

Associations between the local food environment and the severity of food insecurity among new families using community food security interventions in Montreal

Elsury Pérez, MSc,¹⁻³ Federico Roncarolo, PhD,¹⁻³ Louise Potvin, PhD¹⁻⁴

ABSTRACT

OBJECTIVES: To examine the association between the local food environment and the severity of food insecurity among new families using community food security interventions in Montreal.

METHODS: In this cross-sectional study, we analyzed baseline data from 785 adults aged 18–65 years enrolled in the evaluation of the effects of organizations delivering community food security interventions in Montreal. The dependent variable was household food insecurity, while the independent variable was the local food environment, assessed through: location of the most frequently used grocery store, distance between the participant's residence and the community organization used, mode of transportation, walking time to the most frequently used grocery store, satisfaction with the acceptability and affordability of food available at the most frequently used grocery store, and self-reported difficulties in accessing food. We used polytomous logistic regression to estimate the association between household food insecurity and the local food environment. In all the models, we coded food security status in three categories: food security, moderate food insecurity and severe food insecurity. The last group was used as a reference group.

RESULTS: Our data suggest that compared to households with severe food insecurity, those with moderate food insecurity (OR = 0.43, 95% CI: 0.28–0.62) and those with food security (OR = 0.13, 95% CI: 0.06–0.26) were less likely to report difficulties in accessing food due to food affordability. Food-secure households also had lower odds of reporting difficulties in accessing food due to transportation constraints (OR = 0.18, 95% CI: 0.06–0.55) compared with severe food-insecure households. Living a distance of between 1 and 2 km from the organization used was significantly correlated with moderate food insecurity (OR = 1.80, 95% CI: 1.12–2.88).

CONCLUSION: The local food environment is associated with severity of household food insecurity among new families using community food security interventions in Montreal. Future studies should study the relationship between the local food environment and food insecurity across all dimensions of food access.

KEY WORDS: Food supply; food assistance; food environment; Montreal; food insecurity

La traduction du résumé se trouve à la fin de l'article.

Can J Public Health 2017;108(1):e49–e55
doi: 10.17269/CJPH.108.5651

Food insecurity (FI) “exists whenever the availability of nutritionally adequate and safe foods or the ability to acquire acceptable foods in socially acceptable ways is limited or uncertain”.¹ FI is an important public health concern in Canada. In 2013, 12.5% of Canadian and 11.8% of Quebec households were affected by FI.² Research indicates that FI has been linked to an inadequate intake of nutrients,³ chronic disease,⁴ and poor, self-reported, physical and mental health among adults.⁵ FI has also been associated with behavioural disorders,⁶ as well as poor physical and mental health among children.⁷ While limited financial resources is a major determinant of FI,⁸ this problem has been clearly linked to numerous aspects of the local physical and social environment.^{9,10}

In Canada, community food security interventions (CFSI) (food banks, collective kitchens, community gardens, buying groups, etc.) have been the major response to the problem of FI,¹¹ but only about 20%–30% of food-insecure households use CFSI.^{12–14} Even though CFSI cannot be the optimal response to alleviate FI,^{12,15–17} CFSI are, according to users' opinions, essential resources in coping with hunger.¹⁸ Moreover, a recent longitudinal study on 411 new

users of CFSI in Montreal showed that participation in food banks decreases the severity of household food insecurity (HFI) and improves the perception of mental health.¹⁹ With these premises, the importance of CFSI, as components of the local food environment for food-insecure households, is undeniable.

Author Affiliations

- Département de médecine sociale et préventive, École de Santé Publique, Université de Montréal, Montréal, QC
- Institut de recherche en santé publique de l'université de Montréal (IRSPUM), Montréal, QC
- Chaire de recherche du Canada – Approches communautaires et inégalités de santé (CACIS), Université de Montréal, Montréal, QC
- Centre de recherche Léa-Roback sur les inégalités sociales de santé de Montréal, Montréal, QC

Correspondence: Elsury Pérez, Institut de recherche en santé publique de l'université de Montréal (IRSPUM), Pavillon 7101 avenue du Parc, C.P. 6128, Succ. Centre-Ville, Montréal, QC H3C 3J7, Tel: 514-343-6111, ext. 0546, E-mail: ej.perez.isaza@umontreal.ca

Acknowledgements: The project on food security was founded in 2010 by Canadian Institutes of Health Research (CIHR), grant no. G1R-112691. CIHR had no role in the design, analysis or writing of this article. The authors acknowledge the members of the steering committee of the research on the “Effects of interventions in food insecurity” for their contribution and support.

Conflict of Interest: None to declare.

Nevertheless, the association between the local food environment and FI still needs clarification. In Montreal, for instance, there are no food deserts (areas characterized by poor access to healthy affordable food) in low-income neighbourhoods²⁰ and there is a lack of knowledge of conditions related to the local food environment that leaves families using CFSI vulnerable to FI.

Glanz et al. have classified the food environment into the community nutrition environment (number, type, distribution of food outlets and restaurants), the consumer nutrition environment (nutritional qualities, price, promotion, placement, diversity, and nutritional information in food outlets and restaurants), and the organizational nutrition environment (home, school, work and CFSI).²¹ Other authors have argued that this classification of the local food environment also needs to include five dimensions related to food access: *availability*, *accessibility*, *affordability*, *acceptability* and *accommodation*.²² *Availability* refers to the sufficiency of the food supply (food quality, density, and types of food stores).²² *Accessibility* refers to easy access (the geographic location) of the food supply. Transport, travel time and distance are measures of this dimension.²² *Affordability* refers to the relationships between food prices and the consumers' ability to pay.²² *Acceptability* is the concordance between consumers' expectations and attributes of their local food supply (for instance, culturally appropriate food).²² *Accommodation* refers to how well the food supply is adapted to meet consumers' needs (type of payment accepted, opening hours).²²

There has been limited research about the relationship between the local food environment and FI.^{9,10} Furthermore, the results of previous research have not been consistent. For instance, Bartfeld et al. found that living 15–22 miles from the nearest retail food outlet was associated with HFI in Wisconsin, USA.²³ Their results are consistent with the results of Mayer et al. and DeMartini et al., who found that perceived difficult access to food resources was associated with HFI.^{24,25} In contrast with the previously mentioned studies, Mabli and Sharkey et al. did not find a significant association between proximity to food stores and HFI.^{26,27} Neither did Kirkpatrick and Tarasuk, who concluded that, in Toronto, HFI was not associated with the distance between home location and discount supermarkets or community food programs (food banks, community kitchens and community gardens).²⁸

Some of these studies explored the relationship between FI and potential access to food stores or potential access to CFSI (availability and accessibility),^{23,26,28} while other studies explored the relationship between FI and participation in CFSI among low-income households.^{26,27} However, previous research suggests that difficulties in access are one of the major reasons for not attending CFSI.^{13,17} Given the particularities of the food environment in Montreal (absence of food deserts in low-income neighbourhoods),²⁰ we aim to examine the relationship between the local food environment and the severity of FI among new families using CFSI in the Montreal metropolitan area.

METHODS

Recruitment and sampling

This cross-sectional study was based on baseline data from the longitudinal study evaluating the effects of CFSI on the food security status and the perceived health of users in Montreal, Canada.¹⁹ A two-stage cluster sampling frame was used to select participants for

inclusion. Clustering units were based on organizations delivering CFSI in the Montreal metropolitan area. The list of organizations involved in CFSI was validated by a group of experts with in-depth knowledge of the CFSI network in Montreal. Organizations exclusively targeting specific groups, such as children and pregnant women, were excluded. Preliminary research has allowed the identification of 451 organizations delivering CFSI. A random sample of 195 of these organizations was selected and 136 of them agreed to participate in the study, representing 70% of the random sample.²⁹ A total of 16 organizations delivering traditional CFSI (based on food distribution, such as food banks) and 6 organizations delivering alternative CFSI (based on activities to improve social integration and food skills, such as collective kitchens, collective gardens, and buying groups) that met the criteria of a given number of new participants (50 new participants in the last six months for traditional CFSI and 30 for alternative CFSI) were selected.²⁹ Within each selected organization, all users between 18 and 65 years of age who were registered for the first time, and for less than 6 months were invited to participate in the study. People older than 65 years of age and homeless people were excluded because they have living conditions that can lead to biased results.²⁹ Between October 2011 and May 2012, data were collected through structured questionnaires administered by research assistants during face-to-face interviews in French or English. The questionnaire took between 30 and 45 minutes to complete. Participation in the study was voluntary and informed consent was obtained prior to our conducting each interview. Respondents received \$20 upon completing the questionnaire.

The current study was approved by the Health Research Ethics Committee of the University of Montreal.

Measures

Household food insecurity

The 18 items of the Household Food Security Survey Module (HFSSM) were used to determine *the household food insecurity level* during the 12 months prior to the study. Health Canada's coding method was used to calculate scores of HFI.³⁰ The HFSSM questionnaire is composed of 10 questions for adults and 8 for children, regarding food insecurity conditions.³⁰ Each multiple-choice answer is recoded scoring 0 or 1 point. The final score ranges from 0 to 10 for adults and 0 to 8 for children. The HFSSM questionnaire defines three levels of food security: food security, with scores of 0 or 1; moderate insecurity, with a score between 2 and 5 for adults and 2 and 4 for children; and severe insecurity, with a score of above 5 for adults and above 4 for children. Household food security status is dependent on both adult and child scores. In families with children, the household is food-secure if both adults and children are food-secure; the household is moderately food-insecure if either adults or children are moderately food-insecure but neither is severely food-insecure; the household is severely food-insecure if either adults or children are severely food-insecure. In childless households, adults' food security status corresponds to household food security status.³⁰

Accessibility

The distance between participant's residence and the community organization used was measured using the household's self-reported address information and the address of the organization

attended. The distance between these two points was calculated manually through Google Maps. The *walking mode* was used as the base means of transportation to calculate the distance.³¹ All alternative routes provided by Google Maps were analyzed and the shortest route was used for our analysis.

The location of the most frequently used grocery store was based on responses to the open-ended question: “Where is the place where you most frequently buy food for your household?” Possible answers were: “inside their neighbourhood”, “outside their neighbourhood” or “not shopping for food frequently” (because someone else does their groceries, because they receive all groceries from a CFSI or because they use grocery delivery services).

People who answered “inside their neighbourhood” were asked about *walking time to the most frequently used grocery store*. Walking time was measured by asking respondents to report the walking time required to get to their primary food store from their home, given a choice of 0–5 minutes, 6–10 minutes, or more than 11 minutes.

Mode of transportation: all participants were asked how they usually carry their food, given a choice of: taking their car, public transportation (bus or metro), active transport (travel on foot or bicycle), or other.

Self-reported difficulties in accessing food due to the grocery store accessibility were measured by asking two questions related to transportation constraints and distance to the grocery store. The two questions were: 1) “Do you have any difficulty in accessing food for reasons of transportation?” and 2) “Do you have any difficulty in accessing food for reasons of distance from the store?” Each question had a binary (yes/no) response.

Acceptability and affordability

Self-reported difficulties in accessing food due to food acceptability and food affordability were measured by asking two questions related to food choice and food price. The two questions were: 1) “Do you have any difficulty in accessing food for reasons of lack of choice?” and 2) “Do you have any difficulty in accessing food for reasons of high prices?” Each question had a binary (yes/no) response.

Participants who answered “inside their neighbourhood” were also asked about their *satisfaction with the acceptability and affordability of the food available at the most frequently used grocery store*. We defined satisfaction with these aspects of the food by asking four questions about food choice, food price, and food quality in their primary food store. The questions were: 1) “How satisfied are you with your ability to find the foods that you prefer to eat?” 2) “How satisfied are you with your ability to find foods that you can afford to buy?” 3) “How satisfied are you with your ability to find foods that are of high quality?” and 4) “How satisfied are you with your ability to find foods that are nutritious?” Answers were obtained on a Likert scale of 1–4, ranging from very unsatisfied to very satisfied. The sum of the scores ranged from 4 to 16. The higher scores indicated very satisfied. This scale was categorized into four categories according to the 25th, 50th and 75th percentiles (<11, 11–11.9, 12–13, and >13) as very unsatisfied, unsatisfied, satisfied, and very satisfied. This scale has a good internal consistency (Cronbach’s $\alpha = 0.80$). To increase the statistical power of the analysis, the very unsatisfied and unsatisfied categories were collapsed.

Control variables considered in the study were respondents’ gender, age, marital status, perceived mental and physical health,

household income, and household education level. Age was coded into four categories (≤ 29 , 30–39, 40–49, or 50–65 years). Marital status was coded in three categories (single, couple, or other). Perceived mental and physical health were measured using the SF-12-v2 Health Survey, which provides two component summary scores (physical and mental summary – PCS and MCS) that are built on eight subscale domains (physical functioning, role-physical, bodily pain, general health, vitality, social functioning, role-emotional, and mental health). Higher scores indicate better health status.³² PCS and MCS were categorized into four categories according to the 25th, 50th and 75th percentiles (PCS was categorized into: <40.5, 40.6–50.5, 50.6–57, and >57.1, while MCS was categorized into: <33.9, 34–41.2, 41.3–48.4, and >48.5) as poor, fair, good, and very good. To meet the data requirements for statistical analysis, the fair and poor categories were collapsed.

Total household income was coded into four categories according to the number of members and household income reported by responders: not indicated, very low income, low income, or middle income. Household education level was determined by self-reported highest education level achieved by the respondent or their partner. This variable was categorized into four groups: less than a high school diploma, secondary (high) school diploma, post-secondary education, and university degree or above.

Data analysis

All statistical analyses were performed using SPSS v20.0 for Windows (SPSS Inc., Chicago, IL, USA). For all statistical tests, $p < 0.05$ was considered the level of significance. Respondents with missing data on the HFI ($n = 39$), or with missing values on more than 4% of the independent variables, were excluded from the analyses. Unconditional mode imputation was used to replace missing values on independent variables with less than 4% of missing data.³³ An extra category for missing values was created for the household income variable.

We determined the frequency distribution for all independent variables by HFI status with cross tabulation. Bivariate regression analysis was run to examine the association between HFI and all predictor variables. Given that severe food insecurity was the category of the HFI variable with the greatest number of observations, we used this group as reference in two polytomous logistic regression models to estimate odds ratios (ORs) and their 95% confidence intervals (CI) for the association between HFI and the local food environment. The first model was an unadjusted model including only the local food environment questions that were asked to all respondents; the second model was adjusted for the respondents’ health status and socio-demographic characteristics, including age, gender, origin, marital status; as well as household variables, such as level of education and total income.

Since satisfaction with the acceptability and affordability of the food available at the most frequently used grocery store, and walking time to grocery store, were investigated only in the subgroup of respondents that did groceries in their neighbourhood, a separate logistic regression model was performed to explore the association of these variables with HFI in this subgroup. No significant relationship was found (results not published).

RESULTS

The study sample included 785 participants; 681 were enrolled from 16 organizations delivering traditional CFSI and 104 were enrolled from six organizations delivering alternative CFSI. Descriptive characteristics of the study sample and their distribution by HFI are reported in Table 1. Most of the participants (49%) reported severe household food insecurity, while 39% reported moderate household food insecurity. Significant associations were observed between HFI and the socio-demographic characteristics of the respondents. More than 55% of respondents living in severely food-insecure households fell into the following categories: those in the 30–39 age group, those who are neither single nor married, those reporting fair or poor mental and physical health status, those living in a household where none of the adults had a high school diploma, and those with very low income.

More than half of the participants who reported difficulties in accessing food lived in severely food-insecure households (Table 2). The highest proportions of severe food insecurity were observed for participants reporting difficulties in accessing food due to: transportation constraints (63.6%) and food affordability (57%).

The multivariate logistic regression analysis showed that the local food environment is correlated with the severity of food insecurity independent of the participants' socio-demographic characteristics and health status (Table 3). The severity of food insecurity was related to difficulties in accessing food due to

food affordability (moderate food insecurity OR = 0.43, 95% CI: 0.28–0.62; food security OR = 0.13, 95% CI: 0.06–0.26), not shopping for food frequently (moderate food insecurity OR = 0.32, 95% CI: 0.15–0.67), and difficulties in accessing food due to transportation constraints (food security OR = 0.18, 95% CI: 0.06–0.55). In contrast, moderate food insecurity was associated with living between 1 and 2 km from the community organizations used (OR = 1.80, 95% CI: 1.12–2.88).

Owning a car (OR = 2.50, 95% CI: 1.15–5.44) and difficulties in accessing food due to food acceptability (OR = 2.73, 95% CI: 1.27–5.86) were correlated with food security. No significant associations were observed between HFI and other variables of the local food environment.

DISCUSSION

The purpose of this study was to examine the association between the local food environment and severity of HFI among new participants in CFSI in Montreal. The results showed that the severity of HFI was related to three dimensions of the food environment (affordability, accessibility and acceptability). Consistent with previous studies from the US and Australia,^{34–36} we found that difficulties in accessing food due to food affordability were associated with severe food insecurity. This finding supports the hypothesis that higher food prices could increase the severity of food insecurity among vulnerable

Table 1. Socio-demographic characteristics and health status of participants by household food insecurity (785 users of CFSI in Montreal between October 2011 and May 2012)

	Food-secure n = 98 (12%)	Moderately food-insecure n = 304 (39%)	Severely food-insecure n = 383 (49%)	Total n = 785
Gender*				
Male	40 (11.8)	116 (34.3)	182 (53.8)	338
Female	58 (13)	188 (42.1)	201 (44.9)	447
Age (years)*				
≤29	25 (18.9)	51 (38.6)	56 (42.4)	132
30–39	18 (9)	70 (34.8)	113 (56.2)	201
40–49	26 (12.6)	92 (44.4)	89 (43)	207
50–65	29 (11.8)	91 (37.1)	125 (51)	245
Marital status*				
Married/common-law spouse	40 (16)	117 (46.8)	93 (37.2)	250
Single	44 (11.9)	129 (34.8)	198 (53.3)	371
Other (separated, divorced, widowed)	14 (8.5)	58 (35.4)	92 (56.1)	164
Physical health*				
Very good	28 (15.3)	76 (41.5)	79 (43.2)	183
Good	29 (15.8)	79 (43.2)	75 (41)	183
Fair or poor	33 (9)	123 (33.7)	209 (57.3)	365
Missing	8 (14.8)	26 (48.2)	20 (37)	54
Mental health*				
Very good	45 (24.7)	74 (40.7)	63 (34.6)	182
Good	24 (13)	74 (40.2)	86 (46.7)	184
Fair or poor	21 (5.8)	130 (35.6)	214 (58.6)	365
Missing	8 (14.8)	26 (48.2)	20 (37)	54
Household education level*				
Less than a high school diploma	14 (7.2)	60 (30.8)	121 (62)	195
Secondary (high) school diploma	16 (8)	78 (39)	106 (53)	200
Post-secondary education	34 (14)	86 (35.4)	123 (50.6)	243
University degree or above	34 (23.1)	80 (54.4)	33 (22.4)	147
Household income*				
Not indicated	15 (14.6)	45 (43.7)	43 (41.7)	103
Very low income	29 (8.9)	112 (34.2)	186 (56.9)	327
Low income	19 (10.8)	75 (42.6)	82 (46.6)	176
Middle income	35 (19.6)	72 (40.2)	72 (40.2)	179

* p-value < 0.05.

Table 2. The local food environment by household food insecurity status of participants (785 users of CFSI in Montreal between October 2011 and May 2012)

	Food-secure	Moderately food-insecure	Severely food-insecure	Total N = 785
Distance (metres) between participant's residence and the community organization used				
≥2000 m	38 (12.3)	115 (37.3)	155 (50.3)	308
1000–1999 m	25 (11.8)	96 (45.3)	91 (42.9)	212
≤999 m	35 (13.2)	93 (35.1)	137 (51.7)	265
Location of the most frequently used grocery store				
Not shopping for food frequently	4 (5.6)	17 (23.6)	51 (70.8)	72
Outside the neighbourhood	14 (17.7)	33 (41.8)	32 (40.5)	79
In the neighbourhood	80 (12.6)	254 (40.1)	300 (47.3)	634
Walking time to the most frequently used grocery store*				
≥11 minutes	33 (10.5)	119 (37.9)	162 (51.6)	314
6–10 minutes	32 (16.2)	90 (45.7)	75 (38.1)	197
≤5 minutes	15 (12.2)	45 (36.6)	63 (51.2)	123
Mode of transportation*				
Car	36 (20)	73 (41)	69 (38.8)	178
Public transport	22 (10.9)	88 (43.8)	91 (45.3)	201
Active transport	40 (9.9)	143 (35.2)	223 (54.9)	406
Difficulties in accessing food due to transportation constraints*				
Difficult	6 (3.4)	58 (33)	112 (63.6)	176
Not difficult	85 (15.3)	220 (39.6)	251 (45.1)	556
Missing	7 (13.2)	28 (49.1)	20 (37.7)	53
Difficulties in accessing food due to distance to the grocery store				
Difficult	15 (9.6)	52 (33.3)	89 (57.1)	156
Not difficult	76 (13.3)	228 (39.8)	269 (46.9)	573
Missing	7 (12.5)	24 (42.9)	25 (44.6)	56
Difficulties in accessing food due to food acceptability				
Difficult	21 (13.2)	52 (32.7)	86 (54.1)	159
Not difficult	71 (12.6)	221 (39.3)	271 (48.1)	563
Missing	6 (9.5)	31 (49.2)	26 (41.3)	63
Difficulties in accessing food due to food affordability*				
Difficult	40 (7.5)	189 (35.5)	304 (57)	533
Not difficult	58 (23)	115 (45.6)	79 (31.3)	252
Satisfaction with the acceptability and affordability of the food available at the most frequently used grocery store*				
Dissatisfied or very dissatisfied	20 (7.5)	106 (39.7)	141 (52.8)	267
Satisfied	27 (13.9)	86 (44.3)	81 (41.8)	194
Very satisfied	33 (19.1)	62 (35.8)	78 (45.1)	173

* *p*-value < 0.05.

households.³⁵ However, longitudinal data are needed to better explain the causal effects of this association.

In relation to accessibility, our findings are consistent with studies showing that accessibility to grocery stores is not related to HFI.^{26,28} However, our results suggest that owning a car and reporting difficulties in accessing food due to transport constraints were associated with HFI. These findings are in line with previous research studies,^{9,23,25,37} suggesting that accessibility to food stores is not sufficient to improve food access, as also stated by McIntyre.³⁸ Food interventions that lead to improved HFI may need to consider the impact of transportation on FI.

Our findings indicate that the distance between the participant's home location and the organization delivering CFSI used, was correlated with moderate food insecurity. Our findings seem to be in contrast with a previous study done in Toronto by Kirkpatrick and Tarasuk, which suggested that there is no association between proximity to organizations delivering CFSI and HFI among low-income families.²⁸ The differences can be explained by participants' inclusion criteria: while the majority of Kirkpatrick and Tarasuk's sample did not participate in CFSI,²⁸ our sample is exclusively composed of new CFSI users.

Finally, we found that food security was correlated to difficulties in accessing food due to food acceptability. This can be explained by the fact that these families have access to enough nutritious food, but do not have access to food choices. This finding confirms the limitation to the Household Food Security Survey Module to measure the acceptability of food.³⁹

Limitations

Our study has some limitations. First, the data used were from a convenience sample from organizations providing CFSI. As a result, the findings of this study are not generalizable to the food-insecure population. However, they are likely to reflect the situation of the most vulnerable households in Montreal. Second, given the nature of the cross-sectional design of the data, our findings do not assess causal association between the local food environment and food insecurity. Finally, this study did not include the types of the most used grocery store. Therefore, participants who were more likely to use supermarkets or supercentres, which offer more food variety and lower prices than other grocery stores, may have better food security status.

Table 3. Multivariate odds ratios and 95% confidence intervals of being in food-secure or moderately food-insecure households compared to severely food-insecure households according to the local food environment among new users of CFSI in Montreal (between October 2011 and May 2012)

	Food-secure		Moderately food-insecure	
	OR (95% CI)	Adjusted OR (95% CI) [‡]	OR (95% CI)	Adjusted OR (95% CI)
Localization of the most frequently used grocery store				
Not shopping for food frequently	0.30 (0.08; 1.10)	0.34 (0.07; 1.61)	0.34 (0.17; 0.67)*	0.32 (0.15; 0.67)*
Outside the neighbourhood	1.85 (0.80; 4.24)	2.47 (0.96; 6.32)	0.94 (0.51; 1.76)	0.79 (0.40; 1.56)
In the neighbourhood (ref)	1.00	1.00	1.00	1.00
Distance (metres) between participant's residence and the community organization used				
≥2000 m	1.00 (0.55; 1.82)	0.97 (0.49; 1.97)	1.08 (0.73; 1.61)	1.04 (0.67; 1.62)
1000–1999 m	1.16 (0.60; 2.23)	1.11 (0.51; 2.38)	1.51 (0.98; 2.35)	1.80 (1.12; 2.88)*
≤999 m	1.00	1.00	1.00	1.00
Mode of transportation				
Car	2.50 (1.36; 4.59)*	2.50 (1.15; 5.44)*	1.48 (0.95; 2.29)	1.33 (0.79; 2.23)
Public transport	1.80 (0.91; 3.56)	1.31 (0.60; 2.86)	1.81 (1.19; 2.75)*	1.58 (0.99; 2.51)
Active transport (ref)	1.00	1.00	1.00	1.00
Difficulties in accessing food due to transport constraints				
Difficult	0.17 (0.06; 0.45)*	0.18 (0.06; 0.55)*	0.71 (0.45; 1.11)	0.70 (0.42; 1.17)
Not difficult (ref)	1.00	1.00	1.00	1.00
Difficulties in accessing food due to distance to the grocery store				
Difficult	1.55 (0.73; 3.29)	1.82 (0.76; 4.34)	0.83 (0.51; 1.34)	0.84 (0.49; 1.41)
Not difficult (ref)	1.00	1.00	1.00	1.00
Difficulties in accessing food due to food acceptability				
Difficult	2.60 (1.30; 5.17)*	2.73 (1.27; 5.86)*	1.25 (0.81; 1.94)	1.19 (0.73; 1.92)
Not difficult (ref)	1.00	1.00	1.00	1.00
Difficulties in accessing food due to food affordability*				
Difficult	0.12 (0.06; 0.22)*	0.13 (0.06; 0.26)*	0.41 (0.28; 0.60)*	0.43 (0.28; 0.62)*
Not difficult (ref)	1.00	1.00	1.00	1.00

* p-value < 0.05.

[†] Reference group: Severely food-insecure households.

[‡] OR is adjusted for respondent's gender, age, marital status, physical health, mental health, household education level, and household income.

CONCLUSION

This is the first study examining several dimensions of the local food environment among new users of CFSI in Canada. Our results provide important insights into factors of the local food environment that are associated with the severity of household food insecurity. Our findings help in the differentiation of several dimensions of the local food environment and the relevance of each dimension to promote food security. It supports the argument that to improve access to food sources in vulnerable populations is more complex than ensuring adequate availability and accessibility of food stores.³⁰ Future studies should study the relationship between the local food environment and food insecurity across all dimensions of food access.

REFERENCES

- Anderson S. Life sciences research office report: Core indicators of nutritional state for difficult-to-sample populations. *J Nutr* 1990;120:1555–600. PMID: 2243305.
- Tarasuk V, Mitchell A, Dachner N. *Household Food Insecurity in Canada, 2013*. Toronto, ON: Research to Identify Policy Options to Reduce Food Insecurity (PROOF), 2015.
- Kirkpatrick S, Tarasuk V. Food insecurity is associated with nutrient inadequacies among Canadian adults and adolescents. *J Nutr* 2008;138(3): 604–12. PMID: 18287374.
- Laraia BA. Food insecurity and chronic disease. *Adv Nutr* 2013;4(2):203–12. PMID: 23493536. doi: 10.3945/an.112.003277.
- Vozoris NT, Tarasuk V. Household food insufficiency is associated with poorer health. *J Nutr* 2003;133(1):120–26. PMID: 12514278.
- Melchior M, Chastang JF, Falissard B, Galera C, Tremblay RE, Cote SM, et al. Food insecurity and children's mental health: A prospective birth cohort study. *PLoS ONE* 2012;7(12):e52615. PMID: 23300723. doi: 10.1371/journal.pone.0052615.

- Kirkpatrick S, McIntyre L, Potestio ML. Child hunger and long-term adverse consequences for health. *Arch Pediatr Adolesc Med* 2010;164(8):754–62. PMID: 20679167. doi: 10.1001/archpediatrics.2010.117.
- Rose D. Economic determinants and dietary consequences of food insecurity in the United States. *J Nutr* 1999;129(2):517S–20S. PMID: 10064321.
- Gorton D, Bullen CR, Mhurchu CN. Environmental influences on food security in high-income countries. *Nutr Rev* 2010;68(1):1–29. PMID: 20041997. doi: 10.1111/j.1753-4887.2009.00258.x.
- Carter MA, Dubois L, Tremblay MS. Place and food insecurity: A critical review and synthesis of the literature. *Public Health Nutr* 2014;17(1):94–112. PMID: 23561752. doi: 10.1017/S1368980013000633.
- Power E; Dietitians of Canada. Individual and household food insecurity in Canada: Position of Dietitians of Canada. *Can J Diet Pract Res* 2005;65(1): 43–46. PMID: 17068874. doi: 10.3148/66.1.2005.43.
- Loopstra R, Tarasuk V. Food bank usage is a poor indicator of food insecurity: Insights from Canada. *Soc Policy Soc* 2015;14(3):443–55. doi: 10.1017/S1474746415000184.
- Hamelin A-M, Mercier C, Bédard A. Needs for food security from the standpoint of Canadian households participating and not participating in community food programmes. *Int J Consum Stud* 2011;35(1):58–68. doi: 10.1111/j.1470-6431.2010.00927.x.
- Kirkpatrick S, Tarasuk V. Food insecurity and participation in community food programs among low-income Toronto families. *Can J Public Health* 2009; 100(2):135–39. PMID: 19839291.
- Tarasuk V, Dachner N, Hamelin A-M, Ostry A, Williams P, Bosckei E, et al. A survey of food bank operations in five Canadian cities. *BMC Public Health* 2014;14(1):1–11. PMID: 25432209. doi: 10.1186/1471-2458-14-1234.
- Hamelin A-M, Mercier C, Bédard A. Discrepancies in households and other stakeholders viewpoints on the food security experience: A gap to address. *Health Educ Res* 2010;25(3):401–12. PMID: 19564176. doi: 10.1093/her/cyp033.
- Loopstra R, Tarasuk V. The relationship between food banks and household food insecurity among low-income Toronto families. *Can Public Policy* 2012; 38(4):497–514. doi: 10.3138/CP.38.4.497.
- Hamelin AM, Beaudry M, Habicht JP. Characterization of household food insecurity in Quebec: Food and feelings. *Soc Sci Med* 2002;54(1):119–32. PMID: 11820676. doi: 10.1016/S0277-9536(01)00013-2.
- Roncarolo F, Bisset S, Potvin L. Short-term effects of traditional and alternative community interventions to address food insecurity. *PLoS ONE* 2016;11(3):e0150250. PMID: 26974826. doi: 10.1371/journal.pone.0150250.

20. Apparicio P, Cloutier MS, Shearmur R. The case of Montreal's missing food deserts: Evaluation of accessibility to food supermarkets. *Int J Health Geogr* 2007;6:4. PMID: 17295912. doi: 10.1186/1476-072X-6-4.
21. Glanz K, Sallis JF, Saelens BE, Frank LD. Healthy nutrition environments: Concepts and measures. *Am J Health Promot* 2005;19(5):330-33. PMID: 15895534. doi: 10.4278/0890-1171-19.5.330.
22. Caspi CE, Sorensen G, Subramanian SV, Kawachi I. The local food environment and diet: A systematic review. *Health Place* 2012;18(5):1172-87. PMID: 22717379. doi: 10.1016/j.healthplace.2012.05.006.
23. Bartfeld JS, Ryu J-H, Wang L. Local characteristics are linked to food insecurity among households with elementary school children. *J Hunger Environ Nutr* 2010;5(4):471-83. doi: 10.1080/19320248.2010.527278.
24. Mayer VL, Hillier A, Bachhuber MA, Long JA. Food insecurity, neighborhood food access, and food assistance in Philadelphia. *J Urban Health* 2014; 91(6):1087-97. PMID: 25047157. doi: 10.1007/s11524-014-9887-2.
25. DeMartini TL, Beck AF, Kahn RS, Klein MD. Food insecure families: Description of access and barriers to food from one pediatric primary care center. *J Commun Health* 2013;38(6):1182-87. PMID: 23852328. doi: 10.1007/s10900-013-9731-8.
26. Mabl J. *SNAP Participation, Food Security, and Geographic Access to Food*. Prepared by Mathematica Policy Research for the U.S. Department of Agriculture, Food and Nutrition Service, 2014.
27. Sharkey JR, Dean WR, Johnson CM. Association of household and community characteristics with adult and child food insecurity among Mexican-origin households in *Colonias* along the Texas-Mexico border. *Int J Equity Health* 2011;10:19. PMID: 21569496. doi: 10.1186/1475-9276-10-19.
28. Kirkpatrick SI, Tarasuk V. Assessing the relevance of neighbourhood characteristics to the household food security of low-income Toronto families. *Public Health Nutr* 2010;13(7):1139-48. PMID: 20196916. doi: 10.1017/S1368980010000339.
29. Roncarolo F, Adam C, Bisset S, Potvin L. Traditional and alternative community food security interventions in Montreal, Quebec: Different practices, different people. *J Community Health* 2014;40(2):199-207. PMID: 25012098. doi: 10.1007/s10900-014-9917-8.
30. Health Canada. *Canadian Community Health Survey, Cycle 2.2, Nutrition (2004): Income-Related Household Food Security in Canada*. Report No. 4696. Ottawa, ON: Office of Nutrition Policy and Promotion, Health Products and Food Branch, Health Canada, 2007.
31. Silva V, Grande A, Rech CR, Peccin MS. Geoprocessing via Google Maps for assessing obesogenic built environments related to physical activity and chronic noncommunicable diseases: Validity and reliability. *J Healthc Eng* 2015;6(1):41-54. PMID: 25708376. doi: 10.1260/2040-2295.6.1.41.
32. Ware J, Kosinski M, Turner-Bowker D, Gandek B. How to Score Standard Form Scales and Summary Measures. In: Ware J, Kosinski M, Turner-Bowker D, Gandek B (Eds.), *User's Manual for the SF-12v2® Health Survey* (with a supplement documenting FS-12 Health Survey). Lincoln, RI: QualityMetric Incorporated, 2002.
33. Ambler G, Rumana Z, Royston P. A comparison of imputation techniques for handling missing predictor values in a risk model with a binary outcome. *Stat Methods Med Res* 2007;16:277-98. PMID: 17621472. doi: 10.1177/0962280206074466.
34. Tolzman C, Rooney B, Duquette RD, Rees K. Perceived barriers to accessing adequate nutrition among food insecure households within a food desert. *WMJ* 2014;113(4):139-43. PMID: 25211800.
35. Zhang Q, Jones S, Ruhm CJ, Andrews M. Higher food prices may threaten food security status among American low-income households with children. *J Nutr* 2013;143(10):1659-65. PMID: 23946342. doi: 10.3945/jn.112.170506.
36. Nolan M, Williams M, Rikard-Bell G, Mohsin M. Food insecurity in three socially disadvantaged localities in Sydney, Australia. *Health Promot J Austr* 2006;17(3):247-54. PMID: 17176242.
37. Burns C, Bentley R, Thornton L, Kavanagh A. Reduced food access due to a lack of money, inability to lift and lack of access to a car for food shopping: A multilevel study in Melbourne, Victoria. *Public Health Nutr* 2011;14(6): 1017-23. PMID: 21338555. doi: 10.1017/S136898001000385X.
38. Macintyre S. Deprivation amplification revisited; or, is it always true that poorer places have poorer access to resources for healthy diets and physical activity? *Int J Behav Nutr Phys* 2007;4(1):32. doi: 10.1186/1479-5868-4-32.
39. Leroy JL, Ruel M, Frongillo EA, Harris J, Ballard TJ. Measuring the food access dimension of food security: A critical review and mapping of indicators. *Food Nutr Bull* 2015;36(2):167-95. PMID: 26121701. doi: 10.1177/0379572115587274.

Received: April 20, 2016

Accepted: October 28, 2016

RÉSUMÉ

OBJECTIF : Examiner la relation entre l'environnement alimentaire local et la sévérité de l'insécurité alimentaire parmi les nouvelles familles utilisant les organismes communautaires d'intervention en sécurité alimentaire à Montréal.

MÉTHODE : Dans cette étude transversale, nous avons analysé les données de base de 785 adultes âgés de 18 à 65 ans qui ont participé à une enquête sur les effets des interventions en sécurité alimentaire à Montréal. Les variables dépendante et indépendante étaient respectivement, l'insécurité alimentaire des ménages et l'environnement alimentaire local. Cette dernière était évaluée selon différentes mesures : l'emplacement de l'épicerie la plus fréquemment utilisée, la distance entre le domicile du participant et l'organisme communautaire qu'il fréquentait, le mode de transport, le temps de marche pour se rendre à l'épicerie la plus fréquemment utilisée, la satisfaction quant à l'acceptabilité et le caractère abordable des aliments à l'épicerie la plus fréquemment utilisée, et les difficultés d'accès aux aliments. Nous avons utilisé des modèles de régression logistique multinomiale afin d'évaluer la relation entre l'insécurité alimentaire et l'environnement alimentaire local. Dans tous les modèles, l'insécurité alimentaire a été codée selon trois catégories : sécurité alimentaire, insécurité alimentaire modérée et insécurité alimentaire sévère. Le dernier groupe a été utilisé comme groupe de référence.

RÉSULTATS : Nos données suggèrent qu'en comparaison avec les ménages en situation d'insécurité alimentaire sévère, ceux en situation d'insécurité alimentaire modérée (OR = 0,43, IC 95% : 0,28-0,62) et ceux en sécurité alimentaire (OR = 0,13, IC 95% : 0,06-0,26) étaient moins susceptibles de déclarer des difficultés d'accès aux aliments à cause de la cherté des aliments. Les ménages en sécurité alimentaire avaient une probabilité plus faible de déclarer des difficultés d'accès aux aliments à cause de contraintes de transport (OR = 0,18, IC 95% : 0,06-0,55) en comparaison avec les ménages en situation d'insécurité alimentaire sévère. Habiter à une distance entre un et deux kilomètres de l'organisme utilisé était significativement corrélé avec l'insécurité alimentaire modérée (OR = 1,80, IC 95% : 1,12-2,88).

CONCLUSION : L'environnement alimentaire local est associé à la sévérité de l'insécurité alimentaire chez les nouvelles familles qui utilisent les interventions communautaires en sécurité alimentaire à Montréal. Des études futures devraient étudier la relation entre l'environnement alimentaire et l'insécurité alimentaire dans toutes les dimensions de l'accès aux ressources alimentaires.

MOTS CLÉS : approvisionnement alimentaire; aide alimentaire; environnement alimentaire; Montréal; insécurité alimentaire