

**Prevalence and Determinants of Food Insecurity and Its Impact on Diet
Quality in African and Caribbean School-Aged Children in Ottawa**

by

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Abstract

Purpose: Food insecurity is an important social determinant of health and is linked with higher health care costs. There is a high prevalence of food insecurity among recent immigrant households in Canada. The aim of the present project was to evaluate the prevalence of food insecurity in immigrant and non-immigrant households in Ottawa, to explore determinants of food insecurity in that population and to evaluate the link between food insecurity, diet quality and weight status.

Methodology: A cross-sectional study was conducted with a convenience sample of 258 Ottawa households having a child between 6 and 12 years old, with a mother born in Sub-Saharan Africa, the Caribbean or Canada. Health Canada's Household Food Security Survey Module was used to evaluate participants' food access in the past 12 months. Children's dietary intake was evaluated with the use of a 24-hour recall and a modified Healthy Eating Index diet quality score was calculated. Chi-square and logistic and linear regression analyses were used to determine correlates of food insecurity and its link with diet quality and weight status (n=249).

Results: A high rate of food insecurity (39%) was found among participants. Household food insecurity was associated with low education attainment, lone motherhood, mother's visible minority status, recent arrival to Canada, limited English fluency, reliance on social assistance, and subsidized/temporary/COOP housing. Food insecurity was associated with consumption of sweetened beverages, lower consumption of saturated fat among children, and with obesity among mothers.

Conclusion: These findings suggest that food insecurity is associated with certain indicators of poor diet quality among children and with obesity among mothers. The findings also highlight the

need for food insecurity to be explicitly addressed in immigrant integration strategies in order to improve the financial power of new immigrants to purchase sufficient, nutritious, and culturally acceptable foods. Enhancing immigrants' access to affordable child care and well-paid jobs, improving social assistance programs, and providing more subsidized housing programs would be beneficial to help reduce food insecurity and increase diet quality.

Keywords: *Food security, Immigrant, Socioeconomic status, Diet quality, Canada, Children*

Résumé

But : L'insécurité alimentaire est un déterminant important de la santé et est liée à une augmentation des coûts de soins de santé. Il y a une forte incidence d'insécurité alimentaire chez les ménages immigrants récents au Canada. L'objectif du présent projet était d'évaluer la prévalence de l'insécurité alimentaire dans les ménages immigrants et non-immigrants à Ottawa, d'explorer les déterminants de l'insécurité alimentaire chez cette population et d'évaluer le lien entre l'insécurité alimentaire, la qualité de l'alimentation et le statut pondéral.

Méthodologie : Une étude transversale a été menée auprès d'un échantillon de 258 ménages vivant à Ottawa ayant un enfant entre 6 et 12 ans, dont la mère est née en Afrique sub-saharienne, dans les Caraïbes ou au Canada. Le Module d'enquête sur la Sécurité Alimentaire des Ménages de Santé Canada a été utilisé pour évaluer l'accès alimentaire des participants au cours des 12 derniers mois. L'apport alimentaire des enfants a été évalué à l'aide d'un rappel de 24 heures et un score au Health Eating Index modifié a été calculé. Des analyses de Chi-carré ainsi que des régressions logistiques et linéaires ont été utilisées pour identifier les déterminants de l'insécurité alimentaire et son lien avec la qualité de l'alimentation et le statut pondéral (n=249).

Résultats : Un taux élevé de ménages (39%) ont souffert d'insécurité alimentaire. L'insécurité alimentaire a été associée à un faible niveau d'éducation, la monoparentalité maternelle, le statut de minorité visible de la mère, une arrivée récente au Canada, une connaissance limitée de l'anglais, le recours à l'aide sociale, et vivre dans un logement subventionné / temporaire / COOP. L'insécurité alimentaire a été associée à la consommation de boissons sucrées et une consommation réduite en gras saturés chez les enfants, et à l'obésité chez les mères.

Conclusion : Ces résultats suggèrent que l'insécurité alimentaire est liée avec certains indicateurs de mauvaise qualité de la diète chez les enfants et avec l'obésité chez les mères. De plus, ces

résultats pointent à la nécessité que l'insécurité alimentaire soit abordée explicitement dans les stratégies d'intégration des immigrants afin d'améliorer la puissance financière des nouveaux arrivants d'acheter des aliments nutritifs et culturellement acceptables en quantité suffisante. L'amélioration de l'accès aux services de garde abordables et aux emplois bien rémunérés, l'amélioration des programmes d'aide sociale, et le développement supplémentaire de programmes de logement subventionné seraient bénéfiques afin de réduire les taux d'insécurité alimentaire et augmenter la qualité de la diète.

Mots-clés : Sécurité alimentaire, Immigrants, Statut socio-économique, Qualité de l'alimentation, Canada, Enfants

Preface

This master's thesis was carried out as part of the master's program in Interdisciplinary Health Sciences under the supervision of Isabelle Giroux, PhD, RD, Associate Professor in the School of Nutrition Sciences of the University of Ottawa, and the co-supervision of Dia Sanou, PhD, Nutrition Officer at the FAO Subregional Office for Eastern Africa.

This master's project is part of a larger research project coordinated by Rosanne Blanchet, RD, PhD candidate in Population Health. The conception of this study (primary analyses) has been realized by Diana Tarraf, RD, under the critical supervision of professor Giroux and Dr. Sanou.

The work of this thesis has been featured in two articles (Chapters 5 and 6) and 4 conference presentations (two posters and two oral presentations). The first article (Chapter 5) has been accepted by the journal *International Migration, Health and Social Care*. The results of this study analysis have been presented at the 1st Annual Interdisciplinary Food Studies Student Conference in Ottawa on January 22nd 2016 and at the ACFAS conference in Montreal on May 11th 2016. Two posters were created by the candidate and were presented at the Canadian Nutrition Society's 2016 annual conference in Ottawa from May 5th to 7th 2016 and at the *Journées Montfort 2016* from April 7th to 8th 2016. The abstracts of these presentations are presented in **Appendix A**, **Appendix B**, **Appendix C** and **Appendix D**. The second article (Chapter 6) will be submitted to the journal *Ecology of Food and Nutrition*.

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This master's thesis could not have been realized without the precious support and contribution of many people. I would like to take the time to thank them here.

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I would also like to thank my thesis co-supervisor **Dia Sanou, PhD**, for his generous scientific contribution. This thesis owes credit to the suggestions, comments, and hours he spent helping to improve my early drafts. I am thankful for the opportunities he has offered me and for his support and encouragement during the past 2 years.

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List of Abbreviations

AHEI	Alternative Healthy Eating Index
BMI	Body Mass Index
CCHIP	Community Childhood Hunger Identification Project
CCHS	Canadian Community Health Survey
CFGHE	Canada's Food Guide to Healthy Eating
CNF	Canadian Nutrient File
DQI	Dietary Quality Index
DRI	Dietary Reference Intake
EWCFG	Eating Well with Canada's Food Guide
FAO	Food and Agriculture Organization
FMLS	Francophones in a Minority Linguistic Situation
FNS	Food and Nutrition Service
HEI	Healthy Eating Index
HEI-C	Canadian Healthy Eating Index
HFSSM	Household Food Security Survey Module
mHEIC-2009	Modified Canadian Healthy Eating Index (2009)
NFB	Nutritious Food Basket
PHAC	Public Health Agency of Canada

US	United States of America
USDA	United States Department of Agriculture
WHO	World Health Organization
y	Years

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1. INTRODUCTION

Food security exists “when all people, at all times, have physical and economic access to sufficient safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life” (FAO, 1996). Food security has become recognized as an important public health matter (Dietitians of Canada, 2005; Health Canada, 2007) and a determinant of health (McIntyre, 2004; Public Health Agency of Canada [PHAC], 2004; Raphael, 2004, 2010; Tarasuk, 2004, 2005). A great deal has been written about the significance of ensuring food security for everyone, since food is deemed a basic human right (Riches, 1999; Rideout, Riches, Ostry, Buckingham, & MacRae, 2007; United Nations, n.d.) and a crucial condition for a population to be well-nourished and in good physical and mental health (Nord, Andrews, & Carlson, 2009; World Health Organization [WHO], 2004). Yet, this objective has not been entirely achieved for all members of society. Households that are food insecure have trouble, or concern about, consistently accessing adequate and nutritionally adequate food. Food insecurity is understood to be a dynamic process, which can range in severity from uncertainty concerning food supplies, to compromises in the quantity and quality of food intake (Tarasuk, 2001).

In 2011-2012, almost 1.1 million Canadian households experienced food insecurity and the prevalence of food insecurity was higher among recent immigrants who have been in Canada for <10 years (19.6%) compared with non-recent immigrants (11.8%) and the Canadian-born population (12.4%; Health Canada, 2011). Food insecurity is increasingly being recognized as a serious public health problem in high-income countries as it has been linked with higher rates of self-reported poor health and chronic health conditions, including depression, type 2 diabetes, and

heart disease (Kirk et al., 2013; Muldoon et al. 2013; Parker et al., 2010; Seligman et al., 2007; Siefert et al., 2004; Vozoris & Tarasuk, 2003).

The overall objective of this thesis is to assess the prevalence of household food insecurity and identify its determinants among a sample of black immigrants of African and Caribbean descent living in Ottawa. The link between food insecurity and the diet quality of school-aged children from these households will also be examined. This study will contribute to filling a gap in the literature on the issue of food insecurity in black immigrant households and may inform food security interventions targeting black immigrants in Canada.

In the following chapter (chapter 2), the broad literature on food security, its measure, its determinants and its importance to health is critically reviewed. Chapter 3 describes the study's rationale, objectives and hypotheses. The detailed methodology is presented in chapter 4. The research findings are presented in Chapters 5 and 6. Finally, overall conclusions as well as the scientific and practical contributions of this research are brought to light in the last chapter (Chapter 7).

2. LITERATURE REVIEW

2.1 Household food insecurity in Canada and other industrialized countries

2.1.1 Definition and dimensions of food security and food insecurity

The concept of food security was introduced in the 1970s and has evolved over time into a complex and multidimensional concept (Coates, 2013). Today, as described in Canada's Action Plan on Food Security, food security "exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life" (FAO, 1996). In contrast, the definition of food insecurity is globally accepted as the "lack of, or limited access to enough nutritionally adequate and safe food to live a healthy life, and the reduced ability to acquire these foods in socially acceptable ways" (Radimer, 2002). This definition was founded by the Life Sciences Research Office Task Force following a period of dispute in the United States [US] in the 1980s about the way hunger should be defined and measured (Wunderlich & Norwood, 2006). It was found that problems of undernutrition and nutritional deficiencies were basically inexistent in high-income countries, and nevertheless, the wide use of soup kitchens and food banks suggested that many people encountered inadequate food supplies. Anthropometric, clinical, or biochemical indicators of nutritional health status, which had normally been used as pointers of insufficient food intake, could not capture an understanding of the conditions requiring people to use food banks (2006).

The first studies to contribute to the knowledge of the meaning of hunger in developed countries were conducted in the 1980s and 1990s (Radimer et al., 1990; Wehler et al., 1992). Precisely, qualitative studies were published by Radimer, Olson and Campbell and described low income mothers' experiences of hunger (Radimer et al., 1990). The authors described the mothers'

experiences of hunger as having two dimensions (household and individual), and each of these dimensions has four components. *Quantity* at the household level in reference to hunger experience meant insufficient food supplies and, at the individual level, it referred to insufficient intake. *Quality* at the household level referred to food unsuitability (not being able to buy the quality and kinds of food considered appropriate) and, at the individual level, it denoted a problem of intake quality. *Psychological* considerations related to hunger were described as food anxiety, or uncertainty about whether one's food supply would last at the household level, and as feelings of deprivation and/or lack of choice at the individual level. Finally, the *social* component referred to unacceptable means of food acquisition at the household level and disrupted eating patterns (not eating the socially prescribed three meals a day) at the individual level (Radimer et al., 1990).

Qualitative studies in Canada discuss findings that are consistent with those found in the United States [US] (Hamelin et al., 2002; Runnels et al., 2011; Williams et al., 2012). Namely, early studies by Hamelin, Beaudry, and Habicht (2002) found that a shortage of food, the unsuitability of both food and diet, a concern about access to enough food and associated anxiety were core characteristics of food insecurity among low-income households in and around Quebec City, Canada. Manifestations of these experiences of food insecurity included disruptions in eating patterns, food acquisition methods, and familial relationships, as well as hunger and psychological suffering (2002).

Furthermore, differences in the temporality of the experience of food insecurity is another element that surfaced from qualitative works. For example, some families described the experience as precisely associated to a point in time (e.g. following job loss), while others described a monthly recurrence of the experience (e.g. prior to receiving a monthly payment) or a continuous experience

of concern and deficient money for food (Hamelin et al., 2002; Runnels et al., 2011; Williams et al., 2012). Food insecurity was also termed as a “managed process” for families (Radimer et al., 1990), in which case mothers utilized different strategies in the face of food shortage. These strategies included the methods they would use to? alter their diets to ensure the food lasts, particularly for their children (1990). Consequently, the idea that food insecurity is measured on a continuum of severity emerged. In general, households at the least severe end may experience stress and anxiety associated with food supply, by which reducing the variety of foods purchased. Among households at the most severe end, the number of meals and portion sizes may decline. Most of the qualitative food insecurity research (Radimer et al., 1990; Hamelin et al., 2002) has found that mothers rank their children’s dietary needs above their own. This explanation is referred to in order to explain the difference in prevalence rates of food insecurity between adults and children (Nord & Parker, 2010). Recently, however, the legitimacy of parental accounts for children have been questioned, since in-depth qualitative interviews with children aged 9-16 y have shown that they are aware of their household food situations and use approaches to lessen their parents’ stress (Fram et al., 2011).

To date, the definition of food security covers four dimensions: the quality and quantity of food available and the psychological and social impact that this involves (Tarasuk, 2001b; Ashe & Sonnino, 2013). Food insecurity can be examined at the level of the individual, household, community, region, or nation, and can be described on a continuum of severity (Tarasuk, 2001b).

2.1.2 Measurement and classification of household food insecurity

Initial awareness of the issues of food insecurity in Canada came mostly from the high number of people in search of charitable food assistance in the 1980’s. In 1989, the Canadian

Association of Food Banks released its first estimate (named the 'HungerCount'). Since then, usage of food banks has increased dramatically, with 841,191 Canadians using food banks in one month in 2014 (Food Banks Canada, 2014). However, food bank usage likely extremely underestimates the real extent of the problem, as evidence shows that only a slight proportion of households experiencing food insecurity seek charitable food assistance (Che & Chen, 2001; Vozoris & Tarasuk, 2001).

When it was recognized that hunger and food insecurity levels were widespread in the US, the Food and Nutrition Service [FNS] and Department of Agriculture [USDA] acknowledged the need for a standardized nationwide household measure of food insecurity (Radimer & Radimer, 2002), which was based on valid measures developed by the Community Childhood Hunger Identification Project [CCHIP] and by Radimer and Cornell who created a scale based on ethnographic research (Radimer et al., 1990). Based on these two measures, 18 food security questions were identified in the US, of which eight report the experience of food insecurity among children. These questions are frequently used in studies in the US today and classify households into three groups: food secure, low food security and very low food security (previously called food insecurity with and without hunger; Radimer and Radimer, 2002). In Canada, food insecurity is measured by means of the same questionnaire used in the US, but the terminology and classification method differ.

In Canada, data on food insecurity is gathered through the Canadian Community Health Survey [CCHS], a cross-sectional survey administered by Statistics Canada that collects health related information from a large sample of Canadians (about 60,000) per year. The sample, which is designed to be representative of the ten provinces and three territories, excludes persons who

are members of the Canadian Forces (fulltime), those living on First Nations reserves or Crown Lands or in prisons or care facilities and those who are homeless (Gaetz et al., 2013). Since 2004, the Household Food Security Survey Module [HFSSM], which contains 18 questions about the food security situation in the household over the previous 12 months, has been included in the CCHS to monitor households' experiences of food insecurity (Health Canada, 2007; see **Appendix A** for the full 2004 Household Food Security Survey Module). This questionnaire and the methods used to determine household food security status were adapted from food security measurement methods developed in the US (Gary, Nord, Price et al., 2000; Hamilton, Cook, Thompson et al. 1997a, 1997b; Nord and Bickel 2002). The questionnaire is composed of questions asking the respondent whether he/she or other family members experienced various conditions, ranging in severity from experiences of concern that food will run out before money is available to buy more, to adjusting the amount and the quality of food consumed, to experiencing food deprivation, and in extreme cases, children not eating for a whole day. These questions differentiate the experiences of adults from those of children. This distinction is made because parents have been shown to reduce their own food intake in favor of maintaining their children's food intake. Parents therefore buffer the impact of food insecurity on the dietary habits of kids (Tarasuk, 2001b). Ten of the 18 items are specific to the experiences of adults in the household or the household in general, whereas eight are specific to the experiences of children under the age of 18 years living in the household. Each question states a shortage of money as the basis for the behaviour.

Based on the number of affirmative responses given to these questions, households are classified as food secure, moderately food insecure or severely food insecure. Households classified as food secure report no or very few indications of any income-related difficulty of

accessing food. Those classified as moderately food insecure report compromising the quality and/or quantity of food eaten among adults and/or children. Those categorized as severely food insecure report more substantial compromises, including decreased food intake among adults and/or children due to a lack of money for food (see **Table 2.1** for a full description).

Table 2.1: Food security status, based on an 18 item questionnaire

Food Security Status ¹		
	Category Description	
	10-Item Adult Food Security Scale	8-Item Child Food Security Scale
<i>Food Secure</i>	<i>No indication of difficulty with income-related food access</i> <i>0 affirmed response</i>	<i>No indication of difficulty with income-related food access</i> <i>0 affirmed response</i>
<i>Food insecure, marginal*</i>	<i>Indication of some concern or difficulty of food access</i> <i>1 affirmed response</i>	<i>Indication of some concern or difficulty of food access</i> <i>1 affirmed response</i>
<i>Food Insecure, Moderate</i>	<i>Indication of compromise in quality and/or quantity of food consumed</i> <i>2 to 5 affirmed responses</i>	<i>Indication of compromise in quality and/or quantity of food consumed</i> <i>2 to 4 affirmed responses</i>
<i>Food Insecure, Severe</i>	<i>Indication of reduced food intake and disrupted eating patterns</i> <i>≥ 6 affirmed responses</i>	<i>Indication of reduced food intake and disrupted eating patterns</i> <i>≥ 5 affirmed responses</i>

* Marginal food insecurity is not a category used in Health Canada's publications on this module. Following their classification system, those with a single response are considered food secure. The marginal category is included in this report because of a growing body of literature indicating that households reporting at least some level of uncertainty over their access to food are more vulnerable than those who have affirmed no items on the 18-item questionnaire (Coleman-Jensen, A J. U.S. food insecurity status: toward a refined definition. *Soc Indic Res* 2010; 95: 215-230).

¹ Adapted from: Canadian Community Health Survey, cycle 2.2, Nutrition (2004): Income related Household Food Security in Canada(Health Canada 2007).

Another indicator of food access problems among Canadian households has come from the surveillance of the cost of a basic nutritious diet. The assessments of the cost of healthy eating in Canada are mainly based on the Nutritious Food Basket [NFB]¹, which was developed by Health Canada (Lawn, 1998) and was revised to incorporate the latest dietary guidance, as contained in Eating Well with Canada's Food Guide [EWCFG] and the Dietary Reference Intakes [DRIs] (Hatfield, 2002). The NFB describes the quantity of roughly 60 foods that represent a nutritious diet for individuals in different age and gender groups, including pregnant and lactating women (Health Canada, 2009). The objectives of the NFB are to help health and social service agencies to monitor the cost and affordability of a nutritious diet (Lawn, 1998) and to assist policy and decision makers to formulate comprehensive health, nutrition and social policies (Health Canada, 2009).

Local health units in many provinces in Canada regularly collect and report the annual cost of a NFB in their areas (Health Canada, 2009). This information has been used to reveal that social assistance income benefits are insufficient to cover the cost of a basic healthy diet as outlined by the NFB and meet other basic living expenses (Ottawa Public Health, 2015). This work has highlighted the nutritional vulnerability of social assistance beneficiaries (PROOF, 2015). For example, in 2015, Ottawa Public Health determined it costs a minimum of \$835 to feed a family of four every month. To do so, they visited 10 stores and compared 67 food items. Based on their calculations, a family of four on the Ontario Works program, which helps people who are in financial need, would have to spend 63% of their monthly income on rent and 28% on

¹ A Northern Food Basket also exists, which was developed in 1990 by Indian and Northern Affairs Canada as an instrument to monitor the cost of a basic nutritious diet in isolated northern communities (Indian and Northern Affairs Canada, 2003).

food (totally 101%) in order to eat a healthy diet. At the end of the month, the family is short \$12 without even considering all of their other fixed expenses, including telephone, transportation, child care, household and personal care items and clothing (Ottawa Public Health, 2015). Since 2009, the cost of the NFB has risen over 13 per cent. Although 2015 marks a small decline in food costs – 4% from 2014, many families still have to choose between paying for healthy food or other basic living expenses, such as rent, child care and transportation (2015).

2.1.3 Magnitude of the problem in Canada

The most recent available data on household food insecurity is from the CCHS conducted in 2011. During that year, 12.3% of Canadian households, representing almost 1.6 million households or roughly 2.7 million adults and more than 1.1 million children under the age of 18, lived in food insecure households (Health Canada, 2011). Those numbers indicate that 17% of children under the age of 18 years old, or about one in six, resided in households that experienced food insecurity during 2011. More specifically, 5.6% of households (or 730,000 households) were classified as moderately food insecure, indicating compromises in the quality and perhaps quantity of food consumed over the past 12 months, and 2.5% (or 330,000 households) were classified as severely food insecure, reporting obvious indications of food deprivation among household members. Between 2008 and 2011, the prevalence of food insecurity in Canada increased from 11.3% to 12.3%. This means that 450 000 more individuals were living in food insecure households in 2011 than in 2008 (Tarasuk, Mitchell & Dachner, 2013).

2.2 Impact of food insecurity on nutritional intake, health and well-being

2.2.1 Nutritional intake and biomarkers

The first study to assess the association between food insecurity and nutritional intake in the Canadian population was an analysis of the 2004 CCHS by Kirkpatrick and Tarasuk (Kirkpatrick & Tarasuk, 2008). In this study, food insecure women in the 19-30 and 31-50 age groups had lower intakes of dietary fibre. Moreover, food insecurity was linked with lower protein intakes across adult age and sex groups. Also, among males and females in the 19-30 age group and among women in the 31-50 age group, food insecurity was associated with lower consumption of fruit and vegetables. It was also found that food insecure males and females over 50 had lower milk intakes than those who were food secure in the same age group. In all age and sex groups, food insecurity was associated with inadequate intakes of magnesium and protein, and with folate, vitamin A, zinc, and vitamin C for some groups (2008). Some groups of food insecure children in the 9-13 and 14-18 age groups had a high incidence of inadequate intakes of protein, vitamin A, vitamin C, magnesium, and zinc, although results were not consistent across groups. Adolescents who were food insecure also had significantly lower intakes of fruit and vegetables than those who were food secure (Kirkpatrick & Tarasuk, 2008).

In a more recent study by Eicher-Miller et al. (2009), the authors evaluated the association between food insecurity and iron deficiency anemia among 11,247 children aged 12-15 y in the US. Information was collected on participants' demographics, food security status and dietary intake, and anthropometric and laboratory measures were also taken. Serum ferritin concentration, transferrin saturation, and free erythrocyte protoporphyrin were measured and iron deficiency was defined by the presence of 2 or more abnormal values for the aforementioned indicators, as

classified by Looker and colleagues (Looker et al., 1997). In this study, it was found that food insecure children were approximately three times more likely to have iron deficiency anemia than children who were food secure. Children aged 16-19 y living in food insecure households were 1.87 times more likely to have an inadequate iron intake than those living in food secure households (Eicher-Miller et al., 2009; both analyses were statistically significant). Further, in a recent study by Mark et al. (2012), data from the CCHS Cycle 2.2 was used to examine the diets of 8,938 youth aged 9-18 years. Results indicated that low-income food insecure girls had both lower milk consumption and vitamin D intake and a higher intake of sweetened beverage than low-income food secure girls (2012).

Additionally, a recent study assessed the relation of food insecurity to iron deficiency and stature in a cohort of 292 school-aged Inuit children from Nunavik (Northern Quebec), who were followed for 10 years (Pirkle et al., 2014). Food-insecure children were marginally more likely to be anaemic and had significantly lower mean haemoglobin levels than those who were food secure. However, in the fully adjusted models (for age, sex, body mass index [BMI] status and environmental contaminants), food insecurity was not associated with iron depletion or iron-deficiency anaemia (2014). The small number of cases of iron-deficiency anaemia (n=25) may have prevented the observation of a statistically significant association.

Briefly, these results suggest that food insecurity is associated with a greater likelihood of compromised nutritional intakes. In children, nutritional deficiencies can result in learning delays and behavioural problems which will negatively impact their health throughout life (Jyoti, Frongillo & Jones, 2005; Ramsey et al., 2011), increasing health disparities.

2.2.2 Chronic health conditions and well-being

Food insecurity has been linked with higher rates of self-reported poor health and chronic health conditions, including depression, type 2 diabetes, and heart disease (Kirk et al., 2013; Muldoon et al. 2013; Parker et al., 2010; Seligman et al., 2007; Siefert et al., 2004; Vozoris & Tarasuk, 2003). For instance, in a recent study by Kirk and colleagues (2013), multiple regression analysis was used to explore associations between food security status (high food security; marginal, moderate or severe food insecurity), dietary behaviours and intake, and health-related outcomes (body weight, quality of life, mood, peer relationships and externalizing problems) in 5853 grade 5 students in Nova Scotia. This study found that students living in households experiencing moderate or severe food insecurity had poorer diet quality, BMI and poorer psychosocial outcomes than students classified as having high food security or marginal food insecurity (Kirk et al., 2013). Recently, a study by Dubois and colleagues (2011) presented a comparative gender-based analysis of the association between household food insecurity and overweight among 10-to-11-year-old children living in Québec. Girls who lived in food-insecure households had odds of 4.99 (95% CI: 2.4-10.5, $p < 0.05$) for being overweight in comparison to girls who lived in food-secure households. This is mainly important as obesity increases the risk of serious health conditions such as type 2 diabetes mellitus (Boffetta et al., 2011), hypertension and cardiovascular disease (Isomaa et al., 2001), fatty liver disease (Schwimmer et al., 2006), and some types of cancer (Calle & Kaaks, 2004).

2.3 Vulnerability to household food insecurity

2.3.1 Individual and household factors related to food insecurity

Extensive research has focussed on identifying the factors or conditions that place individuals and households at risk for food insecurity. Most of what is known about the factors associated with household food insecurity in Canada comes from national health surveys, such as the CCHS. Cross-sectional surveys in the US (Bhargava , Jolliffe & Howard, 2008; Coleman-Jensen et al., 2012; Huang, 2010) have generated a similar understanding of the determinants of food insecurity.

Annual income is of central importance in determining a household's ability to acquire food (Che & Chen, 2001; McIntyre, Connor, & Warren, 2000; McIntyre, Walsh, & Connor, 2001; Rainville & Brink, 2001; Tarasuk & Vogt, 2009; Vozoris & Tarasuk, 2003; Wu & Schimmele, 2005). The most recent data available from the 2011 CCHS showed that the prevalence of food insecurity was 45% among households whose income was at or below 50% of the low-income measure (Tarasuk, Mitchell & Dachner, 2013). The prevalence reduced to 24% and 13.9% among households between 50% and 100%, and 100% and 150% of the low-income measure, respectively. The Low-income measure is a fixed percentage (50%) of median adjusted total income of households observed at the individual level. In order to calculate the low-income measure, "equivalent household income" for each household is calculated by dividing household income by its "adjusted size", that is the square root of the number of persons in the household. Next, this adjusted household income is assigned to each individual in the population. Then, the median of this "equivalent household income" over the population of individuals is determined, that is the amount where half of all individuals will be above it and half below (Statistics Canada,

2015). Furthermore, in the most recent analysis of national data from Canada, the relationship between annual income and food insecurity was illustrated by examining mean household-size adjusted incomes by severity of food insecurity. It was shown that for every \$1000-dollar increase in income (adjusted for household size), the likelihood of a household being food insecure decreased by 5% (Tarasuk et al., 2013).

In addition, the main source of income has been found to be significantly associated with household food insecurity independent of annual income (Che & Chen, 2001; McIntyre et al., 2000, 2001; Rainville & Brink, 2001; Tarasuk & Vogt, 2009; Vozoris & Tarasuk, 2003; Wu & Schimmele, 2005). The odds of food insecurity ranged from 2.2 times higher to over 3 times higher for Canadian households reliant on social assistance compared with those whose main source was employment (Tarasuk et al., 2013; Rainville & Brink, 2001). Canadian households receiving pensions or dividends were less prone to be food insecure than those relying on employment income (Tarasuk et al., 2013).

Furthermore, two US studies have examined the relationship between income changes and availability of liquid assets (assets that can be converted into cash in a short time, with little or no loss in value) and the experience of food insecurity. They found that households that experienced negative income shocks in the month preceding the administration of the food security questionnaire were more likely to be food insecure at the end of the month (Gundersen & Gruber, 2001; Leete & Bania, 2010). Furthermore, only 3.6% of food insecure households had savings in the form of liquid assets compared to 26.7% of food secure households (Gundersen & Gruber, 2001).

Households prone to food insecurity also include those where parents or head of households have a lower educational achievement (McIntyre et al., 2000, 2001) and households with children, particularly those lead by a single mother (Che & Chen, 2001; McIntyre et al., 2000, 2001; Rainville & Brink, 2001; Vozoris & Tarasuk, 2003; Wu & Schimmele, 2005). In fact, data from the most recent CCHS indicates that food insecurity was more prevalent among households with children under the age of 18 (15.6%) than in households without children (11.4%; Health Canada, 2011). Other characteristics of household membership such as age of children or number of children have not been consistently associated with likelihood of food insecurity independent of other factors (Rainville & Brink, 2001; McIntyre, Bartoo & Emery, 2014; Tarasuk & Vogt, 2009). However, single or unattached individuals (Che & Chen, 2001; Wu & Schimmele, 2005), tenants or those who do not own a house (Che & Chen, 2001; Tarasuk & Vogt, 2009; Vozoris & Tarasuk, 2003), and off-reserve Aboriginal peoples (Che & Chen, 2001; Rainville & Brink, 2001; Willows, Veugelers, Raine, & Kuhle, 2009) are at higher risk of food insecurity.

Recently, an analysis of CCHS data indicated that the risk of being food insecure increased as the number of chronic health conditions increased among adults (Tarasuk et al., 2013). In addition, if the survey respondent had two or more health conditions, households were more likely to experience severe food insecurity in comparison to moderate food insecurity after adjustment for income and other sociodemographic variables. Note that these findings are of cross-sectional nature and that chronic health conditions could also be an outcome of food insecurity. However, these findings are supported by longitudinal studies from the US that have found that transition into poor health correlated with shifts into food insecurity (Heflin, Corcoran, & Siefert, 2007).

In summary, a great deal of the research on food insecurity and its risk factors has focused on poverty. A confirmed link has been identified between food insecurity and the financial security of the household, which suggests that food insecurity is rooted within the context of poverty (Hamelin et al., 2002; McIntyre et al., 2002; PHAC, 2004; Tarasuk, 2001a, 2001b, 2005). However, researchers have insisted that low income by itself cannot explain food insecurity (Alaimo, 2005; Guo, 2011; Heflin, Corcoran, & Siefert, 2007; Mammen, Bauer, & Richards, 2009; Olson, 2005; Ribar & Hamrick, 2003; Siefert, Heflin, Corcoran, & Williams, 2001). In fact, not all food insecure households have a low income and not all low-income households are food insecure. Although the probability of being food insecure is highest for people in the lowest income categories, there are more households in the lower middle and middle income categories who report food insecurity (Che & Chen, 2001; Tarasuk et al., 2013; Tarasuk & Vogt, 2009), which suggests that low income and food insecurity may indicate different aspects of economic deprivation (Ribar & Hamrick, 2003).

2.3.2 The immigrant experience

In this section, the risk factors that place immigrants at greater risk of food insecurity and poor health are discussed.

2.3.2.1 The healthy immigrant effect

Upon arrival to Canada, studies have found that immigrants as a group have a longer average life expectancy, lower levels of disability as well as fewer chronic conditions compared to Canadian-born individuals (Chen et al., 1996; Macdonald and Kennedy, 2004). However,

studies have noted that their health status deteriorates with the number of years spent in Canada (McDonald and Kennedy, 2004; Newbold and Danforth, 2003). For instance, McDonald and Kennedy (2004) noted that recent immigrants had fewer chronic conditions than Canadian-born individuals, but that there is a gradual decline in health status over time in Canada. Also, the prevalence of obesity among immigrants was found to increase with their duration of stay in Canada, although in general, the prevalence of obesity was higher among Canadian-born individuals compared to non-white immigrants (McDonald & Kennedy, 2005). Of note, immigrants were found to be by and large less active than non-immigrants (2005). Furthermore, Newbold and Danforth (2003) found that, with the exception of the most recent arrivals, immigrants experience inferior health status across most dimensions compared to non-immigrants. In a recent scoping review by Sanou and colleagues (2014), time since immigration was correlated with an increased BMI in the majority of the studies reviewed. This trend among immigrants has been noted in many other western countries and has been called the “*healthy immigrant effect*” (Beiser, 2005).

Still, some studies provided mixed support or were unsuccessful in confirming the *healthy immigrant effect* (Newbold, 2005; O Loughlin et al., 2007; Pomerleau & Ostbye, 1996). Despite the heterogeneity in the literature, research, overall, tends to confirm the *healthy immigrant effect* with recent immigrants being in better health compared to established immigrants and non-immigrants despite their socioeconomic status (Sanou et al., 2014).

A considerable body of research has focused on explaining the *healthy immigrant effect*, in Canada as well as in other countries. Data suggests that a number of mechanisms contribute to this decline in health status, including diet and lifestyle changes (Frisbie, Youngtae, & Hummer, 2001),

reduction of socioeconomic status (Bauder, 2003), social exclusion (Omidvar & Richmond, 2003), and a medical system that is lacking in culturally competent care (Betancourt et al., 2003).

2.3.2.2 Convergence and dietary acculturation

The convergence framework (Beiser, 2005) proposes that exposure to the new Canadian environment pushes the immigrants' health status to converge to that of Canadian-born individuals (Dunn & Dyck, 2000; Kleiwer & Smith, 1995a, 1995b). These changes are largely due to shifts in behaviours, including eating habits, smoking, drinking alcohol, and sedentary behaviours (Franzen & Smith, 2009; Kim & Chan, 2004; Unger et al., 2004). The social, cultural and behavioural convergence that takes place is described, by many migration researchers, as “acculturation”, defined as:

Those phenomena which result when groups of individuals having different cultures come into continuous first-hand contact, with subsequent changes in the original cultural patterns of either or both groups (Redfield, Linton, & Herskovits, 1936).

Researchers use various scales to measure acculturation, but the most common one is duration of stay in Canada (Sanou et al., 2014). Other measures, such as birthplace, country of origin, age at arrival to Canada and language use or language proficiency are frequently utilized (2014).

Some studies have examined immigrants' nutrient intake compared to that of the non-immigrant Canadian population. In general, immigrants (especially those of Asian descent) are at higher risk of inadequate intake of calcium, iron and protein (Pomerleau et al., 1998). Also, lengthy exposure to the Canadian culture was associated with an increased fat and sodium intake by

newcomers (Newbold, 2009; Lear et al., 2009). However, one study involving older adult immigrants in London, Ontario, found that maintenance of traditional eating habits and consumption of ethnic foods may increase sodium intake, which was found to be as high as 238–474 % of the daily adequate intake for some individuals (Johnson & Garcia, 2003).

Nevertheless, across studies, immigrants' traditional diet has been believed to be healthier than that of the typical Canadian diet (Sanou et al., 2014). This is particularly true for immigrants of African and Haitian origins (Delisle, 2010). For example, a study found that Francophone Africans in Montréal tended to maintain their home country's traditional diet, which had significantly higher nutritional quality than the modern diet, independently of the length of time since immigration to Canada (Delisle, 2010). The nutritional quality of the identified dietary patterns was determined using a variety of diet quality indices, such as the “micronutrient adequacy” score (FAO, 2001), the “healthfulness” score (WHO, 2003) and the Healthy Eating Index (Guenther et al., 2008), among others. In the sample of Africans in Montreal, participants consuming a modern (or Western) diet had more than twice the odds of being insulin resistant than those consuming a traditional diet (OR = 2.3; CI:1.2–5.0; $p < 0.01$). Also, Punjabi women living in West Toronto continuing to consume a traditional diet were reported to have a healthier diet compared to a typical Western diet (Dhaliwal, 2002). On the other hand, some authors found that Haitian immigrants easily undergo dietary acculturation from their healthier traditional diet to a more Western diet (Desilets et al., 2006; Delisle, 2010), which could place this particular group of immigrants at higher risk of developing chronic disease.

Of note, healthy dietary patterns can only be followed if the food items are available, accessible, and desirable (Delisle, 2010). They are irrelevant if people are in a state of endless food insecurity (2010).

2.3.2.3 Food insecurity among Canadian immigrants

The nutritional health of immigrants may be further compromised by household food insecurity. Newcomers are known to be at a higher risk of household food insecurity than the general Canadian population. In the latest CCHS, 19.6% of newcomer households reported food insecurity compared to 12.4% of non-immigrant households (Health Canada, 2011). Furthermore, studies have documented very high rates of stress, financial hardship, and food insecurity among refugees and other forced migrants in many developed countries, including the US (Patil et al., 2010). Low income, unemployment, and recent arrival were found to be predictors of food insecurity among newcomers to high-income countries (Anderson et al., 2014; Hadley & Patil, 2010; Hadley et al., 2007). Lack of savings or revenue places newcomer families at increased risk of food insecurity in the first year following immigration (Quandt et al., 2004; Quandt et al., 2006), as many struggle to find a job and may face discrimination due to their lack of permanent status (Canadian Council for Refugees, 1999). In fact, more than half of all refugee families with children under five years reported food insecurity in some UK and US studies. In Toronto, Latin American immigrants were found to have a comparable prevalence of food insecurity (Hadley et al., 2007; Sellen et al., 2002; Vahabi et al., 2011).

A few studies have examined factors associated with food insecurity among immigrants in Canadian cities. For instance, a study by Vahabi and colleagues (2011) found three main correlates of food insecurity in Latin American immigrants in Toronto: social assistance as a main income, use of food banks, and limited literacy in English. More specifically, this study, found that the prevalence of food insecurity increased as household income decreased, which corroborates previous findings (Che & Chen, 2001; Rush et al., 2007; Tarasuk & Vogt, 2009; Willows et al., 2008). The incidence of food insecurity was significantly higher in households who reported receiving provincial or municipal assistance as their main source of income (82 vs. 32%; Vahabi and colleagues, 2011). Furthermore, more recent immigrants (less than 1 year in Canada) had significantly higher levels of food insecurity compared with less recent immigrants (1–5 years in Canada; 84% vs. 33%; 2001). Also, respondents who rated their English as poor reported significantly higher food insecurity compared with those who rated their English as good or excellent (74 vs. 25%; 2001), which was also found in Rush and colleagues' study (Rush et al., 2007). On the same note, Gauthier (1996) noted that among new immigrants, Francophone Africans were the highest risk group. Although, in the study of Vahabi and colleagues (2011), the sample size was relatively small and the sampling method was not random, it may have captured a more accurate prevalence of food insecurity among recent immigrants since the surveys were done in native languages, which would allow the inclusion of vulnerable groups who may have been excluded from the CCHS due to their lack of proficiency in English or French (Vahabi and colleagues, 2011).

Although these aforementioned studies have identified many determinants of food insecurity among immigrants in general, none have studied these determinants among immigrants

of African and Caribbean descent. Furthermore, in some studies (Vahabi and colleagues, 2011), questions on immigration status were not included in order to enhance participation and, therefore, the link between immigration status and food security status could be not well understood. In addition, there is a lack of research on the impact of food insecurity on the diet quality of children of African and Caribbean origin living in Canada.

2.4 Immigration trends in Canada

2.4.1 Overview

Canada is a popular destination for immigrants and integration of newcomers is an important strategy for its demographic growth and economic development. Since 1988, Canada has accepted an average of 230,000 immigrants annually (Citizenship and Immigration Canada, 2012). In 2011, the immigrant population in Canada was approximately 20.6% of the total population, or 6.8 million people. By 2031, it is expected that the foreign-born population in Canada will be between 25 and 28% (Statistics Canada, 2010).

Immigrants to Canada land from over 200 countries, and are therefore a tremendously culturally diverse group. Over the past four decades, the home countries of Canada's immigrants have considerably shifted. Prior to the 1970s, the majority of immigrants came from Europe or the US, and fewer than 10% of all immigrants came from Asia. Also, those arriving from Africa, the Middle East, and the Caribbean jointly represented 5% of all immigrants. In 2012, however, almost half (49%) of Canadian immigrants landed from Asia, 23% came from Africa and the Middle East,

15% from Europe, and 10% from South and Central America (Citizenship and Immigration Canada, 2012).

2.4.2 Immigrants from Africa and the Caribbean

According to the 2011 National Household Survey, there has been a slight increase in the share of immigration from Africa, the Caribbean, Central and South America during the past five years (Statistics Canada, 2011). Between 2006 and 2011, 12.5% of the newcomers who arrived during that period arrived from Africa. This was increased from 10.3% among those who arrived during the preceding five-year period (2011). In comparison, individuals born in Africa accounted for 1.9% of immigrants who arrived in Canada before 1971 (2011). Furthermore, people born in the Caribbean, Central and South America represented 12.3% of all newcomers between 2006 and 2011, which was increased from 10.5% for those who came five years earlier. Prior to the 1970s, people from these regions accounted for only 5.4% of immigrants (Statistics Canada, 2011).

2.4.3 Portrait of the immigrant population in Ottawa

The majority of newcomers to Canada settle in urban areas. In 2011, 91% of Canadian immigrants lived in an urban area (Statistics Canada, 2013a). Particularly, Toronto, Vancouver and Montreal, Canada's three largest metropolitan areas, accounted for roughly two thirds (62.5%) of new arrivals (2013a). The Ottawa – Gatineau area was home to 3.5%, or more than 235,300 of the country's immigrant population in 2011. The city had the fifth highest number of immigrants in the country. These immigrants represented almost a fifth, or 19.4%, of Ottawa - Gatineau's total

population (2013a). Furthermore, by 2031, the Ontario part of Ottawa – Gatineau is expected to be one of the few cities with a proportion of foreign-born persons and visible minority persons above the national average (Statistics Canada, 2010).

2.5 Defining “healthy eating”

2.5.1 Nutrition and diet quality

Good nutrition is crucial to developing and maintaining optimal health, as well as in the prevention and management of disease. In children and adolescents, a healthy diet is essential for normal growth and development. Nutrition, as defined by the WHO, is “an input to and foundation for health and development” (World Health Organization, 2009, para. 1). However, this definition is incomplete. For example, if nutrition entails a desired state of health, does *overnutrition* translate into an increased condition of physical wellbeing? On the contrary, *overnutrition* is nonetheless another form of malnutrition presenting great risk to an individual’s health. In *The State of Food Insecurity in the World 2015*, the Food and Agriculture Organization [FAO] defined malnutrition as “an abnormal physiological condition caused by inadequate, unbalanced or excessive consumption of macronutrients and/or micronutrients. Malnutrition includes undernutrition and overnutrition as well as micronutrient deficiencies.” (FAO, 2015, para. 4) According to this definition, malnutrition may refer to either *under-* or *overnutrition*, both of which can lead to an imbalance in the amount of nutrients required and absorbed.

When exploring associations between diet and health outcomes, a strong body of evidence has revealed that it is preferable to measure the total dietary intake and overall diet quality as

opposed to assessing diet based on a single nutrient (Kant, 1996; Kant, 2004; Wirt & Collins, 2009). The human diet is complex and multi-faceted and health is affected by the total dietary intake rather than one specific nutrient (Kant and Graubard, 2005). **Diet quality indices** [DQI] evaluate dietary patterns, which offer a broader account of dietary intake and take into consideration the synergistic effects of whole foods, such as fruits and vegetables, in the diet (Murray et al., 2013). Focusing on dietary patterns instead of specific dietary components allows for the identification of possible interactions between these components. This is advantageous because diverse aspects of the diet are involved in chronic disease development and appreciating the balance among protective and detrimental components of the diet is therefore helpful (McNaughton et al., 2009).

2.5.2 Diet quality indices

Diet quality bears in mind the acceptability of the diet based on recommended nutrient intakes, such as Dietary Reference Intakes [DRIs], and restraint of consumption of nutrients which can become harmful to health (i.e. saturated and trans fatty acids, sugar and sodium). Diet quality indices are often based on national dietary guidelines, such as the *Dietary Guidelines for Americans* (in the US) and *Eating Well with Canada's Food Guide* [EWCFG] (in Canada). A diet quality index is thus a measure, on a numeric scale, of the overall acceptability of food intake of an individual or population compared to dietary guidelines (Wirt & Collins, 2009). A DQI combines a variety of nutritional recommendations into a single measure of diet quality (Garriguet, 2009), which allows the evaluation of an individual or group's diet to be quantified. In addition, DQIs make it feasible to assess the nutritional health of a population, draw trends in eating habits,

make comparisons between groups and evaluate the effect of other health conducts on diet (Garriguet, 2009). The development and application of these tools is expanding rapidly, as is the examination of relationships between indicators of health and disease (Kourlaba & Panagiotakos, 2009; Roman-Vinas et al., 2009). In adults, DQIs have been used to measure the risk of chronic conditions, including cardiovascular disease and some cancers (Wirt & Collins, 2009; Kimokoti & Millen, 2011). However, their utility in pediatric populations globally is relatively under studied (Marshall et al., 2014). Research studies that have used diet quality indices in adults and children are summarized and discussed below.

Many studies in Canada and other countries have used DQIs to assess diet quality among adults and children. Research has shown an association between sociodemographic factors and diet quality in adults. For example, in a study by Huffman and colleagues (2014), the association between language preference and length of stay in the US and diet quality among 132 Haitian Americans aged 35 years and over was examined. In this study, two diet quality indices were used: the Healthy Eating Index [HEI] and the Alternative Healthy Eating Index [AHEI]. In comparison with the HEI, the AHEI makes a distinction of quality within food groups for grains, meat, and fats, and was twice as strong at predicting chronic disease and cardiovascular disease risk compared to the original HEI based on a longitudinal study with data from the Nurses' Health Study and the Health Professionals' Follow-up Study (McCullough and Willet, 2006). Contrary to their hypothesis, participants whose language of preference was Creole scored lower in the HEI than those who preferred at least some English for speaking, reading or writing (Huffman et al., 2014). Also, the authors found a positive relationship with proportion of life spent in the US and

AHEI score, which does not support the Healthy Immigrant Effect. Having an income of less than \$20,000 per year was associated with a lower AHEI score ($p = .014$), but not significantly with a lower HEI score ($p = .051$). However, these models had over 20% missing values (for income) and must be interpreted carefully (Huffman et al., 2014).

In an earlier US study by McCullough and Willett (2006), the authors examined whether the AHEI can predict major chronic disease and cardiovascular disease risk. The sample consisted of 67 271 women from the Nurses' Health Study and 38 615 men from the Health Professionals' Follow-up Study, and dietary intake was obtained using a validated, semi-quantitative food frequency questionnaire which contained approximately 130 questions. It was found that men and women with AHEI scores in the top vs. bottom quintile had a significant 20% and 11% reduction in overall major chronic disease, respectively. After controlling for smoking and other known risk factors, a moderate but significant inverse relation was observed between AHEI scores and overall major chronic diseases in men. After adjusting for risk factors such as age, cigarette smoking, BMI, leisure-time physical activity, total energy intake, history of hypertension or hypercholesterolemia and vitamin E intake, men with highest AHEI scores had a 39% lower cardiovascular disease risk than those with lowest scores (2006).

In another study by Zhijie and colleagues (2014), multivariable regression analyses were used to examine the association between depressive symptoms and diet quality, physical activity, and body composition among 4511 Nova Scotians aged 35–69 years. Depressed individuals were less likely to have a high quality diet (top quintile of HEI) or engage in high levels of physical activity compared with their non-depressed counterparts. Also, compared with non-depressed individuals, those with mild and major depression had significantly increased odds ratios for both

obesity and abdominal obesity, which suggests there may be an additive effect of depression and unhealthy lifestyles on obesity risk. Due to the cross-sectional nature of this study, causation cannot be inferred, and further studies are needed to investigate whether improvement in diet quality and physical activity may lessen depressive symptoms (Zhijie et al., 2014).

Furthermore, the evaluation of pediatric diet quality is highly important because food habits that develop in childhood can remain over time and predict diet-related disease in adulthood (Patterson et al., 2009; Craigie et al., 2011). A number of pediatric diet quality indices have surfaced, such as the North American Youth Healthy Eating Index (Feskanich et al., 2004), the Revised Children's Diet Quality Index (Kranz et al., 2008), the Australian Child and Adolescent Recommended Foods Score (Marshall et al., 2012) and the Greek Preschool Diet-Lifestyle Index (Manios et al., 2010).

A recent systematic review by Marshall and colleagues (2014) described associations between diet quality indices and health-related variables and identified factors that are associated with diet quality in paediatric populations worldwide. Their review included one hundred and nineteen studies between 1980 and 2013, from which 80 different diet quality indices were identified. For instance, only eight studies out of 26 that examined associations between diet quality indices and weight status in populations at risk of over-nutrition (in developed nations) found a significant relationship (Feskanich et al., 2004; Mirmiran et al., 2004; Kranz et al., 2008; Lazarou et al., 2008; Chiplonkar & Tupe, 2010; Kontogianni et al., 2010; Manios et al., 2010; Vitolo et al., 2010; Golley et al., 2011; Jennings et al., 2011). In general, this relationship was inconsistent, with studies finding negative and positive links (Marshall et al., 2014). Furthermore, this review also found numerous demographic factors that were associated with diet quality,

including socioeconomic status (Serra-Majem et al., 2004; Torheim et al., 2004; Kranz et al., 2008; de Andrade et al., 2009; Kleiser et al., 2010; Golley et al., 2011), sex (Kleiser et al., 2009, 2010) and ethnic or migration background (Kranz et al., 2008; Kleiser et al., 2009, 2010).

Specifically, in a study by Serra-Majem and colleagues (2004), lower percentages of high diet quality were observed in low socio-economic groups, compared with middle and upper income cohorts (42.8%, 47.6% and 54.9%, respectively). In another study by Torheim and colleagues (2004), Diet Diversity Score was positively associated with male sex, education, and high socioeconomic score. In a study by Keliser and colleagues (2010) exploring the food intake of young migrants living in Germany, non-migrants had a higher mean dietary quality score than migrants. Also, a lower diet quality score was associated with higher age, male sex, low or middle socio-economic status, among other factors (2010). An Australian study by Golley and colleagues (2011) found that diet quality score was positively associated with: household education level in 4- to 7-y olds; household income in 12- to 16-y olds; and both household income and primary caregiver's education in 8- to 11-y olds. Moreover, this study found an inverse association between diet quality score and a validated measure of food insecurity, which suggests that food insecurity negatively affects Australian children's general diet quality (2011).

2.5.3 The Canadian Healthy Eating Index

The HEI was first developed in the US by Kennedy and colleagues (1995) and includes 10 components (with each receiving a maximum of 10 points) for a possible high score of 100. Five components are based on food groups (grains, vegetables, fruits, milk and meats), and four

components are based on dietary nutrient guidelines (total fat, saturated fat, cholesterol, and sodium). There is also a component for the variety of an individual's diet. All of the components have guidelines for a perfect score of 10 and a minimum score of 0, which correspond to the USDA Food Guide Pyramid's recommendations. A score of 100 represents that an individual is meeting his/her recommendations perfectly, whereas a total score less than or equal to 50 signifies a "poor" diet, a total score between 51 and 80 is deemed to be in the "needs improvement" category and a total score above 80 is considered a "good diet" (Kennedy et al, 1995).

The HEI was later modified by Glanville & McIntyre (2006) to better fit with its use in a Canadian context (now titled HEI-C). The modification was done as part of a study examining the diet quality of Atlantic families headed by single mothers. This study was part of a larger study on food insecurity and dietary adequacy of low-income lone mothers and their children in Atlantic Canada (McIntyre & Glanville, 2002). Weekly 24-h recalls were administered for one month to all family members by trained dietitians. The HEI was modified to correspond to the serving recommendations in Canada's Food Guide to Healthy Eating [CFGHE] (grain products, fruits/vegetables, milk and milk products, meat and alternatives), and the Nutrition Recommendations for Canadians (total fat, saturated fat, cholesterol) (Health and Welfare Canada, 1990). Two other changes were incorporated into the original HEI. Firstly, the variety score was based on servings from food groups rather than the number of different foods consumed, as described and validated by Dubois and colleagues (2000). Secondly, servings from "other foods" were substituted for the sodium category in the original HEI. Inclusion of sodium in the HEI is based merely on sodium found in food, and does not have a measure for use of table salt.

Consequently, this category does not measure total sodium intake. In the CFGHE, "other foods" are foods that are mostly fat; foods that are mostly sugar; high fat and/or high salt snack foods; beverages such as tea, coffee, soft drinks, and condiments such as pickles and ketchup. Since the research was done on low-income mothers and children, consideration of empty calories was an important dimension of diet quality analysis. Final HEI-C scores are rated as poor diet (total score <50), diet needs improvement (51-80) or good diet (>80). Their results show that diet quality of low-income lone mothers was poor (35.5%) or in need of improvement (64.5%), with no mother having a good diet (Glanville & McIntyre, 2006). The diet quality of children differed by age, with 22.7% of children aged 1 to 3 years having a good diet or needing improvement (74.6%), 2.1% of children aged 4 to 8 years and no child aged 9 to 14 years having a good diet, whereas the diets of about 85% of older children in both age categories needed improvement (2006).

In 2009, the HEI-C was adapted by Woodruff and Hanning (2009) to reflect the serving amounts recommended by EWCFG (Health Canada, 2007) as well as the DRIs (Hellwig et al., 2006). It consists of the same nine components as the HEI-C: the number of portions of grain products, fruit and vegetables, milk products, meat products and "other" foods; intake of total fat, saturated fat and cholesterol; and variety. The intakes of foods and nutrients are represented on a categorical density basis for milk, meat and "other" food groups (as amounts/<1600 kcal, amounts/1600-2200 kcal or amounts/>2200 kcal); for the other components, the recommendation is absolute and does not take into account the total energy (kcal/d). All components have a minimum score of 0 and a maximum score of 10, with the exception of the vegetables/fruit category, which has a maximum score of 20 points. Woodruff and Hanning (2009) termed their index the HEIC-2009, to reflect the changes that were made in 2009 from the HEI-C. Total HEI-

C-2009 score ranges from 0–100 points. The higher the score, the more the diet complies with EWCFG and DRI guidelines.

A few recent Canadian studies have used the HEI-C or the HEIC-2009 to evaluate diet quality. For instance, in a pilot study by Asaad and Chan (2012), scores on the *Canadian Healthy Eating Index* [HEI-C] were used to assess diet quality related to food security status of low-income elders with type 2 diabetes mellitus in Edmonton, Canada. However, there was no significant difference in mean HEI-C score between food secure and severely food insecure participants, although this could have been due to the very small sample size ($n=17$), which lead to a lack of power (2012). Furthermore, a cross-sectional study by Wang and colleagues (2015) examined the associations between added sugar intakes (solid vs. liquid), HEIC-2009 score and adiposity indicators in 613 Canadian children aged 8 to 10 years participating in the Quebec Adipose and Lifestyle Investigation in Youth (QUALITY) study. Associations were examined in linear regression models adjusting for age, sex, energy intake, and physical activity. Added sugar consisted of 12% of total energy intake (204 kcal) on average, of which 78% was from solid foods. It was found that a higher consumption of added sugars from either solid or liquid source was linked with higher total energy, lower intake of micronutrients, vegetables and fruit, and lower HEIC-2009 score (Wang et al., 2015). Additionally, each additional 10 g of added sugars consumed from liquid food sources was associated with a 0.4 serving/day decrease of vegetables and fruit, a 0.4 kg/m² increase in BMI, a 0.5 kg increase in fat mass, and a 0.9 cm increase in waist circumference.

As an indicator of the quality of the overall diet, the HEIC-2009 is advantageous for analyses concerned with population health, since it takes into account the complexity of the diet

(Dubois et al., 2000). Furthermore, the HEIC-2009 has been adapted with the latest EWCFG recommendations and is thus ideal for analyses involving Canadian youth. However, when the HEIC-2009 was adapted with the latest dietary guidelines, it was only adapted and tested with children aged 9 to 13 years, and still needs to be adjusted for younger children and older adolescents of other age groups.

3. RATIONALE, OBJECTIVES AND HYPOTHESES

Food insecurity can manifest in various ways, but at its heart, is the experience of not having the financial means required to ensure that a household's food requirements are met. Indications can include compromised mental health, including stress and anxiety, compromises in the quality and/or quantity of foods consumed, and hunger (Mark et al., 2012; Tarasuk, 2001b). It has been shown that food insecurity is associated with a greater likelihood of compromised nutritional intakes and a greater incidence of chronic disease (Tarasuk, 2004). A low socioeconomic status is linked with a higher chance of being food insecure and, by the same token, recent immigrants have higher rates of low income and food insecurity than the Canadian-born population (Health Canada, 2012).

However, there exists a gap in the literature examining the link between food insecurity and nutritional health of immigrants, much less Sub-Saharan African and Caribbean immigrants (Désilets, Rivard, Shatenstein and Delisle, 2006), even though blacks are the third largest socio-cultural group in Canada (Caron Malenfant et al., 2010) and are at high risk of obesity (McDonald & Kennedy, 2005) and type 2 diabetes (Adhikari & Sanou, 2012). Furthermore, the effect of double minority (visible and linguistic minority), which have not yet been studied in this

population, could be combined (Quell, 2008) and result in a population that is even more at risk of chronic disease. It is especially important to study the association between food insecurity, diet quality and weight status among children as food insecurity can negatively impact their health throughout life (Jyoti, Frongillo & Jones, 2005; Ramsey et al., 2011), increasing health disparities. To our knowledge, no study has evaluated the associations among food insecurity and diet quality in immigrant school-aged children living in Canada, or the effects of linguistic minority and years since immigration on these variables.

The aim of this present research study is to evaluate the prevalence and determinants of food insecurity and its association with diet quality and weight status in African and Caribbean school aged children in Ottawa. The specific and operational objectives linked to the research hypotheses are enumerated in **Table 3.1**.

Table 3.1: Specific and operational objectives

Hypotheses	Specific objectives	Operational objectives
1) Immigrants, especially recent immigrants of African and Caribbean descent, have higher rates of food insecurity compared to Canadian born population	To assess the relationship between food security level and immigration status	i. To determine the score on both the Child Food Security Scale and the Adult Food Security Scale
		ii. To determine the prevalence of food insecurity in participating households
		iii. To assess the relationship between household food insecurity and immigration status and the number of years since the mother's immigration
2) The diet quality of school-aged children is poor.		iv. To determine the HEIC-2009 score of school-aged children

	To describe the diet quality of school-aged children	v. To determine the prevalence of poor diet quality using the HEIC-2009 scores among children
3) Food insecurity is associated with demographic and socioeconomic characteristics of households.	To identify sociodemographic determinants of food insecurity of households	vi. To assess relationships between selected socio-demographic factors and household food security status
4) Children living in food insecure households have a poorer diet quality measured by the Healthy Eating Index.	To assess the relationship between food insecurity, diet quality and weight status of children and their mothers	vii. To assess the relationship between household food insecurity and children's HEIC-2009 score
5) Children living in food insecure households have higher rates of overweight and obesity.		viii. To assess the relationship between household food insecurity and the prevalence of overweight and obesity in children
6) Mothers living in food insecure households have higher rates of overweight and obesity.		ix. To assess the relationship between household food insecurity and the prevalence of overweight and obesity in mothers

BMI: body mass index; mHEIC-2009: modified Canadian Healthy Eating Index

4. METHODOLOGY

This chapter describes the general methodology of the project. The study population and sampling method, inclusion and exclusion criteria, data collection methods and tools and statistical analyses performed are thoroughly explained.

4.1 Study population and sampling method

This Master's project, which was done using a cross-sectional descriptive correlational method, is part of a larger research project evaluating the links between acculturation, nutritional health and obesity risk factors in black immigrant children in Ottawa. The study population is comprised of school-aged children of Canadian, Sub-Saharan African and Caribbean descent and their mothers living in Canada. School-aged children were chosen as they have the ability to answer a 24h dietary recall with minimal help. The decision to include mothers (instead of fathers or another caregiver) is based on studies indicating that mothers' feeding practices (Birch & Fisherm, 2000; Lee et al., 2001; Spruijt-Metz et al., 2002) and food intake (Gibson et al., 1998) influence the child's food intake. The study sample includes 190 black mothers and their children between the ages of 6 and 12 years of Sub-Saharan African and Caribbean descent living in the Ontario part of the National Capital region. Another 68 children and their Canadian-born mothers (regardless of the child's place of birth) have been recruited to enrich comparisons between groups. In total, there are 258 child-mother pairs. GPower (Version 3: Faul, Erdfelder, Lang, & Buchner, 2007) was used to calculate sample size with power a power of 80% and α of 5%, a binominal, two-tailed distribution, which estimated a sample size of 190 participants. Another sample size

calculation was done with a power of 95% and an α of 5%, and an estimated sample size of 312 participants is required. Based on similar studies, we have estimated that the sample size is sufficiently large to detect a significant difference between groups with a small to medium effect size (Desilets et al., 2007). The choice of the Ottawa region is based on the strong and growing proportion of its immigrant population, the linguistic profile of the latter and, especially, on the partnership links already established between community organizations and the research team.

Participants have been recruited using the snow-ball sampling method, which involves the enrollment of available volunteers as they enter the study and referred other participants until the desired sample size is reached (DePoy & Gitlin, 2013). Recruitment of participants has been done with the help of agencies and organizations that provide services to immigrants (community organizations, ethno-cultural associations, community radio stations and churches). Some of our community partners include the African Diaspora Association of Canada, the Economic and Social Council of Ottawa-Carleton, the *Réseau de soutien à l'immigration francophone de l'Est de l'Ontario*, the South-East Ottawa Community Health Centre, the Lowertown Community Resource Centre and the Rideau-Rockcliffe Community Resource Centre, among others.

Although not random, the convenience sampling method is nevertheless likely to identify more of the people we want to contact (DePoy & Gitlin, 2013). However, there will be a selection bias as the study has been carried out on volunteers, who may have some different characteristics than that of the study population. For instance, they may perhaps have a greater interest in research resulting from a higher education level, or be in a greater financial need and seek to participate in order to receive a gift card. Therefore, the sample is not entirely representative of the study population.

4.2 Inclusion and exclusion criteria:

Inclusion criteria include being a black woman born in Sub-Saharan Africa or in the Caribbean or a woman born in Canada (regardless of ethnicity), understanding English or French enough to carry a conversation, having a child aged 6-12 y (regardless of place of birth) and living in the Ottawa area (Ontario side). Households where children have medical conditions or allergies that might significantly affect their dietary intake (e.g. Cystic fibrosis) have been excluded from the study. Also, households where the father was the respondent (three in total) were excluded based on a recent study showing that women respondents reported higher household food insecurity than did men in similar Canadian households (Matheson & McIntyre, 2013). Furthermore, one household where the respondent was the adoptive mother of the child was excluded.

4.3 Data collection methods

This cross-sectional survey study began in January 2014 and was completed in April 2015. Data was collected during an individual, face-to-face interview of an approximate duration of 90 minutes with each mother and her child. The questionnaire was administered either in English or French, according to the mother's preference, and was pre-tested before the beginning of the interviews with three black immigrant mothers from Africa and one Canadian mother to ensure comprehension and cultural pertinence of questions. The interviews were conducted by two student dietitians and with the help of research assistants. The dietitians were in charge of gathering data from the mothers using a 24-hour dietary recall and the general questionnaire, including the

HFSSM. Sections of the questionnaire that are pertinent to this thesis are presented in **Appendix E** and **Appendix F**.

Demographic data was collected for the mother (age, marital status, education level, household income, employment status, arrival date to Canada, immigration class², presence of chronic diseases, etc.) and child (age, sex, education level, etc.). The mother and child's height and weight was measured twice, according to WHO recommendations, to ensure the measures are reliable (WHO, 2013). Questions were asked on knowledge of official and unofficial languages, languages spoken at home, the parents' and the child's mother tongue, the child's language of instruction and the preferred contact language of the mother and child, and the variable "first official language" was derived for parents and children (Statistics Canada, 2013b). The derivation first considers the knowledge of the two official languages, second the mother tongue, and third the home language. For example, participants who reported that they can conduct a conversation in French only were assigned "French" as their first official language spoken. For people who reported speaking both English and French well enough to conduct a conversation, responses to questions on mother tongue and home language were subsequently used to establish the first official language spoken (2013).

Particular attention was given to the difficulties that may arise during multicultural interviews. For example, a simple level of language was used in the development of the questionnaires and during the interviews to limit the impact of differences in language.

² Immigrants were grouped in one of the following 3 categories: 1) Economical immigrant (must show proof of funds before migrating to Canada unless they have a valid offer of arranged employment in Canada AND are currently working or authorized to work in Canada; 2) Family class immigrants (those sponsored by a family member living in Canada); and 3) Refugees (including asylum seekers) (Immigration Canada, 2016).

Interviewers also paid attention to participants' social norms and values in order to make the interviews culturally acceptable to them.

4.3.1 Household Food Security Survey Module (HFSSM)

The HFSSM was employed to measure the household's food security status and score (Health Canada, 2007). This questionnaire consists of 18 questions (10 for the adult and 8 for the child) covering a wide range of severity of food insecurity, ranging from worrying about running out of food to the child not eating for a whole day. Every question indicates a lack of money or other funds to obtain food as the basis for the condition or behavior. Thus, the measures were not affected by hunger resulting from voluntary dieting or fasting. All questions were in reference to the preceding 12 months; therefore, the measures mirrored the most severely food insecure circumstance the household faced throughout the year prior to the survey.

4.3.2 24-hour dietary recall

Children's dietary intake was evaluated with the use of a 24-hour recall (for 1 day) carried out with a standardized protocol (Health Canada, 2006). In addition, this 24-hour recall included questions about the type and frequency of vitamin and mineral supplementation and details about salt used in cooking and at the table. The questionnaire was done with the help of the child's mother as it has been shown that school-aged children are able to report what they have eaten with some help (Reynolds et al. 1990). The recalls were done using food portion size models to better estimate the amount of food consumed (2006). It also allowed an estimation of the number of

servings consumed from each food group and total fat, saturated fat and cholesterol intake, which were used to generate a HEI-C score (Woodruff & Hanning, 2009).

4.4 Data analysis methods

4.4.1 Food security status

The food security status of the household was determined according to Health Canada's method of determining the food security status of households in the last CCHS (2007). Responses to the 10 adult questions and the 8 child questions were combined into two divided scales (Adult Food Security Scale and Child Food Security Scale, respectively). The number of food insecure conditions reported - that is, the number of questions in the HFSSM answered affirmatively by the respondent on behalf of the household in each of the scales - determined the food security status at the adult and child level. Depending on the question, a response was considered affirmative if the participant indicated "yes"; "often" or "sometimes"; or "almost every month" or "some months but not every month". Once the adult and child food security status was determined, the food security status of the household was determined using both the adult and child scales. If both adults and children in the household were food secure, the household was considered food secure. If either adults or children, or both adults and children, in the household were marginally food insecure, and neither were moderately or severely food insecure, the household was considered marginally food insecure. If either adults or children, or both adults and children, in the household were moderately food insecure, and neither were severely food insecure, the household was considered moderately food insecure. If either adults or children in the household were severely food insecure, the household was considered severely food insecure (see **Table 2.1** for more details about household food security status classification). There was one change made to Health

Canada's classification of food insecurity status in this thesis, specifically to the classification of marginally food insecure households. Marginal food insecurity is not a category used in Health Canada's publications on this module. Based on their classification system, households with a single response are considered food secure. In this thesis, the marginal category was included since a growing body of literature is indicating that households reporting at least some level of insecurity over their access to food are more vulnerable than those who have affirmed no items on the 18-item questionnaire (Coleman-Jensen, 2010). For statistical analyses, households were categorized in one of the following two groups: 1) food secure; and 2) food insecure.

4.4.2 Canadian Healthy Eating Index score

The 24-hour dietary recalls were compiled and nutrient intakes were calculated using nutritional values available in the Canadian Nutrient File [CNF] (Health Canada, 2012) and using the food analysis software ESHA Food Processor SQL version 14 (ESHA Research). When necessary, research was carried out in other databases to find the nutritional values of ethnic foods that are not in the CNF (e.g. United States Department of Agriculture). Additional information was also sought from food manufacturers if required. One dietetic intern initially analyzed the 24-hour recalls and their analysis was subsequently validated by a registered dietitian. The data was entered a second time by a second registered dietitian and was validated by another registered dietitian. The latter made sure that no differences were observed between data entries. When differences were noticed, errors were corrected.

Afterwards, a HEI-C diet quality score was calculated based on each 24-hour dietary recall and dietary analysis generated with ESHA Food Processor. The HEI-C is a dietary quality index and consists of 9 components, which represent all the major guidelines from *Eating Well with Canada's Food Guide* [EWCFG]. It includes the number of portions of grain products, fruit and vegetables, milk products, meat products and “other” foods (all foods that do not fit into the other four categories, namely foods that are mostly fat and/or sugar; high fat and/or high salt snack foods; beverages such as tea, coffee, soft drinks, and condiments such as pickles and ketchup); intake of total fat, saturated fat and cholesterol; and variety. Since the HEI-C-2009 was designed for children aged 9-13 y, a separate scoring method was developed and used for children aged 6-8 y based on the recommended number of food guide servings per day and the Estimated Energy Requirements [EER] for this age group to determine mHEI-C-2009 scores (Health Canada, 2007). The intakes of foods and nutrients are represented on a categorical density basis for milk, meat and “other” food groups (as amounts/<1400 kcal, amounts/1400-1850 kcal or amounts/>1850 kcal for children aged 6-8 y, and as amounts/<1600 kcal, amounts/1600-2200 kcal or amounts/>2200 kcal for children aged 9-12 y). Those energy cut-offs reflect the mean EER for boys and girls of each age group (6 to 8 y and 9-12 y; Health Canada, 2007). For the other components, the recommendation is absolute and does not take into account the total energy (kcal/d). A minimum score of zero for no intake and a maximum score of both 10 for grain products, milk and meat; and 20 for fruit and vegetables is assigned for healthy components. For the “other” food group and intake of total fat, saturated fat and cholesterol, higher scores are assigned for lower intakes. For children aged 6-8 y, a score of 10 is assigned to “other” foods for intakes of less than 4, 5, or 6 portions per <1400, 1400-1850 and >1850 kcal/d, respectively. For children aged 9-12 y, a score

of 10 is assigned to “other” foods for intakes of less than 4, 6, or 8 portions per <1600, 1600-2200 and >2200 kcal/d, respectively. Total fat, saturated fat and cholesterol receive a score of 10 for intake levels that reflect the Dietary Reference Intakes [DRI] of 25-35% of energy intake from fat, <10% of energy intake from saturated fat and <300mg of cholesterol, respectively (Health Canada, 2010). A maximum variety score of 10 is assigned if at least 1 serving from each food group was consumed. For all categories, individuals with servings between the minimum and maximum cut-offs are given a proportional score. Total mHEIC-2009 score ranges from 0–100 points **Table 6.1** for complete mHEIC-2009 scoring method). The higher the score, the more the diet complies with EWCFG and DRIs guidelines.

The HEIC-2009 was chosen as the diet quality index for this study as it is a validated, Canadian tool used in other populations in Canada and its use would facilitate comparisons with other studies.

4.5 Statistical analysis:

Data was entered and statistical analyses were performed using SPSS Statistics 23. The quality of the data was ensured by double data entry and relevant data were also screened before performing any analyses. For each variable of interest, input errors were corrected, and outliers whose values exceeded 3 standard deviations were eliminated. Categorical variables with a choice of answer "other" or “N/A” and a provided precision were recoded. For certain categorical variables, categories with very low frequencies were grouped to not violate assumptions of the Chi-Square analysis (for this reason, categories in the descriptive statistics tables and inferential

statistics tables may differ slightly). **Table 4.1** summarizes the statistical analysis based on the objectives of the study.

Table 4.1: Statistical analysis plan according to study objectives

Specific objectives	Operational objectives	Statistical analyses
To assess the relationship between food security level and immigration status	i. To determine the score on both the Child Food Security Scale and the Adult Food Security Scale	Mean $\pm$ SD
	ii. To determine the prevalence of food insecurity in participating households	Frequencies
	iii. To assess the relationship between household food insecurity and immigration status and the number of years since the mother's immigration	Pearson's Chi-Square statistics
To describe the diet quality of school-aged children	iv. To determine the HEIC-2009 score of school-aged children	Mean $\pm$ SD
	v. To determine the prevalence of poor diet quality using the HEIC-2009 scores among children	Frequencies
To identify sociodemographic determinants of food insecurity of households	vi. To assess relationships between selected socio-demographic factors and household food security status	Logistic regressions
To assess the relationship between food insecurity, diet quality and weight status of children and their mothers	vii. To assess the relationship between household food insecurity and children's HEIC-2009 score	Linear and logistic regressions
	viii. To assess the relationship between household food insecurity and the prevalence of overweight and obesity in children	Pearson's Chi-Square statistics and linear regressions

	ix. To assess the relationship between household food insecurity and the prevalence of overweight and obesity in mothers	Pearson's Chi-Square statistics and linear regressions
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4.5.1 Descriptive statistics

Continuous and discrete variables were described with means and standard deviations. Categorical variables were described with frequencies and percentages.

4.5.2 Pearson's Chi-Square statistic

For categorical variables, Pearson's Chi-Square analyses were performed to evaluate the bivariate relationship between household and respondent characteristics and food security status, as well as the relationship between household food security status and the prevalence of overweight and obesity in children and mothers. When these analyses were statistically significant, z-tests were performed to identify which groups differed significantly. A significance level of $p < 0.05$ was used for these analyses. This analysis has been used by other researchers in the field of food security in Canada (Matheson & McIntyre, 2013) and elsewhere (O'Connell et al., 2008; Young et al. 2014) and has been chosen to allow data comparison.

4.5.3 Logistic regression analyses

To assess relationships between selected socio-demographic factors and the household food security status, as well as the relationship between food insecurity and diet quality scores, logistic regressions were done. In the first study analysis, food security status was treated as a binary dependent variable (food secure or food insecure). In the second study analysis, dietary characteristics were treated as binary dependent variables. A total of 12 logistic models were

performed with the following binary dependent variables, all coded as yes or no: mHEIC-2009 score poor/needs improvement, energy from carbohydrates <45% or >65%, energy from protein <10% or >30%, energy from fat <25% or >35%, energy from saturated fat >10%, consumed high sugar drinks, sodium intake >UL, did not meet recommendations for grain products, did not meet recommendations for vegetables and fruit, did not meet recommendations for milk and alternatives, did not meet recommendations for meat and alternatives, consumed >30% of energy from other foods.

None of the independent variables were transformed for these analyses as there is no assumption of normality of independent variables for logistic regressions (Tabachnick & Fidell, 2007). In the case of the number of children in the household, four univariate outliers with values over 3 standard deviations above the mean were identified. To avoid the influence of these outliers, the number of children in the household was categorized as: 1-3 and 4 or more. Furthermore, a few cases were identified in the output as having standardized residuals over 2.5. However, they had a Cook's distance < 1 (Cook's distance ranged between 0.00083 and 0.284), and thus were included in the analysis since their effect on the model was not exaggerated (Tabachnick & Fidell, 2007).

Variables including three or more categories were included in the model in a series of binary variables (Cohen et al., 2013). The number of binary variables created for a given variable was equivalent to the number of categories minus 1. For example, the variable "residential status" had 3 categories: 1) home ownership, 2) regular rental, and 3) subsidized/temporary/COOP housing. The number of binary variables created for this variable was two. **Table 4.2** illustrates the coding process of these three variables:

TABLE 4.2: CODING EXAMPLE OF BINARY VARIABLES

Residential status	Binary variables	
	D1	D2
Home ownership	0	0
Regular rental	1	0
Subsidized/temporary/COOP housing	0	1

For the first binary variable (D1), a value of 1 was attributed to respondents who reported paying regular rental while a value of 0 was attributed to all other respondents. This same dichotomous coding was applied to D2: the value of 1 was given to respondents who reside in subsidized/temporary/COOP housing in the case of D2. For these two binary variables, 0 was attributed to respondents who reported owning their home. In the regression model, this category (home ownership) served as a reference group to which the results were compared. For example, if living in subsidized housing made a unique statistically significant contribution to the model, this meant that the odds of being food insecure were significantly different between those who lived in subsidized housing and those who owned their home.

Independent variables were included in the model if there was proof *a priori* that they could be determinants of household food security status or if their inclusion in the model made an improvement to the latter. Precisely, this proof may come from the literature (as discussed in the literature review in Chapter 2) or from the results of bivariate statistics performed in this research study (results for Pearson's Chi-Square statistics are discussed in Chapter 5). Many models have been explored but only two models are presented in the first study analysis (Chapter 5). The predictors included in the full models are: mother's ethnic group (visible minority versus

white/aboriginal), maternal age (treated as a continuous variable), marital status (married/common law relationship versus lone motherhood), number of children in the household (1-3 versus 4 or more), mother's highest education level attained (high school diploma or less versus post-secondary diploma), household received social assistance in the past 12 months (yes versus no), and residential status (home ownership or regular rental versus subsidized/temporary/COOP housing). In the second study analysis (Chapter 6), food insecurity was included as a dichotomous independent variable (food secure versus insecure). Confounding factors included the child's age and sex (boy *versus* girl).

To avoid multicollinearity *a priori*, certain combinations of variables were not included together in the model due to a conceptual overlap. These variables were: having a driver's license and having had access to a vehicle in the past seven days, and household size and the number of children in the household. The scores obtained on the Child Food Security Scale and the Adult Food Security Scale were not included as independent variables in the models as they are used to determine the household's food security status, and are thus a proxy measure of the latter. The absence of multicollinearity between the independent variables of the performed models was evaluated with the variance inflation factor test, of which all values were below 10. Values lower than 10 indicate a probable absence of multicollinearity (Pallant, 2013).

4.5.4 Multivariate linear regression analyses

To assess relationships between food security status, the score on the mHEIC-2009, and weight status, multiple linear regressions were done. The mHEIC-2009 scores, the mother's BMI and child's BMI-for-age z-score were treated as continuous dependent variables.

Prior to conducting analyses, all variables were examined for normality using the eye inspection test. All three variables were normally distributed and no outliers were detected.

Independent variables were included in the model if there was proof *a priori* that they could be determinants of diet quality and/or weight status or if their inclusion in the model made an improvement to the latter. Precisely, this proof may come from the literature (as discussed in **literature review**) or from the results of bivariate statistics performed in this research study (results for Pearson's Chi-Square statistics are discussed in Chapters 5 and 6). For each model, pertinent dichotomous independent variables with a distribution of 90:10 were excluded from the analysis (Tabachnick & Fidell, 2007). The number of independent variables per model was limited to n=15 participants per independent variable, as recommended for social science studies (Tabachnick & Fidell, 2007). Many models were explored but only the most relevant three models are presented in this Master's thesis. Food insecurity was included as a dichotomous independent variable (food secure versus insecure). Confounding factors included the child's age and sex (boy *versus* girl).

To avoid multicollinearity *a priori*, certain combinations of variables were not included together in the model due to a conceptual overlap. These variables were: receipt of social assistance and household food security status. The scores obtained on the Child Food Security Scale and the Adult Food Security Scale were not included as independent variables in the models as they are used to determine the household's food security status, and are thus a proxy measure of the latter. The absence of multicollinearity between the independent variables of the performed models was evaluated with the variance inflation factor test, of which all values were below 10. Values lower than 10 indicate a probable absence of multicollinearity (Pallant, 2013). Residual plot analyses between the predicted depended variable score and its actual value were also done for each model to ensure conditions of normality, linearity and homoscedasticity were met (Pallant, 2010; Tabachnick et Fidell, 2007). The significance level for all analyses was set at $p < 0.05$.

4.6 Ethical considerations and ethics approval

All procedures have been approved by the University of Ottawa's Office of Research Ethics and Integrity (H08-13-17). The approval letter is found in **Appendix G**.

5. Prevalence and determinants of food insecurity in African and Caribbean households in Ottawa

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ABSTRACT

Purpose: Food insecurity is an important social determinant of health and is linked with higher health care costs. There is a high prevalence of food insecurity among recent immigrant households in Canada. The aim of the present project was to evaluate the prevalence of food insecurity in immigrant and non-immigrant households in Ottawa, and to explore determinants of food insecurity in that population.

Design/methodology/approach: A cross-sectional study was conducted with a convenience sample of 259 Ottawa households having a child between 6 and 12 years old, with a mother born in Sub-Saharan Africa, the Caribbean or Canada. Health Canada's Household Food Security Survey Module was used to evaluate participants' food access in the past 12 months. Chi-square and logistic regression analyses were used to determine correlates of food insecurity (n=249).

Findings: A high rate of food insecurity (39%) was found among participants. Household food insecurity was associated with low education attainment, lone motherhood, mother's visible minority status, recent arrival to Canada, limited English fluency, reliance on social assistance, and subsidized/temporary/COOP housing.

Originality/Value: These findings highlight the need for food insecurity to be explicitly addressed in immigrant integration strategies in order to improve the financial power of new immigrants to purchase sufficient, nutritious, and culturally acceptable foods. Enhancing immigrants' access to affordable child care and well-paid jobs, improving social assistance programs, and providing more subsidized housing programs would be beneficial.

Keywords *Food security, Immigrant, Socioeconomic status, Canada*

Paper type *Research paper*

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5.1 INTRODUCTION

In 1974, the United Nations stated that ‘every man, woman and child has the inalienable right to be free from hunger and malnutrition in order to develop fully and maintain their physical and mental faculties’ (Office of the United Nations High Commissioner for Human Rights 1974). Food security (FS), which is an integral part of this basic right to food, exists when ‘all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life’ (FAO 1996). Food insecurity (FI) happens when at least one of the conditions for food security is not met. FI is understood as a dynamic process which can range in severity from uncertainty concerning food supplies to compromises in the quantity and quality of food consumed. Several studies have reported that food insecure households are at risk of having monotonous and low quality diets, reduced micronutrient intake, iron-deficiency anemia, and low intake of fruits, vegetables and dairy products, particularly among women and children (Eicher-Miller *et al.*, 2009; Kirkpatrick & Tarasuk, 2008; Mark *et al.*, 2012; Pirkle *et al.*, 2014). A restricted budget, leading to the procurement of cheaper and more energy-dense foods, has been emphasized as a contributing factor to excessive energy intake and weight gain (Dubois *et al.* 2011; Kirk *et al.* 2013; Delisle & Batal 2016). Likewise, other studies report a positive association between FI and poor diet and health among Canadian immigrants (Girard & Sercia, 2013; Weigel *et al.*, 2007). It can also have a negative effect on self-worth when there is a need to obtain foods in less socially acceptable ways, such as through food banks (Tarasuk, 2001). FI is increasingly being recognized as a serious public health problem in high-income countries because it has been linked with higher rates of self-reported poor health and chronic health conditions, including depression, type 2 diabetes, and heart disease (Kirk *et al.*,

2013; Muldoon *et al.*, 2013; Parker *et al.*, 2010; Seligman *et al.*, 2007; Siefert *et al.*, 2004; Vozoris & Tarasuk, 2003). FI has also been associated with higher health care utilization and costs among Ontario (Canada) adults (Tarasuk *et al.*, 2015).

In 2011, almost 1.1 million Canadian households, comprising roughly 2.7 million adults and more than 1.15 million children under the age of 18, were food insecure (Health Canada 2012). In other words, 17% of children under the age of 18 years, or about one in six, resided in households that experienced FI in 2010-2011. Household characteristics associated with a higher likelihood of FI included being reliant on social assistance, lone motherhood, having an income below the Low Income Measure, renting rather than owning one's home, being Aboriginal and being Black (Health Canada 2012). Further, rates of FI were higher among very recent immigrants (≤ 5 years) compared to long-term immigrants (≥ 10 years) and the Canadian-born population (Health Canada 2012).

In 2011, there were 204,445 immigrants living in Ottawa (22.6% of the total population), and these numbers are expected to increase in the next two decades (Statistics Canada, 2010). The scale of demographic development of immigrant populations in Ottawa, which is comprised of a high proportion of Black immigrants (24.2% of the total visible minority population; Statistics Canada, 2013), as well as their socioeconomic and linguistic profile, means that there is a need for data on their FS situation in order to improve our understanding of the factors that may influence their

vulnerability to FI and, consequently, to a poorer health status. This research project was designed to help address this need.

5.2 PURPOSE

The aim of the present project was to evaluate the prevalence of FI in immigrant and non-immigrant households in Ottawa, and to explore determinants of FI in that population. We hypothesized that rates of FI would be higher among households where the mother was born in either Sub-Saharan Africa or the Caribbean compared to those where the mother was Canadian-born. We also hypothesized that rates of FI would be higher among households where the mother was classified as having a visible minority status, had poor knowledge of the English language and was a refugee (landed refugee or asylum seeker).

5.3 METHODS

5.3.1 Study population and sampling

This study is part of a larger research project evaluating determinants of nutritional health in Black immigrant children of Sub-Saharan African, Caribbean and Canadian decent. Inclusion criteria were being a Black woman born in Sub-Saharan Africa or in the Caribbean or a woman born in Canada (regardless of ethnicity), understanding English or French enough to carry a conversation, having a child aged 6-12 y (regardless of place of birth), and living in Ottawa. This convenience

sample included 259 mothers. Households where the father was the respondent (three in total) were excluded based on a recent study showing that women respondents report higher household FI than do men in similar Canadian households (Matheson & McIntyre 2014). Six other households were excluded due to missing data and one household did not meet the eligibility criteria, which left 249 households for the present analyses.

Participants received a CDN\$25 gift certificate for a grocery store of their choice to compensate for their time and cost associated with participation. Written parental consents and child assents were obtained from all 259 households. Ethics approval for the study was granted by the University of Ottawa's Office of Research Ethics and Integrity (H08-13-17).

5.3.2 Data collection

Data was collected from January 2014 to April 2015 during an individual, face-to-face interview with each mother. The questionnaire was pre-tested before the beginning of the interviews with a small sample of Black immigrant and Canadian-born volunteers to ensure comprehension and cultural relevance of questions. Interviews were conducted in English or French, according to the mother's preference, by a dietitian with the help of a research assistant, when possible.

Demographic data was collected for the mother (age, marital status, education level, household income, employment status, arrival date to Canada, presence of chronic diseases, etc.).

Interviewers also paid attention to participants' social norms and values in order to make the interviews culturally acceptable to them.

5.3.3 Measurement of Food security

The HFSSM was used to measure the income related household's FS status during the year prior to the survey (Health Canada 2007). This questionnaire consists of 18 questions (10 for the adult and 8 for children in the household) covering various levels of FI, ranging from worrying about running out of food to a least one child not eating for a whole day. These questions are not affected by hunger resulting from voluntary dieting or fasting and mirror the most severe food insecure circumstance faced by the household (Health Canada 2007). Responses to the adult and children questions were combined into two scales, an Adult Food Security Scale and a Child Food Security Scale. The number of food insecure conditions reported — that is, the number of questions in the HFSSM answered affirmatively by the respondent on behalf of the household for each of the scales — determined the FS status at the adult and child levels. Depending on the question, a response was considered affirmative if the participant indicated "yes"; "often"; "sometimes"; "almost every month" or "some months but not every month". **Table 5.1** explains the method by which household FS status was classified.

5.3.4 Statistical analyses

Data was entered in Excel and statistical analyses were performed using SPSS Statistics 23 (Armonk, NY, U.S). Frequencies, means and standard deviations (SD) were used to describe

sample characteristics. Pearson's Chi-Square analyses coupled with post hoc z-tests were performed to evaluate bivariate relationships between household and respondent characteristics, and FS status.

Two logistic regression models were performed with FS status as a binary dependent variable (food secure or food insecure) to identify socio-demographic determinants of household FS status. The first model looked at the impact of selected sociodemographic characteristics on household FS status. The second model explored the odds of being classified as FI in relation to residential status. Independent variables were considered for inclusion in the regression models if there was *a priori* evidence from the literature that they could be independent predictors of household FS status. Variables were included in the final models if the *p* value was less than 0.15 or if they were important confounding factors (based on the literature). These variables were: mother's ethnic group (visible minority *versus* white/aboriginal), maternal age (treated as a continuous variable), marital status (married/common law relationship *versus* lone motherhood), number of children in the household (1-3 *versus* 4 or more), mother's highest education level attained (high school diploma or less *versus* post-secondary diploma), household currently receiving social assistance (yes *versus* no), and residential status (home ownership or regular rental *versus* subsidized/temporary/COOP housing). Temporary housing includes shelter, reception house and hotel. Absence of multi-collinearity between independent variables was assessed using a variance inflation factor test and was found to be acceptable (values ranged from 1.07 – 1.25). Reliance on social assistance was used as a proxy of low-income. A significance level of $p < 0.05$ was used for all analyses.

5.4 RESULTS

5.4.1 Sample characteristics

Table 5.2 describes household and respondent characteristics in relation to FS status. The household size varied from 2 to 13 members with a mean size of 4.4 (SD 1.48). Almost one third (31.7%) of families were headed by a lone mother. Slightly more than 4 out of 5 mothers (80.3%) had completed post-secondary education at the time of the interview. Households where the mother had a visible minority status ($p=0.001$), could not carry a conversation in English ($p=0.002$), was not currently working ($p<0.001$), and did not have access to a vehicle in the 7 days prior to the interview ($p<0.001$) were significantly more likely to be food insecure. Further, lone-mother households ($p<0.001$), households with four children or more ($p=0.026$), and households residing in subsidized, COOP or temporary housing ($p<0.001$) reported significantly higher rates of FI. Among immigrants, households where the mother was a very recent immigrant (≤ 5 years) or a refugee (or asylum seeker) were significantly more likely to be food insecure ($p=0.004$ and $p=0.01$, respectively).

Table 5.3 describes the FS situation at the level of adults, children and households. Although the majority (61.0%) of households in our sample were food secure, over a third (39.0%) of them were food insecure. Marginal FI was apparent among 11.2% of families, while over one quarter experienced either moderate or severe FI (20.9% and 6.8%, respectively). A slightly higher proportion of adults were affected by moderate and severe FI compared with children (adults: 20.1% and 6.4%; children 16.1% and 2.4%, respectively, $p<0.01$, result of McNemar's test). A

higher proportion of households of immigrant mothers (31.8%) suffered from moderate or severe FI compared with households of Canadian-born mothers (16.8%) ($p=0.005$, data not shown).

5.4.2 Predictors of household food security

5.4.2.1 Sociodemographic characteristics

Table 5.4 presents the results of a logistic regression model exploring the impact of sociodemographic factors on the likelihood that respondents were living in food insecure households. Among household characteristics, lone motherhood and reliance on social assistance were positively associated with FI. Among mother characteristics, visible minority status and a lower level of education (high school diploma or less) were significant positive determinants of FI. The strongest predictor of being food insecure was reliance on social assistance (OR = 5.63, 95% CI = 2.38-13.34). These predictors accounted for 34.2% of the variation in household FS status (Nagelkerke $R^2=0.342$). The model correctly classified 73.5% of cases (a 12.5% increase from the constant-only model). A test of the final model against the constant-only showed that the model was statistically reliable, indicating these predictors as a set could reliably detect food secure and insecure households.

5.4.2.2 Housing type

Table 5.5 presents the results of a logistic regression model exploring the impact of residential status on the likelihood that respondents were categorized as food insecure. In the adjusted model (adjusted for the number of children in the household, mother's age and highest education level attained, and whether or not the household received social assistance), households residing in subsidized/COOP/temporary housing were 5 times more likely to be food insecure than those who owned their home (OR = 5.01, 95% CI = 2.31-10.86). The predictors accounted for 35.1% of the variation in household FS status (Nagelkerke $R^2=0.351$), and the model correctly classified 74.7% of cases (a 13.7% increase from the constant-only model).

5.5 DISCUSSION AND RECOMMENDATIONS

5.5.1 Rates of household food insecurity

The current study provides evidence suggesting that accessing sufficient, safe and nutritious food is an issue for a very high number Sub-Saharan African, Caribbean and Canadian households with school-aged children living in Ottawa. Indeed, rates of household FI were higher in this study population than in the Canadian population (39.1% *versus* 12.6%, respectively; Health Canada, 2012). Moreover, this sample was more likely to be moderately or severely food insecure than Canadian households (moderate: 20.9% and 6.0%, severely 7.0% and 2.6%, respectively). Furthermore, the FI prevalence among recent immigrant households in this study was much higher

than the rates of FI among recent Canadian immigrants as reported by Health Canada (this study: 60.7% and 22.4%; Canada: 43.9% and 19.6%, respectively).

5.5.2 Determinants of household food security

We found numerous correlates of FI: receipt of social assistance, residential status, lone motherhood, number of children in the household, mother's visible minority status, immigration category, length of stay in Canada, being able to have a conversation in English, access to a vehicle in the past week, education level and employment status. Our study corroborates previous findings suggesting that poor economic status and household reliance on social assistance increase the vulnerability to FI (Rainville & Brink, 2001; Tarasuk & Vogt, 2009; Tarasuk *et al.*, 2013; Vahabi *et al.*, 2011). As FI in Canada is characterized as income-related FI, higher rates are expected among low-income groups (Health Canada 2012). In fact, the rates of FI in the current sample (39.0%) were more comparable to lower-income Canadians (29.0%) than to the general population (12.3%) (Tarasuk *et al.*, 2013). Among Canadian immigrants, the rate of poverty (having an income below the low-income measure adjusted for family size) was 16.4%, almost twice the rate among the general Canadian population (8.8%; Health Canada, 2012). Similarly, in our sample, receipt of social assistance or living in a subsidized/temporary/COOP housing, which can be considered a proxy of low income, was much higher among households where the mother was an immigrant compared to those where the mother was Canadian-born (22.5% *versus* 7.5%, $p < 0.05$; data not shown).

In Canada, social assistance amounts vary across provinces and within provinces. Within provinces, the type and amount of assistance offered is determined by family size, available assets, and housing cost, as well as on the special conditions of individuals (Ministry of Community and Social services 2016). In the province of Ontario, the two social assistance programs are: (1) Ontario Works, which offers financial support to unemployed individuals as long as they participate in required job seeking activities; and (2) the Ontario Disability Support Program, which offers support to individuals judged unable to maintain full employment due to a medical condition (Ministry of Community and Social services 2016). In 2015, the average monthly income for a family of four in Ottawa on Ontario Works was CDN\$2,196. When taking into account rental cost (CDN\$1,373) and the cost of a healthy diet (CDN\$835, based on the 2015 Ottawa Nutritious Food Basket Survey Results; Ottawa Public Health, 2015), the family was short of \$12 a month without even taking into consideration all of their other fixed expenses, such as telephone, transportation, child care, school appliance, and other essential household and personal care items. This is not surprising since social assistance in Ontario is calculated to remain below the low-income measure (Tiessen 2016). In our sample, households receiving social assistance were more than five times more likely to be food insecure than those relying on other sources of income when adjusted for several confounders. These results are consistent with other reports which have found households reliant on social assistance to be much more vulnerable to FI (Food Banks Canada, 2015; Tarasuk, Mitchell, & Dachner, 2013). This highlights concerns over the sufficiency of income-based social assistance to ensure FS (Ottawa Public Health 2015).

Although FI is normally more prevalent among those who are less educated, this phenomenon may also be seen among highly educated and qualified immigrants when their professional skills and diplomas are not recognized limiting their ability to find a job (Girard & Sercia 2013). These migrants must either undergo additional training or accept work that does not fully utilize their abilities, a phenomenon termed “professional downgrading” (or more precisely dequalification of skilled migrants) (Arcand *et al.*, 2009; Labelle, 2011). Therefore, in many cases, particularly among professionals, immigration signifies a substantial drop in available income (Anderson *et al.* 2014; Patil *et al.* 2010; Hadley *et al.* 2007). Similarly, in our sample, about a quarter (24.5%) of households where the mother had a university degree were food insecure. However, in the general Canadian population, the rate of FI among households where at least one member had a university degree was only 6.3% (Tarasuk *et al.*, 2013). This is a clear indication that Black immigrants in our sample are underutilized, as it highlights their difficulties in finding well-paying jobs suitable work which corresponds to their abilities. In other words, even those who are employed, deskilling could further decrease their likelihood of having a well-paying job and increase their incidence of FI. This finding supports previous reports highlighting professional downgrading and underutilization of immigrants in the Canadian economy (Lindsay 2007). This reason could also explain why very recent immigrants were also at higher risk of FI. Indeed, a qualitative study by Creese and Wiebe (2012) found that most skilled and educated African immigrants in Vancouver were engaged in what they called “survival employment” by being forced to accept jobs below their credentials and their dignity instead of pursuing the fields in which they were trained (Creese & Wiebe 2012). Nevertheless, in our sample, the rate of FI among households where the mother had a high school diploma or less was almost three times higher than those where the mother had

a university degree (73.5% *versus* 24.5%, respectively), which corroborates other Canadian studies (Health Canada, 2012; Tarasuk *et al.*, 2013). In the adjusted logistic regression model, the mother's highest education level attained remained significant, even after controlling for many socioeconomic variables, highlighting the importance of this determinant of FS.

Length of stay in Canada was significantly associated with household FI, with very recent immigrants (≤ 5 years) having much higher rates of FI than established immigrants (>10 years). These results are quite surprising when examining immigration category by length of stay in Canada. Economic immigrants, who must show proof of funds before migrating to Canada unless they have a valid offer of arranged employment in Canada AND are currently working or authorized to work in Canada (Immigration Canada, 2016), comprised 49.2% of very recent immigrants in our sample and only 21.7% of established immigrants (data not shown). Refugees, on the other hand, accounted for 36.1% of very recent immigrants and 30.1% of established immigrants. Theoretically, we would hypothesize the following: the higher proportion of economic immigrants in the very recent group would contribute to lowering the incidence of FI. However, unemployment status was much higher among very recent immigrants (72.1%) compared with established immigrants (22.9%; data not shown), which could explain the reason why those in Canada for less than 5 years had higher rates of low-income and FI. Furthermore, economic immigrants' required funds are often not sufficient (CDN\$22,603 for a family of four; Citizenship and Immigration Canada, 2016), given the time needed to find employment. Many other studies documented a considerable wage gap between immigrant and non-immigrant Canadians that point to the disadvantages encountered by recent immigrants (Aydemir & Skuterud 2005; Chui &

Zietsma 2003; Frenette & Morissette 2005; Hiebert & Pendakur 2003; Li 2003; Picot & Hou 2003; Picot & Sweetman 2005). This issue is not only one of migration, but also of racialization; even after controlling for educational attainment, occupation and other factors, Caucasian (White) immigrants manage better than visible minority immigrants (Galabuzi 2006). Unfortunately, our results did not allow us to test this factor because we did not recruit White immigrants.

Limited English language proficiency (not being able to have a conversation in English) was a strong socio-demographic correlate of household FI. Language barriers not only confine immigrants' access to meaningful employment and well-paid jobs, but may also hamper their ability to access food related information. In our study, households where the mother could not carry a conversation in English had higher rates of FI than those where the mother could speak in English; the former group was also more than twice as likely to have an income below the low-income measure, adjusted for family size (85.7 vs 39.6%, respectively, $p < 0.001$, data not shown). Vahabi and colleagues (2011) found similar results in their study that took place in Toronto, an Anglophone city: respondents with poor English proficiency reported significantly higher rates of FI compared with those who rated their English as good or excellent (74 vs. 25%, respectively) (Vahabi et al. 2011). Moreover, in a study by Imbeault and colleagues (2013), Francophones in Canada had higher rates of unemployment (24.4% vs. 21.4%) compared to their Anglophone counterparts (Imbeault *et al.*, 2013). On the other hand, Gagnon-Arpin and colleague (2013) found that Francophones in Ontario were less educated but had a higher income than Anglophones (Gagnon-Arpin *et al.*, 2013). More research is needed to understand if language has an impact on FS by itself or if it is instrumental in securing employment and increasing income. We hypothesise

that providing access to jobs that do not require speaking English (for example, French speaking jobs) could improve the financial situation of immigrants in Ontario and, consequently, reduce their risk of FI. Furthermore, providing affordable and subsidized child care, flexible working hours and an adequate number of sick days, among others, may reduce employment barriers among low income families, especially those receiving social assistance.

Some household and respondent variables were statistically significant in our chi-square results but were not included in the logistic regression model due to a lack of model fit. These variables are: immigration category, length of stay in Canada, being able to have a conversation in English, access to a vehicle in the past week and employment status. In order to respect certain assumptions of logistic regression models (Tabachnick & Fidell 2006), the number of independent variables had to be limited, and only the most significant variables and important confounding factors according to the literature were included. Furthermore, the number of children in the household and the mother's age were included as important confounding factors, but did not remain significant after adjusting for other variables in the model (mother's ethnic group, marital status, education level and receipt of social assistance).

Type of dwelling was a strong predictor of FI in our sample. Families living in subsidized/temporary/COOP housing were five times more likely to be food insecure than those who owned their home. Households residing in rental housing were almost three (2.9) times more likely to report FI compared to home owners. These results are consistent with other Canadian studies (Che & Chen, 2001; Tarasuk & Vogt, 2009; Vozoris & Tarasuk, 2003). Vahabi and colleagues (2011), who explored the extent and correlates of FI among recent Latin Americans in

Toronto, found similar results: none of the respondents who owned their homes reported FI, compared with 59% of those who lived in rental housing and 100% of those who lived in shelters or with friends (Vahabi et al. 2011).

5.5.3 Study limitations

These findings should be interpreted in line with the limitations of the study. For instance, there is a possible selection bias as participants volunteered to participate in the study, so they may have had different characteristics than that of the wider study population (some may perhaps have been in a greater financial need and participated in order to receive the grocery gift card). Still, CND\$25 is not considered to be sufficient to put undue pressure on individuals to participate in research. Although not ideal, convenience sampling was necessary because no sampling frame was available for this hard-to-reach population. Consequently, and given the locality of the study sample, our results cannot be generalized to the broader Black population of Sub-Saharan African and Caribbean descent living in Canada. Moreover, although the instrument used to assess FS is validated and widely used, self-reported responses remain inherently subjective and may be prone to misestimating. As English and/or French fluency was limited for some of the participants, they might have misunderstood nuances between questions which can impact the validity of these results. Furthermore, participants who have experienced famine before their arrival to Canada may not have been classified as being food insecure due to the fact that they have experienced a much more severe state of food deprivation when compared to situations described in the HFSSM. Consequently, as they may have felt much more food secure at the time of the interview, they have

not answered affirmatively to any of the questions even though they have reported using food banks in the same time period. Also, the FS measure pertained to a 12-month period while a small number of immigrants had been settled in Canada for less than a year ($n=15$). Therefore, it was impossible to distinguish their experience in Canada from the one in their home country, making it difficult to evaluate relationships between variables. However, analyses were carried out excluding this subset of immigrants and our results did not differ significantly (data not shown). In addition, no causal inference can be made due to the study's cross-sectional design. Large scale prospective studies are needed to confirm the exact nature of associations reported in this study and to determine the strategies that Black immigrants utilize to cope with FI. Indeed, although not captured in this study, another barrier to FS could be cultural food preferences and the lack of fresh culturally-appropriate foods in the Canadian food environment. This phenomenon has been captured in a qualitative study by Vahabi and Damba (2013) examining barriers in accessing food among Latin-American immigrants in Toronto, Canada. Many participants reported that vegetables, fruits, and meats that were common in their home countries were often hard to find and costly in Canada (Vahabi & Damba 2013). Also, participants noted that only a few stores carried ethnic foods in their neighbourhood (Vahabi & Damba 2013).

Nevertheless, this study is consistent with the literature and brings about a unique contribution to the current body of knowledge in many respects. First, in the majority of large-scale studies, determinants of FI are studied in the general Canadian population, and are not examined among Black immigrants separately. However, this subset of immigrants may have different barriers to accessing food that are specific to their culture and/or their migratory experience. Second, the

importance of language barriers, which has not been studied specifically among Black immigrants in Ottawa, has been highlighted in this study, as we have shown that the ability to speak in English protected participants from FI.

5.6 CONCLUSION

Based on our study results and the literature, FI should be monitored in a systematic way in immigrant populations, and especially among Black immigrants, and be addressed in immigrants' integration policies (including assessment and recognition of prior education). Our study suggests an urgent need for intervention, in a timely manner for very recent immigrants in order to reduce the high prevalence of FI and prevent a deterioration of their health status. We also stress that consequences of FI are engrained in the failure of the social programs to protect low income families (Tarasuk, 2009), and have costly consequences for children and future generations (Mark et al. 2012).

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TABLES

Table 5.1: Food security status, based on an 18-item questionnaire¹

Status	Interpretation	10-Item Adult Food Security Scale	8-Item Child Food Security Scale
Food Secure	<i>No indication of difficulty with income-related food access</i>	<i>No items affirmed² on both scales</i>	
Food insecurity, marginal³	<i>Indication of some concern or difficulty of food access</i>	<i>1 affirmed response on either scale</i>	
Food Insecure, Moderate	<i>Indication of compromise in quality and/or quantity of food consumed</i>	<i>2 to 5 affirmed responses</i>	<i>2 to 4 affirmed responses</i>
Food Insecure, Severe	<i>Indication of reduced food intake and disrupted eating patterns</i>	<i>≥ 6 affirmed responses</i>	<i>≥ 5 affirmed responses</i>

¹ Adapted from: Canadian Community Health Survey, cycle 2.2, Nutrition (2004); Income related Household Food Security in Canada (Health Canada 2007).

² "Yes," "often", "sometimes", "Almost every month" and "some months" were considered to be affirmative responses.

³ Marginal food insecurity is not a category used in Health Canada's publications on this module. Following their classification system, those with a single response are considered food secure. The marginal category is included in this report because of a growing body of literature indicating that households reporting at least some level of uncertainty over their access to food are more vulnerable than those who have affirmed no items on the 18-item questionnaire (Coleman-jensen 2010)

Table 5.2: Sociodemographic characteristics of food secure and food insecure households (n = 249)

Independent variable	All households (n=249)	Household Food Security Status		p
		Food secure (n=152) n (% of households)	Food insecure (n=97)	
Mother's immigration status				
Immigrant	182 (73.1)	100 (54.9) ^a	82 (45.1) ^b	0.001
Non-immigrant	67 (26.9)	52 (77.6) ^a	15 (22.4) ^b	
Mother's ethnic group^s				
Visible minority	210 (84.3)	119 (56.7) ^a	91 (43.3) ^b	0.001
White or aboriginal*	39 (15.7)	33 (84.6) ^a	6 (15.4) ^b	
Immigrant group (based on length of stay in Canada; n=185)¹⁸				
Very recent immigrants	61 (33.0)	24 (39.3) ^a	37 (60.7) ^b	0.004
Recent immigrants	41 (22.2)	23 (56.1) ^a	18 (43.9) ^a	
Established immigrants	83 (44.9)	56 (67.5) ^a	27 (32.5) ^b	
Immigration category (n=180)^s				
Economical	58 (32.2)	40 (69.0) ^a	18 (31.0) ^b	0.008
Family class	50 (27.8)	28 (56.0) ^a	22 (44.0) ^a	
Refugees and asylum seekers	72 (40.0)	30 (41.7) ^a	42 (58.3) ^b	
Mother can speak in English²⁸				
Yes	212 (85.1)	138 (65.1) ^a	74 (34.9) ^b	0.002
No	37 (14.9)	14 (37.8) ^a	23 (62.2) ^b	
Number of children in household				
1-3 children	202 (81.1)	130 (64.4) ^a	72 (35.6) ^b	0.026
4 children or more	47 (18.9)	22 (46.8) ^a	25 (53.2) ^b	
Marital status^s				
Married/Common law relationship	170 (68.3)	121 (71.2) ^a	49 (28.8) ^b	<0.001
Lone motherhood ³	79 (31.7)	31 (39.2) ^a	48 (60.8) ^b	
Mother's highest education level^{4§}				
High school diploma or less	49 (19.7)	13 (26.5) ^a	36 (73.5) ^b	< 0.001
Technical or college diploma	90 (36.1)	56 (62.2) ^a	34 (37.8) ^b	
University degree	110 (44.2)	83 (75.5) ^a	27 (24.5) ^a	
Household received social assistance				
Yes	46 (18.5)	9 (19.6) ^a	37 (80.4) ^b	< 0.001
No	203 (81.5)	143 (70.4) ^a	60 (29.6) ^b	
Mother's employment status				
Currently working	157 (63.1)	110 (70.1) ^a	47 (29.9) ^b	< 0.001
Not currently working	92 (36.9)	42 (45.7) ^a	50 (54.3) ^b	
Residential Status				
Home ownership	99 (39.8)	84 (84.8) ^a	15 (15.2) ^b	< 0.001
Regular rental	59 (23.7)	36 (61.0) ^a	23 (39.0) ^a	
Subsidized, coop or temporary housing	91 (36.5)	32 (35.2) ^a	59 (64.8) ^b	
Access to a vehicle in past 7 days^s				
Yes	201 (80.7)	136 (67.7) ^a	65 (32.3) ^b	< 0.001
No	48 (19.3)	16 (33.3) ^a	32 (66.7) ^b	

¹ In this study, *very recent immigrants*, *recent immigrants*, *established immigrants* are used as equivalents to *immigrants landed 5 years or less earlier*, *immigrants landed between 5 and 10 years earlier*, *immigrants landed more than 10 years earlier*, respectively.

²Participants needed to speak either English or French to participate in this study. Therefore, those who answered “no” spoke only French or French and another language other than English (self-reported data).

³Single/Divorced/Widowed

⁴ Highest level of education attained in the home country or Canada

[§] Values in % are presented in addition to results of Pearson’s Chi-square analysis and post-hoc z-test; *P< 0.05 ** P < 0.01 ***P< 0.001

In each row, different superscripts denote statistically significant differences between food security status (P < 0.05).

*There was only one aboriginal participant in this sample, and they were included with White participants as they are not considered a visible minority by Statistics Canada’s classification of visible minority (Statistics Canada 2015).

Table 5.3: Food security status of families at the level of adults, children and households (n = 249)

	Adults	Children	Households
	n (% of families ¹)		
Food secure	156 (62.7)	177 (71.1)	152 (61.0)
Marginally food insecure	27 (10.8)	26 (10.4)	28 (11.2)
Moderately food insecure	50 (20.1)	40 (16.1)	52 (20.9)
Severely food insecure	16 (6.4)	6 (2.4)	17 (6.8)

¹Percentages are column percentages.

Table 5.4: Logistic regression model exploring the impact of sociodemographic factors on the likelihood that households were food insecure¹ over the past 12 months (n = 249)

	Odds Ratio ²	95.0% C.I. for Odds Ratio		P
		Lower	Upper	
Mother's ethnic group				
Visible minority	3.149	1.107	8.960	0.032
White or aboriginal	1			
Marital status				
Lone motherhood	2.563	1.361	4.828	0.004
Married/common law relationship	1			
Mother's age	.981	.932	1.033	0.461
Number of children in household				
1-3	1			
4 or more	.958	.433	2.123	0.917
Mother's highest education level attained³				
High school diploma or less	3.647	1.650	8.060	0.001
Post-secondary diploma	1			
Household received social assistance				
Yes	5.631	2.377	13.341	< 0.001
No	1			

¹Coding for dependent variable: food secure=0 and food insecure=1

²Odds ratios derived from logistic regression, adjusted for all other variables in the model

³Highest level of education attained in any country

Table 5.5: Logistic regression model exploring the impact of residential status on the likelihood that households were food insecure¹ over the past 12 months (n = 249)

		Unadjusted				Adjusted ²		
	Odds Ratio ³	95.0% C.I. for Odds Ratio		P		95.0% C.I. for Odds Ratio		P
		Lower	Upper			Lower	Upper	
Residential status								
Home ownership	1				1			
Regular rental	3.578	1.68	7.64	0.001	2.904	1.32	6.40	0.008
Subsidized or temporary housing or coop	10.325	5.14	20.75	<0.001	5.012	2.31	10.86	< 0.001
Constant	0.179				0.278			

¹Coding for dependent variable: food secure=0 and food insecure=1

²Adjusted for the number of children in the household, mother's age and highest education level attained, and whether or not the household received social assistance.

³Odds ratios derived from logistic regression

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6. Link Between Food Insecurity, Diet Quality and Weight Status among Black Immigrant Children in Ottawa

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Abstract

This cross-sectional study was conducted in a sample of African, Caribbean and Canadian households living in Ottawa having at least one child between 6 and 12 years of age (n=258) in order to examine the link between food insecurity, diet quality and weight status among black immigrants in Canada. Food security was measured using the Household Food Security Survey Module, diet quality was assessed using a 24-hour recall and the Canadian Healthy Eating Index and anthropometric measurements were done using validated standard methods. Chi-squares and logistic and linear regression models were used to assess relationships between variables. Children living in food insecure households were almost 2.3 times more likely to having consumed sugar-sweetened beverages than those living in food secure households (OR=2.290, 95% CI=1.35-3.90). Food insecurity was also associated with a lower consumption of saturated fat by children (OR=0.570, 95% CI=0.33-0.98). There was no evidence of association between children's weight status and food insecurity. However, mothers living in food insecure households had a higher prevalence of obesity than those living in food secure households (55.2% versus 35.7%, respectively, p=0.012). Overall, in this sample, food insecurity was not associated with the total diet quality score, but with certain indicators of poor diet quality and higher rates of obesity.

KEYWORDS: *Canada, children, diet quality, food insecurity, immigrant, weight status*

6.1 INTRODUCTION

Dietary intake is an important determinant of health (Huffman et al. 2014; Marshall et al. 2014). In adults, diet quality indices have been used to measure the risk of chronic health conditions, such as cardiovascular disease, some cancers, as well as disease specific and overall mortality (Kimokoti & Millen 2011; Wirt & Collins 2009). Diet quality indices measure, on a numeric scale, the overall acceptability of food intake of an individual or population based on dietary recommendations (Wirt & Collins 2009). Currently, there is one diet quality score in Canada, the Canadian Healthy Eating Index (HEI-C). HEI-C was first developed by Glanville & McIntyre

(2006) using Canada's Food Guide to Healthy Eating and the Nutrition Recommendations for Canadians in a sample of low-income lone mothers and their children in Atlantic Canada. It was adapted by Woodruff and Hanning (2010) to reflect the serving amounts recommended by Eating Well with Canada's Food Guide (Health Canada, 2007), as well as the Dietary Reference Intakes (Hellwig et al., 2006). The adapted version of the HEI-C is termed HEIC-2009.

In industrialized countries such as Canada and the US, there is strong evidence of a positive association between diet quality and socioeconomic status as measured by education, occupation, income level, or other indices (Darmon & Drewnowski 2008; Vozoris & Tarasuk 2003). Food security, defined by the Food and Agriculture Organization (FAO) as existing when 'all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life' (FAO 1996), is an important determinant of health. Food insecurity happens when at least one of the conditions for food security is not met. Food insecurity varies in severity, resulting initially in compromises on food quality and then on food quantity.

In 2011, 17% of Canadian children under the age of 18 years, or about one in six, resided in food insecure households (Health Canada 2012). Children living in food insecure households have poor quality diets, reduced micronutrient intake, iron-deficiency anemia, and low intake of fruit, vegetables and dairy products (Eicher-Miller et al. 2009; Mark et al. 2012; Pirkle et al. 2014; Kirk et al. 2013). Some authors report a positive association between food insecurity and poor diet and

health, including higher rates of obesity, among Canadian immigrants (Girard & Sercia 2013; Weigel et al. 2007; Caspi et al. 2016). According to the 2011-2012 Canadian Community Health Survey, recent immigrants in Canada had a higher prevalence of food insecurity than the general Canadian population (19.6% versus 12.4%, respectively; Health Canada 2012). Furthermore, in a recent study, black Canadian immigrants living in Ottawa had a much higher rate of food insecurity (39%; Tarraf et al., under review). This situation is largely attributable to the precarious financial situation that a substantial proportion of newcomers are undergoing (Vahabi & Damba 2013). As a result of this food insecurity and financial pressure, certain subsets of immigrants, notably Black immigrants, are at high risk of obesity (McDonald & Kennedy 2005) and type 2 diabetes (Adhikari & Sanou 2012). Little is known about the association between food insecurity, diet quality and weight status in Canadian immigrants (Désilets et al. 2007), particularly Black immigrants whom encompass a large socio-cultural group of newcomers in Canada (Caron Malenfant et al. 2010). Thus, this study had the following two objectives: 1) To examine the relationship between household food insecurity and children's diet quality; and 2) To examine the relationship between household food insecurity and the prevalence of overweight and obesity in children and mothers.

6.2 METHOD

6.2.1 Participants and sampling method

This study conducted in Ottawa targeted children of Sub-Saharan African and Caribbean decent. Participants were recruited during community events, fairs, religious gatherings, and were referred by participants, community partners, and research team members (Blanchet et al., under review)

Volunteer households were included in the study if the caregiver was a black woman born in Sub-Saharan Africa or in the Caribbean or a Canadian-born woman regardless of ethnicity, if the respondent understood English or French enough to carry a conversation, and if she had a child aged 6-12 y (regardless of place of birth). If two or more eligible children were living in the household, one child was randomly chosen. The sample included 258 caregiver-child pairs. Households where the father was the respondent (three in total) were excluded based on a recent study showing that women respondents report higher household FI than do men in similar Canadian households (Matheson & McIntyre 2014). Six other households were excluded due to missing data, which left 249 households for the present analyses. In the analyses involving participants' weight, a few additional participants were excluded due to incomplete data and because some women were breastfeeding or pregnant.

Participants received a CDN\$25 gift certificate for a grocery store of their choice to compensate for their time and cost associated with participation.

6.2.2 Ethics approval

Written parental consents and child assents were obtained from all 258 volunteered households. Ethics approval for the study was granted by the University of Ottawa's Office of Research Ethics and Integrity (H08-13-17).

6.2.3 Measures

6.2.3.1 Measurement of food security

The Household Food Security Survey Module (HFSSM) was used to assess food security (FS). This questionnaire has 18-item questionnaire validated in Canada and evaluate the income related household's food security status during the 12 months preceding the survey period (Health Canada 2007). Details on the measurement and classification of household food security status are described in Chapter 5. Marginal food insecurity was considered as food insecurity in this article (Coleman-Jensen 2010).

6.2.3.2 Dietary intake

Children's dietary intake was evaluated with the use of a 24-hour recall carried out by registered dietitians with a standardized protocol adapted from the Canadian Community Health Survey (Health Canada 2006). The 24-hour recall was completed in the presence of the child's caregiver and using food portion size models to better estimate the amount of food and beverage consumed (Health Canada 2006).

The 24-hour recall data was compiled and nutrient intakes were calculated with ESHA Food Processor SQL version 11.20.620 (ESHA Research, Salem, Oregon) using the Canadian Nutrient File (Health Canada 2015) . When necessary, research was carried out in databases of the United States Department of Agriculture (USDA) or other databases to find the nutritional values that

were not in the Canadian Nutrient File. Additional information was sought from food manufacturers when required.

6.2.3.3 Measurement of diet quality

A HEIC-2009 diet quality score was calculated based on each 24-hour recall and dietary analysis generated with ESHA Food Processor. The HEIC-2009 is a dietary quality index and consists of 9 subscale scores, which reflect all the major recommendations from Eating Well with Canada's Food Guide. It includes the number of portions of grain products, vegetables and fruit, milk and alternatives, meat and alternatives and "other" foods (all foods that do not fit into these four categories (with the exception of water), namely foods that are mostly fat and/or sugar; high fat and/or high salty snack foods; sugar-sweetened beverages such as tea and coffee with added sugar, soft drinks, and condiments such as pickles and ketchup); intake of total fat, saturated fat and cholesterol; and variety.

Since the HEIC-2009 was designed for children aged 9-13 y, a modified HEIC-2009 (mHEIC-2009) scoring method was developed and used for children aged 6-8 y based on the recommendations for this age group (see **Table 6.1** for complete mHEIC-2009 scoring method) (Health Canada 2011). The intakes of foods and nutrients were represented on a categorical density basis for milk and alternatives, meat and alternatives, and "other" food groups (as amounts/<1400 kcal, amounts/1400-1850 kcal or amounts/>1850 kcal for children aged 6-8 y and as amounts/<1600 kcal, amounts/1600-2200 kcal or amounts/>2200 kcal for children aged 9-12 y).

Those energy cut-offs reflected the mean Estimated Energy Requirements for boys and girls of each age group (6 to 8 y and 9-12 y; Health Canada 2011). For the other components, the threshold did not take into account the total energy intake.

A minimum score of zero for no intake and a maximum score of both 10 for grain products, milk and alternatives and meat and alternatives; and 20 for vegetables and fruit was assigned for healthy components. For the “other” food group and intake of total fat, saturated fat and cholesterol, higher scores were assigned for lower intakes. For children aged 6-8 y, a score of 10 was assigned to “other” foods for intakes of less than 4, 5, or 6 portions per <1400, 1400-1850 and >1850 kcal/d, respectively. For children aged 9-12 y, a score of 10 was assigned to “other” foods for intakes of less than 4, 6, or 8 portions per <1600, 1600-2200 and >2200 kcal/d, respectively. Total fat, saturated fat and cholesterol received a score of 10 for intake levels that reflected the Dietary Reference Intakes of 25-35% of energy from fat, <10% of energy from saturated fat and <300mg of cholesterol, respectively (Institute of Medicine 2011). A maximum variety score of 10 was assigned if at least 1 serving from each food group was consumed. For all categories, individuals with servings between the minimum and maximum cut-offs were given a proportional score.

Total mHEIC-2009 score ranged from 0–100 points. A final score <50 indicated a poor diet, 51–80 indicated a diet that needs improvement, and 81–100 indicated a diet of good quality. Intake of other food groups and nutrients not included in the mHEIC-2009, such as sugar-sweetened beverages and sodium, were also assessed in relation to food security.

6.2.3.4 Determination of weight status

The mothers' and children's height and weight were measured twice, according to WHO recommendations, to ensure the measures were reliable (World Health Organization 2013). Based on BMI (kg/m^2), body weight classifications for mothers were as follows: underweight/normal weight ($\text{BMI} \leq 24.9$), overweight ($\text{BMI} 25.0\text{--}29.9$), and obese ($\text{BMI} \geq 30.0$). For children, weight status was determined using WHO growth classification charts, which uses the BMI-for-age z-scores (World Health Organization 2007). Children who had a BMI-for-age z-score over 1 were considered overweight, and those with a z-score over 2 were considered obese (World Health Organization 2007). Certain weight categories were grouped together since they had a small number of participants.

6.2.4 Statistical analyses

Data was entered in Excel and statistical analyses were performed using SPSS Statistics version 24 (Armonk, NY, U.S). Frequencies, means and standard deviations were used to describe sample characteristics. Means and standard deviations were used to describe the children's mHEIC-2009 score. Chi-square analyses were performed to evaluate the association between household food security and the prevalence of overweight and obesity among children and mothers. Linear and logistic regressions were performed to evaluate relationships between household food security status, children's diet quality and weight status.

Logistic and linear regression models were performed with dietary and weight characteristics as binary dependent variables (for logistic regressions) or continuous dependent variables (for linear regressions). In total, 12 logistic models were performed with the following binary dependent variables, all coded as yes or no: mHEIC-2009 score poor/needs improvement, energy from carbohydrates <45% or >65%, energy from protein <10% or >30%, energy from fat <25% or >35%, energy from saturated fat >10%, consumed sugar-sweetened beverages, sodium intake >UL, did not meet recommendations for grain products, did not meet recommendations for vegetables and fruit, did not meet recommendations for milk and alternatives, did not meet recommendations for meat and alternatives, consumed >30% of energy from other foods. In all models, food insecurity was included as a dichotomous independent variable (food secure *versus* insecure). Three linear regression models were performed with the children's total mHEIC-2009 score, the mothers' BMI and the children's BMI-for-age z-score as continuous dependent variables. Confounding factors in analyses involving the children's intake and weight status included the child's age and sex (boy *versus* girl). In analyses involving the mother's weight status, age of participants was adjusted for. Absence of multi-collinearity between independent variables was assessed using a variance inflation factor test and was found to be acceptable (all values were below 10). A significance level of $p < 0.05$ was used for all analyses.

6.3 RESULTS

6.3.1 Sample characteristics

The mean age of the mothers and children was 39.0 years and 9.2 years, respectively. Over 30% of mothers were single, separated, divorced or widowed and almost 45% had a university degree.

Children's mean modified HEIC-2009 score was 74.0/100 and their mean sodium intake was over 2400 mg the day of the 24-hour recall. **Table 6.2** describes the demographic profile and dietary characteristics of the study sample.

6.3.2 The relationship between household food security and children's diet quality

Multivariate linear regression models were used to assess the ability of household food insecurity to predict mHEIC-2009 score, after adjusting for age and sex of participants. Although the model as a whole reliably predicted mHEIC-2009 scores ($F=3.264$, $p=0.022$, $R^2=0.038$), food insecurity was not significantly associated with mHEIC-2009 scores ($\beta=-0.007$, $p=0.908$) (data not shown).

Table 6.3 presents the results of logistic regression models exploring the link between household food insecurity and the components of the children's diet quality scores. Total mHEIC-2009 scores (grouped as poor/needs improvement *versus* good) were not significantly influenced by household food insecurity, and food insecurity did not have a significant influence on most mHEIC-2009

subscales. Food insecure children were much less likely to exceed recommendations for intake of saturated fats. Among other dietary patterns not included in the mHEIC-2009 subscales, food insecurity was a determinant of consumption of sugar-sweetened beverages. Children living in food insecure households were over twice as likely to consume sugar-sweetened beverages as compared to children living in food secure households (OR = 2.290, 95% CI = 1.35-3.90). Food security status, along with children's age and sex, accounted for 7.1% of the variation in consumption of sugar-sweetened beverages (Nagelkerke $R^2=0.071$). The model correctly classified 61.4% of cases (a 7.6% increase from the constant-only model).

6.3.3 The relationship between household food insecurity and weight status

Table 6.4 presents the prevalence of overweight and obesity among children and mothers by household food security status. The mothers' weight status, but not that of children, was significantly associated with household food security. Mothers living in food insecure households had a higher prevalence of obesity than those living in food secure households (55.2% *versus* 35.7%, respectively, $p=0.012$). However, this association disappeared when adjusted for mother's age ($\beta=-0.124$, $p=0.065$).

6.4 DISCUSSION

This study assessed the influence of household food insecurity on diet quality and weight status among a sample of households of Sub-Saharan African, Caribbean and Canadian descent. Overall,

39.1% of households were food insecure, which provides evidence that accessing sufficient, safe and nutritious food is an issue for a very high number of households among that population. Undeniably, rates of household food insecurity were higher in this study population than in the general Canadian population (39.1% versus 12.6%, respectively; Health Canada 2012).

The overall diet quality of participating children seemed to need improvement. However, this sample of Sub-Saharan African, Caribbean and Canadian children had very similar scores (average=74.0) to those obtained by Woodruff and Hanning (2010), who evaluated the HEIC-2009 score of grade 6 students in Waterloo, Ontario (average score of 74.5; Woodruff and Hanning 2010). It is also similar to the diet quality score obtained by Wang et al. (2015) in a sample of 613 Canadian children living in Quebec (average score=76.0).

6.4.1 The relationship between household food security and children's diet quality

Our results suggest that household food insecurity influences certain aspects of children's diet quality but not the mHEIC-2009. In Fram et al. (2015), child food insecurity was not associated with total HEI score, which resembles our results. Children who were living in food insecure households were more than twice as likely to consume sugar-sweetened beverages and were less likely to exceed the recommended energy intake from saturated fats.

Previous studies have found similar results among different populations, including children. A study of 3605 children in fourth to fifth grade in California by Fram and colleagues found that

child food insecurity was associated with a lower Healthy Eating Index for the vegetable subscale score (Fram et al. 2015). In our study, children living in food insecure households were over 1.8 times less likely meet their recommendations for vegetables and fruit, although this association was not significant. Another study by Nackers and Appelhans found that food insecurity was associated with greater preference to low-quality foods in the kitchen among US children aged 2 to 13 years (Nackers & Appelhans 2013). Although, in our study, food insecurity did not impact consumption of “other foods”, it influenced the consumption of sugar-sweetened beverages, which is considered a low-quality item. Similarly, in the 2003–2010 National Health and Nutrition Examination Survey (NHANES), Nguyen and colleagues found that food insecurity in US adults participants was associated with a lower total HEI score and a higher intake of added sugars (Nguyen et al. 2015). In another study with US participants living in low-income households, Leung and colleagues found that food insecurity was associated with a higher intake of high-fat dairy products, sugar-sweetened beverages, meat and salty snacks (Leung et al. 2014). Although, in our study, food insecurity did not predict consumption of “other foods”, it predicted a higher consumption of sugar-sweetened beverages, which falls in the “other” foods category as well. In contrast, our bivariate results indicate that children in food insecure households had a lower intake of saturated fat, but no significant difference in intake of meat and alternatives, milk and alternatives and “other foods”. This could partly be explained by the fact that households where the mother was born in Sub-Saharan Africa comprised the largest group among those who are food insecure (53.6% of the group), and traditionally have a diet high in cereals (Delisle 2010). In a study by Belachew and colleagues involving a sample of 2084 children aged 13–17 in Southwest Ethiopia, it was found that food insecurity was linked with a lower intake of foods from animal

source, protein-rich food, dairy products, and fruit (Belachew et al. 2013). It is possible that our sample was not large enough to detect a significant difference in mean subscale scores, which is one limitation of this study. More research is needed to examine factors that may make immigrants from low-income countries resilient to food insecurity.

6.4.2 The relationship between household food insecurity and weight status

Discrepancies exist between studies in the degree to which household food insecurity is associated with underweight and overweight (Isanaka et al. 2007; Doak et al. 2000; Delisle & Batal 2016). This likely reflects differences in the severity of food insecurity and complex relationships between poverty, gender, culture, stage of nutritional transition, body weight, among other factors. In this study, food insecurity was not associated with a higher prevalence of obesity in children. Several other studies have not found an association between food insecurity and obesity in children and adolescents. In a study of participants aged from 2 to 11 years in the US, Kaur and colleagues found that food insecurity at the child level was not associated with obesity. Personal food insecurity, however, which is a measure of food insecurity at the individual level (as opposed to all children in the household), was associated with obesity for children aged 6 to 11 (Kaur et al. 2015). Findings from the aforementioned study suggest that the level at which food insecurity is measured can modify results. This could not be captured in our study as the Household Food Security Survey Module evaluated food security related conditions pertaining to all children in the household. Therefore, as there was more than one child in most participating families (86.3% of households), it was impossible to evaluate food security at the individual level.

Some studies have, however, found a relationship between food insecurity and obesity among children. In a study examining a sample of 590 Mexican students in fourth to sixth grades on the Mexican border found that child food insecurity was associated with a heightened risk for obesity (Wojcicki et al. 2012). Also, in a prospective cohort study in the US of 1589 mother-child pairs for 2 years, Suglia and colleagues found that the cumulative social risk score (which included food insecurity as one of six risk factors) was associated with obesity at the age of 5 for girls but not boys (Suglia et al. 2013).

In adults, results about the link between food insecurity and obesity are also mixed. In this study, food insecurity was associated with a higher prevalence of obesity in mothers (in bivariate analyses only). After controlling for the mothers' age, the association was no longer significant. Leung and colleagues studied a large sample (8,129) of low-income Hispanic adults in California and found that very low food security was linked with a higher incidence of obesity and a higher body mass index (Leung et al. 2012). In a study of almost 8000 adults, Martin and Lippert found that food insecure mothers had a higher prevalence of overweight or obesity, compared to food insecure fathers and child-free women, regardless of food security status (Martin & Lippert 2012). The lower prevalence of overweight and obesity among child-free mothers brings an important point of discussion and could in part explain our results. Tarasuk reported that Canadian children were often protected from food insecurity, as compromises in the quality and quantity of children's dietary intake did not occur until later (Tarasuk 2001). Given that marginal and moderate household food insecurity were more prevalent in our sample than severe food insecurity (32.2% *versus* 6.8%, respectively, data not shown), compromises in the mothers' quality of food intake

are more likely than compromises in food quantity. A restricted budget, leading to the procurement of cheaper and more energy-dense and obesogenic foods, has been highlighted as an important contributing factor to excessive energy intake and weight gain (Dubois et al. 2011; Kirk et al. 2013).

6.4.3 Study limitations

These findings should be interpreted in line with the limitations of the study. For instance, there is a possible selection bias as participants volunteered to participate in the study, so they may have had some different characteristics than that of the wider study population. The snow ball sampling approach could have introduced an important selection bias as participants have likely referred their family and/or friends and other individuals in their circle of interaction. Although not ideal, this sampling method was necessary because no sampling frame was available for this hard-to-reach population. Consequently, and given the locality of the study sample, our results cannot be generalized. Also, the food security measure pertained to a 12-month period while a small number of immigrants (n=15) had been settled in Canada for less than a year (data not shown). However, analyses were carried out excluding this subset of immigrants and our results did not differ significantly (data not shown). It is also possible that our sample, who consisted in over a third of refugees (data not shown), have developed resilience to food insecurity and have learned to better cope with situations of food shortages. Large scale prospective studies are needed to confirm the exact nature of associations reported in this study and to determine the strategies that Black immigrant households utilize to cope with food insecurity.

While the mHEIC-2009 is based on several components of Eating Well with Canada's Food Guide and the use of a single ratio variable provides various statistical advantages (Dubois et al., 2000), it is lacking components for sodium, dark green and orange vegetables, whole grains and fish intake, of which guidelines are given in Eating Well with Canada's Food Guide. Further, the associated weighting of each component of the mHEIC-2009 has limits. Calculated as it is, all components are weighted similarly (e.g. 10 points) with the exception of vegetables and fruit (20 points) and a merged 20 points for total fat and saturated fat, although they may (or may not) all have an equivalent influence on diet quality and a similar effect on health. Moreover, calculating an accurate measure of dietary quality depends on participants' 24-hour recall and may have been subject to over- or under- reporting bias. Furthermore, the 24h recall may not be representative of each participant's daily intake.

Nevertheless, this study is consistent with the literature and brings a unique contribution to the current body of knowledge in many respects. First, in the majority of large-scale studies, the relationship between food insecurity and diet quality are studied in the general Canadian population, and are not examined among Blacks predominantly. However, this subset of children may have different eating patterns and resilience factors that are specific to their culture and/or their migratory experience. Secondly, there is a paucity of research examining the influence of food insecurity on diet quality and weight status among black children in Canada, and this research contributed to fill this knowledge gap.

6.5 CONCLUSION

Findings from this study suggest that Canadians and Canadian immigrants of African and Caribbean descent are experiencing high levels of food insecurity. The study provides some evidence of a link between food insecurity, diet quality and weight status. We stress that food insecurity should be monitored in a systematic way in immigrant populations, and especially among Black immigrants, and be taken into consideration in immigrants' integration policies. Indeed, since the immigrant population is increasing at an important rate in Canada, food security interventions should be considered as upstream interventions in conjunction with other measures for integrating immigrants. This would help reduce the negative health impacts of household food insecurity on black immigrant children and their caregivers who are already at increased risk for chronic disease. Understanding the exact nature of the linkages between food insecurity, diet quality and weight status as well as the various factors that mediate the relationships would be useful to inform food insecurity interventions. One of the potential factors to consider is the type of coping strategies that black immigrants use.

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Table 6.1: Components and scoring method of mHEIC-2009* for 6 to 13-year-old children

	Scoring method			
	Children 6 to 8 y		Children 9 to 13 y	
Dietary Components	Maximum scores	Minimum scores	Maximum scores	Minimum scores
Grain products (10 points)	≥ 5 servings	0 servings	≥ 6 servings	0 servings
Vegetables/fruit (20 points)	≥ 4 servings	0 servings	≥ 6 servings	0 servings
Milk and alternatives (10 points)	≥ 2 servings	0 servings	<1600 kcal: 3 servings 1600–2200 kcal: 3.5 servings >2200 kcal: 4 servings	0 servings
Meat and alternatives (10 points)	≥ 1 serving	0 servings	<1600 kcal: 1 serving 1600–2200 kcal: 1.5 servings >2200 kcal: 2 servings	0 servings
“Other” foods ¹ (10 points)	<1400 kcal: ≤ 4 servings ² 1400–1850 kcal: ≤ 5 servings >1850 kcal: ≤ 6 servings	< 1400 kcal: > 7 servings 1400–1850 kcal: > 9 servings > 1850 kcal: > 11 servings	<1600 kcal: ≤ 4 servings 1600–2200 kcal: ≤ 6 servings >2200 kcal: ≤ 8 servings	< 1600 kcal: > 8 servings 1600–2200 kcal: > 11 servings > 2200 kcal: > 14 servings
Total fat (10 points)	≤ 30% of energy from fat	≥ 45% of energy from fat	≤ 30% of energy from fat	≥ 45% of energy from fat
Saturated fat (10 points)	≤ 10% of energy from saturated fat	≥ 15% of energy from saturated fat	≤ 10% of energy from saturated fat	≥ 15% of energy from saturated fat
Cholesterol (10 points)	≤ 300mg	≥ 450mg	≤ 300mg	≥ 450mg
Variety (10 points)	At least one serving from each food group	Failure to eat a serving from any food group	At least one serving from each food group	Failure to eat a serving from any food group
Total score	100	0	100	0

mHEIC-2009, Canadian Healthy Eating Index adapted with Canada’s new food guide recommendations (2009) and modified to include scores for children 6-8 y.

*Individuals with servings between the minimum and maximum cut-offs are assigned a proportional score for the category.

¹“Other” foods include all foods that do not fit into the other four categories, namely foods that are mostly fat and/or sugar; high fat and/or high salt snack foods; sweetened beverages such as tea and coffee with added sugar, soft drinks, and condiments such as pickles and ketchup (Health Canada 2014)

²Assuming one serving contains approximately 60 kcal, servings from “other” foods would contribute 15% (score of 10) to 30% (score of 0) of total energy.

Table 6.2: Demographic profile and dietary characteristics of the study sample (N=249)¹

Variable	Value	SD
Child and household characteristics		
Male, %	47.4	-
Female, %	52.6	-
Age, y	9.2	2.0
Child dietary measures		
Energy, kcal/d	1765.2	535.0
Fat, g/d	56.1	24.0
Protein, g/d	64.1	24.0
Fiber, g/d	16.2	6.8
Sodium, mg/d	2433.1	1013.4
mHEIC-2009 ²		
Total score (0-100)	74.0	12.2
Grain products (0-10)	8.4	2.3
Vegetables and fruit (0-20)	13.4	6.3
Milk and alternatives (0-10)	5.9	3.2
Meat and alternatives (0-10)	8.0	3.0
“Other” foods (0-10)	4.0	4.3
Total fat (0-10)	8.7	2.5
Saturated fat (0-10)	8.2	3.1
Cholesterol (0-10)	9.2	2.5
Variety (0-10)	8.2	1.8
Household food security status		
Food secure, %	71.1	-
Food insecure, %	28.9	-
Children’s BMI-for-age z-score	0.84	1.20
Mothers’ BMI (n=227)	29.6	6.2
Mothers’ age	39.0	6.0
Number of children in the household	2.7	1.4
Lone mother household ³ , %	31.7	-
Household receives social assistance, %	18.5	-
Mother’s highest education level ⁴		
High school diploma or less, %	19.7	-
Technical or college diploma, %	36.1	-
University degree, %	44.2	-
Mother’s immigration status		
Immigrant, %	73.1	-
Canadian-born, %	26.9	-

¹Values are mean ± SD unless otherwise indicated²mHEIC-2009, modified Canadian Healthy Eating Index (2009)³Single/Divorced/Widowed⁴Highest level of education attained in the home country or Canada

Table 6.3 : Link between household food insecurity and children’s dietary intake (n=249)¹

	Food insecure ²	
	OR (95% CI)	P value ³
Dietary food patterns characteristics		
mHEIC-2009 score poor or needs improvement	1.459 (0.84-2.55)	0.183
Energy intake from carbohydrates <45% or >65%	1.260 (0.72-2.20)	0.415
Energy intake from protein <10% or >30%	0.601 (0.22-1.61)	0.312
Energy intake from fat <25% or >35%	1.009 (0.60-1.69)	0.972
Energy intake from saturated fat >10%	0.570 (0.33-0.98)	0.043*
Consumed sugar-sweetened beverages ⁴	2.290 (1.35-3.90)	0.002**
Sodium intake >UL ⁵	0.736 (0.41-1.34)	0.313
Did not meet recommendations for grain products ⁶	0.905 (0.53-1.56)	0.717
Did not meet recommendations for vegetables and fruit ⁷	1.852 (1.00-3.44)	0.051
Did not meet recommendations for milk and alternatives ⁸	0.922 (0.50-1.71)	0.795
Did not meet recommendations for meat and alternatives ⁹	1.008 (0.59-1.73)	0.978
Consumed >30% of energy from “other” foods ¹⁰	0.764 (0.45-1.29)	0.314

mHEIC-2009: modified Canadian Healthy Eating Index

¹Values are odds ratio (95% CI). Coding for independent variable: food secure=0 and food insecure=1.

*P< 0.05, ** P< 0.01

mHEIC-2009, modified Canadian Healthy Eating Index (2009); UL, upper limit

²Food insecure households include marginally, moderately and severely food insecure households.

³P values were determined from logistic regression with the dietary variable as the outcome variable and with independent variables of household food security status and child’s age and sex.

⁴Beverages having added sugar were considered sugar-sweetened beverages.

⁵Upper limit for sodium are the following, according to DRIs: 1900mg for boys and girls aged 4-8y and 2200mg for boys and girls aged 9-13y.

⁶Children met EWCFG recommendations for grain products if they consumed ≥ 4 servings (4-8y) or ≥ 6 servings (9-13y).

⁷Children met EWCFG recommendations for vegetables and fruit if they consumed ≥ 5 servings (4-8y) or ≥ 6 servings (9-13y).

⁸Children met EWCFG recommendations for milk and alternatives if they consumed ≥ 2 servings (4-8y) or ≥ 3 servings (9-13y).

⁹Children met EWCFG recommendations for meat and alternatives if they consumed ≥ 1 serving (all ages).

¹⁰“Other” foods include all foods that do not fit into the other four categories, namely foods that are mostly fat and/or sugar; high fat and/or high salt snack foods; sweetened beverages such as tea and coffee with added sugar, soft drinks, and condiments such as pickles and ketchup (Health Canada 2014).

Table 6.4: Prevalence of overweight and obesity among children and mothers by household food security status¹

		Household food security status§		<i>P</i> value
		Food secure (n=177)	Food insecure (n=72)	
Anthropometric characteristics	n	n (% of participants)		
Child's weight status²	247			
Normal weight		92 (60.9)	51 (53.1)	0.226
Overweight or obese		59 (39.1)	45 (46.9)	
Mother's weight status§	227			
Underweight or normal (BMI < 25.0 kg/m ²)		37 (26.4) ^a	19 (21.8) ^a	0.012*
Overweight (BMI between 25.0 and 29.9 kg/m ²)		53 (37.9) ^a	20 (23.0) ^a	
Obese (BMI ≥ 30.0 kg/m ²)		50 (35.7) ^b	48 (55.2) ^b	

¹Values in % are presented in addition to results of Pearson's Chi-square analysis and post-hoc z-test; *P< 0.05

** P< 0.01 ***P< 0.001. % are column percentages.

²Children's weight status was determined using WHO growth classification charts (World Health Organization 2007)

BMI, body mass index; kg/m²

§ In each column, different superscripts denote statistically significant differences between food security status (P<0.05).

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7. GENERAL DISCUSSION

The following chapter offers an overview of the key findings, an assessment of the hypotheses in light of the main findings, and a discussion of the implications for future research and professional practice, as well as directions for policy and monitoring.

7.1 Key findings

7.1.1 Food insecurity and diet quality

Since large scale studies are often done with the general Canadian population and tend to group all immigrants together, there is little research examining the rates of food insecurity among Black immigrants separately. The first set of analysis was conducted to partly fill this knowledge gap. As shown in chapter 6, many households experienced in the 12 months preceding the survey several conditions of food insecurity ranging from worrying about running out of food to a least one child not eating for a whole day. As a result, 39% of households were categorized as food insecure. The rate of food insecurity was higher in immigrant households as compared to non-immigrant households. Moreover, immigrant households who migrated less than 5 years ago were most likely to experience food insecurity compared to those who were established for more than 10 years. Interestingly, in our sample, about a quarter (24.5%) of households where the mother had a university degree were food insecure, compared to only 6.3% of households in the general Canadian population (Tarasuk et al., 2013). Professional downgrading, or underutilization of skilled migrants, may have impeded them from finding suitable work to match with their abilities. These findings confirm our 4th hypothesis that “*Immigrants, especially recent immigrants of*

African and Caribbean descent, had higher rates of food insecurity. Other researchers, including Vahabi and colleagues (2011), found similar results in their study that took place in Toronto.

As for the children's diet quality, the mean total score on the mHEIC-2009 was 74.0, which falls into the "needs improvement" category. When looking at the various subscales of the m-HEIC-2009, the lowest mean score obtained (4.0/10) belonged to the "other foods" category. This is an indication that our sample consumed a high amount of energy-dense and nutrient-poor foods the day before the interview was conducted. Furthermore, over half (53.8%) of children had consumed sugar-sweetened beverages and their mean sodium intake was over the upper limit recommended of 2300 mg/day. This confirms our 2nd hypothesis, since "*the diet quality of school-aged children is poor*". Other Canadian and US studies have found similar results among children (Wang et al., 2015; Woodfuff & Hanning, 2010).

7.1.2 Vulnerability to food insecurity

Our results have shown that determinants of food insecurity are multifactorial and are linked with household and respondent characteristics. Food security status was associated with many socioeconomic factors such as receipt of social assistance, residential status (regular rental and subsidized/temporary/COOP housing), not having access to a vehicle in the past week, a lower education level and being unemployed. Some of these factors, such as not having access to a vehicle and regular rental and subsidized/temporary/COOP housing, are related to the availability of assets. Furthermore, lone motherhood, a higher number of children in the household, mothers' visible minority status, being a refugee, a short length of stay in Canada, and not being able to have

a conversation in English were significantly linked with food insecurity in our participants. These findings confirm our 3rd hypothesis (*Food insecurity was associated with demographic and socioeconomic characteristics of households*).

Interestingly, of the determinants of food insecurity, many, including lone motherhood, being a refugee, a short length of stay in Canada, being unemployed and reliance on social assistance are related to income. Combined with the high prevalence of food insecurity, this reinforces CCHS conclusions that food insecurity in Canada is mostly “income related” (Health Canada, 2004). The results also corroborate conclusions from previous studies suggesting that poor economic status and household reliance on social assistance increase the vulnerability to food insecurity (Rainville & Brink, 2001; Tarasuk & Vogt, 2009; Tarasuk *et al.*, 2013; Vahabi *et al.*, 2011)

7.1.3 Nutrition and weight-related implications of household food insecurity

Although there is evidence of poor dietary intake among Canadian adults and children living in food insecure households (Eicher-Miller *et al.*, 2009; Kirkpatrick & Tarasuk, 2008; Mark *et al.*, 2012; Pirkle *et al.*, 2014), the extent to which household food insecurity compromises diet quality among black immigrants in Canada has not been investigated. This study assessed the relationship between food insecurity, diet quality and weight status among Sub-Saharan African and Caribbean children in Ottawa. In the current study, children living in food insecure households were almost 2.3 times more likely to have consumed sugar-sweetened beverages the day before the interview. They were also less likely to have exceeded daily recommendations for saturated fat. This suggests that children living in food insecure households had a poorer diet quality when considering the

consumption of sweetened beverages. However, food insecure children seem to have higher diet quality when considering the amount of saturated fat. In addition, household food insecurity did not reliably predict the total score on the HEIC-2009. We conclude that hypothesis 4 (*Children living in food insecure households have a poorer diet quality measured by the Healthy Eating Index*) was not totally confirmed. Our results are in line with those of another study (Fram et al., 2015), who found that child food insecurity was not associated with total HEI score, but with certain subscales, such as fruit and vegetable intake. Our relatively small sample size might however be taken into consideration into the significance of the relationship between food insecurity and the total mHEIC-2009 score and other subscale scores.

Similarly, the association between household food insecurity and children's weight was not significant. Thus, hypothesis 5 (*children living in food insecure households had higher rates of overweight and obesity*) was not confirmed. On the other hand, in bivariate analyses, mothers living in food insecure households had a higher prevalence of obesity than those living in food secure households (55.2% versus 35.7%, respectively, $p=0.012$), which partially confirms our 6th hypothesis, that “*mothers living in food insecure households had higher rates of overweight and obesity*”. However, the difference was no longer significant when controlling for the mothers' age. To better understand the link between the mothers' age and the household food security status, a Spearman correlation test was done with the mothers' age and their score on the *Adult Food Security Scale*. Results show that mothers' age is inversely correlated with their score on the *Adult Food Security Scale* ($r_s = -0.167$, $p = 0.008$), meaning that the younger the mother was, the more food insecure adults in the household were. The mothers' age was also strongly correlated with

their education level (ranked from “less than high school diploma” to “post-doctoral diploma”; $r_s = 0.229$, $p < 0.001$), meaning that older mothers were more educated and therefore more likely to have a higher socio-economic status. These significant correlations might explain why the link between the mothers’ BMI and the household food security status disappeared after controlling for the mothers’ age. Evidently, in our sample, food insecurity did not influence the mothers’ and children’s weight the same way. In the literature, inconsistencies exist between studies in the degree to which household food insecurity is associated with underweight and overweight among children and adults (Isanaka et al. 2007). This likely reflects differences in the severity of food insecurity and complex relationships between poverty, sex, culture, stage of nutritional transition, body weight, among other factors. Furthermore, it has been acknowledged that adults in the households often develop coping strategies that secure their children; thus, children are protected from food insecurity and its link with diet quality and weight status more than adults (Tarasuk, 2001). Also, it is possible that the effects of food insecurity on children’s weight status could not be visible at such a young age. Perhaps, if a longitudinal study was conducted, these children might have a higher prevalence of overweight or obesity as teenagers or adults.

7.2 Study limitations

These findings provide more evidence to the growing literature on the high vulnerability of Canadian immigrants to food insecurity and for the first time, specific insights into some determining factors and the consequences on diet quality and weight status in Black immigrant populations. However, results should be interpreted in line with the limitations of the study. For instance, there is a possible selection bias as participants volunteered to participate in the study, so

they may have had different characteristics than that of the wider study population (some may perhaps have been in a greater financial need and participated in order to receive the grocery gift card). Still, CND\$25 is not considered to be sufficient to put undue pressure on individuals to participate in research. Also, the convenient snow ball sampling approach might present an important selection bias as participants would likely refer their family and friends, or individuals in their social network only. However, although not ideal, snow ball sampling was necessary in this hard-to-reach population given reluctance to participate in health survey in similar populations. Consequently, and given the locality of the study sample, our results cannot be generalized to the broader Black population of Sub-Saharan African and Caribbean descent living in Canada.

Moreover, although the instrument used to assess food security (HFSSM) is validated and widely used in Canada, self-reported responses remain fundamentally subjective and may be prone to misestimating. This is especially true given the sensitivity of the topic of food insecurity, particularly when it relates to the situation of children in the household. It would likely be embarrassing or shameful for a parent to admit that their children have not been getting enough to eat due to a lack of money to buy food. Also, immigrant parents who committed at the time of immigration to have enough resources for the family's basic needs the first three years in Canada without any support might have a fear of being reported to authorities if their situation is extreme, such as when a child spent the entire day without eating because no money was available to buy food.

Another factor that might affect the results is the language of the interview. Indeed, although participants could speak enough of a chosen official language to conduct the interview, the English

and/or French fluency was limited for some of the participants, and they might have misunderstood nuances between questions which can impact the validity of these results. In addition, participants who have experienced famine before their arrival to Canada may not have been classified as being food insecure due to the fact that they have experienced a much more severe state of food deprivation when compared to situations described in the HFSSM. Some of these participants, for example, may have lived in a war-torn country prior to their arrival to Canada, where food availability and access may have been scarce. Consequently, as they may have felt much more food secure at the time of the interview, they may have not answered affirmatively to any of the questions even though they had reported using food banks in the same time period. Also, the food security measure pertained to a 12-month period while a small number of immigrants had been settled in Canada for less than a year ($n=15$). Therefore, they might have difficulties distinguishing between their food security experience in Canada from the one in their home country, making it difficult to evaluate relationships between variables. However, analyses were carried out excluding this subset of immigrants and our results did not differ significantly.

It is also important to mention that no causal inference can be made between variables due to the cross-sectional design of the study. Large scale prospective studies are needed to confirm the exact nature of associations reported in this study and to determine the strategies that Black immigrants utilize to cope with food insecurity.

Although not captured in this study, another barrier to food security could be cultural food preferences, similarly to what has been reported in Aboriginal populations (Power 2008), and the lack of fresh culturally-appropriate foods in the Canadian food environment. This phenomenon has been captured in Canadian qualitative studies (Vahabi & Damba, 2013), in which barriers in accessing food among Latin-American immigrants in Toronto were examined. In this study, many Latinos reported that vegetables, fruits, and meats that were common in their home countries were often hard to find and costly in Canada. In our sample, it is also possible that some participants would rather eat tropical fruits (such as mangos) and cuts of meat (such as duck meat) which could have been widely available in their home country but more expensive in Canada at different periods of the year. However, participants were interviewed throughout 14 months so seasonal availability of some foods was taken into consideration.

Although the mHEIC-2009 is based on several components of EWCFG and the use of a single ratio variable provides various statistical advantages (Dubois et al., 2000), it is lacking components for sodium, dark green and orange vegetables, whole grains and fish and intake, even though guidelines are given in EWCFG for these aforementioned groups and nutrients. Further, the associated weighting of each component of the mHEIC-2009 can be problematic. Calculated as it is, all components are weighted similarly (i.e. 10 points) with the exception of fruit and vegetables (20 points) and a merged 20 points for total fat and saturated fat, although they may (or may not) all have equivalent effects on health and diet quality. Also, the inclusion of cholesterol in the components may be problematic, as research has shown that cholesterol intake is not as closely linked with serum cholesterol levels as we once thought. Moreover, calculating an accurate measure of dietary quality will depend on participants' dietary recall and may be subject to over-

or under-reporting bias. Furthermore, although a single 24-hour recall can be used to describe the average dietary intake of a population, it does not allow us to test relationships between variables (Thompson & Subar, 2008). One 24-hour recall was chosen instead of three or instead of another method (such as a 3-day food journal) to reduce the burden on participants, as the interviews were already 2 hours long. However, most interviews were done at the participants' home and therefore interviewers were able to look at products and product labels to have a more precise measure of the type and quantity of foods and drinks consumed. Therefore, the recall may not be representative of each participant's daily intake, as some may have varying intakes on the weekdays versus on the weekends, or at their mother's house versus their father's house, if the parents are separated/divorced. However, interviews were not done during the Christmas holidays and participants were asked if this was a typical day (if it was not a typical day, the mother was asked not to do the recall that day). In addition, although ESHA Food Processor has a large database, it does not have nutritional values for many ethnic foods likely consumed by the immigrant population. Using American databases (USDA) helped fill in these gaps but is not ideal as food fortification policies are not identical in both countries. Also, if recipes were not offered by the participants, it may have been difficult to have an accurate estimate of the types and amounts of foods consumed.

Furthermore, although the chi-square test does not give us much information about the strength of the relationship or its substantive significance in the population, we have used measures of effect size (Phi and Cramer's V) to measure the strength of the relationship. However, it remains that chi-square tests are sensitive to sample size. What this means is that a reasonably strong association may not come up as significant if the sample size is too small. Conversely, in large samples, we

may find statistical significance when the findings are small and uninteresting. For that reason, logistic and linear regression models were done to evaluate the odds ratios and beta values.

7.3 Implications for professional practice

To improve the food security situation of individuals and households and overall health at the population level, it is clear that issues related to financial access must be reduced. This cannot be accomplished by front line professionals alone, as it calls for policy changes at the municipal, provincial and national level. However, the front line workers, especially dietitians and community nutritionists, can contribute to this solution in different ways, with the main goal of social change. The issue is especially pertinent to dietitians working in public health or in the community, but can also have implications for dietitians working in broader scopes of practice. Members of Dietitians of Canada have worked on a position paper related to food insecurity in Canada and have a list of recommended actions (Dietitians of Canada, 2016). This study highlights unique issues that need to be considered in the next Dietitians of Canada's position paper on food insecurity. For example, some black immigrants experience problems of food access within the next six months upon arrival in Canada. Therefore, food security measures should be mainstreamed in all immigrants' welcoming policies and considered as upstream interventions in conjunction with other measures for integrating immigrants. In addition, dietitians should be part of the team providing early information to immigrant with regards to their economic settlements and integration. In addition, given the critical role of food insecurity in the loss of the healthy immigrant effect, food insecurity should be monitored among Black immigrants attending nutrition counseling or screening sessions.

Also, knowing that while food insecurity may not always influence the child's diet quality, it often impacts other family members, especially caregivers. That being said, when evaluating a child's nutritional status alone, it might seem as though he or she is in good nutritional health. However, this does not mean that other family members would not benefit from culturally-specific recommendations or community programs. Given that food insecurity was linked with obesity among mothers in our sample, dietitians may be able to help this population by recommending low-cost, non-processed foods and by leading black immigrants to specific ethnic food stores that carry African and Caribbean foods. The role of ethnic food stores is extremely important as studies have report that cultural preference might exacerbate food insecurity among minority populations who are undergoing cultural transition. If these individuals are informed on where to obtain traditional food items, they may be less prone to purchasing low-cost, energy-rich foods from typical Canadian stores.

Finally, at the meso and micro levels, this study provides some evidence which will facilitate improving the knowledge and competencies of health professionals, including that of dietitians, in relation to dietary patterns of black immigrants in Canada, but also in offering nutrition services culturally appropriate to immigrant communities of Sub-Saharan African and Caribbean descent.

7.4 Significance and implications for policy

The high level of food insecurity and its potential incidence on diet quality among a group of immigrants in Ottawa provide evidence for awareness and advocacy on this issue among this particular population. Although our sample size was relatively small limiting the generalizability of the results to the broader Black population living in Canada, this research justifies documenting the situation of various other immigrant groups. If these results are replicated with other immigrant groups and with larger samples, they will eventually help in developing and implementing culturally-tailored policies and programs to reduce the burden of food insecurity, rather than the “one size fits all” approach currently undergoing in Canada.

There are several policies that influence the financial resources of Canadian households (e.g., social assistance rates, minimum wage, employment standards, affordable housing, child benefits, affordable child care, etc.) and therefore, change could ultimately be achieved in various ways: a) expanding community-based responses to food insecurity, including community kitchens, food skill workshops on making food from scratch, self-provisioning activities such as community gardens, and alternative food distribution systems such as the “Good Food Box” and farmers’ markets; b) increasing charitable food distribution programs in the form of food banks, which saw a 23% rise in use from 2008 to 2013 across the country and a 19.6% rise in the number of people assisted in Ontario during the same period (Food Banks Canada, 2013); c) expanding school- and community-based feeding programs such as school meal programs; d) increasing federal policy responses, notably increasing income from National Child Benefit pays without reducing the amount of welfare payments by the same amount (Dietitians of Canada, 2005) and increasing rates

of social assistance and indexing them to inflation; e) including ethnic foods among the package provide by food banks. We also hypothesise that providing access to jobs that do not require speaking English (for example, French speaking jobs) could improve the financial situation of Francophone immigrants in Ontario and, consequently, reduce their risk of food insecurity. Furthermore, providing affordable and subsidized child care, flexible working hours and an adequate number of sick days, among others, may reduce employment barriers among low income families, especially those receiving social assistance. Moreover, these findings highlight the need for food insecurity to be explicitly addressed in immigrant integration strategies (including assessment and recognition of prior education) in order to improve the financial power of new immigrants to purchase sufficient, nutritious, and culturally acceptable foods.

Food insecurity is persistent in some Canadian households and poses a serious risk to the nutritional health and well-being of both adults and children. Without policy interventions, it is likely that food-based responses such as food banks will continue to try to fill the policy gap despite evidence showing they are unable to successfully respond to difficulties of household food insecurity.

7.5 Implications for monitoring

Along with the need to implement policy initiatives at the macro level to help improve household food security in this country, efforts are needed to ensure that resources focused towards the measurement of food insecurity on national surveys yield data that can be used to support the

development and evaluation of policies and programs. The inclusion of indicators of food security on national health surveys, such as the Health Canada Household Food Security Survey Module (HFSSM), is currently the only measurement of food security in Canada. This tool was developed based on extensive qualitative research on the experience of household food insecurity and has been validated in many different settings. However, none of this qualitative work was conducted on immigrant populations as the focus, and our understanding of household food insecurity among many vulnerable populations in Canada, including black immigrants and newcomers, is still lacking. Our research indicates that most determinants of household food insecurity among black immigrants were similar to those of Canadian households. However, some factors may be unique to black immigrant populations that should be taken into consideration when measuring food insecurity in these groups. These factors include their challenges in managing household food insecurity due to unemployment after migration as well as their experiences with high levels of food insecurity in their home country, which can affect their perception of their situation here in Canada. More research is needed to examine how past experiences of household food insecurity and challenges in finding reliable employment due to professional downgrading may affect black immigrants' experiences in Canada. This research can contribute to developing a food security questionnaire aimed at measuring these particular aspects of immigrant food insecurity in Canada.

7.6 Implications for future research

The cross-sectional nature of the majority of research on household food insecurity, including the study data analysis in this thesis, have limitations that hinder our understanding of the nature of the problem, the direction of relationships observed and its implications for nutritional health and

wellbeing. Longitudinal studies are needed to examine the conditions that improve or deteriorate food security and its implications for health and well-being among immigrant and Canadian households.

Due to the complexity of social policy programming in Canada, there is a need for research on the different policies that influence the financial power of vulnerable households, such as refugees and very recent immigrants, which could consequently affect household food security. There is no doubt that not all immigrants struggle with food insecurity issues upon settlement in Canada. For various reasons, some immigrant households have developed coping strategies to allow them to find proper tactics. One potential important area to consider for future research is to document the coping strategies that black immigrants or other immigrants use in order to inform policies and programs.

Further, although not investigated in this study, cultural preference for some type of foods might cause immigrants to worry about the type of foods they would like to eat, thus exacerbating their food insecurity level. It might be relevant to investigate the contribution of cultural dimension to high levels of food insecurity among immigrant populations and which specific interventions are required to address this issue.

Mixed research methods would be valuable in evaluating immigrants' experiences of food insecurity and their coping strategies. Evaluating factors that could make immigrants resilient to

food insecurity and assess how their past experiences (in their home country) affect their perception of food insecurity in Canada are needed inform decision makers and to implement culturally appropriate policies and community programs.

7.7 General Conclusion

This present thesis provides insights onto the food security situation of a sample of households of Sub-Saharan African, Caribbean, and Canadian descent living in Ottawa and the association between food insecurity and school-age children's as well as mothers' nutritional health. Our results suggest that food insecurity was widespread in this population, as it was over three times more prevalent than in Canadian households in general. Many determinants of food insecurity have been identified among this population, including mothers' visible minority status, lone motherhood, receipt of social assistance, recent arrival to Canada, and not being able to speak English to carry a conversation, among others. To our knowledge, this is one of the first studies examining determinants of food insecurity and its link with diet quality and weight status in black immigrant children in Canada. Our knowledge of these determinants could inform future interventions to ameliorate the food security situation of these vulnerable households.

However, many potential determinants were not captured in this study and are worth exploring in future research. These include the impact of fluctuations in food prices, proximity of stores carrying fresh ingredients and ethnic foods (e.g. supermarkets), and immigrant mothers' and/or fathers' cooking abilities on food security status. It would also be interesting to explore whether or not immigrant parents' knowledge in nutrition can independently improve their children's diet quality, controlling for food security status and other confounding variables.

Appendix A: Abstract of oral presentation given at the 1st Annual Interdisciplinary Food Studies Student Conference in Ottawa on January 22nd 2016

Insécurité alimentaire chez des enfants immigrants noirs francophones en situation minoritaire vivant à Ottawa

Diana Tarraf, MSc(c), Rosanne Blanchet, PhD(c), Dia Sanou, PhD, Malek Batal, PhD, Constance P. Nana, PhD, Isabelle Giroux, PhD

Contexte : L'insécurité alimentaire (IA) est un déterminant important de la santé et peut contribuer à des problèmes de santé chroniques tels que l'obésité et les maladies cardiovasculaires. La littérature indique que l'incidence de l'IA est plus élevée chez les immigrants récents que chez les Canadiens de naissance. Cependant, la situation des immigrants francophones au Canada, faisant face à un double défi minoritaire (minorité visible et linguistique), est peu documentée.

Méthodologie : En vue de combler partiellement ce manque de connaissances, nous avons recruté 249 ménages vivant à Ottawa, ayant au moins un enfant âgé de 6 à 12 ans, dont la mère était née en Afrique Subsaharienne, dans les Caraïbes ou au Canada et pouvait parler en français ou en anglais. Le Module d'enquête sur la sécurité alimentaire des ménages de Santé Canada a été utilisé afin d'évaluer l'accès alimentaire des participants.

Résultats : Au total, 39% des ménages étaient en IA. Les ménages où la mère était réfugiée et ne pouvait pas soutenir une conversation en anglais étaient plus à risque d'être en IA que ceux dont la mère était immigrante de classe économique et connaissait l'anglais, respectivement ($p < 0.05$).

Conclusion : Le haut taux d'IA observé chez ces ménages nécessite des interventions politiques culturellement et linguistiquement appropriées afin de réduire les inégalités en santé affectant les immigrants francophones canadiens.

Financement : CNFS-volet Université d'Ottawa et Université d'Ottawa.

Mots clés :

Insécurité alimentaire
Facteurs socioéconomiques
Immigrant

Coordonnées :

Diana Tarraf
M.Sc. en sciences interdisciplinaires de la santé
Université d'Ottawa

Appendix B: Abstract of oral presentation given at the ACFAS conference in Montreal on May 11th 2016

Insécurité alimentaire chez des enfants immigrants noirs francophones en situation minoritaire vivant à Ottawa

Diana Tarraf, MSc(c), Rosanne Blanchet, PhD(c), Dia Sanou, PhD, Malek Batal, PhD, Constance P Nana, PhD, Isabelle Giroux, PhD

Contexte: L'insécurité alimentaire (IA) est un déterminant important de la santé et peut contribuer à des problèmes de santé chroniques tels que l'obésité et les maladies cardiovasculaires. La littérature indique que l'incidence de l'IA est plus élevée chez les immigrants récents que chez les Canadiens de naissance. Cependant, la situation des immigrants francophones au Canada, faisant face à un double défi minoritaire (minorité visible et linguistique), est peu documentée.

Méthodologie: En vue de combler partiellement ce manque de connaissances, nous avons recruté 249 ménages vivant à Ottawa, ayant au moins un enfant âgé de 6 à 12 ans, dont la mère était née en Afrique Subsaharienne, dans les Caraïbes ou au Canada et pouvait parler en français ou en anglais. Le Module d'enquête sur la sécurité alimentaire des ménages de Santé Canada a été utilisé afin d'évaluer l'accès alimentaire des participants.

Résultats: Au total, 39% des ménages étaient en IA. Les ménages où la mère était réfugiée et ne pouvait pas soutenir une conversation en anglais étaient plus à risque d'être en IA que ceux dont la mère était immigrante de classe économique et connaissait l'anglais, respectivement ($p < 0.05$).

Conclusion: Le haut taux d'IA observé chez ces ménages nécessite des interventions politiques culturellement et linguistiquement appropriées afin de réduire les inégalités en santé affectant les immigrants francophones canadiens.

Financement: CNFS-volet Université d'Ottawa et Université d'Ottawa.

Appendix C: Abstract of the poster presented at the *Journées Montfort* conference in Ottawa from April 7th-8th 2016

Déterminants de l'insécurité alimentaire chez les enfants de descendance africaine et caribéenne à Ottawa : Résultats préliminaires

Diana Tarraf, MSc(c), Rosanne Blanchet, PhD(c), Dia Sanou, PhD, Malek Batal, PhD, Constance P Nana, PhD, Isabelle Giroux, PhD

Contexte: La sécurité alimentaire est un déterminant important de la santé. Elle existe lorsque les individus ont un accès à une alimentation suffisante, saine et nutritive leur permettant de satisfaire leurs besoins. La littérature indique que l'insécurité alimentaire est plus élevée chez les immigrants récents que chez les Canadiens de naissance. Celle-ci peut contribuer à des problèmes de santé chroniques tels que l'obésité, l'hypertension et les maladies cardiovasculaires et entraîner une augmentation des coûts des services de santé.

Objectif: Évaluer la prévalence et les déterminants de l'insécurité alimentaire chez des ménages immigrants vivant au Canada.

Méthodologie: Nous avons recruté 249 ménages ayant au moins un enfant âgé de 6 à 12 ans, dont la mère était née en Afrique Subsaharienne, dans les Caraïbes ou au Canada et habitait la ville d'Ottawa au moment de l'entrevue. Le Module d'enquête sur la sécurité alimentaire des ménages a été utilisé afin de recueillir de l'information sur l'accès alimentaire des participants. Les ménages étaient considérés en insécurité alimentaire s'ils obtenaient un score ≥ 1 pour la sous-échelle des enfants ou des adultes. Des analyses de chi-carré nous ont permis d'évaluer les caractéristiques des ménages en insécurité alimentaire.

Résultats: Trente-neuf pourcent des ménages avaient été en insécurité alimentaire. Les ménages dont la mère avait le statut de minorité visible étaient plus à risque d'être en insécurité alimentaire que les Blancs ($p < 0.05$). Les ménages dont la mère était réfugiée et recevait de l'aide sociale étaient davantage en insécurité alimentaire que les ménages dont la mère était immigrante de classe économique et ne recevait pas d'aide sociale, respectivement ($p < 0.05$).

Conclusion: Le taux élevé d'insécurité alimentaire observé chez ces ménages vulnérables (3.25 fois plus élevé que la moyenne nationale) nécessite des interventions politiques culturellement et linguistiquement appropriées. Autrement, ce déterminant de la santé continuera de perpétuer les inégalités en santé affectant les immigrants canadiens.

Financement: CNFS-volet Université d'Ottawa et Université d'Ottawa

Appendix D: Abstract of the poster presented at the Canadian Nutrition Society's 2016 annual conference in Ottawa from May 5th to 7th 2016

Prevalence and determinants of food insecurity in African and Caribbean households in Ottawa

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Household food insecurity, defined as insufficient access to food due to financial constraints, is rising in Canada and is an important determinant of health. Food insecurity can contribute to chronic health conditions such as obesity, hypertension and cardiovascular disease, and has been linked with higher annual health care costs. The literature indicates that the rate of food insecurity is higher among recent immigrants than among the Canadian-born population. The objective of this study was to examine the prevalence and determinants of food insecurity among African and Caribbean households living in Ottawa, Canada. We recruited 259 households having at least one child between 6 and 12 years old, where the mother was born in Sub-Saharan Africa, the Caribbean or Canada. The mothers and their child had to be living in Ottawa and were asked to participate in a face-to-face interview. Health Canada's Household Food Security Survey Module (HFSSM) was used to collect data on participants' food access in the past 12 months. Households were considered food insecure if a score of ≥ 1 was obtained on the children or adults HFSSM subscale. Logistic regression analyses implemented in SPSS 23.0 were used to determine predictors of household food insecurity among complete cases (n=249). According to these preliminary results, food insecurity was widespread in this sample, with 39% of households being food insecure. Among individual- and household-level determinants, low education attainment, mother's marital status, mother's visible minority status and receipt of social assistance were all significant predictors of food insecurity. Households receiving social assistance (n=46) were almost 6 times more likely to be food insecure than those not receiving social assistance (OR: 5.8, CI: 2.5 - 13.7). In conclusion, determinants of food insecurity are multidimensional and are associated with various factors including socio-economic status, household demographics and visible minority status. These findings, in line with other Canadian studies, highlight the need for food insecurity to be monitored systematically in black populations in Canada and to be explicitly addressed in immigrant integration strategies. (Supported by the *Consortium national de formation en santé - volet Université d'Ottawa* and the University of Ottawa.)

Appendix E: Canadian Community Health Survey Household Food Security Survey Module (HFSSM)¹

The following questions are about the food situation for your household in the past 12 months.

Q1. Which of the following statements best describes the food eaten in your household in the past 12 months, that is since [current month] of last year?

1. You and other household members always had enough of the kinds of foods you wanted to eat.
2. You and other household members had enough to eat, but not always the kinds of food you wanted.
3. Sometimes you and other household members did not have enough to eat.
4. Often you and other household members didn't have enough to eat.

Don't know / refuse to answer (Go to end of module)

The HFSSM begins here:

Now I'm going to read you several statements that may be used to describe the food situation for a household. Please tell me if the statement was often true, sometimes true, or never true for you and other household members in the past 12 months.

Q2. The first statement is: you and other household members worried that food would run out before you got money to buy more. Was that often true, sometimes true, or never true in the past 12 months?

1. Often true
2. Sometimes true
3. Never true

Don't know / refuse to answer

Q3. The food that you and other household members bought just didn't last, and there wasn't any money to get more. Was that often true, sometimes true, or never true in the past 12 months?

1. Often true
2. Sometimes true
3. Never true

Don't know / refuse to answer

Q4. You and other household members couldn't afford to eat balanced meals. In the past 12 months was that often true, sometimes true, or never true?

1. Often true
2. Sometimes true
3. Never true

Don't know / refuse to answer

IF CHILDREN UNDER 18 IN HOUSEHOLD, ASK Q5 AND Q6; OTHERWISE, SKIP TO FIRST LEVEL SCREEN

Now I'm going to read a few statements that may describe the food situation for households with children.

Q5. You or other adults in your household relied on only a few kinds of low-cost food to feed the child(ren) because you were running out of money to buy food. Was that often true, sometimes true, or never true in the past 12 months?

1. Often true
2. Sometimes true
3. Never true

Don't know / refuse to answer

Q6. You or other adults in your household couldn't feed the child(ren) a balanced meal, because you couldn't afford it. Was that often true, sometimes true, or never true in the past 12 months?

1. Often true
2. Sometimes true
3. Never true

Don't know / refuse to answer

FIRST LEVEL SCREEN (screener for Stage 2): If AFFIRMATIVE RESPONSE to ANY ONE of Q2-Q6 (i.e., "often true" or "sometimes true") OR response [3] or [4] to Q1, then continue to STAGE 2; otherwise, skip to end.

STAGE 2: Questions 7-11 - ask households passing the First Level Screen

IF CHILDREN UNDER 18 IN HOUSEHOLD, ASK Q7; OTHERWISE SKIP TO Q8

Q7. The child(ren) were not eating enough because you and other adult members of the household just couldn't afford enough food. Was that often, sometimes or never true in the past 12 months?

1. Often true
2. Sometimes true
3. Never true

Don't know / refuse to answer

The following few questions are about the food situation in the past 12 months for you or any other adults in your household.

Q8. In the past 12 months, since last [current month] did you or other adults in your household ever cut the size of your meals or skip meals because there wasn't enough money for food?

1. Yes
2. No (Go to Q9)

Don't know / refuse to answer

Q8b. How often did this happen?

1. Almost every month
2. Some months but not every month
3. Only 1 or 2 months

Don't know / refuse to answer

Q9. In the past 12 months, did you (personally) ever eat less than you felt you should because there wasn't enough money to buy food?

1. Yes
2. No

Don't know / refuse to answer

Q10. In the past 12 months, were you (personally) ever hungry but didn't eat because you couldn't afford enough food?

1. Yes
2. No

Don't know / refuse to answer

Q11. In the past 12 months, did you (personally) lose weight because you didn't have enough money for food?

1. Yes
2. No

Don't know / refuse to answer

SECOND LEVEL SCREEN (screener for Stage 3): If AFFIRMATIVE RESPONSE to ANY ONE of Q7-Q11, then continue to STAGE 3; otherwise, skip to end.

STAGE 3: Questions 12-16 - ask households passing the Second Level Screen

Q12. In the past 12 months, did you or other adults in your household ever not eat for a whole day because there wasn't enough money for food?

1. Yes
2. No (IF CHILDREN UNDER 18 IN HOUSEHOLD, ASK Q13; OTHERWISE SKIP TO END)

Don't know / refuse to answer

Q12b. How often did this happen?

1. Almost every month
2. Some months but not every month
3. Only 1 or 2 months

Don't know / refuse to answer

IF CHILDREN UNDER 18 IN HOUSEHOLD, ASK Q13-16; OTHERWISE SKIP TO END

Now, a few questions on the food experiences for children in your household.

Q13. In the past 12 months, did you or other adults in your household ever cut the size of any of the children's meals because there wasn't enough money for food?

1. Yes
2. No

Don't know / refuse to answer

Q14. In the past 12 months, did any of the children ever skip meals because there wasn't enough money for food?

1. Yes
2. No

Don't know / refuse to answer

Q14b. How often did this happen?

1. Almost every month
2. Some months but not every month
3. Only 1 or 2 months

Don't know / refuse to answer

Q15. In the past 12 months, were any of the children ever hungry but you just couldn't afford more food?

1. Yes
2. No

Don't know / refuse to answer

Q16. In the past 12 months, did any of the children ever not eat for a whole day because there wasn't enough money for food?

1. Yes
2. No

Don't know / refuse to answer

End of module

¹Source: Health Canada (2007). Canadian Community Health Survey, Cycle 2.2, Nutrition (2004): Income-Related Household Food Security in Canada. Retrieved from http://www.hc-sc.gc.ca/fn-an/surveill/nutrition/commun/income_food_sec-sec_alim-eng.php#appa

Appendix F: General questionnaire

Language of the interview ☐ French ☐ English

1. What is your relationship with the child participating in the study?

1. Birth mother
2. Adoptive mother
3. Step mother (birth father)
4. Foster family
5. Other, specify : _____

2. What is your marital status :

1. Married
2. Living common-law
3. Widowed
4. Separated
5. Divorced
6. Single, never married

3. How many children do you have? _____

4. What is the rank of the child participating in the study? _____

5. How many people live in your household? _____

6. Do your parents or other family members live with you? ☐ Yes ☐ No

If yes, specify: _____

7. To which racial or cultural group do you identify with? You may belong to one or more racial or cultural groups on the following list. Your husband? Your child?

	You	Your husband	Your child
1. Black			
2. White			
3. South Asian (e.g., East Indian, Pakistani, Sri Lankan)			
4. Chinese			

5. Filipino			
6. Latin American			
7. Arab			
8. Southeast Asian (e.g., Vietnamese, Cambodian, Malaysian, Laotian)			
9. West Asian (e.g., Iranian, Afghan)			
10. Korean			
11. Japanese			
12. Other : _____			

The following questions will focus on your immigration. Questions will relate to you, your husband and your child.

Note to the interviewer: If born in Canada, ask questions 8 and 9 and go to question 19.

	You	Your husband	Your child
1. In what country were you born?			
2. In what city/town were you born?			
3. In your home country, what city/town were you living in before migrating to Canada?			
4. Did you live in another country after leaving your home country and before arriving to Canada?			
5. If yes, which one?			
6. Which date did you leave your country?			
7. On which date did you first come to Canada to live?			
8. When is the last time you went back to your country or your region of origin? <i>If never gone back, go to question 17.</i>			
9. How often do you visit your home country or a country in your region of origin?			
10. To which immigrant category do you belong?			
1. Economic category (Canadian experience class, skilled workers, entrepreneurs, investors, self-employed, provincial nominees, live-in caregivers, visa for business start-up, students)			
2. Family class (family sponsorship)			
3. Other (humanitarian cases, protected persons and refugees according to the Convention, refugees supported by the government, refugees sponsored by the private sector)			
4. Born in Canada			
5. Do not know			

18. Why did you decide to emigrate? _____

The following questions will focus on languages. Again, questions will relate to you, your husband and your child.

1. What language do you speak most often at home?

		You	Your husband	Your child
13	Of English or French, which language(s) do you speak well enough to conduct a conversation? Is it...?			
	1. English only			
	2. French only			
	3. Both English and French			
	4. Neither English nor French			
12	What official language do you prefer to speak?			
13	What language do you speak most often with your friends?			
14	What is the language that you first learned at home in childhood and can still understand?			
15	In what other languages can you conduct a conversation?			

16. Does your child attend ...?

1. An English-language school
2. An English-language school with a French immersion program
3. A French-language school
4. Other, specify: _____

17. In which school grade is your child? _____

Questions related to employment and education

93. Do you or your husband own a business

93.1 In Canada? ☐ Yes ☐ No

93.2 In your home country? ☐ Yes ☐ No

93.3 In another country? ☐ Yes ☐ No

94. What was your occupation before migrating to Canada? _____

95. Are you currently working at a job or a business? ☐ Yes (Go to question 97) ☐ No

96. What is the main reason why you are not currently working at a job or a business?
 _____ (Go to question 103)

97. What language do you speak most often at work? ☐ French ☐ English ☐ Other, specify :

98. What is your main current occupation? _____

99. Do you work at more than one job or business? ☐ Yes ☐ No

100. About how many hours a week do you usually work at your job or business? If you usually work extra hours, paid or unpaid, please include these hours. _____

101. Which of the following best describes the hours you usually work at your main job or business?

1. Regular – daytime schedule or shift
2. Regular – evening shift
3. Regular – night shift
4. Rotating shift (change from days to evenings to nights)
5. Split shift
6. On call
7. Irregular schedule
8. Other – Specify : _____

102. How long does it take to get to your main job? _____

103. Are you currently attending an educational institution (e.g. school, college, cegep, university)?

☐ Yes ☐ No

104. Have you been enrolled in an educational institution in Canada? ☐ Yes ☐ No

105. What is the highest degree, certificate or diploma you have completed? If the participant was enrolled in an educational institution in Canada, note the highest level in Canada as well as in other countries.

Education level	Country	Canada
1. Less than high school diploma or its equivalent		
2. High school diploma or a high school equivalency certificate		
3. Trade Certificate or Diploma		
4. College, cegep or other non-university certificate or diploma (other than trades certificates or diplomas)		
5. University certificate or diploma below the bachelor's level		
6. Bachelor's degree (eg. B.A, B.Sc., LL.B.)		
7. University Certificate above the bachelor's level		
8. Master's degree		
9. Doctorate's degree		
10. Post doctorate		
11. Other, specify		

Questions related to your husband

106. What was your husband's main occupation before migrating to Canada?

107. Does your husband currently work at a job or a business? ☐ Yes (Go to question 109) ☐ No

108. What is the main reason why he is not currently working at a job or a business??

_____ (Go to question 113)

109. What language does he speak most often at work? ☐ French ☐ English ☐ Other, specify :

110. What is his main current occupation? _____

111. Does he work at more than one job or business at the same time? ☐ Yes ☐ No

112. About how many hours a week does he usually work at your job or business? If he usually works extra hours, paid or unpaid, please include these hours. _____

113. Is your husband currently attending an educational institution? ☐ Yes ☐ No

114. Has your husband been enrolled in an educational institution in Canada? ☐ Yes ☐ No

115. What is the highest certificate, diploma or degree that your husband have completed? If the husband was enrolled in an educational institution in Canada, note the highest level in Canada as well as in other countries.

Education level	Country	Canada
1. Less than high school diploma or its equivalent		
2. High school diploma or a high school equivalency certificate		
3. Trade Certificate or Diploma		
4. College, cegep or other non-university certificate or diploma (other than trades certificates or diplomas)		
5. University certificate or diploma below the bachelor's level		
6. Bachelor's degree (eg. B.A, B.Sc., LL.B.)		
7. University Certificate above the bachelor's level		
8. Master's degree		
9. Doctorate's degree		
10. Post doctorate		
11. Other, specify		

We are now going to talk about your neighborhood. Think about the different facilities in your neighborhood. By this, I mean the area around your home that you could walk to in less than 15 minutes.

	Strongly agree	Somewh at agree	Without opinion/ Neutral	Somewh at disagree	Strongly disagree
116. Many shops, stores, markets or other places to buy things I need are within easy walking distance of my home.					
117. It takes less than 15 minute to walk to a transit stop (such as bus, train, subway or street car) from my home.					
118. My neighborhood has several free or low cost recreation facilities, such as parks, walking trails, bike paths, recreation centers, playgrounds, public swimming pools, etc.					
119. The crime rate in my neighborhood makes it unsafe to go on walks at night.					
120. There is so much traffic on the streets that it makes it difficult or unpleasant to walk in my neighborhood.					

121. How satisfied are you with your neighborhood?

1. Very satisfied
2. Satisfied

3. Neither satisfied nor dissatisfied
4. Dissatisfied
5. Very dissatisfied

122. How satisfied are you with your dwelling?

1. Very satisfied
2. Satisfied
3. Neither satisfied nor dissatisfied
4. Dissatisfied
5. Very dissatisfied

123. Do you or your husband own a house

123.1 In Canada? ☐ Yes ☐ No

123.2 In your home country? ☐ Yes ☐ No

123.3 In another country? ☐ Yes ☐ No

124. What is your residential status in Canada?

1. My dwelling is owned by a household member
2. I am a tenant of subsidized housing
3. I am a tenant of a rental property
4. Other, specify: _____

125. How many rooms are in your dwelling (eg. bedrooms, living room, kitchen) ? _____

126. How would you describe your sense of belonging to your local community? Would you say it is...?

1. Very strong
2. Somewhat strong
3. Medium
4. Somewhat weak
5. Very weak

127. Are you experiencing discrimination in Canada?

1. Never
2. Rarely
3. Sometimes
4. Often
5. Always

128. Do you have a valid driver's licence in Canada? Exclude learner's permit. Include licence from other countries valid in Canada even if for a certain period of time

☐ Yes ☐ No

129. In the last 7 days, did you have a vehicle at your disposal? Includes motorcycles. Include access to a family member, friend, co-worker or neighbor's vehicle. Also include a vehicle which the respondent uses for employment purposes but may be used during non-employment hours. ☐ Yes ☐ No

Now, I have a few questions on income. Although many health expenses are covered by health insurance, there is a relationship between health and income. Please be assured that, like all other information you have provided, these answer will be kept strictly confidential.

130. What is the main source of income of your household? ☐ Wages ☐ Other, specify :

131. How often do you or your husband send money to family members in your home country?

- a. Never
- b. Rarely
- c. Sometimes
- d. Often
- e. Very often

132. Can you estimate in which of the following groups your household income falls before taxes and deductions? ☐ Yes ☐ No

If yes, please stop me when I have read the category which applies to your household. In the past 12 months, was the total household income...?

- 1. Less than 10 000 \$
- 2. From 10 000 \$ to less than 20 000 \$
- 3. From 20 000 \$ to less than 30 000 \$
- 4. From 30 000 \$ to less than 40 000 \$
- 5. From 40 000 \$ to less than 50 000 \$
- 6. From 50 000 \$ to less than 60 000 \$
- 7. From 60 000 \$ to less than 80 000 \$
- 8. From 80 000 \$ to less than 100 000 \$
- 9. From 100 000 \$ to less than 150 000 \$
- 10. 150 000 \$ or more
- 11. Do not know
- 12. Refuse to answer

133. Who manages the family budget?

1. Your husband
2. Mostly your husband
3. You and your husband equally
4. Mostly you
5. You
6. Other, specify : _____

The next questions relate to the health of your child. By health, we mean not only the absence of disease or injury but also physical, mental and social well-being.

134. In general, would you say your child's health is:

1. Excellent
2. Very good
3. Good
4. Fair
5. Poor

135. Does your child have...?

Yes No

Asthma

Food allergies or intolerances

A metabolic disease (e.g. cystic fibrosis)

Diabetes

An Intestinal disease

Another disease, specify: _____

136. Does your child regularly take medications or supplements? ☐ Yes ☐ No

136.1 If yes, specify:

136.2 Who prescribed them?

Now, I would like to ask some questions about your own health.

137. In general, would you say your health is:

1. Excellent
2. Very good
3. Good
4. Fair
5. Poor

138. Do you have...?

	Yes	No
High blood pressure?		
If yes, were you pregnant when you first were diagnosed		
Diabetes?		
Type 1		
Type 2		
Did you have gestational diabetes?		
A heart disease		
High cholesterol (hypercholesterolemia)		
Do you suffer from the effects of a stroke?		
Another disease, specify :_____		

139. Do you regularly take medications or supplements? ☐ Yes ☐ No

139.1 If yes, specify: _____

139.2 Who prescribed them? _____

140. Do you have a regular medical doctor, family doctor or general practitioner? ☐ Yes ☐ No

141. When you see a doctor, do you and this doctor usually speak in English, in French, or in another language?

1. English
2. French
3. Other, specify: _____

142. Have you ever consulted a dietitian? ☐ Yes ☐ No

If yes, specify place and circumstance: _____

Now I have a few questions about religion.

143. In general, would you say that you are...?

1. Very religious
2. Religious
3. Not very religious
4. Not religious at all

144. What is your religion? Specify one denomination or religion only, even if you are not currently a practicing member of that group. You can choose no religion _____

Anthropometric Measures

Mother

145. It is important to know when analyzing health whether or not a person is pregnant. Are you currently pregnant?

1. Yes

2. No

146. Are you currently breastfeeding?

1. Yes

2. No

	Measure 1	Measure 2	Measure 3 (if a difference between measure 1 and 2)
Weight (kg)			
Height (cm)			
Waist circumference (cm)			

Child

147. Menstruations have an important impact on the nutritional needs of women. Has your daughter begun having menstrual cycles (periods) yet?

1. Yes

2. No

3. Not applicable

	Measure 1	Measure 2	Measure 3 (if a difference between measure 1 and 2)
Weight (kg)			
Height (cm)			

Appendix G: Ethics approval letter from the University of Ottawa's Office of Research Ethics and Integrity (H08-13-17)

Numéro de dossier: H08-13-17



Date (mm/jj/aaaa): 11/09/2015

Université d'Ottawa **University of Ottawa**
Bureau d'éthique et d'intégrité de la recherche Office of Research Ethics and Integrity

Certificat d'approbation déontologique CÉR Sciences et science de la santé

Chercheur principal / Superviseur / Co-chercheur(s) / Étudiant(s)

<u>Prénom</u>	<u>Nom de famille</u>	<u>Affiliation</u>	<u>Rôle</u>
Isabelle	Giroux	Sciences de la santé / Autres	Chercheur principal
Malek	Batal	Sciences de la santé / Autres	Co-chercheur
Rosanne	Blanchet	Sciences de la santé / Autres	Co-chercheur
Ashley	Gunter	Sciences de la santé / Autres	Co-chercheur
Constance	Nana	Autres / Autres	Co-chercheur
Dia	Samou	Sciences de la santé / Autres	Co-chercheur
Diana	Tarraf	Sciences de la santé / Autres	Co-chercheur
Violeta	Ramirez Banos		Étudiant-chercheur
Teresito	de Jesus Socedo		Autre collaborateur
Daniel	Pizani		Assistant de recherche

Numéro du dossier: H08-13-17

Type du projet: Professeur

Titre: Acculturation, statut linguistique et santé nutritionnelle des enfants immigrants noirs d'âge scolaire

<u>Date de renouvellement (mm/jj/aaaa)</u>	<u>Date d'expiration (mm/jj/aaaa)</u>	<u>Approbation</u>
11/04/2015	11/03/2016	Ia

(Ia: Approbation complète, Ib: Autorisation préliminaire de libération de fonds de recherche)



Université d'Ottawa
Bureau d'éthique et d'intégrité de la recherche

University of Ottawa
Office of Research Ethics and Integrity

This is to confirm that the University of Ottawa Research Ethics Board identified above, which operates in accordance with the Tri-Council Policy Statement (2010) and other applicable laws and regulations in Ontario, has examined and approved the ethics application for the above named research project. Ethics approval is valid for the period indicated above and subject to the conditions listed in the section entitled "Special Conditions / Comments".

During the course of the project, the protocol may not be modified without prior written approval from the REB except when necessary to remove participants from immediate endangerment or when the modification(s) pertain to only administrative or logistical components of the project (e.g., change of telephone number). Investigators must also promptly alert the REB of any changes which increase the risk to participant(s), any changes which considerably affect the conduct of the project, all unanticipated and harmful events that occur, and new information that may negatively affect the conduct of the project and safety of the participant(s). Modifications to the project, including consent and recruitment documentation, should be submitted to the Ethics Office for approval using the "Modification to research project" form available at: <http://research.uottawa.ca/ethics/submissions-and-reviews>.

Please submit an annual report to the Ethics Office four weeks before the above-referenced expiry date to request a renewal of this ethics approval. To close the file, a final report must be submitted. These documents can be found at: <http://research.uottawa.ca/ethics/submissions-and-reviews>.

If you have any questions, please do not hesitate to contact the Ethics Office at extension 5387 or by e-mail at: ethics@uOttawa.ca.

Jasmine Sarazin
Ethics Coordinator
For Catherine Paquet, Director of the Office of Research Ethics and Integrity

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