



The **Research** Shop

COMMUNITY. CAMPUS. COLLABORATION. 

# OPPORTUNITIES TO FILL THE GAPS IN KNOWLEDGE ABOUT THE IMPACTS OF FOOD EDUCATION FOR CHILDREN AND YOUTH IN ONTARIO

MAY 2014

Monika Korzun\* and Carolyn Webb\*

\*Project Manager at the Research Shop

\*\*Coordinator for the Ontario Edible Education Network (OEEN),  
Sustain Ontario

Citation: Korzun, M., & Webb, C. (2014). *Opportunities to fill the gaps in knowledge about the impacts of food education for children and youth in Ontario*. Guelph, ON: Institute for Community Engaged Scholarship.

<https://dspace.lib.uoguelph.ca/xmlui/handle/10214/8902>



**INSTITUTE for  
COMMUNITY ENGAGED SCHOLARSHIP**

College of Social and Applied Human Sciences  
University of Guelph Guelph, Ontario Canada N1G 2W1  
phone: 519 / 824.4120 Ext. 53829 | email: [ices@uoguelph.ca](mailto:ices@uoguelph.ca)  
[www.theresearchshop.ca](http://www.theresearchshop.ca)



## EXECUTIVE SUMMARY

Information is mounting about the health risks associated with poor eating habits, low levels of exercise and lack of knowledge about food and nutrition amongst children and youth. For example, the Ontario Agency for Health Protection and Promotion states that “Less than half of youth aged 12 to 19 in Ontario reported that they consume vegetables and fruit at least five times per day, a trend that has remained consistent over time and is similar to the national rate” (2013, p.19). Evidence demonstrates that if trends continue, the children and youth of this generation will live a shorter life than their parents and will develop chronic illnesses younger than their parents (Olshansky et al., 2005; Reilly & Kelly, 2011).

Government and non-governmental actors throughout Ontario are working to address the increasing health concerns faced by children and youth, including advancing student nutrition programs, food education outside the classroom, food skills and cooking programs, food in the curriculum, and school and community gardens. Collectively these parties have a large amount of anecdotal evidence and experience to speak about the benefits of their work. However, a valid question that often arises is what documented evidence exists to support the impacts of food education on the health and wellbeing of children and youth.

A literature review was undertaken to explore this question, and to gain a better understanding about the availability and gaps of such evidence. It is hoped that capturing this information will help those working in the field by contributing to the overall body of knowledge about food education, by highlighting gaps that can be filled by future research efforts, and by informing advocacy relating to the benefits of food education.

Based on the comprehensive literature review, it appears that both qualitative and quantitative studies capturing the impacts of food education in Ontario are lacking. The information that is available is largely limited to outlining the challenges that children and youth experience relating to their health and well-being, rather than describing food education programs and their benefits.

In addition, various topics of study relevant to food education are lacking, such as the differences between eating habits amongst boys and girls, impacts of food education on academic achievement, bullying and safety in school, physical behaviour, social

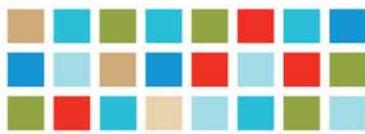


development, mental development, interpersonal relations, community development, and impacts on eating habits outside of school.

The authors suggest several ways in which governmental and non-governmental actors can explore and capture the impacts of food education. These include case studies, statistical analysis, longitudinal and cross-sectional studies.

Until this research is conducted, there appears to be substantial evidence from the United States and internationally that can be referenced to demonstrate the potential benefits that food education can achieve in Ontario.





## TABLE OF CONTENTS

**Executive summary**..... 2

**Introduction** ..... 5

    Research Goals ..... 5

    Scope of the Term “Food Education” Used in This Study ..... 5

**Methods** ..... 5

**Findings** ..... 6

    Concerns Regarding the State of Health of Today’s Children and Youth..... 6

    Benefits of Food Education ..... 7

    Information About the Impacts of Food Education Programs in Ontario ..... 9

**Conclusions**..... 15

**Recommendations** ..... 15

    General Recommendations..... 15

    Specific Recommendations..... 17

**References**..... 19

**Appendix**..... 25





## INTRODUCTION

### RESEARCH GOALS

This report has two purposes. The first is to outline evidence regarding the impacts of food education among children and youth in Ontario. The second is to highlight gaps in research and information regarding this theme. The report then concludes by providing suggestions for actors across sectors to fill gaps in evidence and better document the impacts of food education programs on the health of children and youth and their communities.

This research is intended to help organizations with their food education programming and to make a case for their programs, to contribute to the overall body of knowledge on food education, and to help provide a foundation for stronger advocacy. A better understanding of how various food education programs impact children and youth can help organizations to build evidence for their work and increase the significance and urgency of their programs amongst stakeholders and the general public.

### SCOPE OF THE TERM “FOOD EDUCATION” USED IN THIS STUDY

Food education can occur through numerous forms including school gardens, nutrition and food education embedded in the curriculum as well as nutrition and food related programming outside of the classroom. The search for information on food education included these and other types of food education research and programming. The study focused on food education geared towards school-aged children and youth.

## METHODS

The information presented in this report was obtained via a comprehensive literature review on the topic of food education geared towards children and youth. Two methods were used to gather information. Sustain Ontario had already developed short reports that provided some information relevant to this topic. The authors also accessed information from University of Guelph’s library as well as using various online resources and search engines (such as Google and Google Scholar). Because food education comes in various formats, the search included the use of a wide range of keywords (for example ‘impacts of food education’, ‘food education’, ‘school gardens’, ‘nutrition education’) in an attempt to capture as much information about the impacts of food education as possible.



The literature review explored and summarized published literature, gray literature, official government documents, peer reviewed journal articles, a PhD dissertation, as well as reports from non-profit organizations. These documents demonstrate various types of impacts including impacts of school greening, which is an umbrella term for a wide range of changes taking place on school grounds including tree planting, school gardening and habitat restoration. The impacts also include data on food habits amongst children and youth, impacts of nutrition education, food education via curriculum development and food education for educators.

Although this study focused on Ontario, the authors also examined studies from other Canadian provinces and territories as well as relevant international data. Impacts documented in Ontario are presented in Table 1. Table 2 in Appendix A presents Canadian data from other provinces and territories, and Table 3 in Appendix B outlines data from international studies.

All of the data presented in the tables are direct quotes taken from the documents referenced. In cases where more than one reference is provided, specifically in Appendix A and B, all of the references claim the same statement in their research. In these cases, the direct quotes are taken from the first reference.

## FINDINGS

### CONCERNS REGARDING THE STATE OF HEALTH OF TODAY'S CHILDREN AND YOUTH

In the past decade, there has been an increased concern for the health of children and youth (Aftosmes, 2011; Baker, Campsie & Rabinowicz, 2010; Ontario Agency for Health Protection and Promotion, 2013). Research shows that children and youth now are in much poorer health than previous generations. Evidence suggests that if these trends continue, this will be the first generation that will live a shorter life than their parents and develop chronic illnesses younger than their parents (Olshansky et al., 2005; Reilly & Kelly, 2011). Baker, Campsie and Rabinowicz (2010) state that for the past several decades, people were expected to live longer than past generations, but the trend is now being reversed, with children living much shorter and less healthier lives than previous generations

Many of the health risks facing children and youth are modifiable factors that can be changed by means of choices and behaviour (Henderson et al., 2011; Langelotto &



Gupta, 2012; Ontario Agency for Health Protection and Promotion, 2013). These modifiable factors include, but are not limited to, maternal smoking, physical inactivity and sedentary behaviour, inadequate sleep, irregular eating habits and consumption of unhealthy food and beverages. These factors contribute to overweight and obesity, type 2 diabetes and coronary heart disease in children and youth (Henderson et al., 2011; Langellotto & Gupta, 2012; Ministry of Health Promotion, 2006; Must, Barish & Bandini, 2009; Ontario Agency for Health Protection and Promotion, 2013; Roberts, Shields, Groh, Aziz & Gilbert, 2012; Rosenkranz & Dzewaltowski, 2008). For example, 90% of type 2 diabetes and 80% of coronary heart disease can be avoided by changing to a more active and healthy lifestyle (Ministry of Health, 2006). Obesity is also correlated with isolation and depression as many children and youth are often bullied at school (Healthy Kids Panel, 2013).

In addition to choice and behavioural factors, research suggests that environmental factors contribute to the poor state of health of children and youth. Factors such as the structure of school and neighbourhood play areas (Ontario Agency for Health Protection and Promotion, 2013; Rossiter, Glanville, Taylor & Blum, 2007; Uptis, Hughes & Peterson, 2013), the decreasing accessibility of walking and biking in neighbourhoods (Ontario Agency for Health Protection and Promotion, 2013) and loss of understanding and connection to growing, producing and preparing food (Block et al., 2013; Carlsson & Williams, 2008; FAO, 2012; Keller et al. 2005; Williams & Dixon, 2013; Woodruff & Kirby, 2013) all contribute to the decreasing health of children and youth.

## **BENEFITS OF FOOD EDUCATION**

Research demonstrates that an effective way to positively impact the health of children and youth is to create environments that encourage better lifestyle choices. Research findings illustrate that caregivers, including parents, home caregivers and teachers, greatly impact the food patterns and choices of children and youth. For example:



- Caregivers and school teachers with higher education are more likely to promote healthy eating (Derscheid et al. 2010).
- Research shows that students whose teachers received nutrition and food training have more nutrition and food system knowledge than students whose teachers did not receive training (Graham Beall, Lussies, McLaughlin & Zidenberg-Cherr, 2005; Rossiter et al., 2007).
- A similar trend is also found in research on caregivers (Derscheid, et al. 2010). Caregivers who received nutrition and food education believed that promoting nutritious and healthy eating habits at an early age would have long-term benefits (Derscheid et al. 2010).

This research suggests that impactful food education programs or approaches cannot focus solely on children and youth, but should incorporate their parents, caregivers, teachers and communities in general.

There is also increasing evidence that the school environment plays a large role in contributing to unhealthy weights among children and youth (Gates, Gates, McCarthy & Tsuji, 2013; Ministry of Health Promotion, 2010; Ontario Agency for Health Protection and Promotion, 2013; Rossiter et al., 2007; Upitis et al., 2013). This speaks to significant opportunity for schools to provide positive learning environments and support healthier choices. Children and youth spend most of their day at school and teachers, administrators and coordinators can provide positive influences and act as important role models for children and youth

- Overall, students who enjoy school are more likely to make healthier food choices and have better overall physical and mental health (Ministry of Health Promotion, 2010).
- Early experiences in positive outdoor environments develop a greater sense of environmental stewardship in developing life and adulthood (Upitis et al. 2013)

One area that has seen more research focus than others is that of school gardens.

- School gardens are discussed as being relatively inexpensive compared to other greening interventions, they can be integrated with school curriculum, and they can address multiple issues in a safe and inclusive setting (Ratcliffe, Merrigan, Rogers & Goldberg, 2011).
- Involvement with a school garden has been suggested to increase fruit and vegetable intake and increase the intake of a wider variety of fruits and



vegetables (FAO, 2010; Graham et al., 2005; Langellotto & Gupta, 2012; Ratcliffe et al., 2011; Sustain Ontario, 2012).

- Research demonstrates that incorporating school gardens into curriculum improves academic performance (Bell & Dymont, 2008; Dymont & Bell, 2007; Klemmer, Hedley, Hedley, Wong & Vanderkooy, 2005; Smith & Motsenbocke, 2005;), specifically in science and math (Block et al., 2013; Williams & Dixon, 2013).
- Students involved with school gardens develop better social relations, a better relationship with the environment and are more engaged, enthusiastic and aware in school (Bell & Dymont, 2008; Dymont & Bell, 2007; FAO, 2010; Lieberman & Hoody, 1998).
- Schools with gardens have more opportunities for play, as they create opportunities for games of various group sizes, for more open-ended play, for girls and boys to play together, and they increase cooperative play. This is especially important for isolated students who may prefer creative and smaller group activities (Bell & Dymont, 2008; Dymont & Bell, 2007).
- Schools with gardens experience less conflict inside the classroom (Bell & Dymont, 2008).
- Data suggests that teachers believe and enjoy incorporating the outdoors and nature into their teaching (Tan & Pedretti, 2010).

Childhood offers a range of opportunities to learn health practices and behaviours that can be maintained throughout adulthood (Ministry of Health Promotion, 2010; Sustain Ontario, 2012). Interventions to improve the health of children and youth are likely to be more successful when they involve parents and their caregivers, address physical activity and eating habits together, develop long term goals, are integrated into the school curriculum, modify the school environment, are culturally sensitive, and are done in collaboration with community partners (FAO, 2010; Ministry of Health Promotion, 2006; Ontario Agency for Health Protection and Promotion, 2013).

## **INFORMATION ABOUT THE IMPACTS OF FOOD EDUCATION PROGRAMS IN ONTARIO**

Despite the increasing number of research studies on food education seen across North America, few have focused on Canada and on Ontario. There is a vast body of research on various aspects of food education in the United States. Although food education programs continue to increase in number in Canada, as communities are recognizing



the benefits of food education, there are a limited number of studies that evaluate the impacts of these programs. Russell et al. (2008) claim the reports that do exist are methodologically limited. Russell et al. (2008) suggest that this may be a result of the lack of federal funding for school food programs.

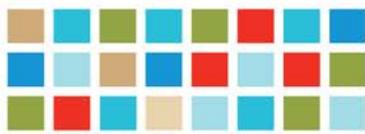
Table 1 below provides a full list of the reported impacts from food education programs in Ontario, Canada, that were found during the study’s literature review. As can be seen, the research and information about Ontario is largely limited to outlining existing concerns faced by today’s children and youth. Only one study, by Dymont (2005), developed a case study based on primary data gathered in 45 schools in the Toronto District School Board. This study provides valuable information about the ways that school ground greening impacts student health as well as teaching practices, academic performance and student social development.

Tables 2 and 3 in the Appendices provide findings from outside of Ontario, including other Canadian provinces, the United States and beyond.

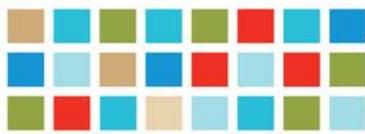
**How to use the tables in this report:** All of the tables below provide direct quotes from the referenced studies and reports. There are examples in Appendix A and B that have more than one reference. The direct quote has been taken from the first reference in all cases. Subsequent references contain the same information, but used different words to describe it.

**Table 1: Evidence in support of food education (Ontario data)**

Direct Quote from Study	Reference
Concerns regarding the State of health of today’s children and youth	
<b>Unhealthy food consumption and lack of food literacy</b>	
Only half of youth [in Ontario] consume the recommended number of vegetable and fruit servings per day, and many children and youth are consuming too many calories from sugar-sweetened beverages.	Ontario Agency for Health Protection and Promotion, 2013
Less than half of youth aged 12 to 19 in Ontario reported that they consume vegetables and fruit at least five times per day, a trend that has remained consistent over time and is similar to the national rate.	Ontario Agency for Health Protection and



	Promotion, 2013
Similar to other research conducted with Ontario adolescents (Greene-Finestone et al., 2005; Pender, 2003) the proportion of students consuming the recommended number of servings of Vegetables and Fruit, and Grain Products was low in grade six and even less by grade nine. Poor intake of vegetables and fruit has been observed in previous reports on adolescents (Janssen, 2008; King, Boyce, & King, 1999; Neumark-Sztainer, Story, Resnick, & Blum, 1996); yet vegetables and fruit are an important nutrient-dense source of energy.	Rossiter et al. 2012
We are seeing the decline of food literacy, that is, the ability of people to shop for and cook food in a healthy way; choosing and preparing the most economical and healthy foods (from high-fibre grains and dried beans to inexpensive cuts of meat) requires some knowledge.	Baker, Campsie and Rabinowicz, 2010
Many Ontarians see food as fundamental to their personal health and the health of their communities, but they cannot always make the connection to the kind of food they want.	Baker, Campsie and Rabinowicz, 2010
Our data indicate a similar situation; at baseline 74.4% of youth in Kashechewan and 82.9% in Attawapiskat failed to reach minimum recommendations.	Gates et al. 2013b
<b>Unhealthy weights</b>	
27.1% of youth aged 12 to 17 self-reported a [body mass index] BMI considered overweight or obese in 2009–2010.	Roberts et al. 2012
The problem should be addressed early, as childhood weight and dietary habits track into adulthood.	Gates et al. 2013b
<b>Overall health and wellbeing</b>	
If nothing is done, the current generation of children in Ontario will be the first that has a lower quality of life than their parents. They will	Healthy Kids



develop chronic illnesses much younger and be more affected as they age	Panel, 2013
Ontarians are increasingly unhealthy, particularly children and youth, who are facing new health problems such as diabetes at greatly increased rates. As many commentators have noted, after decades in which members of each generation could expect to live longer, healthier lives than those in the preceding generation, this trend has been reversed. In many families, the children may live shorter, less healthy lives than their parents	Baker, Campsie and Rabinowicz, 2010
In Ontario, one in every nine children lives in poverty. Meanwhile, rates of diabetes and obesity are increasing among Ontario's children. The serious consequences of these trends for children's health and educational outcomes are foreseeable, and the effects of those outcomes on Ontario's health care costs and future economy can also be predicted. These problems could be alleviated with school food programs that ensure that children have both the nutrition and food literacy they need to focus on their studies today and to ensure their health in the future.	Baker, Campsie and Rabinowicz, 2010
Nutrient inadequacies in Aboriginal children and adolescents from certain communities have been documented for iron, folate, vitamin D, calcium and vitamin A.	Skinner et al. 2012
<b>Economic costs</b>	
The total economic burden of physical inactivity was \$3.4 billion (\$1.02 billion in direct costs and \$2.34 billion in indirect costs) while the cost associated with obesity was \$4.5 billion (\$1.60 billion in direct costs and \$2.78 billion in indirect costs) in Ontario for the year 2009.	Katzmarzyk, 2011
<b>Benefits of food education</b>	



<p>A study of 45 schools in Toronto, Canada, indicates that school ground greening actually calms student traffic and softens play surfaces so that there are, in fact, fewer 'knock-and-bump' injuries.</p>	<p>Dyment, 2005</p>
<p>Participants indicated that when school grounds had been greened, they tended to become more peaceful, harmonious and socially inclusive. They reported, for example, an increase in cooperative play (73% of study participants), a decrease in boredom (74%) and a decrease in negative and aggressive play (66%). They noted that students were being more civil (72%), communicating more effectively (63%) and being more cooperative (69%). They also reported that discipline problems had decreased (44%) or remained the same (40%) and that incidents of aggressive behaviour had likewise decreased (45%) or remained the same (53%). About half of the study participants felt that green school grounds were more inclusive with respect to gender (54%), class (42%), race (46%) and ability (52%), while the other half reported no change.</p>	<p>Dyment, 2005</p>
<p>Questionnaire respondents indicated that students were more likely to explore widely (90%), to learn about their local environment (91%), and to have a greater sense of wonder and curiosity (92%) after their school ground had been greened. Over 90% of respondents also indicated that student environmental awareness and stewardship had increased on the green school ground.</p>	<p>Dyment, 2005</p>
<p>Students indicated that the snack program helped them to eat healthier by motivating them (74%), eating more fruit (86%), and making better dietary choices (68%). However, the majority (50%) did not think that the snack program encouraged them to ask their parents to purchase vegetables or fruit that they had tried at school.</p>	<p>Skinner et al. 2012</p>
<p>Overall, participants felt the Northern Fruit and Vegetable Pilot Program (NFVPP) was a valuable program and would participate in a program like this again. Participants felt the program helped students make healthier food choices at school and at home. Many also felt that some students in this region had limited exposure to fruit and</p>	<p>He et al. 2007</p>



vegetables, making this region especially suitable for the program. A few observed a difference in student behaviour, such as greater attention in class.

Over 80% of students liked the idea of receiving free fruit at school. Approximately 60% to 70% of students liked the idea of receiving vegetables.

Comparing change of students' responses to each of the cognitive and behavioural questions at baseline and endpoint, it was noted that students' preference for certain types of fruit and vegetables were shifted from 'never tried it' towards 'like it'

There were favourable preference changes on certain fruit and vegetables with a shift from 'never tried it' towards 'like it'.

The authors suggested that exposure is a promising technique for improving children's liking of vegetables.

There is very little Ontario-specific data that demonstrates the benefits of food education programs. Authors of these studies themselves recognize the lack of research and tools for monitoring the impacts of food education. As Hanning et al. states, "Valid, practical tools are needed to assess school children's food and nutrient intakes for surveillance and monitoring. Such data can be used for needs assessment and evaluation of dietetic practice, including community based program and policy intervention" (2009, p.177). Russell et al. (2008) demonstrate that despite the increasing number of nutrition programs in Canada, the research is scarce. They state there is an extensive body of research on school nutrition programs, but they are predominately from the US, partly due to the available funding for that research.

It is apparent that both quantitative and qualitative research from the perspective of students, educators and community members are needed to demonstrate the impacts of food education programs. While many stories and personal experiences exist about the benefits of such programs, data would help those working with children and youth as well as advocates to better communicate the value and potential reach of these efforts.





## CONCLUSIONS

Evidence about the impacts of food education in Ontario was largely found in academic journals. About half of the studies were undertaken by researchers in academic institutions such as the University of Toronto, University of Guelph, University of Western Ontario and University of Tasmania in Australia. The other half of the Ontario studies were completed by non-academic institutions including government funded agencies such as the Ontario Agency for Health Protection and Promotion, Public Health Agency of Canada and from the not-for-profit organizations of Foodshare, Evergreen and Sustain Ontario.

In Ontario, research has largely identified the problems that children and youth face in terms of their eating habits, lack of physical activity and other issues that can be partly addressed by food education. The research currently available in Ontario does not go so far as to demonstrate the numerous opportunities as well as the limitations of food education programs. There appears to be a great opportunity for not-for-profit organizations, researchers, and other bodies to gather data that can provide a better understanding of how food education programs in Ontario can reverse some of the worrisome trends that children and youth are currently experiencing with regard to their health and wellbeing.

## RECOMMENDATIONS

### GENERAL RECOMMENDATIONS

Statistical information and case studies that report on the impacts of food education programs in Ontario are limited. Documented information is lacking regarding most potential sources of food education, including student nutrition programs, food skills and cooking programs and community gardens that engage children and youth. What is also lacking is complex data that examines critical elements of analysis such as gender, age, race, socio-economic class, family composition, immigration status and geographical regions.

For example, although Dymont (2005) provides a wealth of information about the impact of school ground greening, she does not illustrate how those impacts may differ amongst various groups. The 45 schools and the participants in the study are presented as a homogenous group. There is very little illustration of variation amongst participants



and how the unique circumstances of each school contribute to the impacts of food education.

It would be valuable for future research in Ontario to ask some of the following questions:

1. How do eating habits differ amongst boys and girls?
2. What methods of food education appeal to different age groups?
3. How can ethnic food and different cultures be incorporated into food education?
4. How does food education impact discipline, learning and academic achievement?
5. How does food education influence students' nutrition and health knowledge?
6. Do altered eating habits in school translate to altered eating habits outside of school and inside the home?
7. How does food education influence bullying and safety in school?
8. What are the long-term impacts of food education on individual health?

Additional contributions could be made through comparative studies that contrast schools with food education programs versus schools without these programs (Bell and Dymont 2008). It is also important to mention that there is a lack of research, not only in Ontario but overall, that captures the voices of students, children and youth themselves. To get a more holistic illustration of food education in Ontario, more complex and multi-faceted questions should be asked. This could help identify gaps, limitations and challenges relating to food education.

A body of evidence that better demonstrates the value of food education would provide support for policy decision-making and the addition and expansion of programs across the province. Developing and partaking in research may also spark an interest among others including parents, administrators and health advocates (Bell & Dymont, 2008; Carlsson & Williams, 2008).



## SPECIFIC RECOMMENDATIONS

The following provide a number of specific ways for organizations, researchers and other parties to capture information and impacts about food education:

- 1. Case studies:** Case studies provide an in-depth analysis of a program, person or event. This approach can represent a case in a meaningful, complex and holistic manner. Case studies can be completed using the format of a 'fact-sheet' or 'school profiles.' They can also be presented in a more lengthy and in-depth manner where cases are combined or compared.
  - Example of case studies:* Evergreen, a national not-for-profit organization with a focus on making schools, communities and cities across Canada greener has developed case studies that provide some in-depth information about the impacts of greening schools.
  - Example of information provided:* "Teachers and parents have been similarly inspired. Ted remarks that 'in terms of community participation, they understand that the parks and school grounds are theirs, and that if they wait for somebody else to do things, nothing is going to get done. If they get involved in a constructive way, however, they see that they can change the facilities and the environment that their kids learn in. For us, building the planters was one of the key things. People saw that changes could be made, and that they could be done well.'"
  - Link:* <http://www.evergreen.ca/docs/res/Grounds-For-Learning.pdf>
- 2. Statistical analysis:** Statistics can help summarize data, and help us understand a process and possibly make predictions based on this understanding. Compiling simple data, such as the number of schools or students partaking in specific programs, would be an important start. Analysis can then be undertaken that accounts for more than one variable.
  - Example of statistical analysis:* REAL School Gardens help develop and support school gardens in the Washington, DC area in the US by facilitating garden design, training teachers and embedding school gardens to school curriculums.
  - Example of information provided:* "REAL School Gardens partner schools have seen standardized test score pass rates increase between 12% - 15%. Science



scores saw the largest increases, placing students on a path for success in a professional job market that increasingly requires STEM skills.”

- *Link:* <http://www.realschoolgardens.org/real-results.aspx>

1. Longitudinal and cross-sectional studies: These types of studies involve making the same observations numerous times over a long period of time. Most longitudinal studies occur over decades. Such studies could be designed to measure if and how a food education program altered students’ behaviour throughout the course of primary, middle or secondary school. For example, specific observations can take place at the beginning of grade 9 and then at the beginning of every school year until grade 12. Cross-sectional studies that collect data from a population at one specific time, providing a snapshot such as a census, could be combined with longitudinal studies. Such studies would help to examine changes overtime and help determine what programs are successful over time.

- *Example of a longitudinal study:* Freedman et al. (2009) developed a cross-sectional and longitudinal study to examine whether obese children are more likely to become obese adults. They used several medical measures such as the BMI, waist/height ration and skinfold sum to measure obesity.
- *Example of information provided:* One longitudinal study in the United States (Bogalusa Heart Study) found that 87% of obese children and 66% of overweight children went on to become obese adults.
- *Link:* <http://pediatrics.aappublications.org/content/123/3/750.full.pdf>

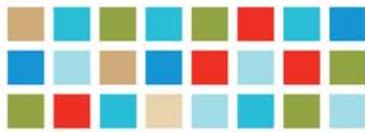


## REFERENCES

- Aftosmes, A. (2011). Impact of Farm-to-School programs: A research brief to the Massachusetts Food Policy council. *The Harvard Clinical and Translational Science Centre*, 1-10.
- Baker, L., Campsie, P., & Rabinowicz, K. (2010). Menu 2020: Ten good food ideas for Ontario. *George Cedric Metcalf Charitable Foundation: Toronto, Canada*.
- Bell, A.C., & Dymont, J.E. (2006). *Grounds for action: Promoting physical activity through school ground greening in Canada*. Retrieved from [www.evergreen.ca/en/lg/lg-resources.html](http://www.evergreen.ca/en/lg/lg-resources.html)
- Bell, A. C. & Dymont, J.E. (2008). Grounds for health: The intersection of green school grounds and health-promoting schools. *Environmental Education Research* 14(1), 77-90.
- Block, K., Gibbs L., Staiger, P.K., Gold, L., Johnson, B., Macfarlane S., Long, C. & Townsend, M. (2012). Growing community: The impact of the Stephanie Alexander Kitchen Garden Program on the social and learning environment in primary schools. *Health Education & Behaviour*, 39(4), 419-432.
- California School Garden Network. (2013) *Garden-based learning working group - Research 'briefs' academics: For teachers and administrators*. Retrieved from <http://www.csgn.org/sites/csgn.org/files/academicsBrief.pdf>
- Canadian Restaurant and Foodservices Association (CRFA). (2010). *Foodservice Facts 2010*.
- Carlsson, L. & Williams, P.L. (2008). New approaches to the health promoting school: participation in sustainable food systems. *Journal of Hunger & Environmental Nutrition* 3(4), 400-417.
- Centers for Disease Control and Prevention. (1996). Guidelines for School health programs to promote lifelong healthy eating." *Morbidity and Mortality Weekly Report* 45(RR-9), 1-42.
- Chu Y.L., Farmer, A., Fung, C., Kuhle, S., & Veugelers, P.J. (2013). Involvement in home meal preparation is associated with food preference and self-efficacy among Canadian children. *Public Health Nutrition* 16,108-112.
- Derscheid, L.E., Umoren, J., Kim, S., Henry, B.W. & Zittel, L.L. (2010). Early childhood teachers' and staff members' perceptions of nutrition and physical activity practices for preschoolers. *Journal of Research in Childhood Education* 24, 248-265.



- Downs, S.M., Arnold, A., Marshall, D., McCargar, Linda J., Raine, K.D. & Willows, N.D. (2009). Associations among the food environment, diet quality and weight status in Cree children in Québec. *Public Health Nutrition* 12(9), 1504-1511.
- Dubois, L., Farmer, A., Girard, M., Burnier, D. & Porcherie, M. (2011). Demographic and socio-economic factors related to food intake and adherence to nutritional recommendations in a cohort of pre-school children. *Public Health Nutrition* 14(6), 1096-1104.
- Dyment, J.E. (2005). Gaining ground: The power and potential of green school grounds in the Toronto District School Board. Retrieved from [www.evergreen.ca/en/lg/lg-resources.html](http://www.evergreen.ca/en/lg/lg-resources.html)
- Dyment, J.E. & Anne, C.B. (2007). Active by Design: Promoting Physical Activity through School ground Greening. *Children's Geographies* 5(4), 463-477.
- Food and Agriculture Organization (FAO). (2010). A new deal for school gardens. Document prepared by Muehlhoff, E. & Boutrif, E. *Nutrition and Consumer Protection Division*. FAO, Rome.
- Food Banks Canada. (2012). *Hunger Count 2012: A comprehensive report on hunger and food bank use in Canada, and recommendations for change*. Toronto: Food Banks Canada.
- Foster, G.D., Sherman, S., Borradaile, K.E., Grundy, K.M., Vander Veur, S.S., Nachmani, J., Karpyn, A., Kumanyika, S., and Shults, J. (2008). A policy-based school intervention to prevent overweight and obesity. *American Academy of Pediatrics* 121, e794-e802.
- Freedman D.S., Dietz, W.H., Srinivasan, S.R. & Berenson, G.S. (2009). Risk factors and adult body mass index among overweight children: the Bogalusa Heart Study. *Pediatrics* 123(3), 750-7.
- Gates, M., Hanning, R.M., Gates, A., Isogai, A., Tsuji, L.J.S. & Metatawabin, J. (2013a). A pilot comprehensive school nutrition program improves knowledge and intentions for intake of milk and milk alternatives among youth in a remote first nation. *Journal of Nutrition Education and Behavior* 45(5), 455-459.
- Gates, M., Hanning, R. M., Gates, A., McCarthy, D.D., & Tsuji, L.J.S. (2013b). Assessing the impacts of pilot school snack programs on milk and alternatives intake in 2 remote First Nation Communities in northern Ontario, Canada. *Journal of School Health* 83(2): 69-76.



- Graham, H., Beall, D.L., Lussies, M., McLaughlin, P. & Zidenberg-Cherr, S. (2005). Use of school gardens in academic instruction. *Journal of Nutrition Education and Behavior* 37: 147-151.
- He, M., Beynon, C., Sangster Bouck, M., Onge, R., Stewart, S., Khoshaba, L. & Lemieux, S. (2007). *Northern fruit and vegetable pilot program: Final report*. London, Ontario: Middlesex-London Health Unit.
- Health Canada. (2012). Healthy eating after school: Integrating healthy eating into after-school physical activity initiatives. *Ministry of Health*.
- Healthy Kids Panel. (2013). *No time to wait: The healthy kids strategy*. Queen's Printer for Ontario: Toronto, Ontario.
- Henderson, T., Rader, M., Sorte, B., Ratcliffe, M.M., Lawrence, A., Lucky, J., & Harris, C. (2011). Health impact assessment: Oregon Farm to School and School Garden Policy. *HB2800, Upstream Public Health and the Health Impact Project*.
- Herman, K.M., Craig, C.L., Gauvin, L., & Katzmarzyk, P.T. (2009). Tracking of obesity and physical activity from childhood to adulthood: the Physical Activity Longitudinal Study. *International Journal of Pediatric Obesity* 4(4),281-8.
- Katzmarzyk, P.T. (2011). The economic costs associated with physical inactivity and obesity in Ontario. *The Health and Fitness Journal of Canada* 4(4),31-40.
- Keller, H.H., Hedley, M., Hedley, T., Wong, S., & Vanderkooy P. (2005). Food workshops, nutrition education and older adults: A process evaluation. *Journal of Nutrition for the Elderly* 24(3), 5-23.
- Klemmer, C.D., Waliczek, T.M., & Zajicek, J.M. (2005). Growing minds: The effect of a school gardening program on the science achievement of elementary students. *HortTechnology* 15(3), 448-452.
- Kranz S., & Siega-Riz, A.M. (2002). Sociodemographic determinants of added sugar intake in preschoolers 2 to 5 years old. *Journal of Pediatrics* 140(6), 667-672.
- Langellotto, G. A., & Gupta, A. (2012). Gardening increases vegetable consumption in school-aged children: A meta-analytical synthesis. *HorTechnology* 22(4), 430-445.
- Le Petit C., & Berthelot, J.M. (2012). Obesity: A growing issue. *Statistics Canada Catalogue* no. 82-618-MWE2005003.
- Lieberman, G.A., & Hoody, L. (1998). *Closing the achievement gap: using the environment as an integrating context for learning*. Sacramento, CA: CA State Education and Environment Roundtable.



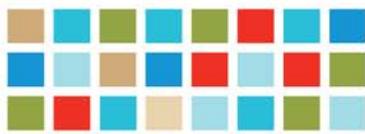
- Ministry of Agriculture and Lands. (2008). *The British Columbia Agriculture Plan: Growing a Healthy Future for B.C. Families*. Retrieved from [http://www.al.gov.bc.ca/Agriculture\\_Plan/growing\\_future.html](http://www.al.gov.bc.ca/Agriculture_Plan/growing_future.html)
- Ministry of Health Promotion. (2006). *Ontario's action plan: For healthy eating and active living*. Queen's Printer for Ontario: Toronto, Canada.
- Ministry of Health Promotion. (2010). *School health: Guidance document*. Queen's Printer for Ontario: Toronto, Canada.
- McPhail, D., Chapman, G.E. & Beagan, B.L. (2013). The rural and the rotund? A critical interpretation of food deserts and rural adolescent obesity in the Canadian context. *Health and Place* 22, 132-139.
- Must, A., Barish, E.E. & Bandini, L.G. (2009). Modifiable risk factors in relation to changes in BMI and fatness: what have we learned from prospective studies of school aged children? *International Journal of Obesity* 33(7),705-715.
- Murphy, M. & Schweers, E. (2003). *Evaluation of a food systems-based approach to fostering ecological literacy. Final Report to Center for Ecoliteracy*. Retrieved from: [www.ecoliteracy.org](http://www.ecoliteracy.org)
- Olshansky, S.J., Passaro, D.J., Hershov, R.C., Layden, J., Carnes, B.A., Brody, J., Hayflick, L., Butler, R.N., Allison, D.B., & Ludwig, D.S. (2005). A potential decline in life expectancy in the United States in the 21st century. *New England Journal of Medicine* 352,1138–1145.
- Ontario Agency for Health Protection and Promotion (Public Health Ontario). (2013). *Addressing obesity in children and youth: Evidence to guide action for Ontario*. Queen's Printer for Ontario: Toronto, Canada.
- Ozer, E. J. (2007). The effects of school gardens on students and schools: Conceptualization and considerations for maximizing healthy development. *Health Education Behavior* 34(6), 846–863.
- Ratcliffe, M.M., Merrigan, K.A., Rogers, B.L., & Goldberg, J.P. (2011). The effects of school garden experiences on middle school-aged students' knowledge, attitudes and behaviors associated with vegetable consumption. *Health Promotion Practice* 12(1), 36-43.



- Real School Gardens. (2013). *Real results*. Retrieved from: <http://www.realschoolgardens.org/real-results.aspx>
- Roberts K.C., Shields, M., De Groh, M., Aziz, A., & Gilbert, J.A. (2012). Overweight and obesity in children and adolescents: results from the 2009 to 2011 Canadian Health Measures Survey. *Health Reports* 23(3),37-41.
- Rosenkranz R.R., & Dzewaltowski, D.A. (2008). Model of the home food environment pertaining to childhood obesity. *Nutrition Reviews* 66(3),123-140.
- Rossiter, M., Glanville, T., Taylor, J., & Blum, I. (2007). School food practices of prospective teachers. *Journal of School Health* 77(10), 694-700.
- Rossiter, M. D., Evers, S.E. & Pender, A.C. (2012). Adolescents' diets do not comply with 2007 Canada's food guide recommendations. *Appetite* 59, 668-672.
- Shields, M. (2006). Overweight and obesity among children and youth. *Health Reports* 17(3),27-42.
- Skelly, S. M. & Bradley, J.C. (2000). The important of school gardens as perceived by Florida elementary school teachers. *HortTechnology* 10(1), 229-231.
- Skinner, K., Hanning, R.M., Metatawabin, J., Martin, I.D. & Tsuji, L.J.S. (2012). Impact of a school snack program on the dietary intake of grade six to ten First Nation students living in a remote community in northern Ontario, Canada. *Rural and Remote Health* 12, 1-17.
- Slunner, W.M., Cumberland, W.G., Browdy, B.L. & Neumann, C. (2007). A school salad bar increases frequency of fruit and vegetable consumption among children living in low-income households. *Public Health Nutrition*, 10(12), 1490-1496.
- Smith, L. L., & Motsenbocke, C. (2005). Impact of hands-on science through school gardening in Louisiana Public Elementary Schools. *HortTechnology* 15(3), 439-443.
- Statistics Canada. (2006). *Canada's farm population: Agriculture-population linkage data for the 2006 census*. Retrieved from: <http://www.statcan.gc.ca/ca-ra2006/agpop/article-eng.htm>
- Sustain Ontario. (2012). *Backgrounder on food literacy, student nutrition and food service in schools*.
- Tan, M. & Pedretti, E. (2010) Negotiating the complexities of environmental education: A study of Ontario teachers. *Canadian Journal of Science, Mathematics and Technology Education* 10(1), 61-78.



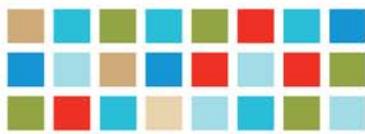
- Unusan, N. (2007). Effects of a food and nutrition course on the self-reported knowledge and behavior of preschool teacher candidates. *Early Childhood Education Journal* 34(5), 323–327.
- Upitis, R., Hughes, S., and Peterson, A. (2013). Promoting environmental stewardship through gardens: A case study of children's views of an urban school garden program. *Journal of the Canadian Association for Curriculum Studies* 11(1), 92-135.
- Valaitis, R.F., Hanning, R.M. & Herrmann, I.S. (2013). Programme coordinators' perceptions of strengths, weaknesses, opportunities and threats associated with school nutrition programmes. *Public Health Nutrition*, 1-10.
- Vinitor, F. (2004). Revised definition means millions more have pre-diabetes. *News Release from the U.S. Department of Health and Human Services*. Retrieved from: <http://www.hhs.gov/news>.
- Williams, D.R., & Dixon, P.S. (2013). Impact of garden-based learning on academic outcomes in schools: Synthesis of research between 1990 and 2010. *Review of Education Research* 83(2), 211-235.
- Woodruff, S. J., & Kirby, A.R. (2013). The associations among family meal frequency, food preparation frequency, self-efficacy for cooking and food preparation techniques in children and adolescents. *Journal of Nutrition Education and Behaviour* 45(4), 296-303.



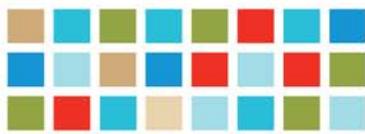
## APPENDIX

**Table 2: Evidence in support of food education (Canadian data)**

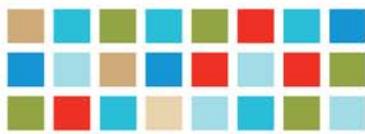
Direct Quote from Study	Reference
Concerns regarding the State of health of today's children and youth	
<b>Unhealthy food consumption and lack of food literacy</b>	
The British Columbia Agriculture Plan, Strategy 20, directly identifies the growing divide between youth and the origins of their food and stresses the need to reconnect young people with the land, link urban and agricultural communities together, and provide hands-on learning opportunities to the leaders of tomorrow.	Ministry of Agriculture and Lands, 2008
Disparities in food consumption are also observed in childhood. National nutrition surveys such as the Continuing Survey of Food Intakes by Individuals (CSFII and the National Health and Nutrition Examination Survey (NHANES have shown that children and adolescents are consuming products high in sugar and fat, and low in nutrient value. It is also reported that children and adolescents rarely meet nutritional recommendations for intakes of fruit, vegetables and whole-grain product.	Dubois et al. 2011
When analysing the diet of 10 000 children aged 3 years from the Avon Longitudinal Study of Pregnancy and Childhood (ALSPAC), North and Emmett showed that children's junk food intake was significantly associated with having a younger, less-educated mother and a mother of lower social class	Kranz and Siega-Riz, 2002
The present study indicates that mother's immigrant status, mother's level of education and sex of the child are especially central socio-economic and demographic factors that relate to children's food intakes. Children of immigrant mothers are also more likely to be raised in a low income family compared with children of Canadian-born mothers. Most studies support a positive association between	Dubois et al. 2011



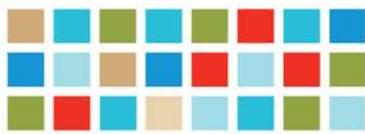
parental level of education and intakes of healthy foods.	
Among dietary concerns faced by Aboriginal Canadians is a low intake of milk and milk alternatives (MMA); in some regions, less than half of Aboriginal youth are meeting Canada's Food Guide (CFG) recommendations.	Gates et al. 2013a
Among Canadians aged four or older, 41% of snack calories came from foods that are not within one of the four food groups in Canada's Food Guide.	Health Canada, 2012
The proportion of meals that Canadians prepare and eat at home declined from 70 per cent in 2001 to 65 per cent in 2008, and the average Canadian visited restaurants 184 times in 2007	Canadian Restaurant and Foodservices Association (CRFA) 2010
Canada is the only nation in the former G8 that has no universal student nutrition policy and no federal funding for student nutrition programs.	Baker, Campsie and Rabinowicz, 2010; Russell et al. 2008
In 2004, the 59% of Canadian children and youth aged 2 to 17 who consumed fruits and vegetables less than 5 times a day were significantly more likely to be overweight or obese than those who ate fruits and vegetables more frequently	Ministry of Health Promotion, 2006
While data are limited in Canada, undesirable dietary patterns have been reported for children and adolescents.	Rossiter et al. 2012
In particular, 15% of males and 21% of females met the recommendations for Vegetables and Fruit, and only 9% of males and 11% of females consumed the minimum number of servings of Grain Products. The mean number of servings per day for Vegetables and Fruit and Grain Products were below that recommended for both	Rossiter et al. 2012



males and females in grade six.	
Less than one-fifth (19.1%) of children consumed at least 2 servings of milk daily as recommended by Canada's Food Guide. Almost all children (98.5%) consumed fewer than 5 fruits and vegetables daily.	Downs et al. 2009
The diets of many Canadian children and adolescents are characterized by low intakes from the nutrient-dense food groups of Canada's Food Guide, high intakes of energy-dense/nutrient-poor foods and suboptimal food patterns, including breakfast skipping.	Valaitis et al. 2013
<b>Unhealthy weights</b>	
Presently, almost one-third of Canadian children and youth are overweight or obese. Childhood obesity is associated with both immediate and long-term health risks, as well as an economic burden to the health care system.	Ontario Agency for Health Protection and Promotion, 2013; Roberts et al. 2012; Sustain Ontario 2012
The prevalence of obesity among Canadian children and youth increased significantly from 6.3% in 1978–1979 to 12.7% in 2004 based on measured height and weight, while the prevalence of overweight increased from 17% to 22%, representing an increase of 102% and 29% respectively.	Roberts et al. 2012; Ontario Agency for Health Protection and Promotion, 2013
There were significant differences in self-reported BMI between males and females; in 2009–2010, 33.5% of males versus 20.4% of females reported being overweight or obese.	Roberts et al. 2012; Ontario Agency for Health Protection and Promotion, 2013



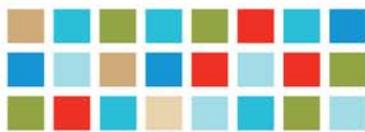
<p>Data show that about 55% of First Nations children on reserve and 41% of Aboriginal children and youth living off reserve are either overweight or obese.</p>	<p>Ontario Agency for Health Protection and Promotion, 2013</p>
<p>A Canadian longitudinal study (Physical Activity Longitudinal Study) found that the likelihood of being overweight or obese in adulthood was over six times greater in overweight or obese youth when compared to healthy weight youth, and that 83% of overweight or obese youth in the study remained overweight or obese as adults</p>	<p>Herman et al. 2009</p>
<p>About 30 per cent of our children and youth – almost one in every three children – are now an unhealthy weight. The problem is serious for everyone, but it is more severe for boys than girls and for Aboriginal children.</p>	<p>Healthy Kids Panel, 2013</p>
<p>By 2040, up to 70 per cent of today’s children will be overweight or obese adults and almost half our children will be an unhealthy weight. A much larger proportion of children will cross the line from being overweight to being obese, and the impact on their physical and mental health and well-being will be severe.</p>	<p>Le Petit and Berthelot, 2012</p>
<p>Other provinces are investing in their obesity strategies. For example, Nova Scotia, Quebec and Alberta are investing, on average, \$5.87 per capita per year to prevent and reduce obesity, and we recommend that Ontario commit at the same level. Given the size of its population, Ontario should invest at least \$80 million each year in new funding that targets childhood overweight and obesity. That represents only .17 per cent of the province’s health budget and 1.7 per cent of what Ontario is currently spending on the consequences of obesity.</p>	<p>Healthy Kids Panel, 2013</p>
<p>Rates of obesity in rural areas in Canada are said to be higher than in urban areas. Rural adolescents are positioned as more obese than their urban</p>	<p>Ministry of Health Promotion,</p>



counterparts.	2006; McPhail et al. 2013
The rates of obesity among Aboriginal people are nearly twice the overall rate for Canadian adults, and this is accompanied by high rates of type 2 diabetes in Aboriginal communities in Canada.	Ministry of Health Promotion, 2006
Statistics Canada has found that 26% of children aged 6 to 11 are overweight or obese. The percentage rises to 28% for Canadian teenagers and a staggering 61% for Canadian adults.	Baker, Campsie and Rabinowicz, 2010
In Canada, Aboriginal people have 2.5 times greater odds of being obese than non-Aboriginals. <sup>2</sup> Childhood overweight and obesity are mounting problems; in 2004, 21% of off-reserve Aboriginal youth aged 12 to 17 years were overweight, and 20% were obese (compared to 29% and 9% in the general population).	Gates et al. 2013b
<b>Overall health and wellbeing</b>	
Health Canada recently reported that over 10% of Canadian households with children experienced moderate or severe income-related food insecurity in 2004; 5.2% of these families experienced food insecurity at the child level.	Carlsson and Williams, 2008
Cree children were at risk for Zn inadequacy and had intakes of vitamin D and Ca below the adequate intake, which confirms findings of low intakes of several micronutrients in Aboriginal communities in Canada. Milk was an important source of Ca and vitamin D for Cree children and an increase in diet quality would be anticipated if milk consumption was increased.	Downs et al. 2009
<b>Economic costs</b>	



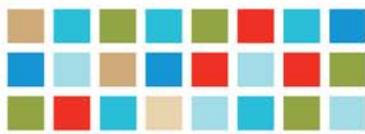
<p>In 2000/2001, obesity cost Canada’s health care system an estimated \$4.3 billion: \$1.6 billion in direct costs, such as hospital care, drugs and physician services, and \$2.7 billion in indirect costs, such as lost earnings due to illnesses and premature deaths associated with obesity. (8) Other risk factors that appear in childhood also contribute to the potential economic burden and underscore the importance of effective and comprehensive health promotion approaches.</p>	<p>Ministry of Health Promotion, 2010; Katzmarzyk, 2011</p>
<p><b>Benefits of food education</b></p>	
<p><b>Broad benefits</b></p>	
<p>Dietitians of Canada asserts that, when systemic and comprehensive approaches place equal value on the ecological, social, educational, and economic aspects of the dominant food system in Canada, many of its unintended harms—food insecurity and environmental degradation—will be addressed. Schools can play a particularly important role within such a systemic, comprehensive approach. They reach the majority of children and youth who are captive audiences ripe for learning in multiple settings and engaged in multiple activities.</p>	<p>Carlsoon and Williams, 2008</p>
<p>The Pan-Canadian Joint Consortium for School Health reports that “research has shown that it is more effective to work more comprehensively, that is, integrating policies and practices that support student learning, health and well-being into every aspect of the school environment.</p>	<p>Ministry of Health Promotion, 2010.</p>
<p>In Canada, an Ontario government–commissioned report states: “Schools have a vital role to play in preparing our young people to take their place as informed, engaged, and empowered citizens who will be pivotal in shaping the future of our communities, our province, our country, and our global environment” (Bondar et al., 2007, p. 6).</p>	<p>Tan and Pedretti. 2010</p>
<p><b>Healthy weights</b></p>	
<p>A national study of Canadian children and youth found that those who</p>	<p>Shields, 2006; Ontario Agency</p>



<p>eat vegetables and fruit at least five times a day are substantially less likely to be overweight or obese than those who ate these foods less often.</p>	<p>for Health Protection and Promotion, 2013</p>
<p><b>Overall health and wellbeing</b></p>	
<p>Healthy eating patterns during childhood are associated with reduced risk of chronic diseases and obesity later in life. Evidence suggests that eating habits developed during early childhood are sustained into adolescence and adulthood.</p>	<p>Ratcliffe et al. 2011; Health Canada, 2012</p>
<p><b>Academic achievement, classroom behaviour and food literacy</b></p>	
<p>Over the course of a school year, the scores in mathematics and science for students involved in the school garden program showed significantly greater gains than the scores of students in the control school. The students in the garden-- -based program also made greater gains in understanding ecological cycles and showed an improved understanding of sustainable agriculture. Teachers involved in the garden-- -based program rated their school as more conducive to learning than the teachers in the control school, and they ranked compassion for living things as one of their top three teaching priorities.</p>	<p>Upitis et al. 2013</p>
<p>Describes benefits of school gardens in terms of improved academic performance through outdoor labs, enhanced student experience through the beautification of the grounds, and the promotion of healthy eating habits and exercise.</p>	<p>Ozer, 2007</p>
<p>The vast majority of survey respondents (91%) reported that opportunities to harvest and taste food from the garden foster student awareness and appreciation of nutritional food.</p>	<p>Bell and Dymont, 2006</p>
<p>A recent report among grade 5 students from Alberta, Canada suggested that higher food preparation frequency was associated</p>	<p>Chu et al. 2013</p>



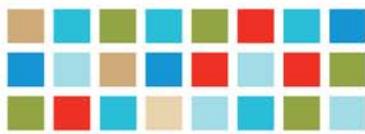
with greater fruit and vegetable preference and self-efficacy for healthy eating.	
Many coordinators felt the programme had positive academic and social impacts on students. Literature on school meal programmes also suggests that the school food environment has social and academic benefits for students, which can impact students' eating habits.	Valaitis et al. 2013
Additionally, food focused activities such as food gardens and culinary programs help to bring education to life for children and youth, especially when linked to the curriculum. By taking learning outside of the classroom and into real-world settings children and youth become more engaged in learning about topics from math and science to English and history and gain useful and marketable skills. And yet, only 0.5 percent of Canada's 16,000 schools have food gardens. In contrast, 10 percent of schools in the UK have food gardens and 30 percent of California schools have them.	Sustain Ontario, 2012
<b>Physical activity</b>	
The vast majority of participants (89%) indicated that food gardens at their schools are providing important opportunities for moderate physical activity.	Bell and Dymment, 2006



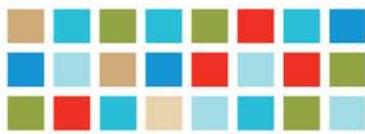
## APPENDIX B

**Table 3: Evidence in support of food education (International data).**

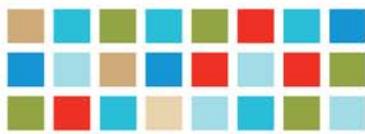
Direct Quote from Study	Reference (country of research in brackets )
Concerns regarding the state of health of today's children and youth	
<b>Unhealthy weights</b>	
One longitudinal study in the United States (Bogalusa Heart Study) found that 87% of obese children and 66% of overweight children went on to become obese adults.	Freedman et al. 2009 (US)
Obesity in young persons is related to elevated blood cholesterol levels and high blood pressure, and some very obese youths suffer from immediate health problems (e.g., respiratory disorders, orthopedic conditions, and hyperinsulinemia). Being overweight during childhood and adolescence has been associated with increased adult mortality.	Centers for Disease Control and Prevention, 1996 (US)
Nearly one in three children and adolescents in the United States is overweight or obese.	Aftosmes, 2011 (US)
<b>Chronic disease and overall health and wellbeing</b>	
Families and children do not feel the impact of hunger at just the dinner table; food insecurity manifests itself in many other social outcomes, including health, education, and economic prosperity.	Augustine-Thottungal et al. 2013 (US)
Food insecurity in early childhood (ages 0-3) is associated with impaired cognitive development, which can negatively impact a child's future potential academic and economic success.	Augustine-Thottungal et al. 2013 (US)
Without intervention, one in every three children born in 2000 is likely to develop type 2 diabetes in their lifetime, and for children of color	Victor, 2004 (US)



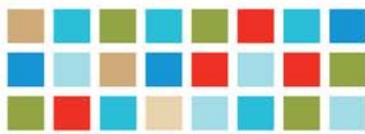
the likelihood increases to one in two.	
Perhaps most importantly, there is evidence that this is the first generation that will have a shorter life expectancy than their parents if the obesity epidemic continues.	Olshansky et al. 2005 (US)
<b>Benefits of Food Education</b>	
<b>Broad benefits</b>	
<b>Healthy weights</b>	
Significantly fewer children in the intervention schools (7.5%) than in the control schools (14.9%) became overweight after 2 years (unadjusted means).	Foster et al. 2008 (US)
After 2 years, the unadjusted prevalence of overweight had decreased by 10.3% in intervention schools and had increased by 25.9% in control schools.	Foster et al. 2008 (US)
<b>Overall health and wellbeing</b>	
Teachers, parents, and volunteers all remarked on the growth in confidence, independence, and self-esteem they had witnessed in the children since they had been participating in school gardening program.	Block et al. 2013 (Australia)
At one culturally diverse school, teachers felt that kitchen classes functioned as a natural environment in which to discuss and incorporate diversity.  Parents from non-English speaking backgrounds, typically uncomfortable in classroom literacy programs, also volunteered in the kitchen and garden.	Block et al. 2013 (Australia)
In one review, seven qualitative studies indicate school gardens have a strong community-building component, promoting teamwork, student bonding and school engagement with parents and neighbors. Researchers observe that gardens affect a school's social learning environment in ways that may alter the school culture and identity.	Henderson et al. 2011 (Oregon, US)



<b>Academic achievement, classroom behaviour and food literacy</b>	
<p>REAL School Gardens partner schools have seen standardized test score pass rates increase between 12% - 15%. Science scores saw the largest increases, placing students on a path for success in a professional job market that increasingly requires STEM skills.</p> <p>When an independent research team isolated our impact, at least 1/3 of the standardized test score pass rate increases were proven to be a direct result of the REAL School Gardens program.</p> <p>84% of students had high levels of engagement in math and science when in a REAL school garden.</p> <p>Teachers in the REAL School Gardens program reporting they were satisfied with their position increased more than 100%.</p> <p>Educators with a REAL school garden were 5 times more likely to spend substantial time using the outdoors for academic instruction.</p>	<p>REAL School Gardens, Retrieved 2013 (Washington, DC area.)</p>
<p>Numerous studies have proven that garden-based education improves academic performance and may lead to higher test scores in student populations. Some of the strongest academic gains appear to be in the areas of math and science, and overall improvement on standardized achievement tests has been well documented.</p>	<p>California School Garden Network, Retrieved 2013 (US)</p>
<p>Participants in a school garden program in California experienced significant gains in overall GPA in math and science, and improvement on a standardized psychosocial questionnaire.</p>	<p>Murphy 2003 (US)</p>
<p>A broad study of 40 schools from across the U.S. shows that environment-based education curriculum results in better performance on standardized achievement tests.</p>	<p>Lieberman and Hoody 1998 (US)</p>
<p>84.3% of teachers exposed to school gardens think gardens help students learn more effectively.</p> <p>73% of teachers surveyed think experiential learning in gardens is</p>	<p>Skelly and Bradley 2000 (Florida, US)</p>



effective.	
Students who participate in school meal programs learn better and have a better chance of academic achievement.	Henderson et al. 2011 (Oregon, US)
Studies show that children who spend time in the garden learn better, get physical activity and behave better in the classroom.	Henderson et al. 2011 (Oregon, US)
Although breakfast consumption has been repeatedly shown to improve short-term cognitive function, such as memory, it has not been significantly associated with longer learning outcomes other than educational attainment. Breakfast is a key component of maintaining a healthy diet and has a much more profound effect on under-nourished and food insecure children.	Henderson et al. 2011 (Oregon, US)
One study examined the effects of healthy nutrition knowledge from a 10-week course on self-reported behaviors of preschool teacher candidates in Turkey. Unusan (2007) found that nutrition health knowledge scores improved significantly from pre- to posttest for 9 of the 18 practices, with more practices (13 of the 18) improved on follow-up. The follow-up practices indicated that teacher candidates not only reduced their intake of sodium and sugar, but also drank more water and did not skip eating breakfast and lunch, despite having early morning classes and classes that ran through the day (Unusan, 2007). If preschool teachers realize the importance of their own health practices, they may be able to more successfully model and promote healthy practices when working with preschoolers.	Unusan, 2007 (Turkey)
Schools are ideal settings for nutrition education for several reasons: <ul style="list-style-type: none"> <li>· Schools can reach almost all children and adolescents.</li> <li>· Schools provide opportunities to practice healthy eating. More than one-half of youths in the United States eat one of their three major meals in school, and 1 in 10 children and adolescents eats two of</li> </ul>	Centers for Disease Control and Prevention, 1996 (US)



<p>three main meals in school.</p> <ul style="list-style-type: none"> <li>- Schools can teach students how to resist social pressures. Eating is a socially learned behavior that is influenced by social pressures. School-based programs can directly address peer pressure that discourages healthy eating and harness the power of peer pressure to reinforce healthy eating habits.</li> <li>- Skilled personnel are available. After appropriate training, teachers can use their instructional skills and food service personnel can contribute their expertise to nutrition education programs.</li> <li>- Evaluations suggest that school-based nutrition education can improve the eating behaviors of young persons.</li> </ul>	
<p>Schools, and in particular school cafeterias, have been identified as reasonable settings to effectively impact children’s nutrition.</p>	<p>Aftesmes, 2011 (Massachusetts, US)</p>
<p>Research shows that children consume more fruits and vegetables when fresh produce is made available and accessible. Schools offering a wide variety of produce have seen increases in children’s fruit and vegetable intake and changes in their food choices and preferences.</p>	<p>Aftesmes, 2011 (Massachusetts, US)</p>
<p><b>Physical activity</b></p>	
<p>After 2 years, the unadjusted hours of total inactivity increased by ~3% in the control group and decreased by ~9% in the intervention group.</p> <p>Similarly, after 2 years, unadjusted weekday television watching increased by ~7.5% in the control group and decreased by ~1% in the intervention group.</p>	<p>Foster et al. 2008 (US)</p>