of hours required to achieve learning outcomes (Kann et al., 2007; Perera et al., 2015). In addition, school food policies and guidelines have been implemented in the United States, Europe, Australia, and Japan over the past decade, in an effort to improve child nutrition and health (Phorson, 2015). Academic research on food literacy has also increased substantially from 267 results identified in 2010 on Google Scholar, rising to 3,290 results in 2019. Given the increase in food education programs and research, it is important to know whether children have improved their food-related knowledge and dietary intake as a result of these initiatives.

Previous systematic reviews have synthesized literature on food literacy interventions among adolescent populations. These interventions demonstrated positive impacts on healthy food and nutrition knowledge (Bailey et al., 2019) and may have the potential to

improve adolescents' dietary intake (Vaitkeviciute et al., 2015; Wickham & Carbone, 2018). However, evidence supporting changes in dietary intake is limited and further research is recommended (Bailey et al., 2019; Brooks & Begley, 2013). There are currently no food literacy systematic reviews investigating younger populations, specifically school-aged children 6 to 12 years. Yet, it has become widely known that dietary patterns begin to form in early years (Birch et al., 2007). This presents a timely and critical opportunity to explore food literacy intervention impacts on elementary school-aged children.

The aims of this systematic review are to identify existing school food literacy interventions and subsequent impacts on children's knowledge, determinants of behaviour, and intake of healthy foods. In particular, this review will explore the characteristics, design, and delivery of multiple interventions to see how effective these food literacy initiatives are at influencing children's nutrition. The following research questions are explored: *What are the characteristics of current food literacy interventions in schools globally? In what ways do food literacy interventions influence children's knowledge, determinants of behaviour, and intake of healthy foods (e.g., fruit, vegetables)?* This review investigates children's knowledge about food and nutrition; determinants of behaviour regarding healthy eating (i.e., self-efficacy, preferences, willingness to try, intentions, and confidence), and intake of nutritious foods. It was hypothesized that food literacy interventions would have a positive impact on children's knowledge and determinants of behaviour to make appropriate decisions regarding their nutrition and overall health, as well as improve their intake of healthy foods.

1.2 Methods

A systematic search of five databases following the Preferred Reporting Items for Systematic Reviews and Meta-Analysis was undertaken in June 2018 to identify relevant quantitative, qualitative, and mixed-method studies (Moher et al., 2009). An interdisciplinary team of health sciences, nutrition, and geography researchers developed the search strategy for this review. Three main concepts were developed to create a consistent and comprehensive strategy: *population* to focus the search on children, *food*

literacy to reflect the specific nature of the interventions, and *intervention* to filter results away from guidelines and theoretical strategies. Variations of each concept were identified, and key terms were searched (Figure 1.1). A librarian at Western University was consulted at the commencement of the search process to verify procedures and assist with identifying relevant databases. The search strategy was applied to five multidisciplinary databases relevant to health, nutrition, and education (i.e., CINAHL, ProQuest Education, Embase, PubMed, and Web of Science). A hand search of the reference lists of included articles was also conducted to identify any additional relevant articles.

Figure 1.1 Search Concepts and Terms

		AND	*AND*
	Concept 1: *Population*	Concept 2: *Food Literacy*	Concept 3: *Intervention*
Terms	Child*	Nutrition/Food Literacy	Intervention
OR	Student*	Nutrition/Food Education	Program*
OR	Adolescen*	Food Label*	Initiative
OR	Youth	Food Skill*	Project
OR	Pupil*	Food/Meal Preparation	Promot*
OR		Food/Meal Selection	
OR		Cooking	
OR		Food Safety	
OR		Food/Meal Purchasing	

The studies in this review were required to meet 10 inclusion criteria: (a) a peer-reviewed journal article; (b) written in English; (c) published from 2009 onward; (d) full-text available; (e) contained a primary evaluation; (f) based in a developed country (Society for the Study of Reproduction [SSR], 2018); (g) offered nutrition education or food literacy intervention; (h) conducted in a school setting; (i) targeted children ages 6 to 12 years, or if no age is reported, school grades 1 to 8; and (j) reported outcomes pertaining to children's food knowledge, determinants of behaviour, and/or intake. Articles were excluded if they did not meet the above criteria; if the intervention incorporated non-educational components (i.e., food provision, cafeteria alterations) or components not related to food literacy (i.e., physical activity); or if they aimed to address children with specific diseases or conditions (i.e., cystic fibrosis, HIV, kidney disease).

Two independent researchers conducted the systematic search, screening, and extraction of studies. A PRISMA flow diagram was used to display the systematic review search process and selection of studies according to predetermined inclusion criterion (Moher et al., 2009). Lists of potentially relevant articles from each database were exported into an Excel spreadsheet. A Duplicate Remover add-in was used to find and remove repeated articles in the Excel spreadsheet. Researchers independently assessed the inclusion of studies at each title, abstract, and full-text screening stage. The exclusion of studies prior to 2009 was applied at the full-text screening stage to further focus the results on current interventions within the last decade. The reference list of each study was then screened to identify any additional studies for inclusion. Any discrepancies in screening were collectively discussed with co-authors until a final consensus was achieved. A meta-analysis was not conducted for this review due to the varied study designs and outcome measures.

Data were extracted using The Cochrane Collaboration Effective Practice and Organization of Care Data Collection Form (EPOC, 2018) by two-independent researchers (P.C. & E.T.). General information, such as the article name, study authors, and reference citation, were initially extracted. Data were then extracted according to the population and setting, including a description of the participants, study location, and methods of recruitment. The methods of the study (i.e., aims and design) were then extracted. Specific information pertaining to the study participants (i.e., sample size, baseline imbalances, withdrawals and exclusions, and demographic information) were gathered. Food literacy interventions were thoroughly described including the duration, method of delivery, theoretical foundation, and other characteristics. Relevant outcomes related to food and nutrition knowledge, determinants of behaviour regarding healthy eating (i.e., self-efficacy, preferences, willingness to try, intentions, and confidence), and intake of nutritious foods were reported. Subsequently, a description of the overall results (i.e., comparison groups, baseline and follow-up data, and main findings) and key conclusions were presented.

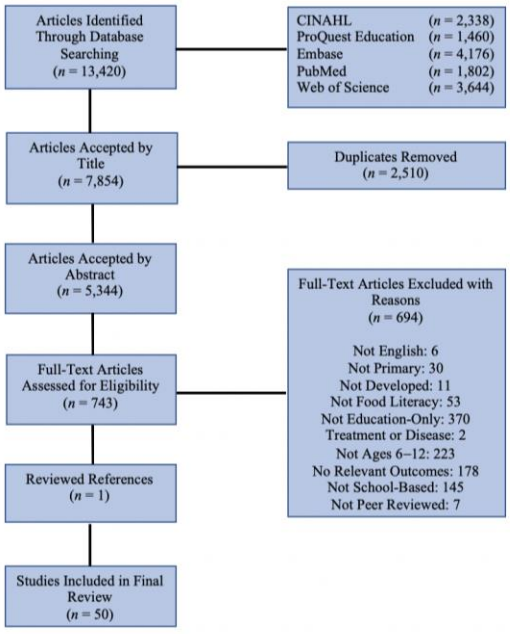
A quality assessment of each included article was evaluated using the 2018 Mixed Methods Appraisal Tool (MMAT) by two independent researchers (Hong et al., 2018).

This tool was designed to critically appraise the methodological quality of quantitative (*n* = 42), qualitative (*n* = 2), and mixed-methods (*n* = 6) studies. All studies were included regardless of differences in quality ratings as per MMAT guidelines (Hong et al., 2018). The quality of studies included in this review are presented in Table 1.1. Research evidence was critically appraised and synthesized to address the research questions.

1.3 Results

A search of five databases resulted in a total of 13,420 studies. The initial title screening identified 7,854 potentially relevant articles. After the title screening, 2,510 duplicate studies were removed, and a remaining 5,344 abstracts were then reviewed according to the initial eligibility criteria. Of these, 816 studies met the criteria and subsequently received a full-text review. The exclusion of studies prior to 2009 was applied at the full-text screening stage to further focus the results on current interventions within the last decade. A total of 49 articles met all inclusion criteria for the current systematic review. The reference list of each study was then screened, resulting in one additional study included in the present review. A flow diagram of the systematic search is presented in Figure 1.2.

Figure 1.2 PRISMA Systematic Review Flow Diagram of Databases Searched



The search resulted in the retrieval of 50 articles (published 2009–2018), representing 40 distinct food literacy programs. Table 1.1 provides an overview of studies included in the systematic review, consisting of: study population; study design and quality assessment; theory; intervention description; duration; research evaluation; relevant outcomes; and results. The articles included a variety of qualitative (*n* = 2), quantitative randomized controlled trials (*n* = 15), quantitative non-randomized controlled trials (*n* = 27), and mixed-methods (*n* = 6) study designs. Studies were included from a diversity of developed countries: United States (*n* = 17), England (*n* = 7), Italy (*n* = 7), Netherlands (*n* = 5), Australia (*n* = 3), Canada (*n* = 2), Taiwan (*n* = 2), Cyprus (*n* = 1), Denmark (*n* = 1), France (*n* = 1), Portugal (*n* = 1), Scotland (*n* = 1), Slovenia (*n* = 1), and Wales (*n* = 1). Each program was conducted in a school-based setting with interventions ranging from 1 to 140 schools. Children in the studies were ages 6 to 12 years, with a greater representation of children in the upper years. The number of participants ranged from small-sample (*n* = 30) initiatives, to larger (*n* = 2,564) region-wide interventions.

The methodological quality of quantitative, qualitative, and mixed-method studies included in this review were assessed using the 2018 Mixed Methods Appraisal Tool by two independent researchers (Hong et al., 2018). Studies were classified as high-quality (4 or 5), mid-quality (2 or 3), and low-quality (1 or 0) according to criterion met. The majority of studies were high-quality (*n* = 34), with fewer mid-quality (*n* = 16) and none that were deemed to be low-quality. A detailed presentation of the methodological quality of each article can be found in Table 1.1 and in the discussion.

Studies assessed participant food-related knowledge and determinants of behaviour primarily using questionnaires and surveys. Dietary intake was largely measured using food frequency questionnaires, as well as some direct intake measures and food diaries/records. Body mass indexing and blood samples were also reported in a few studies. Qualitative evidence was obtained using interviews, focus groups, observations, and drawings.

Table 1.1 Studies Included in the Systematic Review

Ref	Study Population[a]	Study Design & Quality[b]	Theory	Intervention Description	Duration[c]	Research Evaluation[d]	Relevant Outcomes[e]	Results
Classroom Lessons and Activities								
Adamo et al. 2013	*n* = 942 6–12 yrs. 14 schools Canada	Quasi-Experimental High-quality	Not stated	Freggie Friday Schools: presentation and teacher-led tool kit to promote F/V intake and healthy food choices	3 mos. 1 visit & tool kit	Pre- and post-FFQ and adapted Pro Children questionnaire	Intake Knowledge Determinants of Behaviour	Non-significant effects on F/V or snack intake, knowledge or attitudes related to F/V intake (p > .05)
Bevelander et al. 2013	*n* = 306 7–9 yrs. 8 schools Netherlands	Mixed-Method High-quality	Not stated	Monkey See, Monkey Don't: 1) peer modeling lessons with photos, video clips, and activities; 2) similar intervention with puppet monkey	6 mos. 8 mins. morning break	Pre- and post-intake measures; post-questionnaire; interviews; BMI	Intake	1) reduced candy intake in boys (p = .004), not girls (p = .98); susceptibility to peers' eating; 2) non-significant effect on candy intake (p = .34)
Carraway-Stage et al. 2015	*n* = 762 10 yr. 34 classes USA	Quasi-Experimental High-quality	Constructivist Learning	FoodMASTER: teacher-led curriculum using food to teach math and science	1 yr. 18 hrs.	Pre- and post-questionnaire	Knowledge	Improvement in nutrition knowledge (p < .001) of food groups, safety, labels, grains, fats, and micronutrients
Faccio et al. 2013	*n* = 249 9–11 yrs. 12 schools Italy	Qualitative High-quality	Not stated	Mission on the Invisible World: expert-led healthy campaign with practical and theoretical methods to provide food safety education	2 lessons 2 hrs. each	Drawings; semi-structured interviews	Knowledge	Increased understanding of microorganisms, consequences on people and the environment, and ways to prevent spread of harmful organisms
Forneris et al. 2010	*n* = 2120 6th grd. 23 schools USA	Randomized Control Trial High-quality	Not stated	Goals for Health (GFH): peer-led goal setting and life skills to promote healthy eating	12 wks.	Pre- and post-knowledge test; FFQ	Intake Knowledge Determinants of Behaviour	Non-significant intake of fat, fiber, or F/V (p > .05). Increase in knowledge of fat and fiber (p <. 003) and healthy eating self-efficacy (p < .05)
Gower et al. 2010	*n* = 201 6–10 yrs. 3 schools USA	Quasi-Experimental High-quality	Not stated	Fit Kids 'r' Healthy Kids: nutrition student-led classes with activities (i.e., peer interaction, tastings) to build child nutrition knowledge	4 wks. 4, 20–30 mins.	Pre- and post-nutrition knowledge survey	Knowledge	Significant improvements in nutrition knowledge (p <. 001) i.e., food groups, healthful foods, food function

Grassi et al. 2016	*n* = 60 10 yrs. 4 schools Italy	Mixed-Methods High-quality	Reasoned Action & Social Cognitive	Nutrition & media literacy: researcher and dietician-led nutrition media sessions to promote F/V intake	10 wks. 12, 2hrs.	Pre- and post-FFQ; focus group	Intake Determinants of Behaviour	Increased children's F/V intake (p = .000), motivation and self-efficacy for eating F/V (p = .000)
Griffin et al. 2015	*n* = 268 10–12 yrs. 14 schools Scotland	Randomized Control Trial Mid-quality	Not stated	Interactive education: researcher-led sessions on sugars, content in foods/beverages, and minimizing intake.	34 wks. 2, 45 mins.	Pre- and post-knowledge test; FFQ	Intake Knowledge	No significant changes in dietary intake of sugar. Intervention group exhibited greater knowledge of sugar than control group (p < .001)
Hamilton-Ekeke et al. 2011	*n* = ~141 10–11 yrs. 1 school Wales	Randomized Control Trial Mid-quality	Social Constructivist	Teaching/Learning Sequence (TLS): teacher-led sessions on dietary knowledge to improve students' understanding of food classification	3 wks. 45 mins. weekly	Pre- and post-questionnaire	Knowledge	Children's classification of food items i.e., carbohydrate, protein, fat, vitamin, and mineral, was improved (p < .01)
Katz et al. 2011	*n* = 1180 7–9 yrs. 5 schools USA	Randomized Control Trial Mid-quality	Not stated	Nutrition Detectives: PE instructor-led lessons on the selection of healthful foods	4, 20 mins.	Pre- and post-nutrition knowledge test; YAQ; FFQ; BMI	Intake Knowledge	No significant improvements in total caloric, sodium, and sugar intake (p > .05). Nutrition knowledge significantly improved (p < .01)
Liao et al. 2016	*n* = 140 10–11 yrs. 1 school Taiwan	Quasi-Experimental High-quality	Planned Behaviour & Social Cognitive	Food advertising literacy (FA): researcher-led lessons to promote healthy food purchasing Nutrition education (NE): researcher-led lessons without food advertising	6 wks. 40 mins. / wk.	Pre- and post-questionnaire	Knowledge	FA short-term improvements in nutrition knowledge, food advertising literacy, and food purchasing (p < .001). NE significant increase in nutrition knowledge.
Linnell et al. 2013	*n* = 68 5th grd. 2 classes USA	Quasi-Experimental Mid-quality	Social Cognitive	Calcium Counts: nutrition student-led curriculum on calcium healthy relationships, food label literacy, and dietary sources of calcium	4 wks. 30 mins. / wk.	Pre- and post-knowledge questionnaire	Knowledge	Increase in knowledge of calcium rich foods (p < .01)
Losasso et al. 2013	*n* = 249 9–11 yrs. 12 schools Italy	Quasi-Experimental High-quality	Not stated	Mission on the Invisible World (see Faccio)	5 mos.	Pre- and post-child and parent questionnaires	Knowledge	Improvement in children's knowledge (p < .001) i.e., microorganisms and food contamination, and

								behaviours ($p < .001$) (i.e., hygiene) of food safety
Ovca et al. 2016	n = 1272 10–12 yrs. 26 schools Slovenia	Cross-sectional High-quality	Not stated	Food safety workshop: teacher-led workshop on food safety (i.e., kitchen microbiological hazards)	5 wks. 45 mins.	Pre- and post-food safety questionnaire	Knowledge	Children demonstrated improvements of food safety knowledge and self-reported practices ($p < .05$).
Panunzio et al. 2010	n = 199 2–5 grds. 8 classes Italy	Quasi-Experimental High-quality	Not stated	Bring Fruit to School: teacher-led nutrition education to promote importance of F/V	15 wks.	Daily dietary diary	Intake	Increase in F/V intake during intervention and at follow-up ($p < .001$)
Perikkou et al. 2013	n = 218 9 yrs. 6 schools Cyprus	Randomized Control Trial High-quality	Social Cognitive	Educational Material group: Teacher-led curriculum to promote a healthy lifestyle and bring/select healthy food Exposure group: No curriculum, exposed to teacher consuming fruit	1 yr. 29 lessons, 15 mins.	Baseline questionnaire; pre- and post-2-day food record; BMI	Intake	Both groups consumed significantly more fruit than control ($p < .001$). At one-year follow-up, exposure group maintained F consumption ($p < .001$).
Roccaldo et al. 2017	n = 494 8–10 yrs. 13 schools Italy	Quasi-Experimental High-quality	Not stated	Teachers nutrition training program: teacher-led nutrition education lessons promoting taste and intake of F/V	1 mon. 6 hrs.	Pre- and post-KIDMED test; BMI	Intake	Increase in F/V intake ($p < .0001$). Improved adherence to the Mediterranean Diet ($p = .001$).
Wall et al. 2012	n = 2231 7–12 yrs. 140 schools USA	Quasi-Experimental High-quality	Not stated	SNAP-Ed: local organizations deliver vegetable-focused nutrition education lessons with tastings, worksheets, handouts, and activities	3–5 wks.	Pre- and post-questionnaire	Knowledge Determinants of Behaviour	Improved vegetable-related knowledge, attitudes, self-efficacy, and preferences ($p < .001$).
<u>Technology and Gaming</u>								
Bech-Larsen et al. 2013	n = 256 12 yrs. 12 schools Denmark	Randomized Control Trial Mid-Quality	Goal	Nutrition education & SMS: dietician-led nutrition education and SMS-based feedback to set consumption goals	15 wks. 4 SMS wks.	SMS diaries; Pre- and post-questionnaires	Intake	Low pre-intervention users increased F/V intake during intervention ($p < .05$). High pre-intervention users decreased F intake ($p < .05$).

Dias et al. 2011	*n* = 234 7–8 yrs. 5 schools Portugal	Cross-sectional High-Quality	Cognitive Development	Advergame: online games, with healthy and unhealthy versions, offering food content designed persuade children to adapt behaviours	5 mins.	Post-questionnaire	Knowledge Determinants of Behaviour	No change in nutritional knowledge (p = .089). Children playing healthy version selected healthier options (p < .000). Children playing unhealthy version preferred nutrient-poor food (p < .000).
Lakshman et al. 2010	*n* = 2519 9–11 yrs. 38 schools England	Randomized Control Trial High-Quality	Not stated	Top Grub: card game with food items and nutritional values, and teacher-led healthy eating curriculum	9 wks.	Pre- and post-nutrition knowledge questionnaire	Knowledge Determinants of Behaviour	Nutrition knowledge higher in intervention than control (p = .042). Intervention group eats healthy or would try to eat a healthy diet (p < .001).
McEvoy et al. 2014	*n* = 166 9–10 yrs. 1 school USA	Quasi-Experimental Mid-Quality	Not stated	HealthSLAM: medical student-led flipped classroom with video and lessons on nutrition education	58 mins.	Pre- and post-test	Knowledge	Improved children's nutrition knowledge (p < .001).
Pempek et al. 2009	*n* = 30 9–10 yrs. 5 schools USA	Cross-sectional High-quality	Not stated	Advergame: (see Dias)	5 mins.	Post-questionnaire; food selection test	Intake Determinants of Behaviour	Children playing healthy version selected and ate healthier options than unhealthy version (p = .001).
Quick et al. 2013	*n* = 1387 6–8 grds. 2 states USA	Randomized Control Trial Mid-Quality	Health Belief Model & Planned Behaviour	Ninja Kitchen: A web-based school safety education game	1–2 wks.	Pre- and post-questionnaire	Knowledge Determinants of Behaviour	Increased food safety knowledge (p < .05). Stronger attitudes, intentions and confidence to practice safe food handling and handwashing (p < .05).
Rosi et al. 2015	*n* = 76 8–10 yrs. 2 schools Italy	Quasi-Experimental High-Quality	Not stated	5 a Day: teacher-led lessons and educational video games about healthy eating and lifestyle habits	3 mos.	Pre- and post-3-day food diaries	Intake	Daily consumption of F/V increased (p = .016)
Rosi et al. 2016	*n* = 112 8–10 yrs. 3 schools Italy	Randomized Control Trial Mid-Quality	Not stated	Master of Taste: game-based, nutritional education led by nutritional educator (MT) or humanoid robot with educator (MT + NAO)	1 mon. 1hr./ class	Pre- and post-carbohydrate knowledge questionnaire	Knowledge	Increase in child nutritional knowledge for the MT (p = .004) and MT + NAO (p < .001) groups, although both groups showed similar scores.
Struempler et al. 2016	*n* = 2564 3rd grd. 22 schools USA	Quasi-experimental Mid-quality	Experiential Learning	Body Quest: self- and teacher-directed curriculum with iPad applications and traditional	1 yr. 17 classes	Pre- and post-questionnaire	Knowledge	Increased children's nutrition knowledge (p < .001).

				tools (i.e., guide, posters, cards, bracelet)				
Yien et al. 2011	*n* = 66 3rd grd. 1 school Taiwan	Quasi-experimental High-quality	Cognitive & Situational Learning	Game-based nutrition education: e-learning website with games to build nutrition knowledge, attitudes, and healthy eating behaviours	4 wks. once/wk.	Pre- and post-questionnaires	Knowledge Determinants of Behaviour	Intervention promoted children's nutrition knowledge ($p < .001$), and food habits ($p = .05$). Non-significant effects on nutrition attitudes ($p = .66$).
<u>Cooking</u>								
Caraher et al. 2013	*n* = 169 9–11 yrs. 4 schools England	Quasi-experimental High-quality	Not stated	Chefs Adopt a School: chefs provide sessions on hygiene and health, appreciating food using senses, and practical cooking/food preparation.	1 yr. 3 sessions	Pre- and post-questionnaire	Intake Determinants of Behaviour	Student's V intake ($p = .002$), confidence in cooking i.e., food preparation ($p = .000$), and asking confidence for V increased ($p < .001$).
Cunningham-Sabo et al. 2013	*n* = 257 4th grade 4 schools USA	Randomized Control Trial Mid-quality	Not stated	Cooking with Kids (CWK): food-educator delivered cooking and tasting lessons	10 wks. 10 hrs.	Pre- and post-questionnaire	Determinants of Behaviour	Increases in V preference ($p = .03$) and cooking attitudes ($p = .02$). Change in self-efficacy ($p = .063$) and F preferences ($p = .087$) not statistically significant.
Cunningham-Sabo et al. 2014	*n* = 1442 8–12 yrs. 11 schools USA	Quasi-experimental High-quality	Behaviour change	Cooking with Kids: (see Cunningham-Sabo) Tasting Curriculum: curriculum focused on tasting	5, 2hr cooking; 5, 1hr tasting	Pre- and post-questionnaire	Determinants of Behaviour	CWK positively affected F/V preferences ($p = .045$) and cooking self-efficacy ($p = .01$).
Nguyen et al. 2017	*n* = 50 4–5 grds. 1 school USA	Quasi-experimental High-quality	Social Cognitive	Nutrition education and cooking: graduate student-led nutrition lessons with cooking demonstrations, food-related games, and tastings	3 mos. 1.5 hr. weekly	Pre- and post-questionnaire	Knowledge Determinants of Behaviour	Significant increase in nutrition knowledge i.e., serving sizes, food labels ($p < .001$), and self-efficacy related to healthful food choices ($p < .05$).
Ritchie et al. 2015	*n* = 118 6 & 11 yrs. 1 school Australia	Quasi-experimental Mid-quality	Not stated	Kids in the Kitchen: parent-led program engages children in preparing snacks and meals	10 wks.	Pre- and post-questionnaire Skill audit tool	Knowledge Determinants of Behaviour	Increase in F correctly identified, tried and liked ($p = .0001$). Number of V identified increased ($p = .0001$), but no change in V tried or liked. Food

				with F/V to consume				preparation skills improved (p = .0001).
Zahr et al. 2017	n = 100 4–5 grds. Canada	Quasi-Experimental Mid-Quality	Not stated	Project CHEF (Cook Healthy Edible Food): chef-led cooking and tasting program with food safety, knife skills, and food preparation	4–5 sessions, 2.5 hrs each	Pre- and post-questionnaire	Determinants of Behaviour	Greater familiarity and preference for foods provided, improved cooking skills, and increased confidence in the kitchen (p < .05).
Gardening								
Christian et al. 2014a	n = 1256 7–11 yrs. 23 schools England	Randomized control trial Mid-quality	Social Cognitive	Royal Horticultural Society (RHS)-led school gardening and growing activities. Teacher-led school garden with training at RHS-led school.	18 mos.	Pre- and post-24 hr. CADET food diary questionnaire	Intake	Little evidence to support improvement in F/V intake (p = .06)
Christian et al. 2014b	n = 2529 8–11 yrs. 54 schools England	Randomized control trial High-quality	Social Cognitive	Trial 1: RHS-led or a teacher-led gardening intervention. Trial 2: Teacher-led intervention or control group.	18 mos.	Pre- and post-24 hr. CADET food diary questionnaire	Intake Knowledge Determinants of Behaviour	Non-significant improvements in F/V intake (p = .06). No change in knowledge and attitudes.
Hutchinson et al. 2015	n = 1256 7–10 yrs. 21 schools England	Randomized control trial Mid-quality	Social Cognitive	RHS- & Teacher-led (see Christian)	18 mos.	Pre- and post-questionnaire 24-hr. food diary	Knowledge Determinants of Behaviour	HRS increase in V recognized (p = .031). Teacher-led more likely to eat lots of (p = .009) and try F (p = .045). No improvements in attitudes or associations between F/V recognition and intake.
Nolan et al. 2012	n = 141 2–5 grds. 4 schools USA	Quasi-experimental Mid-quality	Not stated	Junior Master Gardener (JMG): Gardening combined with nutrition education curriculum led by teachers.	8 mos.	Pre- and post-FVP questionnaire	Knowledge Determinants of Behaviour	Improved nutritional knowledge, increased preference for F/V, and positive impact on snack choices (p < .05)
Parmer et al. 2009	n = 115 ~7 yrs. 1 school USA	Mixed-Method High-quality	Not stated	1) teacher-led nutrition education and gardening (NE+G) 2) teacher-led nutrition education	28 wks. 1 hr. weekly	Pre- and post-questionnaires Interviews Observation	Intake Knowledge Determinants of Behaviour	NE&G were likely to try (p = .005) and consume V (p < .01). NE+G and NE groups improved nutrition knowledge and taste ratings (p < .001).

				curriculum only (NE)				
Sarti et al. 2017	*n* = 45 9–10 yrs. 12 schools Netherlands	Qualitative High-quality	Relational Social	Amsterdam school gardening program: educator-led initiative to grow V, herbs and flowers, and learn how nature and nutrition relate.	25 lessons, 90 mins. each	Observation Interview Focus groups	Determinants of Behaviour	Enthusiasm about gardening improved their attitudes towards eating V.
Combined Cooking and Gardening								
Davis et al. 2016	*n* = 304 8–10 yrs. 4 schools USA	Randomized Control Trial High-quality	Social Cognitive & Self-Determination	LA Sprouts: nutrition, cooking, and gardening lessons led by an educator with a nutrition or gardening background.	12 wks. 90 mins. weekly	Pre- and post-questionnaires BMI	Knowledge Determinants of Behaviour	Improved nutrition and gardening knowledge (p = .003), and identification of V (p = .001). Self-efficacy to consume, cook or garden did not improve, nor preferences and willingness to try F/V.
Eckermann et al. 2014	*n* = 751 8–12 yrs. 42 schools Australia	Mixed Methods High-quality	Not stated	Stephanie Alexander Kitchen Garden: specialist-led gardening and cooking program to promote enjoyable food education.	2 yrs. 45/90 mins. weekly	Pre- and post-questionnaires Interviews	Intake Determinants of Behaviour	Improve food choices (p = .024), cooking domains (p = .019) and F/V intake. Non-significant trend for eating habits or gardening domains.
Ensaff et al. 2017	*n* = 338 7–9 yrs. 2 schools England	Longitudinal High-quality	Experiential Learning & Social Cognitive (not explicit)	Jamie Oliver's Kitchen Garden: kitchen-cooking sessions led by school staff, where students prepared, cooked and ate food. Teacher-led gardening activities.	1 yr. 90 mins. biweekly	Pre- and post-questionnaires	Determinants of Behaviour	Increase scores for taste description and liking of cooking (p = .004). Improved cooking experience (p = .03). No effect related to food neophobia (p = .053).
Ensaff et al. 2015	*n* = 43 7–9 yrs. 2 schools England	Qualitative High-quality	Grounded	Jamie Oliver's Kitchen Garden (see Ensaff)	1 yr. 90 mins. biweekly	Focus groups Interviews	Knowledge Determinants of Behaviour	Increased enthusiasm and enjoyment of cooking, willingness to try foods, food awareness and knowledge, and produce something tangible through cooking.
Gatto et al. 2017	*n* = 319 8–10 yrs. 4 schools USA	Randomized control trial Mid-quality	Behavioural Change	LA Sprouts (see Davis)	12 wks. 90 mins. weekly	Pre- and post-FFQ, BMI Blood samples	Intake	Increased dietary fiber intake (p = .04). No differences in fruit intake and decrease in most vegetable intake (p = .04).

Gibbs et al. 2013	*n* = 764 8–12 yrs. 12 schools Australia	Mixed-methods High-quality	Social-ecological (not explicit)	Stephanie Alexander Kitchen Garden (see Eckerman)	2 yrs. 45/90 mins. weekly	Focus groups Interviews Observations Pre- and post-questionnaires	Knowledge Determinants of Behaviour	No differences in describing foods. Increase in willingness to try (p = .03), cook (p = .001) or grow foods (p = .001). Some influences on healthy eating.
Sensory and Tasting Education								
Battjes-Fries et al. 2017	*n* = 1010 10–11 yrs. 34 schools Netherlands	Quasi-experimental High-quality	Not stated	Taste Lessons (TL): teacher-led lessons on taste, healthy eating, and food quality. Taste Lessons Vegetable Menu (TLVM), extended version with experiential activities led by a dietician	5 lessons, 45 mins. each	Pre- and post-taste test and questionnaire	Intake Determinants of Behaviour	No significant effects on V intake, willingness to taste V, or food neophobia (p > .05).
Battjes-Fries et al. 2016	*n* = 1010 8–11 yrs. 34 schools Netherlands	Quasi-experimental High-quality	Not stated	TL and TLVM (see Battjes-Fries)	5 lessons, 45 mins. each	Pre- and post-questionnaire	Knowledge Determinants of Behaviour	TLVM exhibited increased knowledge (p < .001) and attitudes (p < .05) pertaining to V consumption. TL group showed increased knowledge (p < .001).
Battjes-Fries et al. 2014	*n* = 1183 9–12 yrs. 21 schools Netherlands	Quasi-experimental High-quality	Not stated	TL (see Battjes-Fries)	Flexible, 1+wks.	Pre- and post-questionnaires	Knowledge Determinants of Behaviour	Long-term knowledge increase (p < .05) Increase short-term knowing and tasting unfamiliar foods, eating healthy, and intentions to consume (p < .05).
Reverdy et al. 2010	*n* = 203 8–10 yrs. 4 schools France	Quasi-experimental High-quality	Motivational & Arousal	Classes du Goût: teacher and professional-led classes to become well-informed and aware of the quality and differentiation of foods using senses.	4 mos. 12 lessons 1.5 hrs.	Taste tests Pre- and post-questionnaires	Determinants of Behaviour	Increased liking of foods with higher arousal potential by exposure, with intervention extending preference (p < .05).

Note.

[a] Study Population: total number of child participants, age, number of schools, and location.

[b] Study Design & Quality: quality is assessed based on the 2018 MMAT methodological study criteria ranking out of five. Four or five 'yes' is high-quality, two or three 'yes' is mid-quality, and one or zero 'yes' is low-quality.

[c] Duration: intervention duration and frequency of delivery.

[d] Research Evaluation: FFQ- Food Frequency Questionnaire; YAQ- Youth and Adolescent Questionnaire; BMI- Body Mass Index; KIDMED- Mediterranean Diet; Quality Index; SMS- Short Message Service; CADET- Child and Diet Evaluation Tool; FVP- Fruit and Vegetable Preference.

[e] Relevant Outcomes: outcomes relevant to the proposed research question.

The studies included in this review presented 40 distinct food literacy programs, categorized into six major thematic groupings: Classroom Lessons and Activities (*n* = 17); Technology and Gaming (*n* = 9); Cooking (*n* = 5); Gardening (*n* = 4); Combined Gardening and Cooking (*n* = 3); and Sensory and Tasting Education (*n* = 2). Theoretical basis for program development was predominantly guided by social cognitive theory (*n* = 12), although the majority of programs did not include a theoretical underpinning (*n* = 27). Intervention duration ranged from brief exposure of 5 minutes to multi-year programming. Studies reporting significant positive influences on children's dietary intake had interventions averaging six and a half months in duration, often implemented for one to two hours weekly. Most programs were led by teachers (*n* = 13) or food-related experts (*n* = 12) with fewer administered by university or college students (*n* = 4), peers (*n* = 2), parents (*n* = 1), self-administered (*n* = 3), or a combination thereof (*n* = 5).

The systematic search identified 18 studies incorporating teacher or nutrition-educator led classroom lessons, often supplemented with experiential learning activities (i.e., experiments, group projects, artistic creations). Of these studies, fourteen interventions evaluated changes in children's food knowledge. Results from thirteen studies indicated increased knowledge of nutrition (Carraway-Stage et al., 2015; Forneris et al., 2010; Gower et al., 2010; Griffin et al., 2015; Katz et al., 2011; Liao et al., 2016; Linnell et al., 2013; Wall et al., 2012), food safety (Carraway-Stage et al., 2015; Faccio et al., 2013; Losasso et al., 2013; Ovca et al., 2016), classification of food items (Carraway-Stage et al., 2015; Hamilton-Ekeke & Thomas, 2011), food groups (Carraway-Stage et al., 2015; Gower et al., 2010), food labels/advertisement literacy (Carraway-Stage et al., 2015; Liao et al., 2016) and food purchasing (Liao et al., 2016).

Of the 18 studies incorporating classroom lessons and activities, four studies analyzed changes in children's food-related determinants of behaviour. Three studies reported improved healthy eating self-efficacy (Forneris et al., 2010; Grassi et al., 2016; Wall et al., 2012) and preferences for vegetables (Wall et al., 2012). One study involving a classroom presentation and teacher toolkit had non-significant program effects on participant knowledge and attitudes of fruit and vegetables (F/V) (Adamo et al., 2013). Nine studies presented conflicting findings regarding program influences on children's

dietary intake. Of which, four studies indicated improvements in F/V intake (Grassi et al., 2016; Panunzio et al., 2010; Perikkou et al., 2013; Roccaldo et al., 2017). Four studies reported non-significant effects on F/V and nutrient intake (Adamo et al., 2013; Forneris et al., 2010; Griffin et al., 2015; Katz et al., 2011), as well as consumption of snack foods (i.e., chocolate, cookies, ice-cream) (Adamo et al., 2013). One study involving peer modeling lessons reported reduced candy consumption among boys, not girls (Bevelander et al., 2013).

Innovative programs involving games and technology have emerged to improve children's food literacy. Programs identified in this review incorporated traditional gaming (i.e., cards; Lakshman et al., 2010), advergaming (Dias & Agante, 2011; Pempek & Calvert, 2009), tablet application (Struempler et al., 2016), short message service (SMS; Bech-Larsen & Gronhoj, 2013), webgames (Quick et al., 2013; Yien et al., 2011), videos (McEvoy et al., 2014; Rosi et al., 2015), and robots (Rosi et al., 2016) to educate children about nutrition, food safety and healthy eating. Of the 10 studies identified, seven studies evaluated changes in children's knowledge. Six studies reported improved knowledge of nutrition (Lakshman et al., 2010; McEvoy et al., 2014; Rosi et al., 2016; Struempler et al., 2016; Yien et al., 2011) and food safety (Quick et al., 2013). One study involving advergaming did not produce changes in children's nutritional knowledge (Dias & Agante, 2011).

Five studies investigated children's determinants of behaviour associated with game and technology programs. Of which, four studies indicated improvements in children's selection (Dias & Agante, 2011; Pempek & Calvert, 2009), preferences (Dias & Agante, 2011) and willingness to try (Lakshman et al., 2010) healthy foods, as well as food safety practices (Quick et al., 2013). One study involving a game-based website had non-significant effects on children's nutrition attitudes (Yien et al., 2011). Outcomes related to dietary intake were reported in three studies. Each of these three studies demonstrated positive increases in children's F/V (Bech-Larsen & Gronhoj, 2013; Rosi et al., 2015) and heathy food intake (Pempek & Calvert, 2009); although, one SMS study presented decreased fruit intake for high pre-intervention consumers (Bech-Larsen & Gronhoj, 2013).

Eighteen interactive programs involving cooking, gardening or a combination thereof were identified in this review. Six studies evaluated the impacts of school cooking programs; of which, two studies evaluated changes in children's knowledge. Both studies presented increases in children's nutrition knowledge (i.e., serving sizes, food labels) (Nguyen & Murimi, 2017) and identification of F/V (Ritchie et al., 2015). Six studies investigated school gardening interventions, including four studies evaluating program impacts on children's knowledge. Three studies presented improvements in children's food knowledge, such as an increase in vegetables recognized (Hutchinson et al., 2015) and nutrition knowledge (Nolan et al., 2012; Parmer et al., 2009). One study with gardening education did not change children's knowledge of F/V (Christian et al., 2014b). Our search identified six studies with combined cooking and gardening interventions, three of which evaluated children's knowledge. Two studies presented increases in children's nutrition and gardening knowledge (Davis et al., 2016), as well as identification, awareness and knowledge of foods (Davis et al., 2016; Ensaff et al., 2015). One study reported no differences in children's ability to describe foods (Gibbs et al., 2013).

Sixteen studies assessed cooking, gardening, or combined program influences on children's food-related determinants of behaviour. Significant improvements in children's determinants of behaviour were reported in six cooking (Caraher et al., 2013; Cunningham-Sabo & Lohse, 2013; Cunningham-Sabo & Lohse, 2014; Nguyen & Murimi, 2017; Ritchie et al., 2015; Zahr & Sibeko, 2017), four gardening (Hutchinson et al., 2015; Nolan et al., 2012; Parmer et al., 2009; Sarti et al., 2017), and four combined studies (Eckermann et al., 2014; Ensaff et al., 2015; Ensaff et al., 2017; Gibbs et al., 2013). Some of these changes included increased F/V preferences (Cunningham-Sabo & Lohse, 2014; Nolan et al., 2012; Ritchie et al., 2015; Zahr & Sibeko, 2017), self-efficacy to select and consume healthy foods (Nguyen & Murimi, 2017), and willingness to try foods (Ensaff et al., 2015; Gibbs et al., 2013; Hutchinson et al., 2015; Parmer et al., 2009; Ritchie et al., 2015). Conversely, four of these studies also reported some non-significant changes in children's determinants of behaviour (Christian et al., 2014b; Cunningham-Sabo & Lohse, 2013; Hutchinson et al., 2015; Ritchie et al., 2015). One study involving a school gardening program did not improve children's attitudes towards F/V (Christian et

al., 2014b). One study with a combined gardening and cooking intervention did not improve children's self-efficacy to garden or cook, nor preferences and willingness to try F/V (Davis et al., 2016).

Our search identified six studies investigating program impacts on food intake, including one cooking, three gardening, and two combined programs. One study evaluating a chef-led school cooking program increased children's vegetable intake (Caraher et al., 2013). Results from two studies investigating a gardening program presented little evidence to support improvements in children's F/V intake (Christian et al., 2014a; Christian et al., 2014b). One study with nutrition education and gardening improved consumption of vegetables (Parmer et al., 2009). A combined gardening and cooking program improved children's dietary fiber intake; although, no differences in fruit intake and decreases in vegetable intake were reported (Gatto et al., 2017). Conversely, one study investigating a partnered gardening and cooking program improved children's F/V intake (Eckermann et al., 2014).

The search identified four studies evaluating sensory and tasting education programs. Two studies evaluated taste lessons with and without experiential learning, of which participants exhibited improvements in children's knowledge (Battjes-Fries et al., 2014; Battjes-Fries et al., 2016). Results from three studies identified increases in children's behaviours and intentions to consume healthy foods (Battjes-Fries et al., 2014; Battjes-Fries et al., 2016), as well as increased preference of foods by mere exposure (Reverdy et al., 2010). One study indicated that sensory education had no significant effects on children's willingness to try vegetables or food neophobia (Battjes-Fries et al., 2017). Outcomes related to dietary intake were reported in one study. Taste lessons had no significant effects on children's vegetable intake (Battjes-Fries et al., 2017).

A comparative analysis of study outcomes related to food knowledge, determinants of behaviour, and intake indicated limited association. A total of 17 studies reported outcomes related to food knowledge and determinants of behaviour; of which, 12 studies representing each program type described positive intervention impacts on children's food knowledge and determinants of behaviour related to healthy eating (Battjes-Fries et

al., 2014; Battjes-Fries et al., 2016; Ensaff et al., 2015; Forneris et al., 2010; Hutchinson et al., 2015; Lakshman et al., 2010; Nguyen & Murimi, 2017; Nolan et al., 2012; Parmer et al., 2009; Quick et al., 2013; Ritchie et al., 2015; Wall et al., 2012). Eight studies presented outcomes pertaining to determinants of behaviour and intake of foods. One study of each program type, excluding sensory and tasting education, presented positive outcomes related to determinants of behaviour and intake (Caraher et al., 2013; Eckermann et al., 2014; Grassi et al., 2016; Parmer et al., 2009; Pempek & Calvert, 2009). This review identified six studies investigating intervention effects on knowledge and intake. Of these six studies, one teacher-led nutrition education and gardening program increased children's nutrition knowledge and intake of vegetables (Parmer et al., 2009). A summary of food literacy intervention outcomes is presented in Table 1.2.

Table 1.2 Summary of Intervention Outcomes

Intervention	Studies	Knowledge		Attitudes		Intake	
		PR	Total	PR	Total	PR	Total
Classroom Lessons and Activities	18	12	13	3	4	5*	9
Technology and Gaming	10	6	7	4	5	3*	3
Cooking	6	2	2	6**	6	1	1
Gardening	6	3	4	4*	5	1	3
Combined Cooking and Gardening	6	2	3	4*	5	2*	2
Sensory and Tasting Education	4	2	2	3	4	0	1

Note. PR = number of positive results and statistically significant if quantitative study.
* represents the number of studies which had both positive results and non-significant or negative results.

1.4 Discussion

This systematic review provides a comprehensive overview of worldwide studies evaluating food literacy program influences on children's knowledge, determinants of behaviour, and intake of healthy foods. A growing body of evidence suggests that school-based food literacy initiatives may have a positive influence on children's dietary behaviours (Vaitkeviciute et al., 2015; Wickham & Carbone, 2018). Schools have been identified as the most effective setting to facilitate dietary education (Black et al., 2017; Bullen, 2000; Hamilton-Ekeke & Thomas, 2011). Results from this review further support the success of school-based food literacy interventions in building children's

food-related knowledge and determinants of behaviour, as well as some intake of healthy foods.

The present systematic review identified distinct food literacy initiatives, including classroom lessons and activities, technology and gaming, cooking, gardening, and sensory and tasting education. The effects of these school-based programs were difficult to assess due to varied study designs, intervention methods, research evaluations, and reported outcomes. None of the studies incorporated a comprehensive tool or standardized procedure to define, measure, and evaluate food literacy. Nevertheless, most studies presented statistically significant improvements in children's knowledge and determinants of behaviour related to healthy food, irrespective of intervention strategy. Limitations to intervention success were often associated with inadequate program duration (Davis et al., 2016; Dias & Agante, 2011; Gibbs et al., 2013), low-intensity (Adamo et al., 2013; Battjes-Fries et al., 2017), inconsistent delivery (Adamo et al., 2013; Christian et al., 2014a), and high pre-intervention scores (Dias & Agante, 2011). Previous research recommends the implementation of food education on a weekly or biweekly basis for a minimum of six months to be effective (Murimi et al., 2018). Providing programs with regular implementation, alongside adequate intensity is suggested to facilitate behaviour change.

The acquisition of nutrition knowledge in childhood is fundamental in improving nutritional choices to support healthy living (Carraway-Stage et al., 2015; Rosi et al., 2015; Wardle et al., 2000). Previous research affirms the need to build nutrition and food knowledge as an initial step (Lakshman et al., 2010). However, translating knowledge into practical change in behaviour requires intensive intervention and complex evaluation (Campbell et al., 2007; Lakshman et al., 2010). Interventions in this review were successful in improving children's food-related knowledge, but did not consistently facilitate changes in dietary intake (e.g., Griffin et al., 2015). Only one teacher-led nutrition education and gardening intervention at seven schools in the United States improved children's nutrition knowledge and consumption of vegetables (Parmer et al., 2009). Far fewer hours of nutrition education are required to improve children's health knowledge relative to time needed to alter health behaviours (Connell et al., 1985; Gibbs

et al., 2013). In this review, food literacy interventions that had a positive influence on children's dietary intake were on average more than six months in duration.

Findings from this review suggest improved determinants of behaviour related to healthy eating may be associated with increased dietary intake. Each of the program types, with the exception of sensory and tasting education, had positive influences on children's food-related determinants of behaviour and intake. Personal factors, such as food preferences, willingness to taste, attitudes, self-efficacy in eating and preparing foods, have the potential to mediate consumption of F/V (Hutchinson et al., 2015; Rasmussen et al., 2006). This appears consistent with previous reviews which indicate the positive impact of food literacy interventions on healthy eating attitudes and dietary intake (Wickham & Carbone, 2018).

Results from this review suggest that innovative gaming and technology interventions may be effective in improving children's intake (Bech-Larsen & Gronhoj, 2013; Pempek & Calvert, 2009). Gaming can be used as a motivational tool to facilitate change in consumption patterns (Baranowski et al., 2011; Wickham & Carbone, 2018). A few interventions involving classroom lessons with experiential learning influenced children's intake in this review (Bevelander et al., 2013; Grassi et al., 2016; Panunzio et al., 2010; Perikkou et al., 2013; Roccaldo et al., 2017). This may be attributed to the influence of modeling by teachers (Perikkou et al., 2013), parents (Grassi et al., 2016), or peers (Bevelander et al., 2013) to invoke dietary change. Cooking and gardening may also be effective in promoting behavioural change and skill development (Caraher et al., 2013; Eckermann et al., 2014; Gatto et al., 2017; Parmer et al., 2009). However, this review presented somewhat limited and conflicting evidence on dietary intake, calling for further primary research to discern which school-based initiatives are most effective.

The quality of studies included in the current review should be considered when interpreting their findings. Studies were predominantly high-quality, with fewer mid-quality and none of low-quality. Most quantitative studies included pre-post evaluations, except two studies involving a brief advergame intervention (Dias & Agante, 2011; Pempek & Calvert, 2009). Several quantitative studies did not include control or

comparison groups which may increase risk of bias (McEvoy et al., 2014; Nguyen & Murimi, 2017; Nolan et al., 2012; Panunzio et al., 2010; Ritchie et al., 2015; Rosi et al., 2015). Small sample sizes were frequently mentioned as study limitations (Grassi et al., 2016; Liao et al., 2016; McEvoy et al., 2014; Rosi et al., 2015; Rosi et al., 2016; Zahr & Sibeko) and may have increased likelihood for error, resulting in decreased statistical power. Study outcomes were often based on self-reported measures which may be subject to recall error, inaccurate reports of information, and social desirability bias. Nevertheless, self-reported data on food consumption has been shown to be as reliable as comprehensive 24hr dietary recall assessments (Brener et al., 2003; Vaitkeviciute et al., 2015).

Previous reviews have emphasized developing food literacy programs with theoretical underpinnings (Brooks & Begley, 2013; Hoelscher et al., 2002). Evaluations of food literacy interventions grounded in behavioural theories have resulted in positive dietary change (Brooks & Begley, 2013). Theory-driven interventions focus on specific, desired behaviours and provide a foundation for designing strategic programs to support behavioural change (Brooks & Begley, 2013, Hoelscher et al., 2002; Lytle, 2005). Social cognitive theory (STC) is the most commonly used theory to facilitate behavioural change in children (Hutchinson et al., 2015; Lytle, 1995). SCT posits that learning occurs through a dynamic and reciprocal social interaction involving personal, behavioural, and environmental determinants (Bandura, 1986). This review presented several food literacy programs guided by SCT, although many studies did not explicit state a theoretical foundation. Personal factors such as self-efficacy, preferences, and attitudes were associated with increased intake of healthy foods. Study interventions led by teachers, peers, and food-related experts further demonstrated the influence of environmental factors in changing dietary behaviours. Principles of SCT may be considered in the development of future food literacy interventions.

This review had some limitations that warrant consideration. The search was limited to articles published in peer-reviewed academic journals, which may lead to an inherent problem caused by publication bias, that is, a bias to publish studies that show significant results. Several studies included in this review, did however, present non-significant

results. Incorporating qualitative, quantitative, and mixed-method study designs may have resulted in limitations pertaining to differences in measurement. In addition, the search process did not include explicitly searched terms relevant to different food literacy program types due to the exploratory nature of this search strategy. A more targeted search of key terms relevant to the program categories identified in this review (e.g., gardening, videogame, sensory) may yield further results specific to program type. This review focused on school-based settings which may have limited the scope of food literacy impacts on child nutrition. Another limitation was the inclusion of articles only written in English. An expanded search of articles written in other languages and other intervention contexts is encouraged.

1.5 Conclusion

This systematic review synthesized research on school-based food literacy programming around the world. Most food literacy programs identified in this review had a statistically significant impact on children's food-related knowledge and determinants of behaviour; however, there was limited and conflicting evidence regarding intervention impacts on children's dietary intake. Findings from this review indicate that school-based food literacy interventions with innovative technology and games, as well as experiential learning through gardening, cooking or other interactive methods, may have the potential to positively influence children's intake of healthy foods. The existing research demonstrates important implications for health professionals, educators, and policy makers in future program development. It is recommended to design multi-component food literacy initiatives with consistent implementation, alongside adequate duration and intensity to facilitate behaviour change. Additional rigorous and long-term evaluations of novel school-based food literacy interventions using validated tools are needed to determine the most effective intervention strategies and delivery methods to establish life-long improvements in the quality of children's diets.

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Chapter 2

2 Examining Elementary School Children's Knowledge about Food and Nutrition

2.1 Introduction

Poor dietary trends in childhood are associated with an increased risk for health conditions such as obesity and type 2 diabetes (Frerichs et al., 2016; Schwimmer, 2005). Energy intake from major food groups, including fruit, vegetables, whole grains, and milk are lacking in children's diets (Gu & Tucker, 2017; Jessri et al., 2016; Minaker & Hammond, 2016; Moreno et al., 2014). Overconsumption of energy from discretionary foods are ubiquitous in many developed countries (e.g., Australian Bureau of Statistics, 2014; Public Health England, 2017; Slining & Popkin, 2013). Public health efforts involving food literacy and nutrition education for children have been advised to counteract these trends (Colley et al., 2018; Vaitkeviciute et al., 2014). Yet, limited research has been conducted to investigate school-aged children's knowledge of food and nutrition to inform curricula and programming (Frerichs et al., 2016; Nemet et al., 2012; Xu & Jones, 2015).

Knowledge is a fundamental determinant in influencing children to make nutritional choices that support lifelong healthy eating behaviours (Wiseman & Harris, 2015; Zarnowiecki et al., 2011). It has become increasingly evident that individuals require essential food knowledge and associated skills to select, prepare, and consume foods in accordance with current nutrition guidelines (Vanderlee et al., 2015). Seabrook et al. (2019) found that meal preparation as an adolescent was the strongest predictor of food skills in young adults. Knowledge of nutrition has also been associated with increased adherence to dietary recommendations, particularly fruit and vegetable (F/V) intake (Spronk et al., 2014).

Previous research has explored children's knowledge pertaining to the identification of food items (Edwards & Hartwell, 2002; Tsao & Ramsay, 2016). Children were able to

group foods according to similarity and nutritional value (Brophy et al., 2012; Nguyen, 2007; Zarnowiecki et al., 2011), but not in all cases (De Vlieger et al., 2020; Hart et al., 2002; Tsao & Ramsay, 2016). Social influences from media, peers, parents, and social institutions have affected children's food knowledge, preferences, and practices (Atik & Ertekin, 2013; Hart et al., 2002; Slaughter & Ting, 2010; Stewart et al., 2015; Xu & Jones, 2015). Awareness of the links between diet and health have been explored (e.g., Hart et al., 2002; Schultz & Danford, 2016). Some studies, but not all (Schultz & Danford, 2016; Stewart et al., 2015), have identified children's lack of knowledge about the nutritional composition of foods (Nemet et al., 2012) and relationship to health (Brophy et al., 2012; Lanigan, 2011; Tsao & Ramsay, 2016). Children develop a greater conceptual understanding of food and its associated health benefits as they become older (Xu & Jones, 2015; Zeinstra et al., 2007).

Research in North America indicates that children may be lacking broader food literacy, including limited awareness of where food is grown, how it is produced and distributed, and influences on health (Benn, 2014; Nowak et al., 2012; Powell et al., 2008). Brophy et al. (2012) found that primary school children knew more about the physical appearance of food than its underlying nature or origin. The aforementioned gaps and limitations present a valuable opportunity to further explore children's food literacy.

Therefore, the primary objective of this study was to investigate elementary-school children's knowledge of food and nutrition in Southwestern Ontario (SWO), Canada. In particular, children's understanding of Canada's Food Guide (2007) recommendations, healthy eating efficacy, selection of healthier foods, local F/V awareness, nutrition knowledge, and food preparation skills were explored. The secondary objective was to identify sociodemographic factors related to children's knowledge of food and nutrition. These objectives helped delineate areas of strength and/or gaps in children's knowledge in order to develop strategic food education programming that promote lifelong healthy eating habits.

2.2 Methods

This cross-sectional study occurred in elementary schools across SWO during the 2017/18 and 2018/19 school years. Cluster sampling was used to select schools from two English-language school boards (Thames Valley District School Board and London District Catholic School Board), which represented all areas within the counties of Middlesex, Oxford, and Elgin, and cities of London and St. Thomas. Sixty elementary schools, from a list of 160 eligible schools, were randomly invited and agreed to participate in the study. Principals from each of the participating schools received a letter of information. Our research team presented an overview of the study to school staff and responded to any questions.

Teams of researchers from Western University visited each of the participating schools to provide informational presentations for children in grades 5 to 8 and answer any questions. This age group was targeted because children's cognitive development is sufficient to complete quality, survey research (Borgers et al., 2000). A letter of information, parental consent and child assent forms, and a parent/guardian survey were sent home following the presentations. The parent/guardian survey was used to obtain sociodemographic information in this study. All children were required to have written parental consent, in addition to personal child assent in order to participate. The study protocol was approved by the research offices of both school boards, school principals, as well as Western University (Non-Medical Research Ethics Board Approval #108549).

Our research team returned to each participating school to administer a child survey once during the academic school year in the fall, winter, or spring. A sample of sixty schools with 9,627 children in grades five to eight were eligible to participate in the study. Parent or guardian consent was obtained for 2,443 (25.4%) of the eligible child participants. Within each school, children with parental consent were brought together in a central space, such as the school's resource room, library, classrooms, or gym, to complete a child survey. A member of our research team reviewed the child assent form and provided verbal instructions. Any children who had parental consent but did not want to participate were exempt from the study. The research team were available to assist with

spelling and answer any questions related to comprehension during the survey. Participants absent on the day of the survey were provided with written instructions and completed the survey at school another day.

The child survey questions included 124 items under four domains: sociodemographic information, eating habits, nutrition and food knowledge, and food preferences. Knowledge questions were adapted from previously used surveys (Catch Kids Club, 2014; Champions for Change, 2010-11; Deakin University Australia, 2011; Northern Fruit and Vegetable Program, 2016; Wisconsin Farm to School, 2013) and designed by members of our research team, including registered dietitians and educators. Multiple question types were incorporated, such as multiple choice, yes/no, true/false, Likert-type scale, and fill-in the blanks. Students completed the child survey in approximately 25-30 minutes. The parent/guardian survey consisted of 22 items under three domains: sociodemographic information, child eating habits, and parent eating habits. The parent survey was used to validate and supplement information pertaining to participants' sociodemographic characteristics derived from the child survey. The parent/guardian survey was estimated to be completed in 10-15 minutes.

A total food and nutrition knowledge score was calculated by summing the number of correct responses derived from forty-six individual questions in the child survey. The survey included knowledge questions on the recommendations from Canada's Food Guide (2007), efficacy pertaining to healthy eating, food selection, locally-sourced produce, nutrition content, and food preparation. For example, "How many servings of F/V should children your age eat every day based on Canada's Food Guide? (2-8 servings); "Which of the following F/V are grown in Ontario? e.g., Apples (True, False)." The minimum possible score a child could achieve was 0 and the maximum was 46. If participants responded to less than or equal to half of the knowledge questions (n = 23), survey data were excluded from total score calculations. All remaining observations that were not responded to, were considered 'I don't know' and as a result incorrect. Descriptive statistics were used to explore individual-level knowledge of specific content areas (i.e., Canada's food guide, healthy eating efficacy, selection of healthy foods, local F/V, nutrition, and food preparation). Participant sociodemographics, including gender,

age, ethnicity, living arrangement, parental education, geographic region and household income, and total food-related knowledge scores were investigated to identify correlations. Child-reported data were primarily used; however, where missing, parent-reported data were substituted.

Data were analyzed using IBM SPSS Statistics, version 25 (Armonk, NY: IBM Corp). Descriptive statistics were used to describe the characteristics of the sample, as well as the participants' food and nutrition knowledge. The Pearson correlation coefficient was used to assess the strength and direction of the association between continuous sociodemographic variables and total knowledge score. Independent samples *t*-tests were used to compare group means between categorical sociodemographic variables and total knowledge score. Where categorical independent variables had three or more groups, the one-way analysis of variance (ANOVA) compared means of continuous dependent variables and the Tukey post hoc test assessed all pairwise comparisons. Multiple regression analysis was conducted to examine the relationship between total knowledge and various sociodemographic predictor variables. *P* values ≤ 0.05 were considered statistically significant.

2.3 Results

A total of 2,431 child participants assented and completed the child survey. The parent survey was completed by 2,334 parents or guardians. Sociodemographic characteristics of the sample population are presented in Table 2.1. The mean age of the participants was 11.2 years (*SD* = 1.3), with 58.1% self-identified as female. A higher proportion of female participants is typical of studies involving elementary school children in SWO (e.g., Irwin et al., 2019). The majority of participants identified as Caucasian (86.4%), which is similar to the ethnic distribution for Middlesex, Elgin, and Oxford counties as was reported in the 2016 Census (i.e., 87.2% Caucasian). Most participants (80.5%) lived in two-parent households and had a median family size of four people. Demographics related to living arrangement are similar to previous studies involving children in this region (Smith et al., 2019), as well as data reported in the 2016 Census. Nearly one-third (31.2%) of participants resided in rural settings. Wilson et al. (2018) conducted a

population health intervention involving elementary school children in SWO and reported a similar distribution of participants living in rural settings (32.3%).

Of the respondents' parents, 68.8% had a college or university level education. The 2016 Census indicates over half of parents have post-secondary education (52.3%); however, high levels of parental education similar to this study have been reported in other elementary school-based studies in this region (Clark et al., 2019). The median household income was between $90,000 and $99,999, although nearly one-third of participants did not disclose their income level. Household income levels reported in this study were greater than the median household income in the region ($67,861; Statistics Canada, 2016).

Table 2.1 Sociodemographics of Elementary School Children and Their Parents/Guardians in Southwestern Ontario, Canada

Characteristic	Frequency	%	Mean or *Median	*SD*
Gender				
Female	1405	58.1		
Male	1013	41.9		
Age (years)				
9 to 14			11.2	1.3
Ethnicity				
Caucasian	1990	86.4		
Visible Minority/Mixed Race	313	13.6		
Geographic Setting				
Urban–London	42	1.9		
Suburban–London	299	13.3		
Urban Small Town	627	28.0		
Rural Small Town	575	25.6		
Rural	700	31.2		
Household Income Level				
<$20,000	24	1.4		
$20,000–29,999	135	7.9		
$30,000–39,999	97	5.7		
$40,000–49,999	86	5.0		
$50,000–59,999	116	6.8		
$60,000–69,999	112	6.5		
$70,000–79,999	102	6.0		
$80,000–89,999	127	7.4		
$90,000–99,999	141	8.2		
$100,000–109,999	136	7.9		

$110,000–119,999	93	5.4	
$120,000–129,999	117	6.8	
$130,000–139,999	60	3.5	
$140,000–149,999	92	5.4	
>$150,000	274	16.0	
Highest Level Parental Education Completed			
Less than High School	156	7.1	
High School	534	24.1	
College/University	1323	59.8	
Graduate School	199	9.0	
Living Arrangement			
One parent/guardian household	438	18.1	
Two parent/guardian household	1951	80.5	
Other arrangement	36	1.5	
Total People Living in Main Home			
2 to 6+			*4

Note. Any numbers unaccounted for were non-responses.

The mean total knowledge score for the sample of elementary school children was 29.2 (*SD* = 7.1) out of a possible 46 points (63.5% correct responses). The survey questions and associated correct response percentages are presented in Table 2.2. Children's knowledge about the number of F/V servings that they should eat based on Canada's 2007 Food Guide was low (24% responded correctly). The majority of respondents were able to correctly identify strategies that would encourage children to eat more F/V, with an average of 71.1% answering each sub-question correctly. Incorrect responses were frequently reported for "eating F/V that are different colours every day" and "eating fruit gummies". Most participants demonstrated strong practical nutrition knowledge by correctly selecting the healthier food or drink option from each pair (84.2% answering each sub-question correctly). There were mixed findings pertaining to children's knowledge of F/V grown in Ontario, with correct responses for items ranging from a low of 31.1% correct for cantaloupe to 91.5% correct for apples. Respondents demonstrated a moderate understanding of the nutritional value of F/V, with an average response of 65.6% correct for each sub-question. Children's knowledge of F/V fiber content (56.4%; 49.9% correct responses) and the nutritional value of frozen F/V (28.6%; 22.4% correct responses) were limited. Most participants were able to correctly identify the safest way to clean fresh produce using cold running water (70.9% correct responses).

Table 2.2 Food and Nutrition Knowledge of Elementary School Children in Southwestern Ontario, Canada

Content Area	Questions	% Correct
Food Guide	1. How many servings of F/V should children your age eat every day based on Canada's Food Guide (2007)? *(Response options: 2-8, I don't know)*	24.0
Healthy Eating Efficacy	2. Which of the following statements below will help children your age eat more F/V?	
	a) Eat F/V that are different colours every day	57.5
	b) Eat F/V at every meal	71.9
	c) Eat more French fries and vegetable chips	77.5
	d) Eat fruit as dessert	70.8
	e) Eat F/V at home	88.7
	f) Eat fruit gummies	60.2
	(Response options: Yes, No, I don't know)	
Food Selection	3. Select the food or drink in each pair that should be chosen most often:	
	a) Orange or orange juice	82.7
	b) Tomato ketchup or tomato sauce	75.9
	c) Fresh strawberries or strawberry frozen yogurt	93.1
	d) French fries or baked potato	85.3
	e) Raspberry jam or fresh raspberries	93.2
	f) Frozen blueberries or blueberry muffin	69.4
	g) Apple pie or apple	90.0
	(Response options: Select one item)	
Local Foods	4. Which of the following F/V are grown in Ontario?	
	a) Apples	91.5
	b) Broccoli	52.1
	c) Cantaloupe	31.1
	d) Cauliflower	43.5
	e) Celery	41.8
	f) Cherry tomatoes	69.7
	g) Cucumber	73.8
	h) Grapes	64.4
	i) Kiwis	46.1
	j) Melon	47.6
	k) Orange peppers	55.7
	l) Oranges	38.5
	m) Pears	59.2
	n) Pineapple	56.2
	o) Plums	39.7

		p) Red peppers	64.9
		q) Strawberries	87.4
		r) Sugar snap peas	37.6
		s) Yellow peppers	60.5
		(Response options: Yes, No, I don't know)	
Nutrition Knowledge	5.	Answer true or false for each statement about F/V:	
		a) Vegetables have fiber	49.9
		b) Vegetables are low in sugar	76.3
		c) Vegetables come in many colours which give you different kinds of nutrients	69.1
		d) Vegetables that are frozen have fewer vitamins and minerals compared to fresh vegetables	22.4
		e) Vegetables are only good for you if you eat them raw	80.5
		f) Vegetables only need to be eaten at dinner time	93.2
		g) Vegetables have many types of vitamins and minerals	89.6
		h) Fruits have fiber	56.4
		i) Fruits do not have added sugar	65.7
		j) Fruits come in many colours which give you different kinds of nutrients	65.3
		k) Fruits that are frozen have fewer vitamins and minerals compared to fresh fruit	28.6
		l) Fruit are only good for you if eaten at breakfast	90.4
		(Response options: True, False, I don't know)	
Food Preparation	6.	What is the safest way to clean fresh F/V? *(Response options: Regular soap, Hot water, Cool running water, You don't need to wash fresh F/V, I don't know)*	70.9

Associations between children's total knowledge score and various sociodemographic factors are presented in Table 2.3. A statistically significant difference between child gender and total knowledge was identified, with a higher mean score reported for females (M = 30.0, SD = 6.6) compared to males (M = 28.0, SD = 7.5); $t(2216) = 6.8$, $p < .001$. There was no relationship between age and total knowledge score ($r = .03$, $p = .11$). Caucasian children had higher total knowledge scores than visible minorities (M = 29.5, SD = 6.9 vs. M = 27.7, SD = 7.4); $t(2106) = 4.1$, $p < .001$, respectively. Children's total knowledge scores were significantly different across urban-London (M = 25.9, SD = 7.8) and suburban-London (M = 27.7, SD = 7.2), compared to urban small town (M = 29.2,

SD = 7.0), rural small town (*M* = 29.6, *SD* = 6.8) and rural settings (*M* = 29.9, *SD* = 6.9) [*F*(4, 2047) = 7.4, *p* < .001]. A weak positive correlation between household income level and child knowledge was reported (*r* = .15, *p* < .001). Higher levels of parental or guardian education from less than high school (*M* = 27.2, *SD* = 7.4) to university/college (*M* = 29.6, *SD* = 6.8) or graduate school (*M* = 29.9, *SD* = 7.2) were associated with increased knowledge among children [*F*(3, 2019) = 6.7, *p* < .001]. There were no significant differences in total knowledge scores between one-parent (*M* = 28.6, *SD* = 7.2) and two-parent (*M* = 29.3, *SD* = 7.1) households [*F*(2, 2223) = 2.5, *p* = .08]. Associations between the total number of people living in the main home and children's total knowledge were not statistically significant (*r* = -.04, *p* = .07).

Table 2.3 Associations Between Participant Sociodemographics and Total Baseline Knowledge Score

Variable		Knowledge Score		*P*-value
Gender		Mean (*SD*)	T Value (*t*)	< .001
	Female	30.0 (6.6)	6.8	
	Male	28.0 (7.5)		
Age	Mean (*SD*)	Mean (*SD*)	Correlation (*r*)	.11
	11.21 (1.3)	29.2 (7.1)	.03	
Ethnicity		Mean (*SD*)	T Value (*t*)	< .001
	Caucasian	29.5 (6.9)	4.1	
	Visible Minority/Mixed Race	27.7 (7.4)		
Setting		Mean (*SD*)	F Value (*F*)	< .001
	Urban–London	25.9 (7.8)	7.4	
	Suburban–London	27.7 (7.2)		
	Urban Small Town	29.2 (7.0)		
	Rural Small Town	29.6 (6.8)		
	Rural	29.9 (6.9)		
Household Income	Median	Mean (SD)	Correlation (*r*)	< .001
	$90,000–$99,999	29.2 (7.1)	.15	
Maximum Household Education		Mean (*SD*)	F Value (*F*)	< .001
	Less than High School	27.2 (7.4)	6.7	
	High School	28.7 (7.3)		
	University/College	29.6 (6.8)		
	Graduate School	29.9 (7.2)		

Living Arrangement		Mean (*SD*)	F Value (*F*)	.08
	One parent/guardian	28.6 (7.2)	2.5	
	Two parent/guardian	29.3 (7.1)		
	Other arrangement	27.4 (7.7)		
Total People in Main Home	Mean (*SD*)	Mean (*SD*)	Correlation (*r*)	.07
	4.4 (1.1)	29.2 (7.1)	-.04	

Multiple regression analysis was used to test if sociodemographic variables significantly predicted participants' total knowledge scores (Table 2.4). The results of the regression indicated that the five predictors explained 4.6% of the variance [$R^2 = .046$, $F(5,1146) = 13.88$, $p < .001$]. It was found that female gender ($\beta = -.138$, $p < .001$) significantly predicted higher total food and nutrition knowledge scores, as did higher household income ($\beta = .110$, $p < .001$) and small town and rural settings ($\beta = .075$, $p = .01$).

Table 2.4 Multiple Regression of Participant Sociodemographics and Total Baseline Knowledge Score

Variable	*B*	*SE B*	*β*	*t*	*P-value*
Female	-1.929	.361	-.138	-5.348	< .001
Caucasian	-.293	.570	-.014	-.515	.61
Small Town and Rural Settings	.484	.172	.075	2.815	.01
Higher Household Income	.182	.047	.110	3.855	< .001
University/College Parent Education	.412	.270	.042	1.523	.13

2.4 Discussion

The present study describes the food and nutrition knowledge of a large sample of elementary school children in SWO. Our results provide valuable insight regarding strengths and gaps in children's food-related knowledge. Indeed, knowledge in our sample was somewhat low overall with an average score of 29.2 out of 46 (63.5% correct responses). Children demonstrated limited knowledge of where select F/V are grown, despite being in an agriculturally-rich region of the country. Results further indicated that participants residing in urban- and suburban-London had significantly lower food and nutrition knowledge scores compared to small town and rural regions. These findings

appear consistent with prior research indicating children's lack of knowledge surrounding the origins of food (Jackson, 2015). Several other studies from other regions in North America have identified a disconnect in knowledge regarding where food is grown, how it is produced and distributed, and its impacts on health (Bellotti, 2010; Colatruglio & Slater, 2014; Lea & Worsley, 2008; Nanayakkara et al., 2017).

Most participants were unable to recall national dietary guidelines pertaining to the intake of F/V (Health Canada, 2007), despite several learning expectations focused on Canada's Food Guide in the Ontario Curriculum for elementary students (Ministry of Education, 2018). This information was gathered prior to the implementation of the updated 2019 Canada Food Guide. Evidence in other countries similarly report that children have limited knowledge of food intake guidelines (Pettigrew et al., 2009). Although knowledge is one of many factors that influence dietary intake, it may not be feasible for individuals to meet national guidelines if they are not aware of the guidelines (Vanderlee et al., 2015). Consequently, a lack of knowledge pertaining to F/V recommendations may translate into inadequate intake of healthy foods. Educating children about national guidelines and recommendations is warranted, particularly in accordance with the implementation of the updated 2019 Food Guide in Canada (Slater & Mudryj, 2018).

Despite the aforementioned gaps in knowledge, participants demonstrated some nutrition competency and food skill knowledge. Respondents were able to identify strategies that encourage F/V consumption, select healthier food or drink options, and safely prepare fresh produce. These findings differ from recent research which suggests that child nutrition knowledge and food skill knowledge are limited (Ronto et al., 2016; Slater et al., 2018). Children's food and nutrition knowledge may be driven by the educational curricula and practices in Ontario elementary schools. The Ontario Health and Physical Education curriculum incorporates a healthy eating component, which equips students with the knowledge and skills needed to make healthy food choices (Ministry of Education, 2018). Participant knowledge did not, however, improve across age groups. This may be attributed to the lack of curricular content on local foods in the intermediate division. Integrating additional curricular content on the origins of food, national food

guide recommendations, and nutrition topics may be one avenue to enhance children's food literacy, particularly in later years of elementary school.

Study results should be interpreted in light of some limitations. Parent or guardian consent was obtained for 2,443 (25.4%) of eligible child participants. This fairly low participation rate may restrict the generalizability of study results. Similar response rates have been reported in studies involving elementary school children in this region (e.g., Irwin et al., 2019). The child survey used in this study relied on self-reported measures of knowledge and may be subject to recall bias. As a result, participant responses may not be consistently accurate. Strategies to reduce likelihood for recall bias included: ample time, uninfluenced support in seeking clarification on questions, and a parent survey to validate sociodemographic responses. This study incorporated a cross-sectional design representative of a specific point in time. Participant engagement with the Ontario Health and Physical Education curriculum during the school year may have influenced their knowledge scores. Procedures were administered to investigate participants' food and nutrition knowledge at different times in the academic year.

2.5 Conclusion

This cross-sectional study provides important information regarding the state of children's food and nutrition knowledge in SWO, Canada. Knowledge in our sample was somewhat low, although participants did demonstrate some nutrition competency and food skills. Future interventions to improve children's food literacy should therefore incorporate education programs. Multi-component programs with food provision, parental involvement, school nutrition policies, and experiential learning (i.e., cooking) have been shown to positively influence children's nutrition knowledge and dietary intake (Colley et al., 2018). Additional research is recommended to evaluate whether changes in knowledge yields improvements in dietary behaviour.

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Chapter 3

3 Evaluating a Take-home Food Literacy Resource for Elementary School Children: A Randomized Controlled Trial

3.1 Introduction

Food choice is guided by several determinants including complex social, economic, and physiological factors (Brug, 2008; Leng et al., 2017). Knowledge about food and nutrition has been identified as a fundamental factor in influencing food choices that drive dietary patterns (Asakura et al., 2017; Zarnowiecki, et al., 2011). The acquisition of nutrition knowledge at an early age is critical to support the selection and intake of healthy foods that meet current nutrition guidelines (Worsley, 2002). Nevertheless, research indicates that children may be lacking essential food literacy (Bereznay et al., 2019; Ronto et al, 2016).

Food literacy can be defined as "the capacity of an individual to obtain, interpret, and understand basic food and nutrition information and services as well as the competence to use that information and services in ways that are health enhancing" (Kolasa et al., 2001, p. 2). Described in this way, the acquisition of knowledge related to food is a precondition in supporting self-regulating dietary habits that meet physiological and nutritional needs (Vaitkeviciute et al., 2015). Consequently, limited food and nutrition knowledge has been shown to facilitate the onset of poor dietary behaviours that often carry into adulthood (Grosso et al., 2012).

Previous research has explored children's identification and classification of foods (e.g., (Edwards & Hartwell, 2002; Nguyen, 2017; Zarnowiecki et al., 2011). In some studies, children were unable to categorize (De Vlieger et al., 2020; Hart et al., 2002) and understand the nutritional composition of foods (Nemet et al., 2012; Resnicow & Reinhard, 1991). Many children have limited awareness sounding the origins of food (Brophy et al., 2012; Nowak et al., 2012), the process in which food reaches the plate (Benn, 2014; Powell et al., 2008), and its effects on health (Lanigan, 2011; Tsao &

Ramsay, 2016). Wickham and Carbone (2018) found that adolescents lack the ability to apply food knowledge and skills to plan, select, prepare, and consume healthy foods. The aforementioned gaps in children's food knowledge may play a part in the poor dietary trends of children in many countries (Grosso et al., 2012).

Health promotion programs are needed to counteract this trend and support life-long healthy eating behaviours (Wickham & Carbone, 2018). Interventions that focus on the core concepts of food literacy have been identified as a promising method to improve food-related knowledge and behaviours (Bailey et al., 2019), as well as positive changes in children's healthy food intake (Vaitkeviciute et al., 2015; Wickham & Carbone, 2018). Recent reviews, however, have identified limited studies with rigorous methodological designs that measure multiple aspects of food literacy (Bailey et al., 2019; Vaitkeviciute et al., 2015).

The purpose of this study was to evaluate a novel food literacy intervention provided to elementary school children in Southwestern Ontario (SWO), Canada. A food literacy resource, known as the Tasty Ontario Food Literacy Book, was created in partnership with the Ontario Student Nutrition Program (OSNP). The book includes fruit and vegetable (F/V) information sheets, maps to show where food from OSNP are produced, parent and child-friendly recipes, and weekly educational activities for children. An experimental study design with pre- and post-evaluations was conducted to investigate the impacts of this food literacy resource on children's knowledge related to Canada's 2007 national food guide, healthy eating efficacy, food selection, locally-sourced F/V, nutrition, and food preparation.

3.2 Methods

The OSNP Food Literacy intervention was an eight-week program for elementary school children that focused on building food literacy knowledge and skills. The intervention included a Tasty Ontario Food Literacy Book with four weekly themed worksheets totalling thirty-two pages: 1) a F/V themed page with information on selecting, storing, preparing, eating, seasonality, and nutrition; 2) a picture and map of a local farm where

food from the OSNP program is produced; 3) parent and child-friendly recipes that center around a F/V theme; and 4) an educational page with facts, games, quizzes, and activities involving local foods. The food literacy resource was collaboratively designed by graduate students and professors, OSNP coordinators, school board members, and public health staff. The book was delivered to 18 intervention schools and sent home to families with children in grades five to eight. Intervention schools also received daily high-nutrient quality snacks, including locally-sourced F/V, as part of a larger OSNP intervention involving 30 elementary schools in SWO. The control group, comprised of 20 schools, did not receive the Tasty Ontario Food Literacy book or food provision during the intervention period, but schools were offered the resource online following completion of the study.

A randomized controlled trial occurred in elementary schools across SWO. Ethics approval for this study was granted by Western University's Non-Medical Research Ethics Board (NM-REB #: 108549). Schools in the Thames Valley and London regions were randomly selected from a list of 160 eligible institutions involved with OSNP. Supporting study approval and ethics was provided by the Thames Valley District School Broad, the London District Catholic School Board, and principals of participating schools. Eligible institutions were grouped according to socioeconomic status and urbanicity. In each group, schools willing to participate were then randomly assigned to intervention or control conditions. A sample of 38 schools with 6,120 children in grades five to eight were eligible to participate in the study. Children in this age group were targeted, as they have reached sufficient cognitive development to effectively complete survey research (Borgers et al., 2000). Parent or guardian consent was obtained for 30.1% (n =1,844) of eligible child participants.

Data collection took place between September 2017 and May 2019. Teams of researchers from the Human Environments Analysis Laboratory in the Department of Geography at Western University visited each participating school to provide student presentations and deliver parent consent forms and surveys to be completed at home. The research team returned to each school to administer a child survey pre- and post-intervention. Our team provided verbal instructions on how to complete the survey, helped with spelling, and

answered questions related to comprehension. Participants absent on the day of survey administration were given the opportunity to complete the survey during school hours at a later date.

The child survey consisted of 124 questions in four domains: sociodemographics, eating patterns, food and nutrition knowledge, and food preferences. Multiple question formats were used, such as multiple choice, true/false, Likert-scale, and fill-in the blanks. Children completed the survey in approximately 25-30 minutes. The parent/guardian survey included 22 questions in three domains: sociodemographics, child eating patterns, and parent eating patterns. Information derived from the parent survey was used to supplement child survey responses. The parent survey was estimated to be completed in 10-15 minutes. Survey questions were designed by academics in the field, dietitians, and educators using previously used nutrition surveys (Catch Kids Club, 2014; Champions for Change, 2010-11; Deakin University Australia, 2011; Northern Fruit and Vegetable Program, 2016; Wisconsin Farm to School, 2013).

Sociodemographic characteristics of the sample population were reported in the child and parent/guardian surveys. Participant gender, age, ethnicity, household geographic setting (i.e., urban, rural), household income, parental education, parental/guardian living arrangement, and total people residing in the home, were described. Data were used primarily from the child survey; however, when data were missing, data from the parent/guardian survey were substituted.

Children's food and nutrition knowledge was assessed using the child survey. The sum of correct responses from 46 questions in the child survey was used to calculate a total food and nutrition knowledge score pre- and post-intervention. The survey included questions pertaining to Canada's Food Guide (2007), efficacy for healthy eating, food selection, local sources of F/V, nutrition content, and food preparation. A minimum possible score of 0 and maximum score of 46 could be attained. If participants responded to fewer than or equal to half of the knowledge questions (n = 23), survey data were excluded from this study. All remaining questions that were not responded to were considered 'I don't know'

and identified as incorrect. Individual knowledge scores were also measured to identify any specific increases in knowledge following the intervention.

Data analysis was performed using IBM SPSS Statistics, version 25 (Armonk, NY: IBM Corp.). Descriptive statistics including means and frequencies were used to report the sociodemographic characteristics of the sample population. A one-way analysis of covariance (ANCOVA) was used to detect mean differences between the control and intervention group total knowledge scores whilst controlling for pre-knowledge scores. Paired samples *t*-tests compared individual level pre- and post-knowledge scores to identify any specific increases in knowledge following the intervention. *P* values ≤ 0.05 were considered statistically significant.

3.3 Results

A total of 1,836 child participants assented and completed the child survey at baseline. The follow-up child survey was completed by 1,657 children, for a retention rate of 90.3%. A parent survey was completed by 1,759 parents or guardians. Sociodemographic characteristics of participating elementary school children and their parents/guardians are presented in Table 3.1. The mean age of respondents was 11.2 years (*SD* = 1.3), 58.2% self-identified as female, and 88% were Caucasian. The majority of participants resided in rural neighborhoods (36.6%) and had a median family size of four people. Respondents predominantly lived in two-parent households (81%) and parents were often college/university educated at the undergraduate level (56.7%). The median total household income level was between $90,000 and $99,999; however, approximately 31% of respondents did not disclose their household income.

Table 3.1 Child and Parent/Guardian Sociodemographic Characteristics at Baseline

Characteristic	Frequency	%	Mean or *Median	*SD*
Gender				
Female	1064	58.2		
Male	758	41.5		
Age (years)				
9 to 14			11.2	1.3
Ethnicity				

Caucasian	1527	88.0	
Visible Minority/Mixed Race	208	12.0	
Geographic Setting			
Urban–London	30	1.8	
Suburban–London	161	9.6	
Urban Small Town	390	23.2	
Rural Small Town	486	28.9	
Rural	615	36.6	
Household Income Level			
<$20,000	0	0	
$20,000–29,999	119	9.3	
$30,000–39,999	70	5.5	
$40,000–49,999	70	5.5	
$50,000–59,999	88	6.9	
$60,000–69,999	89	7.0	
$70,000–79,999	82	6.4	
$80,000–89,999	88	6.9	
$90,000–99,999	102	8.0	
$100,000–109,999	101	7.9	
$110,000–119,999	71	5.6	
$120,000–129,999	91	7.1	
$130,000–139,999	41	3.2	
$140,000–149,999	63	4.9	
>$150,000	199	15.6	
Highest Level of Parental Education Completed			
Less than High School	142	8.5	
High School	455	27.2	
College/University	947	56.7	
Graduate School	126	7.5	
Living Arrangement			
One parent/guardian household	322	17.6	
Two parent/guardian household	1480	81.0	
Other arrangement	25	1.4	
Total People Living in Main Home			
2 to 6+			*4

Note. Any numbers unaccounted for were non-responses.

A one-way ANCOVA was used to detect mean differences between control and intervention group total knowledge scores whilst controlling for pre-knowledge scores. Descriptive statistics derived from the univariate analysis of variance indicated a control group mean knowledge score of 28.9 (*SD* = 7.9) and an intervention group mean knowledge score of 29.9 (*SD* = 7.5). There was no significant difference in mean total

knowledge scores between intervention and control groups pre- to post-intervention [$F(1, 1478) = 2.7$, $p = .10$].

Paired samples *t*-tests compared individual level pre- and post-knowledge score means to identify any increases in food literacy knowledge among participants receiving the intervention (Table 3.2). Participants demonstrated statistically significant increases in efficacy to consume F/V of different colours every day ($M = .56$, $SD = .5$ vs. $M = .59$, $SD = .49$); $t(798) = 2.2$, $p = .03$), while remaining efficacy scores did not improve significantly. Knowledge pertaining to the selection of healthy food or drink options remained relatively consistent pre- to post-intervention apart from respondents' increased knowledge pertaining to the selection of French fries versus a baked potato ($M = .85$, $SD = .35$ vs. $M = .88$, $SD = .33$); $t(761) = 2.0$, $p = .05$). Children's knowledge of F/V grown in Ontario, such as celery ($M = .43$, $SD = .5$ vs. $M = .48$, $SD = .5$); $t(796) = 2.5$, $p = .01$), snap peas ($M = .38$, $SD = .49$ vs. $M = .47$, $SD = .5$); $t(803) = 4.3$, $p < .001$), and orange peppers ($M = .57$, $SD = .5$ vs. $M = .64$, $SD = .48$); $t(791) = 2.7$, $p = .007$), increased pre- to post-intervention; however, knowledge of remaining local produce did not increase significantly. Participants demonstrated increased nutrition knowledge of fruit fiber ($M = .57$, $SD = .5$ vs. $M = .65$, $SD = .48$); $t(793) = 4.8$, $p < .001$) and vegetable fiber ($M = .48$, $SD = .5$ vs. $M = .62$, $SD = .49$); $t(801) = 8.1$, $p < .001$) and that fruit does not have added sugar ($M = .65$, $SD = .48$ vs. $M = .69$, $SD = .46$); $t(794) = 2.6$, $p = .009$), while remaining scores pertaining to F/V did not improve.

Table 3.2 Children's Pre-Post Food and Nutrition Knowledge Scores

Content Area	Questions	Baseline % Correct	Follow-up % Correct	T Value (*t*)	Significance Level (*p*)
Food Guide	1. How many servings of F/V should children your age eat every day based on Canada's Food Guide (2007)? *(Response options: 2-8, I don't know)*	22.3	21.7	-.13	.90
Health Eating Efficacy	2. Which of the following statements below will				

		help children your age eat more F/V?				
		a) Eat F/V that are different colours every day	56.1	59.0	2.2	.03
		b) Eat F/V at every meal	71.9	75.3	1.9	.06
		c) Eat more French fries and vegetable chips	76.9	77.3	.6	.56
		d) Eat fruit as dessert	71.3	73.6	1.2	.23
		e) Eat F/V at home	87.6	88.6	1.5	.13
		f) Eat fruit gummies	62.1	59.9	-1.3	.18
		(Response options: Yes, No, I don't know)				
Food Selection	3.	Select the food or drink in each pair that should be chosen most often:				
		a) Orange or orange juice	83.7	86.3	1.8	.07
		b) Tomato ketchup or tomato sauce	75.4	76.1	.2	.83
		c) Fresh strawberries or strawberry frozen yogurt	93.3	92.6	-.5	.62
		d) French fries or baked potato	85.3	87.6	2.0	.05
		e) Raspberry jam or fresh raspberries	92.9	93.6	1.1	.29
		f) Frozen blueberries or blueberry muffin	67.4	66.4	.0	1.0
		g) Apple pie or apple	88.6	91.3	1.8	.08
		(Response options: Select one item)				
Local Foods	4.	Which of the following F/V are grown in Ontario?				
		a) Apples	93.3	91.7	-1.4	.17
		b) Pears	64.4	63.1	-.8	.43
		c) Celery	42.5	47.7	2.5	.01
		d) Broccoli	53.4	53.7	-.2	.86
		e) Cantaloupe	35.1	32.8	-1.5	.13
		f) Oranges	37.6	38.0	-.1	.94
		g) Cauliflower	45.1	45.6	.6	.58
		h) Grapes	65.0	65.1	.0	1.0
		i) Cherry tomatoes	71.6	73.1	.9	.35

		j) Cucumber	78.1	75.7	-1.8	.08
		k) Orange peppers	57.3	63.8	2.7	.007
		l) Sugar snap peas	38.4	46.6	4.3	<.001
		m) Kiwis	46.1	48.4	.8	.44
		n) Melon	52.8	47.1	-2.8	.006
		o) Pineapple	57.2	54.9	-1.3	.19
		p) Plums	42.6	42.4	-.2	.81
		q) Yellow peppers	63.1	64.8	.6	.57
		r) Red peppers	68.4	67.1	-1.1	.25
		s) Strawberries	87.9	87.4	-.4	.71
		(Response options: Yes, No, I don't know)				
Nutrition Knowledge	5.	Answer true or false for each statement about F/V:				
		a) Vegetables have fiber	48.3	62.3	8.1	<.001
		b) Vegetables are low in sugar	73.8	74.0	.1	.89
		c) Vegetables come in many colours which give you different kinds of nutrients	70.8	64.0	-2.9	.004
		d) Vegetables that are frozen have fewer vitamins and minerals compared to fresh vegetables	22.1	22.4	.4	.69
		e) Vegetables are only good for you if you eat them raw	79.4	79.7	-.5	.61
		f) Vegetables only need to be eaten at dinner time	92.7	90.4	-2.5	.01
		g) Vegetables have many types of vitamins and minerals	88.8	87.1	-1.7	.1
		h) Fruits have fibre	57.4	64.6	4.8	<.001
		i) Fruits do not have added sugar	64.7	69.3	2.6	.009
		j) Fruits come in many colours which give you different kinds of nutrients	66.4	63.5	-1.3	.2

		k) Fruits that are frozen have fewer vitamins and minerals compared to fresh fruit	28.9	29.5	.2	.81
		l) Fruit are only good for you if eaten at breakfast	90.1	86.8	-2.7	.006
		(Response options: True, False, I don't know)				
Food Preparation	6.	What is the safest way to clean fresh F/V? *(Response options: Regular soap, Hot water, Cool running water, You don't need to wash fresh fruits and vegetables, I don't know)*	70.4	63.0	-4.2	<.001

3.4 Discussion

The present study evaluated the OSNP Tasty Ontario Food Literacy book provided to elementary school children in SWO. Our results indicated that this eight-week food literacy intervention did not significantly influence children's total food and nutrition knowledge scores. Study participants did, however, demonstrate some improvements in knowledge related to healthy eating efficacy, food selection, identification of local foods, and nutrition. In analyzing these questions further, the food literacy resource presented this content in the form of healthy eating tips, games (i.e., crosswords, word scrambles, matching), and fun facts. While not all questions delivered in this format produced increased knowledge, the incorporation of interactive game-related activities may result in improved food and nutrition knowledge (Holzmann et al., 2019). Interventions involving gaming have been effective in engaging participants, whilst building internal motivation to increase knowledge and facilitate behavioural change (Baños et al., 2013; Baranowski et al., 2011; Thompson et al., 2010). Combining elements of gaming with

interactive technology have also resulted in positive knowledge outcomes related to nutrition (Rosi et al., 2016; Yien et al., 2011) and food safety (Quick et al., 2013).

Designing future food literacy interventions with interactive experiential learning may be one avenue to enhance children's food-related knowledge. Previous evaluations of school-based cooking programs showed improvements in children's knowledge of nutrition (Nguyen & Murimi, 2017) and food preparation skills (Caraher et al., 2013; Jarpe-Ratner et al., 2016). School gardening positively influenced children's willingness to try healthy foods (Parmer, 2009) and preferences for F/V (Nolan et al., 2012). Ensaff et al. (2015) found that children engaged in a school-based kitchen project had a greater understanding of food, its origins, and health implications. Integrating cooking and gardening into food education may be an effective approach to build upon children's limited knowledge of local food, as identified in this study. In addition, multi-component interventions involving experiential learning have positively influenced children's intake of healthy foods (Eckermann et al., 2014; Jarpe-Ratner et al., 2016; Muzaffar et al., 2018).

Minimal change in children's overall food-related knowledge reported in this study may be attributed to intervention duration and method of delivery. The food literacy resource was intended to be sent home for children and their families to use on a weekly basis. Direct measures of participants' time engaging with the books was not completed. A qualitative evaluation of children's experiences engaging with the OSNP program indicated that some children did not receive the food literacy book from their teacher or in some cases, did not take initiative to bring the book home and read it. A less intensive, hands-off approach may not be the most effective method to deliver food literacy programming. Previous evaluations of food literacy interventions have indicated low-intensity as a frequent barrier to program success (Adamo et al., 2013; Battjes-Fries et al., 2017). Providing programs with regular implementation, alongside adequate intensity is recommended to improve children's food knowledge.

Participants were expected to engage with the food literacy book at home, while simultaneously receiving daily food provision at school for eight weeks. Nutrition

education interventions targeting school aged children are recommended to be delivered on a weekly or biweekly basis for a minimum of six months to be effective (Murimi et al., 2018). Consequently, studies delivering nutrition education interventions within a period of less than six months were less likely to be successful in achieving their objectives (Murimi et al., 2018). Participants' limited increase in food and nutrition knowledge may be attributed to the short-term intervention duration at home.

This study presented some limitations that should be considered when interpreting the results. A random sampling strategy was used to select groups of children at schools across SWO. Descriptive statistics of the sample population presented a greater portion of children self-identified as female (58.2%) and Caucasian (88%) compared to population census data from the entire province. Children aged 0 to 14 in Ontario were 49% female and 64% Caucasian (Statistics Canada, 2016). Sociodemographic characteristics of the sample population were, however, similar to previous studies involving children in this region (Clark et al., 2019; Irwin et al., 2019; Smith et al., 2019; Wilson et al., 2018). Participants frequently resided in households with total income levels between $90,000 and $99,999, greater than the provincial total family median income ($86,081; Statistics Canada, 2016). The sample sociodemographic characteristics may not be generalizable to other populations and locations.

Data were collected within schools guided by the Ontario Ministry of Education's Elementary Curriculum. Participant knowledge scores may have been influenced by the Health and Physical Education curriculum or other related educational practices during the evaluation period. Procedures were administered to measure children's food-related knowledge scores during fall, winter, or spring seasons to holistically assess knowledge at different times in the academic year. School administrators and teachers were advised to avoid supplementary nutrition education instruction during the eight-week intervention and evaluation period.

3.5 Conclusion

This randomized controlled trial provided an evaluation of a novel take-home food literacy resource. The OSNP Tasty Ontario Food Literacy book provided eight weeks of F/V information sheets, maps of local farms, parent and child-friendly recipes, and weekly educational games and activities. A pre- and post-evaluation of this food literacy resource presented mostly non-significant effects on children's food-related knowledge in SWO. Future food literacy interventions should be provided over a longer period of time with consistent and intensive methods of delivery. Designing initiatives with multi-component, experiential learning may be successful in enhancing children's food-related knowledge. Additional long-term evaluations of food literacy interventions are required to identify the most effective implementation practices and strategies to improve children's knowledge and associated dietary behaviours.

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Chapter 4

4 Children's Perceptions of a Centrally Procured School Food Program in Southwestern Ontario, Canada

4.1 Introduction

Public health professionals have become increasingly concerned about the quality of children's diets in Canada (Health Canada, 2012). A meagre 10% of Canadian children between the ages of 6 and 12 years consume 5 or more servings of fruit and vegetables (F/V) daily (Minaker & Hammond, 2016). Similar trends can be found across remaining food groups, with few children meeting basic nutrition standards for whole grains, milk products, meat and alternatives (Jessri et al., 2016). This leaves a considerable portion of children's diets to be comprised of high-calorie, low nutrient-dense foods with unhealthy fats, salt, and added sugar (Jessri et al., 2016). Regularly consuming foods of low-nutritional value can lead to inadequate nutrition and dietary excess (Taylor et al., 2005).

Poor nutrition is one of the leading causes of obesity in children (Swinburn et al., 2004). Rates of obesity have reached epidemic proportions, with nearly one-third of Canadian children being overweight or obese (Peirson et al., 2015). Obesity can lead to a lifetime of health complications including type 2 diabetes, hypertension, heart disease, sleep apnea, and liver disease (Daniels et al., 2005). Inadequate nutrition can also impact brain development, leading to a variety of psychosocial problems such as anxiety and depression (O'Neil et al., 2014). With inhibited cognitive development, children often display a lack of energy, inability to focus, and failure to thrive academically (Rampersaud et al., 2005). These trends reflect an important health issue that warrants immediate attention, given that childhood dietary patterns of low-nutritional quality often persist into adulthood (Winpenny et al., 2017). It has become a national priority to improve children's dietary behaviours in an effort to reduce the risk of debilitating, life-long dietary health problems (Government of Canada, 2019a).

School nutrition programs have been identified as an effective method to promote healthy eating, aid in reversing declining nutrition levels, and ultimately improve the overall health of children (Fung et al., 2012; He et al., 2009). A recent systematic review of 11 Canadian school nutrition program studies found that multi-component food provision interventions positively influenced children's nutrition knowledge, attitudes toward healthy foods, and intake of nutrient-dense foods, such as F/V (Colley et al., 2018). While recent research suggests that school nutrition programming may yield positive health benefits, there are limited experimental studies evaluating school food programming in Canada (He et al., 2012). Moreover, to our knowledge there has been only one qualitative study investigating children's perceptions of and experiences with elementary school food programs nationally (Colley et al., 2018). This presents a critical and timely opportunity to solicit the views and opinions of children directly receiving these initiatives.

The purpose of this study was to investigate children's perceptions of Ontario Student Nutrition Program's (OSNP) Centrally Procured School Food Program (CPSFP) in Southwestern Ontario (SWO). OSNP offers a network of funding and support for elementary schools across the province to implement nutritious breakfasts, snacks, or meals for students in the community. Program funding is funneled through the Government of Ontario Ministry of Children and Youth Services and allocated to 15 lead agencies across the province. The lead agency in Southwestern Ontario is the Victorian Order of Nurses (VON). VON implemented an innovative CPSFP in the region. The purpose of this program was twofold: 1) to improve the nutritional quality of food being offered through existing programs, and 2) to establish local food procurement strategies to support the local food economy.

The CPSFP is one of the largest free, locally-sourced school food programs in Canada. Participating schools receive weekly deliveries of fresh fruit, vegetables, dairy products, whole grains, and meat alternatives. By offering a dietitian-approved menu, the CPSFP offers daily, high-nutrient quality snacks that follow nutritional guidelines proposed by the Ministry of Children and Youth Services (2016). This school-based initiative also incorporates centralized food procurement strategies in order to source a greater

proportion of program food, a minimum of 20%, from local farmers. The CPSFP nourishes thousands of elementary school children on a daily basis, aiming to fuel young minds and promote healthy eating patterns.

This study contributes to existing Canadian school nutrition literature by evaluating children's perceptions of and suggestions for the CPSFP. The research objectives were to investigate:

1) perceived influences of the program on children's dietary behaviours; and

2) factors contributing to or detracting from program success, including future program development recommendations.

4.2 Methods

This study incorporated a child-centered research design guided by an epistemological stance that research is *with* children, rather than *on* children (Matthews, 2010). The research approach employed qualitative methods that value children's voices and experiences, rather than assuming adult program administrators 'know-all' (Morgan et al., 2002). Supplementing this child-centered approach, the data collection and analysis processes were supported by the moderator's educational experience engaging with children to facilitate an open, respectful conversation, and knowledge of the local, sociocultural context. Focus groups were facilitated to create a receptive and constructive dialogue amongst child participants to gather perceptions of and suggestions for the nutrition program in a permissive, non-threatening environment. This qualitative approach is optimal in addressing the research objectives related to children's perceptions of the CPSFP.

This qualitative study incorporated child focus groups at participating elementary schools involved with the CPSFP. Ethics approval was granted by the Non-Medical Research Ethics Board of Western University (NM-REB #: 108549). Study approval was granted by the Thames Valley District School Board and the London District Catholic School Board, and principals of participating elementary schools. The research team

administered a letter of information to school principals and presented an overview of the study to school staff. The team also facilitated classroom presentations at each school for children in grades five to eight (ages 9 to 14 years) to further explain the research process and answer any immediate questions. Previous research using focus groups with children have shown that by this age they can effectively express their perspectives on and recommendations for improving their situation in and around school (Tucker et al., 2008; Wilson et al., 2018). Following these presentations, a letter of information, parent consent, and child assent forms were sent home for review by parents. Signed parental and child assent were required to participate in the study, including consent to audio record and transcribe verbatim all focus group material. Participants were informed that anonymized direct quotations may be used for the purpose of this research.

A cluster randomized sampling strategy was used to invite 30 schools engaged in the CPSFP research evaluation to participate in child focus groups. Schools were represented in all areas within the counties of Middlesex, Oxford and Elgin, and cities of London and St. Thomas. Twenty-one out of 30 potential schools agreed to participate in the follow-up child focus groups. Depending on the number of parental and child assent forms, 1 or 2 focus groups were conducted at each of the 21 participating schools.

The CPSFP was offered to children from kindergarten to grade 8 in each participating elementary school for ten weeks. All children in grades 5 to 8 (aged 9-14 years) in the 21 schools were invited to participate (n = 3,432) and 647 of the invited children had parental consent. Of those, 4 to 12 children in each school were randomly selected by school principals for participation, yielding a sample of 208 children who assented and participated in the child focus groups. Thirty-eight focus groups comprised of 4 to 6 children were conducted across 21 schools during the 2017/2018 school years. Sociodemographic characteristics of the focus group participants were obtained from child and parent surveys. The schools and participants were selected as part of a larger collaborative, multiple methods intervention study which focused on this age group.

A doctoral research candidate trained in qualitative methods moderated each focus group, accompanied by a research assistant who took notes and audio recorded the discussions.

A semi-structured interview guide was developed by several members of an interdisciplinary team comprised of child health researchers and educators (included as appendix H). The questions posed during the focus groups facilitated discussion about children's perceptions of the CPSFP, specifically targeting any perceived dietary impacts. The focus group protocol followed a general question structure but was flexible to allow participants to guide the conversation. The moderator did, however, maintain the flow of the conversation and ensured it remained on topic by using subsequent prompts. Each focus group ranged in duration from 20 to 60 minutes, with most approximately 30 minutes in length. Focus groups were held in each school's resource room, library, classrooms, or gym. All focus groups were conducted in English, audio recorded, transcribed verbatim, and double-checked for accuracy.

Thematic analysis was employed to identify existing patterns within the data. An inductive approach to coding was used to analyze specific participant responses and form broader conclusions. Independent coders followed Braun and Victoria's (2006) systematic process for thematic analysis, which involved familiarizing oneself with the data, generating initial codes, searching for, mapping, and defining themes, and producing a final analysis. QSR International's NVivo version 12 (2018) was used to organize and review the transcripts from each school. Two independent reviewers coded transcripts to identify key themes relevant to the research objectives.

Several protocols were integrated to ensure rigor in the analysis. The focus group moderator created the initial codes to ensure significant content was represented accurately in conjunction with what was observed and heard within the focus groups. A secondary coder, a research assistant, was employed to complete an independent secondary code of the data to mitigate any internal bias. There was a high degree of similarity between the general codes identified among the two independent researchers. A comparison of coded data was completed by the moderator and research assistant to identify any missing or contradictory codes, which were then resolved through consensus with the team. The study aimed to align with child-centered principles and actively present the analysis using the voices and ideologies of children.

4.3 Findings

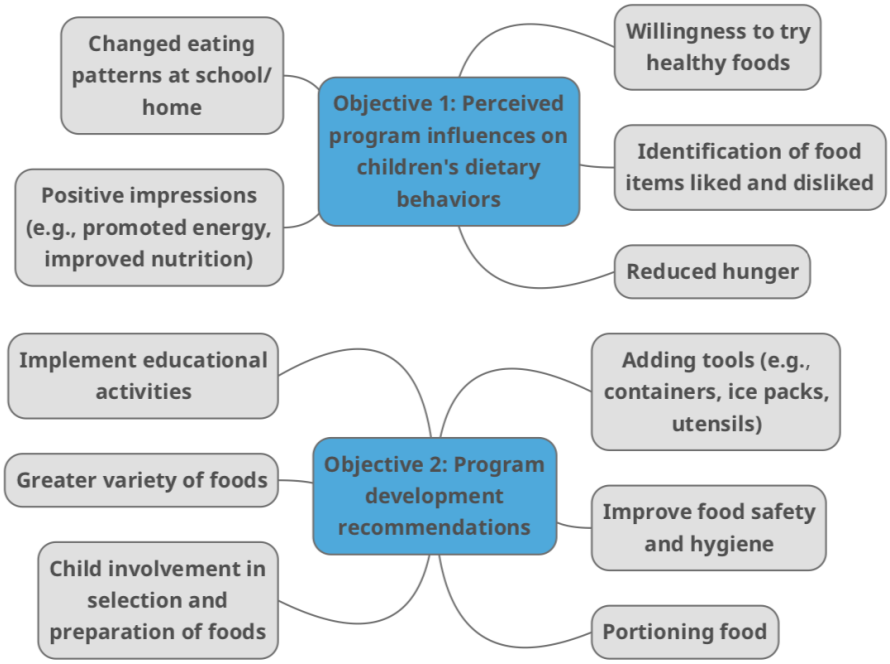
In total, 208 students participated in 38 focus groups. Details regarding participant sociodemographic characteristics are presented in Table 4.1. Themes that emerged during the data analysis process were organized into key domains that address the main research objectives: 1) child perceptions of the CPSFP; and 2) participant recommendations to improve the program. A summary of findings related to each research objective are presented in Figure 4.1.

Table 4.1 Sociodemographic Characteristics of Child Participants Enrolled in the Centrally Procured School Food Program Intervention

Characteristic	Frequency	%
Gender		
Female	134	64.4
Male	74	35.6
Age (years)		
9	12	5.8
10	49	23.6
11	61	29.3
12	49	23.6
13	36	17.3
14	1	.5
Geographic Setting		
Urban–London	1	.5
Suburban–London	20	9.6
Urban Small Town	78	37.5
Rural Small Town	25	12.0
Rural	78	37.5
Household Income Level		
<$20,000	0	0
$20,000–29,999	11	5.3
$30,000–39,999	9	4.3
$40,000–49,999	7	3.4
$50,000–59,999	21	10.1
$60,000–69,999	10	4.8
$70,000–79,999	12	5.8
$80,000–89,999	14	6.7
$90,000–99,999	5	2.4
$100,000–109,999	12	5.8
$110,000–119,999	11	5.3
$120,000–129,999	10	4.8
$130,000–139,999	1	.5

$140,000–149,999	11	5.3
>$150,000	30	14.4

Figure 4.1 Summary of Key Findings



Overall, the CPSFP was positively received by most children. Participants stated that they liked the program, enjoyed the foods, and appreciated the healthy snacks. Positive impressions of the program and its influence on their nutrition were frequently described by participants:

> *"I think it gives an opportunity for a lot of students to not be hungry" female, grade 7*

> *"It fuels the rest of our day, the snack program, because they have all the stuff that gets our energy going" male, grade 6*

> *"It's kind of the things like this [program], I think that kind of keeps kids' nutrition up" male, grade 6*

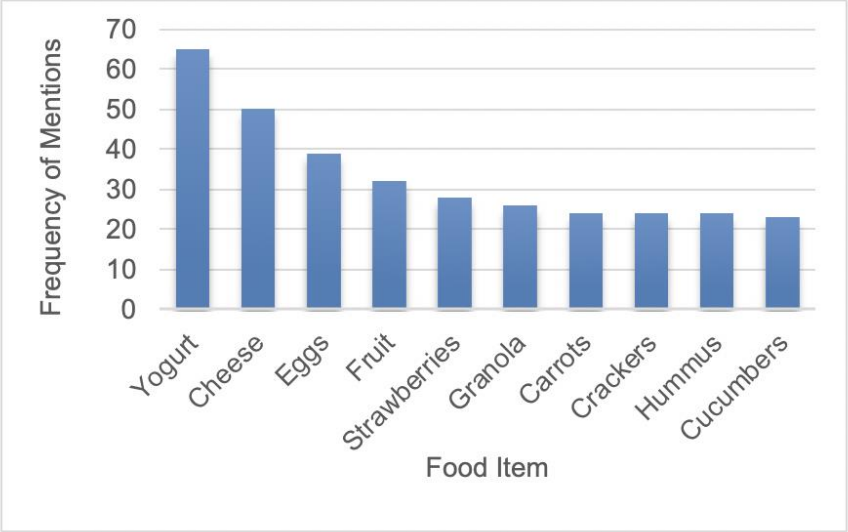
"I know it takes a lot of work, and a lot of us are very thankful for that 'cause it does help out a lot of students" female, grade 7

"I would make sure every school in Ontario gets the food program" male, grade 5

Many participants described how the program reduces hunger, promotes energy, encourages proper nutrition, and helps many children during the school day.

The CPSFP provided weekly deliveries of fresh fruit, vegetables, dairy products, whole grains, and meat alternatives at each participating school, according to pre-set weekly menus. Children consumed daily snacks comprised of multiple food groups. Participants described many foods that they liked from the program including yogurt, cheese, eggs, and fruit. A word frequency analysis was conducted using mentions of foods liked to identify preferences (Figure 4.2).

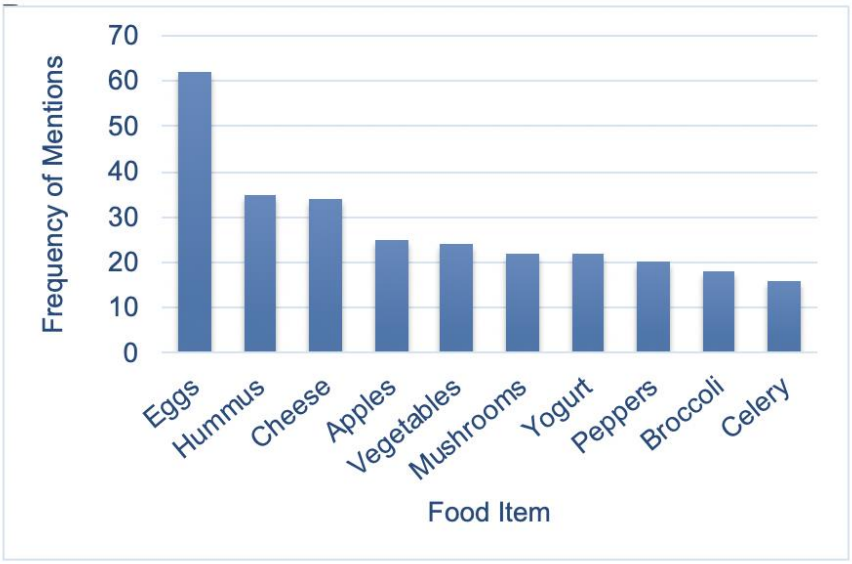
Figure 4.2 Food Items Liked from the Centrally Procured School Food Program



Participants also reported foods that they disliked from the program such as eggs, hummus, cheese, and apples (Figure 4.3). Concerns pertaining to the quality of these food items, including the freshness of produce, temperature of dairy products, and texture of particular items such as vegetables, were described at some schools. Frequently

mentioned items, including eggs, hummus, cheese and yogurt, were both liked and disliked by participants. However, there were fewer references in total pertaining to items disliked in comparison to foods liked in the program. There were a total of 718 mentions of 83 different food items which were liked, compared to 498 total mentions of 70 different food items which were disliked.

Figure 4.3 Food Items Disliked from the Centrally Procured School Food Program



Many children reported that they were often hungry prior to receiving food from the program. Most schools offered the snack program in the morning, usually around the first break. Some children stated that they do not eat breakfast before school and were hungry at the start of the school day.

> *"I like getting snacks because for one, they're very tasty, and if I haven't had breakfast then I can just have some of the snacks in the bin" male, grade 6*

> *"Some people like don't have time to eat breakfast in the morning, so it's good to get to school and then like have something there that you can just grab and eat so that you're not like – your tummy isn't like grumbling during math class – it's just enough to hold you through 'til first break" female, grade 8*

Many children emphasized that they preferred to receive the program in the morning, to curb hunger and provide a healthy start to the day.

> *"Probably like first thing in the morning 'cause a lot of people don't eat breakfast and then they're like, 'I'm hungry, but I have nothing in my lunch'" female, grade 7*

> *"I'd also prefer the snack program in the morning, because you want to get a healthy nutritious snack in the morning, so it gets your brain running and working functionally so you can do well in your classes" male, grade 5*

Many of the participants indicated that the program helped them to feel full, depending on the type and quantity of snack offered. On the other hand, there were some participants who were not hungry prior to receiving the program. This was often attributed to the time of day the program was delivered and whether they had eaten breakfast. As two participants describe:

> *"Not always because we have it [program] at the end of lunch" female, grade 8*

> *"Depends what I ate for breakfast" male, grade 5*

The majority of participants still indicated that they enjoyed the program in the morning. Although, some participants expressed wanting the program near the end of the day, as they often run out of food and are hungry.

> *"I think we should have them at second break because that's when people run out of food mostly" female, grade 6*

> *"Usually we eat all of our lunch first break because we're hungry and second break we don't have any food" male, grade 6*

When asked if the participants would like to have the program more than once throughout the day or all-day, nearly all participants preferred multiple snack times.

"I would have [the snack program] during the whole day so I wouldn't be hungry" female, grade 7

Many of the classes ate all of the foods provided by the snack program daily. This suggests that the snacks were generally well-received and enjoyed by the children. Participants highlighted how the food items are quickly consumed, with few or no items remaining. However, intake of foods provided by the program was at times dependent on the specific item, preferences for select foods, and general hunger levels.

"Well, usually by the time you get something it's already gone. A lot of people in our class run to the bin" female, grade 6

"There's barely any [food] left, it depends on the day and what stuff is in it [snack bin]" male, grade 8

"Sometimes they put like all the favourite foods, and then it's all gone really quick" male, grade 5

"Some people don't get any, so I'm really thankful for what we get, but I just wish it was a little bit more" female, grade 5

The majority of participants indicated that they wanted more snacks, particularly of the foods they liked.

Many children felt that the program had positively influenced their eating patterns at school and home. Participants described consuming more F/V, whilst reducing their intake of unhealthy snacks since participating in the program.

"I started packing my lunch a lot differently. A lot of the times I have no junk food in my lunch and more fruit and vegetables" male, grade 5

"I started to eat a lot healthier because of the snack bin. I used to eat a lot of junk food, like packaged things but now like – the fresh fruit and vegetables – I started eating those a lot more" male, grade 6

Whilst the majority of participants indicated that the program changed their eating patterns, some children reported no changes.

> *"Not really, I eat the same things at home and stuff regularly, so it didn't really change" female, grade 8*

A few participants indicated that the program did not change their eating patterns, since they already thought that they had a healthy diet.

Many children described how the program encouraged them to try various healthy foods that they have never consumed before.

> *"By letting us eat more healthier and figure out what we like" female, grade 6*

> *"There's a lot of different food that I've never had before in the snack program, so that kind of encouraged me to eat different foods" female, grade 6*

Children perceived that access and exposure to healthy food items may have influenced their willingness to try and consume diverse foods. Furthermore, children discussed how they influenced their parents' purchasing patterns since participating in the program.

> *"If I try something at school and then I really like it, then I'll go home and want it, so then my parents buy it for me and I'll eat that" female, grade 8*

A central theme emerged surrounding implementation of tools to support the program. Children recommended adding containers to portion food, adding more snack bins for delivery, and coolers or ice packs to keep items cold. For example,

> *"Or like having some way to keep the dairy products cold. Like having an icepack in [..] the bucket or something" female, grade 8*

Several participants desired utensils to aid in consuming select foods, such as a spoon for yogurt. Finally, there were some concerns pertaining to food safety and hygiene practices, such as issues of contamination by children touching food products.

> *"Sometimes people don't eat because like other people like put their like dirty hand into it" female, grade 6*

> *"Some people just use their bare hands and they don't use the tongs. So, they just like grab a handful and no one else wants it because they have germs" male, grade 6*

A couple participants suggested adding hand sanitizer, gloves, tongs, or hand washing practices for children.

Many participants described interpersonal issues and general conflict associated with the snack program. In particular, there was disorganization during the delivery of the program with some children fighting or running to get food, playing with food, and a lack of supervision. Another recurrent issue presented by participants was an unequal distribution of food items amongst peers. Participants suggested adding tools (e.g., scales, measuring cups) to provide equal portions.

> *"I think they should install like a weighter thing to see how many grams and put the same, equal amount of grams in every cup" male, grade 5*

> *"Yeah, so I'd have like a measuring cup or something, make sure it's the same amount in each one" female, grade 7*

> *"[…] portioning is a much better thing, for like health" female, grade 6*

Portioning food into recommended serving sizes and distributing these items equally amongst students was frequently mentioned. A small number of participants also described specific limitations to consuming food from the program. Some children were limited in the foods they could eat due to food allergies, dietary requirements, braces, or general anxiety about taking food from the snack bins.

A major theme emerged surrounding future program development ideas. Participants desired more educational initiatives, such as healthy eating messaging and announcements, cooking classes, field trips, and school gardening.

"Posters. Um, pictures of fruit and vegetables saying 'eat healthy'; showing how much calories it may have or nutrients" male, grade 7

"Yeah, you have like a sheet of paper and it's like what fruit or vegetable you have in that bin, […] the name of it, and like a cool like fact about that fruit or vegetable" female, grade 5

"If school is to prepare you for life, then they should probably have a cooking class. Because you can't just go to fast food restaurants or dining all your life. You'll run out of money. You need to make your own food" male, grade 8

"We should take a trip to learn about agriculture" female, grade 8

Participants also desired more engaging methods to encourage healthy eating. Educational games or food-related themes were often suggested.

"I think we should do like a contest for whatever class that is like…so you do like a 7-day challenge to see which class will eat the most vegetables" male, grade 8

"We should have like a "Watermelon Wednesday" male, grade 8

Creating engaging opportunities to enhance children's knowledge about nutrition and motivation to maintain a healthy diet was encouraged by several participants.

The majority of participants enjoyed the foods provided by the CPSFP. In particular, children expressed positive feedback regarding the large variety of foods offered.

"Usually everyday there's like a different variety of snacks for people to choose from, like if they don't like that there's always something else" male, grade 6

"I do enjoy the different variety of stuff that we have been getting" male, grade 8

Although there were many different foods provided through the program, some children expressed wanting a greater variety. Participants proposed adding meat products, a salad bar, and tropical or exotic fruit. In addition, several children offered recommendations to

improve consumption of less-preferred foods, by adding dips or spreads to enhance flavour.

> *"More of that dip stuff because I would eat more vegetables if there was dip" female, grade 6*

Foods offered through the program were based on a dietitian-approved menu, which introduced a new fruit or vegetable of the week, along with a variety of locally-sourced produce and supplementary food items. Participants were interested in being involved with the selection process of food items. In particular, many children recommended conducting a survey in each school to gather children's food preferences.

> *"I would, like, take some requests from kids, so you have an idea of what to put on it [program]" female, grade 8*

> *"I was thinking maybe we could do like a survey to see what kind of food people like" female, grade 5*

Catering the program in accordance with child preferences was promoted by several participants. Gathering feedback on food items provided and offering greater quantities of items liked was encouraged, particularly to reduce any food waste.

Weekly deliveries of food items were often prepared by school staff members, parent volunteers, and in some cases by children. Some participants wanted to be more involved with the preparation and delivery of snacks.

> *"I feel like […] every first break, they should like take 5 or 6 students down to help them prepare like what they should have for the next day, and like help them bring everything so they have more helpers in there" female, grade 6*

Many recognized the time and labor needed to maintain the snack program and participants desired to aid with this process.

4.4 Discussion

The findings from this qualitative analysis indicated that many children enjoyed the snack program and believed that it positively influenced their eating patterns. Participants' perceptions of and recommendations for the CPSFP were explored through the use of focus groups. Findings from this study can be used to improve the program and enable greater accessibility of this initiative in elementary schools across the province of Ontario.

Currently, there is limited research exploring children's perceptions of school nutrition programs in Canada (Colley et al., 2018; He et al., 2009). A recent systematic review identified one qualitative study investigating children's experiences engaging in the Northern Fruit and Vegetable Program (NFVP), in a geographically remote area in Northern Ontario, Canada (He et al., 2009). Similarly, this food program received overwhelming positive feedback from participants. Child participants from the NFVP study recognized the program's potential significance in promoting F/V consumption among economically disadvantaged children (He et al., 2009). The CPSFP evaluation elicited some similar findings; however, most participants described positive nutrition impacts, independent of household socio-economic status. The CPSFP was offered to all children in participating schools, in an effort to improve child nutrition across the region.

Participants liked many of the fresh fruit, vegetables, dairy products, whole grains, and meat alternatives provided by the program. Consuming daily snacks comprised of multiple food groups can offer essential nutrients to support children's health and development (Government of Canada, 2019b). Many participants indicated that they often did not consume breakfast prior to school. A recent study has identified that on average, 1 in 10 Canadian children do not eat breakfast daily (Barr et al., 2014). Consuming a nutritious morning meal is critical to replenish essential nutrients needed to maintain energy levels throughout the day (Barr et al., 2014). Participants believed that the snack program improved nutrition, reduced hunger, and increased their energy levels. Moreover, the majority of participants indicated that they would prefer more healthy snacks, twice or multiple times a day.

While most participants liked many of the snacks offered through the program, there were some indications that the quality of food may limit the extent to which they enjoyed select items. For example, the freshness of produce, temperature of dairy products, and texture of select vegetables (e.g., mushrooms, cucumbers, celery, peppers) were described by participants as factors influencing preferences.

Participants offered valuable insight on methods to improve preferences of foods, by adding tools such as ice packs to maintain temperature and freshness. Research suggests that routine exposure and tasting opportunities may also improve children's acceptance of foods (Lakkakula et al., 2010). However, some participants desired a greater variety of foods, such as tropical or exotic fruit. Establishing a balance between children's preference for greater variety, whilst maintaining regular distribution of local and seasonal foods, is recommended. Masking the taste of food items using dips, spreads, or sauces may be another effective strategy to promote F/V intake (Zeinstra et al., 2007).

Study participants also desired greater involvement with the selection, preparation, and delivery of food items through the program. Increasing autonomy by selecting and preparing food has been shown to improve preferences and willingness to try foods (DeCosta et al., 2017). In addition, child participants recommended adding educational initiatives, such as food-related themes, games, and experiential learning. Multi-component interventions partnering food provision with education have been shown to be an increasingly effective method to enhance child nutrition (Colley et al., 2018). Furthermore, programs involving experiential learning (i.e., school garden, cooking and food preparation activities) have been identified as the most effective strategy to encourage F/V intake and improve nutritional knowledge (Dudley et al., 2015).

An important finding from the focus groups was that children believed the CPSFP changed their eating patterns at school and home. Daily food provision enabled children to access and try a variety of healthy foods. The majority of participants described how they ate more F/V, since participating in the program. In congruence, some children believed that they were eating fewer unhealthy snacks. These patterns have transcended into the household, as some children felt that they influenced their parents to purchase

healthy foods that they ate through the school snack program. Similar findings were identified in recent experimental evaluations of school nutrition programs in Canada (Colley et al., 2018). School food programs increased children's preference for high-nutrient dense foods, such as F/V (Hanbazaza et al., 2015; Woodruff, 2019), as well as their attitudes and willingness to try a variety of foods (Bisset et al., 2008; He et al., 2009). This qualitative study offers contextually rich data to further support these findings and extend understanding regarding the positive impacts associated with school nutrition programs.

Although the program was generally positively received, some participants described challenges with program delivery. Interpersonal issues and general conflict administering the snack program were often presented. Some of these issues may be attributed to a lack of resources and support systems (e.g., financial, human) needed to effectively deliver the program. Process evaluation research on school nutrition programming has indicated similar challenges (Day et al., 2008; Gates et al., 2013) and recommend establishing guidelines to effectively facilitate nutrition programming in schools (Godin et al., 2017).

Focus groups provide insight into the perspectives, opinions, and experiences of participants on a shared topic. However, participants engaged in focus groups may be intentionally or unintentionally influenced by their social grouping. Information shared amongst participants in this study may have been shaped by peer dynamics. The focus groups were conducted by university student researchers in an elementary school setting, naturally creating power asymmetricities between students and the moderator. This relational dynamic may have influenced what participants were choosing to share.

Self-selection of focus groups by school principals may have provided an overrepresentation of children who were more interested in CPSFP. In addition, this study might be context-specific to the geographical location and influenced by sociodemographic characteristics of the participants. While it was not intended to examine sociocultural differences amongst children participating in the CPSFP, it may be beneficial to investigate these factors in relation to school nutrition programming within future research.

Focus group results are also subject to social desirability bias, whereby participants respond in a manner to which they think the researcher would prefer. The moderator made efforts to minimize social desirability by avoiding leading questions.

The target population for this study was elementary school children. Their ability to articulate pragmatic recommendations to improve the program may be limited. Yet, children are the primary recipients of the program and are key informants in providing feedback pertaining to program impacts and opportunities for improvement. Findings from this study offer valuable data that may be relevant, applicable, and useful for various nutrition programs in Canada.

4.5 Conclusion

The CPSFP offers a promising approach to improve children's nutrition in elementary schools. The CPSFP offered free, locally-sourced snacks that were well-received by most participants, including positive reports of increased consumption of F/V, willingness to try new foods, improved eating habits, and general feelings of health and well-being. Child participants offered useful insights to improve the program, such as incorporating educational initiatives, increasing frequency and variety of foods, and improving food quality. This qualitative evaluation offers rich, data-driven research to support the development and sustainability of nutrition programming regionally and beyond. In addition, this research informs comprehensive nutrition policies that support greater accessibility to centrally procured food provision practices in elementary schools in Canada.

4.6 References

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Chapter 5

5 Synthesis and Conclusions

5.1 Summary

The overarching purpose of this dissertation was to investigate the influences of school food programs on children's food-related knowledge and behaviours. To achieve this objective, the first phase was to undertake a systematic review of existing research. This review identified concerns surrounding the quality of children's diets (Colley et al., 2018). Many children in developed countries have unhealthy food habits and unhealthy diets largely comprised of foods high in refined carbohydrates, added sugar, sodium, and saturated fat, and low intakes of nutrient-dense foods such as fruit, vegetables, and whole grains (Jessri et al., 2016; Krebs-Smith et al., 2010; Moreno et al., 2014). These poor dietary trends have resulted in increased risk for developing a variety of adverse health problems, including obesity, type 2 diabetes, cardiovascular disease, psychosocial and behavioural problems, and some forms of cancer (Calle & Kaaks, 2004; Daniels et al., 2005; Dietz, 2004; Pi-Sunyer, 2009). The review emphasized the need to educate young people about consuming healthy food in appropriate quantities to improve nutritional status (Food and Agriculture Organization [FAO], 2011). Becoming food literate has been identified as a critical life skill to enhance resiliency in today's modern food culture (Food Secure Canada, 2013a).

Studies involving food literacy – the ability to obtain, process, and understand basic information about food and nutrition as well as the competence to use that information to make appropriate health decisions (Kolasa et al., 2001) – have increased substantially over the past decade. This systematic review was the first to evaluate the influences of current food literacy initiatives on elementary school children's knowledge, determinants of behaviour, and intake of healthy foods. A comprehensive search strategy resulted in the retrieval of 50 studies, representing 40 distinct food literacy programs.

Interventions involving classroom lessons and activities, technology and gaming, cooking, gardening, and sensory and tasting education improved children's knowledge and attitudes related to healthy food; although, there were limited and conflicting evidence regarding intervention impacts on children's dietary intake. Barriers to program success were often associated with inadequate duration (Davis et al., 2016; Dias & Agante, 2011; Gibbs et al., 2013), low-intensity (Adamo et al., 2013; Battjes-Fries et al., 2017), or inconsistent methods of delivery (Adamo et al., 2013; Christian et al., 2014a). Nonetheless, findings from this review indicated that school-based food literacy interventions with innovative technology and games, as well as experiential learning through gardening, cooking or other interactive methods, may have the potential to positively influence children's intake of healthy foods. Additional primary evaluations of novel food literacy interventions were recommended to determine the most effective implementation methods and practices to support healthy dietary behaviours.

This systematic review of global food literacy interventions set a foundation for the subsequent three studies. It was first imperative to understand what Canadian children currently know about food and nutrition, as well as the factors influencing their knowledge. Previous research suggests that knowledge is fundamental in influencing one's ability to make nutritional choices that support lifelong healthy eating behaviours (Okoro et al., 2017). The first empirical study in this thesis (reported in Chapter 2) assessed elementary school children's (n = 2,431) knowledge of Canadian food guide recommendations, healthy eating efficacy, selection of healthy foods, local fruit and vegetables (F/V), nutrition, and food preparation, in Southwestern Ontario (SWO).

Results from Study 1 provided valuable insight regarding strengths and gaps in children's food-related knowledge. Greatest predictors of children's knowledge were female gender, higher household income, and rurality, respectively. Knowledge in our sample was somewhat low overall with an average total knowledge score of 29.2 out of 46 (63.5% correct responses). Participants demonstrated knowledge pertaining to healthy eating efficacy, food preparation, and selection of healthy foods. Awareness of locally-sourced foods and national food guide recommendations were limited. These findings appear consistent with prior research indicating a disconnect in knowledge regarding where food

is grown, how it is produced and distributed, and its impacts on health (Bellotti, 2010; Colatruglio & Slater, 2014; Lea & Worsley, 2008; Nanayakkara et al., 2017). Evidence in other countries similarly report that children have limited knowledge of food intake guidelines (Pettigrew et al., 2009). Consequently, it may not be feasible for individuals to meet national guidelines if they not aware of the guidelines (Vanderlee et al., 2015). Findings from this study can be used to design future food literacy programs that address gaps in children's knowledge of local food, national food guide recommendations, and nutrition.

In partnership with the Ontario Student Nutrition Program (OSNP), our research team developed the Tasty Ontario Food Literacy Resource to address current gaps in children's food-related knowledge. This resource included eight weeks of worksheets about local F/V, as well as the nutritional benefits of these foods. The second empirical study in this thesis (reported in Chapter 3) evaluated children's (n = 1,836) food-related knowledge associated with this take-home resource in SWO, Canada. This resource was administered in conjunction with daily, healthy snacks delivered directly to schools as part of OSNP. Our results indicated that this food literacy intervention did not significantly influence children's food-related knowledge. Participants demonstrated limited increases in knowledge of healthy eating strategies, food selection, identification of local produce, and nutrition.

Factors pertaining to intervention duration and method of delivery may have resulted in limited improvement of food-related knowledge. Previous research, including the food literacy systematic review, recommend delivering food education interventions for a minimum of 6 months (Murimi et al., 2018). This eight-week resource may not have been of sufficient duration to facilitate improvement in child knowledge. In addition, the resource was intended to be sent home for children and their families. The low-intensity, self-directed nature of this intervention might not have been the most effective approach to educate children about food-related topics. Involving teachers and nutrition educators is likely to be successful in improving implementation practices.

Results from Study 2 presented interesting findings related to the presentation of food-related content. While participants' total knowledge scores did not change, some specific increases in knowledge of food selection, healthy eating strategies, identification of local produce, and nutrition were identified. The food literacy resource presented this content in the form of healthy eating tips, games, and fun facts. Incorporating game-related activities may be an effective approach to engage participants, whilst building motivation to improve food and nutrition knowledge (Baños et al., 2013; Baranowski et al., 2011; Thompson et al., 2010). Combining elements of gaming with interactive technology have also resulted in positive knowledge outcomes related to nutrition (Rosi et al., 2016; Yien et al., 2011) and food safety (Quick et al., 2013), as described in the previous systematic review. This study concluded with recommendations to design future initiatives with multi-component, experiential learning to enhance children's food-related knowledge.

As part of a larger evaluation, the final portion of this dissertation (reported in Chapter 4) was to investigate children's perceptions of and suggestions for OSNP's innovative Centrally Procured School Food Program (CPSFP) in SWO. The CPSFP is one of the largest, locally-sourced food provision programs in Canada. While recent research suggests that school food programs may yield positive health benefits, there are currently limited experimental studies evaluating school nutrition programming in Canada. Moreover, there is only one qualitative study investigating children's perceptions of and experiences with Canadian school food programming, directly from individuals receiving these initiatives (He et al., 2009). Study 3 used focus groups to gather elementary school children's perceptions of the CPSFP.

Findings from this qualitative study indicated that the CPSFP was generally positively received by students. The elementary school children liked many of the foods provided and acknowledged the nutritional benefits. Prior to receiving the snacks, many children indicated that they were often hungry, and this helped them to feel full and replenish their energy levels. An important finding from the focus group study was that the program improved children's F/V consumption at home and school, and also enabled them to try a variety of healthy foods. Recommendations to improve the program included additional

education activities, a greater variety and quantity of fresh foods, and child involvement in program implementation. Study limitations were reported at the end of each chapter.

5.2 Implications for Policy and Practice

School food programs are currently guided by a variety of policies to support healthy eating in Canada (Hernandez et al., 2018). Over the past decade, there have been policies and guidelines implemented by several provinces and territories (Hernandez et al., 2018), many of which are voluntary. The purpose of these policies was to improve school food environments, while outlining requirements and recommendations for foods and beverages available in schools (Hernandez et al., 2018). Mandatory school food policies exist in six provinces and territories (Canadian Cancer Society, 2019; Hernandez et al., 2018). New Brunswick was the first to implement the Healthier School Food Environment policy in 1991, followed by British Columbia's Guidelines for Food and Beverage Sales in B.C. Schools in 2005. In 2006, the Food and Nutrition Policy for Nova Scotia and the School Nutrition Policy for Prince Edward Island were implemented. Shortly after, the Yukon School Nutrition Policy was passed in 2008 and the Ontario School Food and Beverage Policy in 2010.

Policies improving the food environment in schools have been associated with healthier food choice and intakes (Food Secure Canada, 2013b; Mullally et al., 2010). The nutritional benefits of the Prince Edward Island nutrition policy were assessed by examining student food consumption prior to and following implementation of the policy (Mullally et al., 2010). Following the implementation of the policy, students were more likely to consume fewer low-nutrient dense foods and meet national serving recommendations for fruit, vegetables, milk and alternatives (Mullally et al., 2010). Another study evaluated children's dietary intake and weight status before and after the Food and Nutrition Policy for Nova Scotia (Fung et al., 2013). The school nutrition policy had some positive influences on diet quality, including higher consumption of milk and decreased sugar-sweetened beverage intake (Fung et al., 2013); although no significant effects on overweight or obesity were observed over time. Research suggests that further action is required to change the prevalence of childhood obesity (Fung et al.,

2013). Comprehensive, multi-faceted approaches involving school nutrition programming may have a larger impact on students' diets than a single nutrition policy (Mullally et al., 2010; Veugelers & Fitzgerald, 2005).

The varied policy landscape presents an opportunity to establish a national food policy that is consistent across provinces and territories. A comprehensive policy should address multiple aspects of school food, including foods available, the food environment, nutrition education, health services and counselling, family and community involvement (McKenna, 2010). The 2019 Canadian federal budget takes steps towards building a healthier society. The Government is committed to establishing A Food Policy for Canada involving four action areas, including: 1) improved accessibility to healthy food; 2) prioritizing Canadian food at home and abroad; 3) supporting food security in northern and indigenous communities; and 4) reducing food waste. To support food policy priorities, the Government proposed a $134.4 million investment over five years.

A priority area listed in the Canadian Government 2019 Budget is to collaborate with provinces and territories to develop a National School Food Program. Currently, a patchwork of regional and provincial programs reaches only a small portion of Canada's five million school-age children (United Nations Children's Fund [UNICEF], 2019). One in six children in Canada is food insecure, making Canada one of the worst performers internationally in access to food and childhood nutrition (UNICEF, 2019). A national school food program would address issues related to food accessibility through the provision of daily school meals for all students.

A summary of characteristics recommended for a National School Food Program are presented in Table 5.1. This summary takes into consideration findings from studies included in this dissertation, previous research on provincial and regional school nutrition programs, as well as adapted recommendations from "The Case for a Canadian National School Food Program" (Hernandez et al., 2018). A new recommendation regarding the use of evidence-based research to guide the creation of a food program is presented. The following six characteristics are proposed: 1) a universal design that meets the needs of all students; 2) comprehensive school food policies; 3) evidence-based practice; 4) local

food procurement strategies; 5) multi-component food education; and 6) financial and logistical sustainability. These key characteristics should be considered in the development and implementation of a National School Food Program in Canada.

Table 5.1: Recommendations for a National School Food Program in Canada

Characteristic	Description
Universal	Design a program that meets the needs of students across Canada. Offer for free or subsidized foods to mitigate financial barriers. Promote the program to ensure accessibility of healthy food for all students. Adapt to local food cultures and geographies, including the involvement of stakeholders with experience in diverse regions.
Policy	Comprehensive policies involving healthy food provision, school food environments, nutrition education, health services, and family/community involvement should guide program implementation and practices (McKenna, 2010).
Evidence	Develop a program that is guided by evidence-based practice. International and national reviews of current literature on school food programs should be consulted to inform best practices. Evidence from provincial and regional studies can guide adaptations for local contexts.
Local	Establish local food procurement strategies where possible to support the economy and reduce environmental impact. Engage with the broader community, including parents, local businesses, health professionals, and community leaders to drive sustainability.
Multi-Component	Integrate educational components involving food literacy, nutrition education, and food skills. Provide students with hands-on learning experiences involving food, such as gardening and cooking.
Sustainable	Create a universal program that is financially and logistically sustainable. Ensure program staff and volunteers receive adequate training and support. Program success will require regular monitoring

and evaluation, as well as local adaptations in diverse communities and school environments.

5.3 Recommendations for Future Research

Canada is one few industrialized countries without a universal school food program (Food Secure Canada, n.d.). There are many regional and provincial initiatives comprised of different funding systems, program components, and delivery methods that vary by region and school. Nine Canadian elementary school food programs have been formally evaluated and reported (Colley et al., 2018), in addition to the studies presented in this dissertation. This presents a timely and critical opportunity to investigate additional, multi-component school food programs and subsequent impacts on child nutrition in Canada. Future research can inform evidence-based practice and guide the development of a national school food program.

Opportunities for additional research on food literacy have been discussed in this dissertation. Future studies should incorporate a comprehensive tool or standardized procedure to define, measure, and evaluate food literacy. This will set a strong foundation to effectively assess the impacts of food literacy interventions. Food literacy programs have been associated with improved food-related knowledge and determinants of behaviour; however, there have been limited and conflicting evidence regarding intervention impacts on children's dietary intake. Designing food literacy interventions of sufficient duration with innovative technology and experiential learning may be an effective approach to enhance child nutrition. Future studies should investigate children's dietary behaviours associated with novel food literacy programs.

5.4 Conclusion

This dissertation examined the impacts of school food programs on children's nutrition and health. A preliminary assessment of elementary school children's food and nutrition knowledge offered insight regarding current gaps and strengths in knowledge.

Participants demonstrated some nutrition competency and food skills; although, awareness of food guide recommendations and local foods were limited. Results from this research can be used to design a food literacy program that caters to children's educational needs.

A randomized controlled trial investigated children's food-related knowledge associated with a take-home food literacy resource. The food literacy intervention involved an eight-week resource with F/V information sheets, maps to show were local foods are produced, parent and child-friendly recipes, and educational games and activities. Study results presented predominantly non-significant effects on children's food-related knowledge. Additional food literacy interventions are needed to identify best practices that produce sustainable changes in knowledge and dietary behaviours.

A qualitative study explored children's perceptions of and suggestions for a regional CPSFP. This program offered daily fruit, vegetable and supplementary food groups snacks directly to elementary school children. Study participants described several positive influences on dietary behaviour. Findings from this study suggest integrating educational components, greater variety of foods, and student involvement into future school food programs.

The three studies and associated literature presented in this dissertation offer rich evidence to help inform the development of a national school food program in Canada. Characteristics of a national school food program should include a universal design, comprehensive food policies, evidence informed practice, local food procurement, multi-component food literacy, and sustainability. Investigating these program characteristics in action are recommended to ensure success in improving child nutrition.

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Appendices

Appendix A: Thames Valley District School Board Ethics Approval Letter

9 Feb 2017

Dear Dr. Clark:

Your project, entitled "Evaluating the impacts of an innovative centrally-procured school food program on student nutrition and the local food economy" has been approved by Research and Assessment Services at the Thames Valley District School Board. Please ensure that all members of your research team who will be assisting with data collection involving students have an up-to-date criminal record check. You may contact the schools that have been identified.

The continued willingness of our families and staff to participate in research studies is greatly enhanced by pertinent feedback of findings. It is suggested that direct feedback be provided to the school(s), staff, students, and/or families involved in the study. Please find attached the Thames Valley District School Board Study Completion Form. Once you have completed your research in our board, please complete this form and submit it to Research and Assessment Services. This form should be submitted within two years of receiving approval. If the study is not completed within two years of the date on this letter, please submit a study extension request to Dr. Sarah Folino.

All the best with your research. Please feel free to contact me if I can be of further assistance.

Sincerely,

Sarah Folino, Ph.D.
Research and Assessment Services
Thames Valley District School Board

Appendix B: London District Catholic School Board Ethics Approval Letter

LONDON DISTRICT
Catholic School
BOARD

CATHOLIC EDUCATION CENTRE
5200 Wellington Road S. London, Ontario N6E 3X8 Canada
T 519-663-2088 F 519-663-9250

August 25, 2017

Dr. Andrew Clark
Project Coordinator & Research Associate
Human Environments Analysis Laboratory, Department of Geography
SSC 2206, Western University
London, Ontario, Canada N6A 5C2

RE: Letter of Approval for Ontario Student Nutrition Program (OSNP) Evaluation

Dear Andrew:

This letter is intended to serve as formal acknowledgement of approval by my school board for the revisions made to Ontario Student Nutrition Program (OSNP) Evaluation project. We appreciate that the revisions made to the project were principally informed by feedback and comments from schools in which your team has worked with thus far.

It is anticipated that the findings from this study will help inform the development of a model by the OSNP that can be used for snack programs across the country.

Thank you for including our schools in your research.

Sincerely,

Terry Spencer
Research and Evaluation Officer
London District Catholic School Board

Appendix C: Western University Ethics Approval Letter

Western Research

Research Ethics

Western University Non-Medical Research Ethics Board
NMREB Delegated Initial Approval Notice

Principal Investigator: Dr. Jason Gilliland
Department & Institution: Social Science\Geography,Western University

NMREB File Number: 108549
Study Title: Evaluating the impacts of an innovative centrally-procured school food program on student nutrition and the local food economy

NMREB Initial Approval Date: November 29, 2016
NMREB Expiry Date: November 29, 2017

Documents Approved and/or Received for Information:

Document Name	Comments	Version Date
Instruments	PEAS Questionnaire - Balanced School Day	2016/11/29
Instruments	PEAS Questionnaire - Traditional School Day	2016/11/29
Western University Protocol	Received November 29, 2016	
Recruitment Items	Facebook Announcement	2016/11/29
Letter of Information & Consent	Facilitator - Focus Group/Interview (Written)	2016/11/29
Letter of Information & Consent	Facilitator - Interview (Verbal)	2016/11/29
Letter of Information & Consent	Parents - No Observation	2016/11/28
Letter of Information & Consent	Parents - Observation	2016/11/29
Assent	No Observation	2016/09/27
Assent	Observation	2016/09/27
Data Collection Form/Case Report Form	Observational Data - Received September 28, 2016	
Instruments	Parent Survey	2016/08/30
Instruments	Facilitator Focus Group Guide	2016/09/27
Instruments	Youth Focus Group Guide - Received September 28, 2016	
Instruments	Youth Survey	2016/11/03

The Western University Non-Medical Research Ethics Board (NMREB) has reviewed and approved the above named study, as of the NMREB Initial Approval Date noted above.

NMREB approval for this study remains valid until the NMREB Expiry Date noted above, conditional to timely submission and acceptance of NMREB Continuing Ethics Review.

The Western University NMREB operates in compliance with the Tri-Council Policy Statement Ethical Conduct for Research Involving Humans (TCPS2), the Ontario Personal Health Information Protection Act (PHIPA, 2004), and the applicable laws and regulations of Ontario.

Members of the NMREB who are named as Investigators in research studies do not participate in discussions related to, nor vote on such studies when they are presented to the REB.

The NMREB is registered with the U.S. Department of Health & Human Services under the IRB registration number IRB 0000094l.

Ethics Officer, on behalf of Dr. Riley Hinson, NMREB Chair or delegated board member

Ethics Officer: Erika Basile ___ Nicole Kaniki ___ Grace Kelly ___ Katelyn Harris ✓ Vikki Tran ___ Karen Gopaul ___

Appendix D: Child Letter of Information and Assent Approval Letter

Child Assent: Ontario Student Nutrition Program

Principal Investigator: Dr. Jason Gilliland, Department of Geography, University of Western Ontario

Western

Hello! We are researchers from Western University and we are doing a study in your school. We need students in Grades 5-8, like you, to help us learn about how your school's snack program changes your eating habits.

What are we going to study? We'd like to know what you eat and drink during the school day, as well as understand what fruits and vegetables you like. We are also interested in learning what you know about fruits and vegetables!

What we are asking you to do? If you agree to participate, we'd like you to complete three steps:

1) Fill out two short ***surveys*** (one today and one in a few months) on what you eat during the school day, your food preferences, and what you know about vegetables and fruits. You will fill these out at school with your classmates and each survey takes 25-30 minutes to finish but you can take as much time as you need.
2) Have a Western Researcher watch what you eat for 1 day while you are at school.
3) At the end of our project, you could also join in a ***group discussion*** with some of your classmates to talk to us about your school's snack program. You do not have to join in this group activity. This will take place at your school during lunch. We would like to audio record our talk. All group discussions are audio-recorded and transcribed word for word. Therefore, if you do not wish to be audio-recorded you will not be able to participate in the discussions. We cannot guarantee what is said in the group discussion won't be shared by your classmates, but we always remind all students not to share what they have heard. We will also be using the things you say from our discussion in our writing, but we will make sure no one can tell that it is you who said it.

Do you have to join this project? No – you only join if you want to. You can also decide at any time that you would like to stop. We will never share your information with anyone else, even your parents, but you can ask to see it at any time. You can ALWAYS talk to your teacher or the researchers if you have any questions or worries.

☐ Check this box, if you want **to participate in this study!**

AND do you want to participate in the audio recorded group discussion:

☐ Yes, I want to participate in the audio recorded group discussion.

☐ No, I do not want to participate in the group discussion.

_____
Print your first & last name

_____ _____
Sign your name ***Today's Date***

_____ _____
Researcher's Signature ***Today's Date***

Appendix E: Parent Letter of Information and Consent

Research Project: Ontario Student Nutrition Program Evaluation

***Principal Investigator**: Dr. Jason Gilliland, PhD Department of Geography, University of Western*

Western

Dear parent or guardian,

Dr. Jason Gilliland and his research team from Western University invite you and your child to participate in a study aimed at understanding how the Ontario Student Nutrition Program (OSNP) may impact your child's eating habits at school. The study involves students from **grades 5 through** 8 at participating elementary schools in London-Middlesex, Elgin-St. Thomas, and Oxford.

What is being studied?

Our team is studying how the OSNP snack program influences your child's eating habits and knowledge. By participating in this study, you and your child can help inform the OSNP on what can improve the program overall, and more specifically, in your child's school.

What will happen in this study?

If you agree to allow your child to participate in our project, **your child** will be asked to:

- **Complete 2 *surveys***. Children are invited to participate in one survey now and an identical follow-up survey in 9 to 10-weeks. Both surveys ask children about themselves (e.g., gender, age, household status), the food they eat during the school day, and knowledge about vegetables and fruit. Each survey will take place during school hours and usually takes about 25-30 minutes to complete (Note: Students not filling out the survey will be given quiet activities to do at their desks).
- ***Food intake observation***. Your child's food intake at school **may** be observed and recorded during one of the days that the survey is being completed. Observers will be located at least 6-feet from the lunch table and will not interact with the children directly.
- **Participate in a group discussion.** Children will also be invited to participate in a group discussion to talk about their snack program and to help clarify how the program benefited them. The 30 to 60-minute group discussion will involve 4-6 youth and will take place at school during lunch. Participation in the group discussion is completely voluntary; a child can decide not to participate and still be allowed to participate in the rest of the study. All discussions are audio-recorded and transcribed verbatim. Anonymous direct quotes from the group discussions may be used by the research team in publications. We as researchers cannot guarantee what is said in the group discussion won't be shared by classmates, but we always remind students not to share what they have heard.

If you would like your child to participate, **parents** are asked to:

- **Complete and return the *attached consent form* in the envelope provided to school.**
- **Complete the attached *survey***. The survey asks questions about your household and what you and your family eat and drink. It usually takes about 10-15 minutes to fill out. The Parent Survey is completely voluntary – your child can still join the study themselves even if you decide not to fill out the Parent Survey; however, as the survey gives us critical information from the point of view of parents, we would really appreciate your participation.

Do we have to participate in this study?

Your participation in this study is completely voluntary. You and your child do not have to participate. You can each refuse to answer any survey questions, and can choose to leave the study at any time. If you or

your child decides to leave the study at any time (even up to 30 days AFTER the study has been completed), any data collected from you or your child will be immediately destroyed and excluded from the analysis.

What are the benefits and risks if my child participates?

By participating in this research, students and parents will help us evaluate the effectiveness of how providing a nutrition snack program improves children's eating patterns and knowledge about healthy eating. By better understanding this relationship, the OSNP can develop a model that can be used for snack programs across Canada. This will help students can gain the maximum health benefit when receiving snacks at school.

There is little risk to your child if he/she participates in this study, but there is a slight chance that you or your child may be uncomfortable sharing details of your family, such as economic status, eating patterns. We are also asking for your postal code in the parent survey to provide us an approximation of where you live, so that we can have a better understanding of your neighbourhood (e.g., proximity to grocery stores, fast food outlets, variety stores, neighbourhood level income). We are minimizing the risks you may feel as follows:

- All information collected in this study is kept strictly confidential.
- You or your child will not be personally identified or identifiable by name in any of the documents related to the study, except for the consent form and the daily school food journal. This will be accomplished by assigning a unique identification code. Until the unique identification code is recorded your consent and parent survey will be stored together to ensure the connection between surveys is maintained.
- Materials and data files will ONLY be viewed by members of the research team and will be stored in a locked filing cabinet until transferred onto a password protected computer in a secure facility at the University of Western Ontario.
- To minimize children being uncomfortable while they are eating and being observed, observers will be located at least 6 feet from the lunch table and will not interact with the children directly.

Representatives of The University of Western Ontario's Non-Medical Research Ethics Board may require access to your study-related records to monitor the conduct of the research. Data will be kept until the conclusion of data analysis and publications from this study are completed. The results of this study will only be presented for groups so that children will never be individually identifiable. While we do our best to protect your information there is no guarantee that we will be able to do so. If data is collected during the project which may be required to report by law, we have a duty to report. You do not waive any of the legal rights you would otherwise have as a participant in a research study.

Who do I contact if I have any other questions?

Should you have any questions or concerns about participating in this project, you can contact the lead researcher (Dr. Jason Gilliland) at the University of Western Ontario by phone or email . If you have any further questions regarding your rights as a study participant, please contact the Office of Human Research Ethics by phone or email .

This letter is for you to keep. Please complete and return the attached consent form to your child's school if you would like him/her to participate in this study.

Research Project: Ontario Student Nutrition Program Evaluation

Parent / Guardian Consent Form (Grades 5-8)

Western

Principal Investigator: Dr. Jason Gilliland, PhD Department of Geography, University of Western Ontario

We ask that you allow your child in grades 5-8 to participate in this study during class time to help us understand how the Ontario Student Nutrition snack program impacts your child's eating habits at school. Please ensure you review the ***Letter of Information*** before providing your child's consent.

WE NEED YOUR PERMISSION TO HAVE YOUR CHILD PARTICIPATE IN THE STUDY

1. Study Participation:

☐ Yes, I would like my child to participate in this study.

2. Group Discussion:

☐ Yes, I would like my child to participate in the audio-recorded group discussion, where anonymous direct quotes from the group discussions may be used by the research team in publications.

OR

☐ No, I would not like my child to participate in the group discussion.

I agree for my child _____ to participate in this study.
please clearly print your child's full name

_____ _____
Parent / Guardian's signature ***Date***

_____ _____
School name ***Teacher's name***

Completed consent forms should be returned to the school with the child who brought it home by

DATE.

Appendix F: Child Survey

Youth Survey

We need your help to make our study a success. Your honest answers to the items in this survey are very important to us. This will not take too long to complete. Remember…

- We want to know what you think
- There are no right or wrong answers, and
- Everything you tell us will be kept strictly confidential (secret)

Answer Selection: Correct = ● Incorrect = ⊗ ✓ ⊖

A. General Information

1. I am a O Girl O Boy O Other: _____
2. What is your age: ⑨ ⑩ ⑪ ⑫ ⑬ ⑭ years old
3. What grade are you currently in? ⑤ ⑥ ⑦ ⑧
4. I live at my main home (where I sleep most nights) with…

   O One-parent O Two-parents O Other: _____
5. How many people live (including yourself) in your main home?

   O 1 O 2 O 3 O 4 O 5 O 6 or more
6. How many children (including yourself) live in your main home?

   O 1 O 2 O 3 O 4 O 5 or more

B. Knowledge

1. How many servings of fruit and vegetables should children your age eat everyday based on Canada's Food Guide?

   O 2 O 3 O 4 O 5 O 6 O 7 O 8 O I don't know
2. Which of the following statements below will help children your age eat more vegetables and fruit?

	Yes	No	I don't know
a. Eat fruit and vegetables that are different colours every day	O	O	O
b. Eat vegetables and fruit at every meal	O	O	O
c. Eat more french fries and vegetable chips	O	O	O
d. Eat fruit as a dessert	O	O	O
e. Eat vegetables and fruit at home	O	O	O
f. Eat fruit gummies	O	O	O

3. Select the food or drink in each pair that should be chosen most often:

a. O Orange……OR…… O Orange Juice
b. O Tomato Ketchup……... OR…… O Tomato Sauce
c. O Fresh Strawberries……...OR…… O Strawberry Frozen Yogurt
d. O French Fries……... OR…… O Baked Potato
e. O Raspberry Jam……..……... OR…… O Fresh Raspberries
f. O Frozen Blueberries..…… OR…… O Blueberry Muffin
g. O Apple Pie……..... OR……..... O Apple

4. Which of the following vegetables and fruit are grown in Ontario?

	Yes	No	I don't know
a. Apples	O	O	O
b. Pears	O	O	O
c. Celery	O	O	O
d. Broccoli	O	O	O
e. Cantaloupe	O	O	O
f. Oranges	O	O	O
g. Cauliflower	O	O	O
h. Grapes	O	O	O
i. Cherry tomatoes	O	O	O
j. Cucumber	O	O	O
k. Orange peppers	O	O	O
l. Sugar snap peas	O	O	O
m. Kiwis	O	O	O
n. Melon	O	O	O
o. Pineapple	O	O	O
p. Plums	O	O	O
q. Yellow peppers	O	O	O
r. Red peppers	O	O	O
s. Strawberries	O	O	O

5. Answer true or false for each statement about vegetables or fruit.

	True	False	I don't know
Vegetables…			
a. Have fibre	O	O	O
b. Are low in sugar	O	O	O
c. Come in many colours which give you different kinds of nutrients	O	O	O
d. That are frozen have fewer vitamins and minerals compared to fresh vegetables	O	O	O
e. Are only good for you if you eat them raw	O	O	O
f. Only need to be eaten at dinner time	O	O	O
g. Have many types of vitamins and minerals	O	O	O
Fruits…			
h. Have fibre	O	O	O
i. Do not have added sugar	O	O	O
j. Come in many colours which give you different kinds of nutrients	O	O	O
k. That are frozen have fewer vitamins and minerals compared to fresh fruit	O	O	O
l. Are only good for you if eaten at breakfast	O	O	O

6. What is the safest way to clean fresh fruits and vegetables?

O Regular soap O Hot water O Cool running water

O You don't need to wash fresh fruits and vegetables O I don't know

C. The Types of Food You Eat & Drink

1. In a typical day, about how many servings of fruit do you eat?

Example – 1 serving is equal to:

- A piece of fresh fruit, like an apple
- A small bowl of fruit salad

O None O 1 O 2 O 3 O 4 or more

2. In a typical day, about how many servings of vegetables do you eat?

Example – 1 serving is equal to:

- A carrot or other fresh vegetable (Do not count French fries, potato chips)
- A small bowl of green salad or cooked vegetables

O None O 1 O 2 O 3 O 4 or more

D. Eating & Drinking during the School Day

1. Do you take part in your school's milk program?

O Yes O No O I don't know

2. Are you personally allowed to leave the school grounds at lunch time?

O Yes O No O I don't know

3. During a normal school week, how many ***days per week*** do you:

Number of days per week	**0**	**1**	**2**	**3**	**4**	**5**
a. Go home to eat lunch	O	O	O	O	O	O
b. Bring a lunch from home	O	O	O	O	O	O
c. Eat lunch off school grounds at a store/ restaurant?	O	O	O	O	O	O

E. Food Preference

1. What are your attitudes and beliefs about eating fruit and vegetables?

	Disagree very much	**Disagree a little**	**Agree a little**	**Agree very much**	**I don't know**
a. I think fruit taste good	O	O	O	O	O
b. I like to eat fruit	O	O	O	O	O
c. I think vegetables taste good	O	O	O	O	O
d. I like to eat vegetables	O	O	O	O	O
e. I will have more energy if I eat fruit and vegetables	O	O	O	O	O
f. I will get sick more if I don't eat fruit and vegetables	O	O	O	O	O
g. Eating fruit and vegetables will help me grow	O	O	O	O	O
h. I will have healthier skin if I eat fruit and vegetables	O	O	O	O	O
i. I will have stronger eyes if I eat fruit and vegetables	O	O	O	O	O
j. I will be able to think better if I eat fruit and vegetables	O	O	O	O	O
k. Eating fruit and vegetables will keep me from getting cavities	O	O	O	O	O

2. Which of these fruits & vegetables do you like or dislike?

	Dislike a Lot	Dislike a Little	Like a Little	Like a Lot	I have never tried / I don't know	I am allergic
a. Apples	O	O	O	O	O	O
b. Pears	O	O	O	O	O	O
c. Celery	O	O	O	O	O	O
d. Broccoli	O	O	O	O	O	O
e. Cantaloupe	O	O	O	O	O	O
f. Oranges	O	O	O	O	O	O
g. Cauliflower	O	O	O	O	O	O
h. Grapes	O	O	O	O	O	O
i. Cherry tomatoes	O	O	O	O	O	O
j. Cucumber	O	O	O	O	O	O
k. Orange peppers	O	O	O	O	O	O
l. Sugar snap peas	O	O	O	O	O	O
m. Green beans	O	O	O	O	O	O
n. Kiwis	O	O	O	O	O	O
o. Melon	O	O	O	O	O	O
p. Pineapple	O	O	O	O	O	O
q. Plums	O	O	O	O	O	O
r. Red peppers	O	O	O	O	O	O
s. Yellow peppers	O	O	O	O	O	O
t. Strawberries	O	O	O	O	O	O

3. Do you have fruits to eat at home?

O Never O Sometimes O Usually O Always

4. Do you have vegetables to eat at home?

O Never O Sometimes O Usually O Always

5. Do you like to try new foods?

O Never O Sometimes O Usually O Always

6. How often do your parents eat fruits?

O Never O A few days a week O Most days a week
O Every day O I don't know

7. How often do your parents eat vegetables?

O Never O A few days a week O Most days a week
O Every day O I don't know

8. How often do your friends eat fruits?

O Never O A few days a week O Most days a week
O Every day O I don't know

9. How often do your friends eat vegetables?

O Never O A few days a week O Most days a week
O Every day O I don't know

10. What would help make you try a new fruit or vegetable that you have never tried before?

	Yes	No	I don't know
a. I think it will taste good	O	O	O
b. It looks good	O	O	O
c. My friend likes it	O	O	O
d. It's given out at school	O	O	O
e. It's available at home	O	O	O
f. Served with dip	O	O	O
g. I know that it's healthy	O	O	O
h. I know that it's locally grown	O	O	O
i. Other people want me to try it	O	O	O
j. It's colourful	O	O	O
k. It's with another food I like	O	O	O
l. It's easy to eat	O	O	O
m. Other (please specify): _____	O	O	O

11. These "I think I can" statements are different ideas to help you get more vegetables and fruit in your diet. How much do you agree or disagree that you can do each one?

	Disagree very much	Disagree a little	Agree a little	Agree very much	I don't know
For breakfast, I think I can…					
a. Drink a glass of juice (e.g., 100% orange juice)	O	O	O	O	O
b. Add a fruit to eat (e.g., an apple, blueberries)	O	O	O	O	O
c. Add a vegetable to eat (e.g., peppers in an omelette)	O	O	O	O	O
For lunch, I think I can…					
d. Eat vegetables (e.g., carrots, cucumber) instead of chips or other treats	O	O	O	O	O
e. Eat fruit instead of a dessert	O	O	O	O	O
f. Add more vegetables to my lunch (e.g., lettuce and tomato in a sandwich or wrap)	O	O	O	O	O
g. Eat more than one kind of vegetable at lunch (e.g., cauliflower and snap peas)	O	O	O	O	O
For a snack, I think I can choose…					
h. Fruit instead of a cookie or candy	O	O	O	O	O
i. Vegetables instead of other snacks (like chips, granola bars, cookies or candy)	O	O	O	O	O
j. Raw vegetable with dip (e.g., celery with hummus)	O	O	O	O	O
For dinner, I think I can…					
k. Eat a big serving of vegetables	O	O	O	O	O
l. Eat more than one kind of vegetable	O	O	O	O	O
m. Eat salad more often	O	O	O	O	O
n. Eat fruit instead of my usual dessert.	O	O	O	O	O

You are finished!

Thank you for completing

the survey.

Appendix G: Parent Survey

HEAL
HUMAN ENVIRONMENTS ANALYSIS LABORATORY

Parent/Guardian Survey

We need your help to make this study a success. Your honest answers to the items in this survey are very important. This will not take too long to complete. If you have more than one child bringing home a survey – we would appreciate you filling out a survey for each child since many answers will be specific to each child.

Answer Selection: Correct = ● Incorrect = ⊗ ✓ ⊖

A. General Information

1. My child is O Female O Male O Other: _____
2. My child's current age is ⑨ ⑩ ⑪ ⑫ ⑬ ⑭ years old.
3. What is your relationship to the child (taking part in the study)?

   O Mother O Father O Primary caregiver/Guardian O Other: _____
4. If your child has two parents/guardians, what is the relationship between your child (taking part in the study) and the other parent/guardian?

   O Mother O Primary caregiver/Guardian O Other: _____
   O Father O N/A
5. My child lives primarily in a:

   O Single-parent/guardian household
   O Two-parent/guardian household
   O Other: _____
6. My child:

   O Lives in a single household
   O Splits their time equally between 2 households
   O Lives in one household but regularly visits/lives in a second household
   O Has another household arrangement
7. Postal code of your child's primary home: ___ ___ ___ - ___ ___ ___
8. How many motor vehicles in working order (cars, vans, trucks, and motorcycles) are there at your household?

   O None O 1 O 2 O 3 O 4 or more
9. Select the highest level of education **you** have completed.

   Grade: ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑪ ⑫ ⑬
   O College/University
   O Graduate School
   O N/A

10. Select the highest level of education the **second parent/guardian** has completed.

Grade: ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑪ ⑫ ⑬

- O College/University
- O Graduate School
- O N/A

11. Which of the following best describes **your** current work status?

- O Employed full-time
- O Employed part-time
- O Student
- O At home with children
- O Unemployed
- O I prefer not to answer
- O N/A
- O Other: _____

12. Which of the following best describes the current work status of the **second parent/guardian**?

- O Employed full-time
- O Employed part-time
- O Student
- O At home with children
- O Unemployed
- O I prefer not to answer
- O N/A
- O Other: _____

13. Please indicate the total income from all sources that you and other members of your household received in the last year (Jan-Dec) before taxes. The total income from all sources was:

- O Less than $20,000
- O $20,000 - $29,999
- O $30,000 - $39,999
- O $40,000 - $49,999
- O $50,000 - $59,999
- O $60,000 - $69,999
- O $70,000 - $79,999
- O $80,000 - $89,999
- O $90,000 - $99,999
- O $100,000 - $109,999
- O $110,000 - $119,999
- O $120,000 - $129,999
- O $130,000 - $139,999
- O $140,000 - $149,999
- O $150,000 or more
- O I don't know
- O I prefer not to answer

14. What is your child's primary race / ethnic background (choose 1 or 2)?

- O White/Caucasian
- O South Asian (e.g. East Indian, Pakistani, Sri Lankan)
- O East Asian (e.g., China, Japan, Korea)
- O Middle Eastern (e.g., Egypt, Iran, Lebanon)
- O Latin American
- O Aboriginal (First Nations, Métis, or Inuit)
- O Black/African/Caribbean

B. Your Eating Habits

1. In a typical day, about how many servings of fruit do **you** eat?

Example – 1 serving is equal to:

- A piece of fresh fruit, like an apple
- A small bowl of fruit salad

O None O 1 O 2 O 3 O 4 or more

2. In a typical day, about how many servings of vegetables do **you** eat?

Example – 1 serving is equal to:

- A carrot or other fresh vegetable (Do not count French fries, potato chips)
- A small bowl of green salad
- A small bowl of fresh or cooked vegetables

O None O 1 O 2 O 3 O 4 or more

C. Your Child's Eating Habits

1. In a typical day, about how many servings of fruit does **your child** eat?

Example – 1 serving is equal to:

- A piece of fresh fruit, like an apple
- A small bowl of fruit salad

O None O 1 O 2 O 3 O 4 or more

2. In a typical day, about how many servings of vegetables does **your child** eat?

Example – 1 serving is equal to:

- A carrot or other fresh vegetable (Do not count French fries, potato chips)
- A small bowl of green salad
- A small bowl of fresh or cooked vegetables

O None O 1 O 2 O 3 O 4 or more

3. Please indicate your degree of agreement with each of the following statements.

	Strongly Disagree	Disagree	Agree	Strongly Agree
a. My child is a picky eater.	O	O	O	O
b. If my child doesn't know what is in a food, he or she won't try it.	O	O	O	O
c. My child is afraid to eat things he or she has never had before.	O	O	O	O
d. My child is very selective about foods he or she will eat.	O	O	O	O
e. My child will eat almost anything.	O	O	O	O

You are finished! Thank you for completing the survey.

Appendix H: Child Focus Group Questions

Introduction and Icebreaker

We are here today to talk about your school's snack program. To begin, please tell us your name and favourite food.

Questions

1) When do you usually get your snacks from the program?
   Follow-up: Do you like getting snacks at this time? Would you prefer them at a different time?
2) Before you get your snack, are you usually hungry?
   Follow-up: Was there enough snack each time? Should we provide more or less food?
3) Can you tell me about the snacks you liked from the program? Why did you like these snacks?
   Follow-up: Are there any other healthy snacks you would like?
4) Can you tell me about the snacks you did not like? Why did you dislike these snacks?
   Follow-up: Could the snacks you didn't like be served in a different way to help you eat them?
   Follow-up: If a certain snack did not look good, did you eat it?
5) Did you eat all of the snacks from the program?
   Follow-up: If not, what happens when the snacks are not eaten?
6) Has the snack program changed the way you eat?
   Follow-up: Has the snack program changes the way you eat at home?
7) If you were in charge of a healthy snack program, what would you do?
   Follow-up: What foods would you have?
8) Is there anything else you would like to tell us about the snack program?
   Follow-up: Was there anything you really liked about the program? Is there anything that should be changed?

Curriculum Vitae

Name:	Paige Colley
Post-secondary Education and Degrees:	Brock University St. Catharines, Ontario, Canada 2010-2015 B.A., B.Ed. University of Oxford Oxford, United Kingdom 2015-2016 M.Sc. Western University London, Ontario, Canada 2016-2020 Ph.D.
Honours and Awards:	Children's Health Research Institute Graduate Scholarship 2016-2017 Western Graduate Research Scholarship 2016-2020 National Collaborating Centres for Public Health Knowledge Transfer Award 2018 Canadian Institute of Health Research Travel Award- Institute Community Support 2019 Ontario Graduate Scholarship 2018-2019, 2019-2020
Related Work Experience:	Research Assistant Western University 2016-2019 Teaching Assistant Western University 2018 Lecturer Western University 2019

Publications:

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