Food insecurity and hunger: A review of the effects on children's health and behaviour

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Food insecurity and hunger are significant problems in Canada, with millions of Canadians experiencing some level of food insecurity. The purpose of the present article is to review what is currently known about the effects of food insecurity and hunger on children. Longitudinal studies in Canada indicate that hunger is related to poor health outcomes, including a higher risk of depression and suicidal ideation in adolescents, and chronic conditions, particularly asthma. In addition, nutrient deficiencies, such as iron deficiency, are known to impair learning and cause decreased productivity in school-age children, and maternal depressive disorders. School-based nutrition programs and innovations, such as subsidized food (apples, cheese, soy nuts, carrots and broccoli), are an essential immediate need, but long-term solutions lie in adequate incomes for families.

Key Words: *Children; Food insecurity; Hunger*

L'insécurité alimentaire et la faim : une analyse de leurs effets sur la santé et le comportement des enfants

L'insécurité alimentaire et la faim sont de graves problèmes au Canada, car des millions de Canadiens présentent un certain niveau d'insécurité alimentaire. Le présent article vise à analyser ce que l'on sait des effets de l'insécurité alimentaire et de la faim chez les enfants. D'après des études longitudinales au Canada, la faim est liée à une mauvaise santé, y compris un risque plus élevé de dépression et d'idéation suicidaire à l'adolescence, ainsi que de maladies chroniques, notamment l'asthme. En outre, on sait que les carences nutritionnelles, telles que l'anémie ferriprive, nuisent à l'apprentissage et sont responsables d'une diminution de la productivité chez les enfants d'âge scolaire, ainsi que de troubles dépressifs chez les mères. Les programmes et les innovations en milieu scolaire, comme les denrées subventionnées (pommes, fromage, noix de soja, carottes et brocoli) représentent un besoin immédiat essentiel, mais les solutions à long terme dépendent d'un revenu suffisant pour les familles.

In 2012, an estimated four million Canadians, including 1.15 million children, lived in households that experienced some degree of food insecurity (1). Food insecurity refers to the lack of nutritious foods in sufficient quantities to maintain good health. The measurement and monitoring of food insecurity in Canada focuses on a household's experience of food insecurity, or the inadequate or insecure access to adequate food due to financial constraints (2). While children living in households classified as food insecure are not necessarily going hungry, 25% of students in grade 6 surveyed by the Public Health Agency of Canada reported that they sometimes went to bed hungry because there was not enough food in the house (3). Therefore, it is surprising that the effects of hunger on children are not well documented, and this remains an important area for further research.

The purpose of the present article is to review the immediate and long-term effects of hunger on children's physical development, mental health and behaviour. We will also examine the indirect effects of maternal hunger on child development. A limitation of the present review is that food insecurity is inextricably linked to other social and environmental problems such as poverty and stress. Therefore, it is challenging to isolate the effects of food insecurity and hunger on children and mothers. Furthermore, much of the current research has been performed in the United States, and experiences of food insecurity may be different in Canada. In addition, there is a lack of research examining vulnerable groups, such as First Nations populations, who have unique food security considerations related to traditional food practices (4).

EFFECTS ON CHILDREN

Reduced learning and productivity

Iron deficiency (ID) remains a public health concern in high-income countries in the context of pregnancy and infancy, and there is some evidence of a link between food insecurity and ID (3,5). Low prenatal iron levels are associated with poor performance on language comprehension tests and an inability to follow directions over the first five years of a child's life. ID is also related to delays in socioemotional, cognitive, motor and neurophysiological development (3). Tamura et al (6) reported that five-year-old children who were born with low cord serum ferritin levels performed poorly on tests of fine motor skills and language development compared with children born with normal ferritin levels. Studies also suggest that chronic ID early in life may cause irreversible neurophysiological changes including changes to dopamine metabolism, and hippocampal structure and function. In addition, ID can indirectly affect school-age children because the hesitation and wariness associated with ID may cause children to benefit less from school environments and opportunities for early development (3).

During schooling years, nutritional deficiencies directly undermine students' cognitive capacities. Based on data from the Longitudinal Study of Child Development in Quebec, Melchior et al (7) found that children from food-insecure households were two times more likely to experience persistent symptoms of hyperactivity/inattention than children who are not food insecure. In addition, children in food-insecure households tend to have diets that are

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high in refined sugars and low in iron, which can have behavioural consequences including hyperkinesia, inattention and poor memory (8). Although there is some controversy surrounding the reported link between food insecurity and hyperactivity/inattention, recent intervention trials have reported an improvement in symptoms of attention deficit hyperactivity disorder (ADHD) in some children after the introduction of a healthy diet (8-10).

Mental health

Based on data from the Canadian National Longitudinal Survey of Children and Youth, McIntyre et al (11) found that child hunger was a predictor of depression and suicidal ideation during late adolescence and young adulthood, even after adjusting for potential confounding factors. It is hypothesized that child hunger may be related to depression later in life as a result of nutritional deprivation.

Other studies have found food insecurity to be linked with higher rates of a wide range of adolescent mood, behaviour and substance abuse disorders (12). It has also been reported that food insecurity early in life can weaken infants' attachments to parents, which may negatively affect children's mental health later in life (8,13).

Chronic diseases

In 2012, the American Academy of Pediatrics released a report indicating that children who are exposed to early life toxic stress are at high risk for adverse health outcomes later in life, including cardiovascular disease, obstructive pulmonary disease, cancers, asthma, autoimmune disease and depression (14). Toxic stress was defined as extreme, frequent or extended activation of the stress response accompanied by the absence of a supportive adult. The stress response can be activated in early life by the lack of nurture and care from an adult, poverty and trauma. It is important to note that health outcomes in adulthood vary considerably among individuals who were exposed to similar environments as a result of differences in genetics, coping skills and developmental stage (14). Based on the Canadian National Longitudinal Survey of Children and Youth, Kirkpatrick et al (15) found that children who experienced hunger were more likely to have poorer health and repeated episodes of hunger were particularly toxic. Multiple episodes of hunger were also associated with a higher likelihood of chronic conditions and of asthma compared with those who were never hungry.

Overweight status

A few studies conducted in Canada and the United States have reported a positive association between food insecurity and childhood obesity (16,17). It is hypothesized that food insecurity is related to more restrictive and pressuring maternal feeding styles compared with food-secure mothers. Controlling feeding styles decrease the ability of children to self-regulate eating behaviours, which may lead to future childhood obesity (18). Sex differences also appear to be relevant, with significantly more food-insecure girls at risk for obesity compared with boys (18). Additional research is required for us to better understand the reported link between food insecurity and children weight status.

EFFECTS ON MOTHERS

With high housing expenses in Canada, many low-income families are forced to choose between expenditures, such as rent, and putting food on the table (19). Not only are children going hungry, but parents themselves are also going hungry. Medical trainees participating in a new social paediatrics elective have reported both parent and youth hunger (20,21).

Depression is common among mothers with young children. Studies have suggested that ID may be a risk factor for maternal depressive disorders. In one study, low maternal hemoglobin status was associated with postpartum depression in a sample of American mothers (22). Symptoms include fatigue, low energy and difficulty concentrating on daily tasks. As a result, maternal depression is associated with lower child health status, which may result from unresponsive caregiving practices (3,23). In addition, maternal depression has shown to have negative effects on early childhood growth, particularly stunting, which results from chronic nutritional deficiencies and is also associated with unresponsive caregiving. The effects of unresponsive caregiving have also been extended to delays in children's cognitive development (3).

Furthermore, Weinreb et al (24) showed that mothers of severely hungry school-age children were more likely to have a lifetime diagnosis of post-traumatic stress disorder or substance abuse, which can also negatively affect a mother's ability to respond to children's physical and emotional needs.

RECOMMENDATIONS TO DECREASE FOOD INSECURITY

While food banks are an attempt to address unmet food needs, they are not a solution because the food provided is low in nutrients. There is no fresh milk or produce available in food banks and their existing food supply is limited (25). In addition, a study conducted in Toronto (Ontario) indicates that participation rates are extremely low among low-income families and that food banks are only considered at times of desperation as opposed to a routine service for food acquisition (26). Based on these findings, food banks should not be considered in any way an adequate component of our social safety net. In contrast, subsidized food may be a solution that could help improve the quality of people's diets and significantly reduce hunger. As for housing, there is a potential for subsidized food with foods such as apples, cheese, soy nuts, carrots and broccoli to be provided at all food stores at a fixed low price.

Canada is the only G8 country that does not have a national feeding program in schools. A national food supplementation program could strengthen household food security by providing breakfast, lunch and/or snacks either at no cost or at a reduced price in schools. This would free up household resources that could be used to feed other family members and provide other necessities. The program would also reduce substantial stress for children who do not know when they will have their next meal in addition to meeting a portion of their food needs (27). Roustit et al (28) found that the association between household food insecurity and scholastic difficulties in adolescents was no longer present among those who benefitted from school food supplementation programs.

However, these immediate solutions to urgent and compelling needs will not solve the issue of hungry infants and toddlers who are below school-age, nor after-school, weekend, holiday and parent nutrition needs. Therefore, we also need to target the issue of poverty. One way of doing this would be by advocating for an increase in minimum wage and also ensuring that fresh groceries are affordable. In addition, we need to educate society about making healthy food choices for their children and how they can ensure their children are getting sufficient nutrients. Health professionals are an important point of contact at which education should occur, and it is important for food security to be addressed during routine checkups. Children and adolescents who are experiencing recurrent hunger can be identified efficiently by a brief verbal assessment. This provides health professionals with the opportunity to link families to the appropriate social services. For example, doctors should ask their patients whether they have eaten today and yesterday, and provide resource brochures to target the immediate problem of food insecurity while higher-level policy changes are being implemented.

TABLE 1
Potential findings associated with food insecurity and hunger*

Infant	Increased risk of weakened attachment to parents (8,13)
Child	Poor performance on language comprehension tests (3)
	Inability to follow directions over the first five years of age (3)
	Delays in socioemotional, cognitive and motor development (3)
	Higher level of hyperactivity/inattention and poor memory (7,8)
	Higher frequency of chronic illnesses (14,15)
	Increased risk of childhood obesity (16,17)
Youth	Depression and suicidal ideation (11)
	Mood, behaviour and substance abuse disorders (12)
Maternal and family	Increased risk for maternal depressive disorders (19)
	Mothers of severely hungry school-age children more likely to have a lifetime diagnosis of post-traumatic stress disorder or substance abuse (24)
	Higher likelihood of unresponsive caregiving practices (3,24)

**Causality not necessarily confirmed*

CONCLUSION

Household food insecurity is a significant problem in Canada that affects an estimated one in every six children (1). It is shocking that food insecurity continues here, especially given the plethora of wide-ranging effects – reduced learning and productivity, mental health, chronic diseases and effects on mothers (Table 1). School food supplementation programs and subsidized food are an essential immediate need and we need to advocate for these at a national level. However, these solutions are not sufficient on their own. Health professionals are an important point of contact to educate parents about making healthy food choices for their family and to link patients who are experiencing recurrent hunger to the appropriate services. It is clear from our review that there are gaps in the literature regarding the effects of food insecurity and hunger on children, and limitations to existing studies. Therefore, we should continue to improve our understanding of hunger through future research in Canada, but we also must act now.

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