

# The Relationship Between Household Food Insecurity With Food and Nutrition Literacy Among Children in Mashhad, Iran: A Cross-sectional Study

**Fateme Khorram Rouz**

Mashhad University of Medical Sciences <https://orcid.org/0000-0002-1316-4624>

**Azam Doustmohammadian**

Iran University of Medical Sciences

**Omid Eslami**

Iran University of Medical Sciences

**Majid Khadem-Rezaiyan**

Mashhad University of Medical Sciences

**Parisa Pourmohammadi**

Varastegan Institute for Medical Sciences

**Maryam Amini**

Shaheed Beheshti University of Medical Sciences

**Maryam Khosravi** (✉ [Khosravim@mums.ac.ir](mailto:Khosravim@mums.ac.ir))

Department of Nutrition, School of Medicine, Mashhad University of medical Sciences, Mashhad, Iran

<https://orcid.org/0000-0001-9708-5466>

---

## Research note

**Keywords:** Food and Nutrition literacy, Food Insecurity, Children

**Posted Date:** July 20th, 2020

**DOI:** <https://doi.org/10.21203/rs.3.rs-42646/v1>

**License:** © ⓘ This work is licensed under a Creative Commons Attribution 4.0 International License.

[Read Full License](#)

---

**Version of Record:** A version of this preprint was published on September 15th, 2020. See the published version at <https://doi.org/10.1186/s13104-020-05280-2>.

# Abstract

## Objective

The aim of this study was to assess the relationship between household food insecurity (HFI) with food and nutrition literacy (FNLIT) in a sample of Iranian children. This cross sectional study was performed on 315 children aged 9 to 12 years recruited from the primary schools throughout Mashhad, Iran. The Household Food Insecurity Access Scale (HFIAS) was used to assess the HFI. Also, overall FNLIT score and its sub-categories were evaluated using a validated 40-item questionnaire.

## Results

The prevalence of HFI in the total sample was about 56 %. Also, almost 14 % of students had a low FNLIT score. HFI was inversely associated with overall FNLIT score ( $\beta = -0.12$ ,  $p = 0.006$ ), as well as nutritional health knowledge ( $\beta = -0.08$ ,  $p = 0.01$ ), and food label literacy ( $\beta = -0.15$ ,  $p < 0.001$ ). Furthermore, food-insecure children had a higher likelihood of having low FNLIT score (OR = 2.89, CI: 1.03-8.09;  $p = 0.04$ ) than the food-secure subjects. In conclusion, there is a negative association between HFI and FNLIT in children. Further studies to confirm this finding are needed.

## Introduction

Household food insecurity (HFI), which is defined as the limited access to nutritionally adequate and safe food or inability to acquire foods in socially acceptable ways, has become a major public health concern throughout the world. HFI is shown to be positively related to the several adverse health outcomes in children including infectious diseases, anemia, psychological distresses, and growth disorders (1). Several socio-economic and environmental factors are proposed that might influence access to healthy foods in low-income or food-insecure individuals (2, 3). Of these, the role of financial constraints is well established. Although household income is a major potential contributor to food access, it is only a part of the story. As the results of a survey conducted in Canadian households demonstrated that about 15% of food-insecure households were not considered as the low-income group (4). This is a matter of great importance to public health since it highlights the role of non-financial factors in determining food access at the household level. One of the factors that have been recently gained attention is food and nutrition literacy (FNLIT).

The FNLIT is a relatively new term that reflects the technical, cultural and ethical aspects of the foods beyond just a source of satisfying the caloric requirements (5). Food literacy is defined as 'the knowledge, skills, and behaviors required to plan, manage, select, prepare and eat foods to meet needs and determine food intake'(6). While nutrition literacy refers to the ability to obtain, understand and interpret the nutrition concepts and information for adopting the appropriate nutritional health-related decisions (7). Although the two terms describe distinct concepts, they can complement each other, since nutrition literacy can serve as a prerequisite for a wider range of practical knowledge, skills, and behaviors describe as the food literacy (8).

Findings from some recent studies have shown that in comparison to the food-secure households, those with food insecurity had lower FNLIT mainly characterized by unfavorable food choices and purchasing decisions as well as poor food preparation skills (9–12). However, this evidence was limited to the adult population living in high-income and developed countries; thus it is unknown whether these findings are generalizable to the children and adolescents particularly in the low-income and developing nations. To our knowledge, no study has examined the relationship between HFI and food literacy in children yet. With this regard, the present study aimed to assess the association of HFI with FNLIT and its sub-categories in a sample of Iranian children.

## Main Text

## Methods

A total of 315 children aged 9 to 12 years-old were recruited from the primary schools throughout the city of Mashhad, north-east of Iran. Data were collected from December 2018 to March 2019. Study subjects were chosen using a multi-stage random cluster sampling method. Children in the fourth, fifth and sixth grades who had not any chronic or acute diseases, were eligible to participate in the study.

Sociodemographic data including child's age, birth order, parents' age, parental education was obtained through interviews with students and verified by their mothers or caregivers by experienced interviewers.

Anthropometric measurements were performed by a trained dietitian using the calibrated equipment. Body mass index (BMI) was calculated as weight in kilograms divided by the square of height in meter. The BMI Z-score for age and sex was calculated based on the World Health Organization Child Growth Standards software (AnthroPlus, World Health Organization, Geneva, Switzerland, 2007). The weight status of children was reported in four categories including underweight (z-score < 2 standard deviation (SD), normal (z-score  $\geq -2$  SD and  $\leq 1$  SD), overweight (z-score > 1 SD and  $\leq 2$ SD), and obese (z-score > 2 SD).

The Household Food Insecurity Access Scale (HFIAS) was used to assess HFI in the study sample. The validity and reliability of the Persian version of questionnaire in the Iranian population was confirmed by Salarkia et al (13). The questionnaire consists of 9 items investigating a wide range of food-related behaviors, experiences, and conditions due to the financial limitation over a recall period of past month. Based on the total score, households were categorized as food secure (0–1 point), mild (2–7 points), moderate (8–14 points), and severe food insecure (15–27 points).

The FNLIT was measured using a developed questionnaire. The questionnaire examining FNLIT in two distinctive domains with 7 subscales, including 1) cognition domain: understanding food and nutrition information and nutritional health knowledge; 2) skills domain: functional FNLIT, interactive FNLIT, food choice literacy, critical FNLIT and food label literacy, respectively.

We confirmed the validity and reliability of FNLIT in this population. Content Validity Ratio (CVR) and Content Validity Index (CVI) of the 40-item questionnaire were at acceptable levels of 0.87 and 0.99. The internal consistency and test-retest reliability were assessed using Cronbach  $\alpha$  (subscale-specific, range: 0.68–0.8) and intra-class correlation coefficients (ICC: 0.97, CI: 0.94-98), respectively. FNLIT scores were ranked into 3 categories as low FNLIT ( $\leq 58$ ), medium FNLIT ( $> 58$ -<81) and high FNLIT ( $\geq 81$ ).

## Statistical Analysis

Statistical analysis was performed using SPSS version 25 (SPSS Inc., Chicago, Illinois, USA). Chi-square test was used to compare the demographic and anthropometric variables between the food-secure and food-insecure subjects. Crude and adjusted linear regression models were performed to determine the influence of HFI on changes in overall FNLIT score and its sub-categories. Also, to determine the odds of having low FNLIT score in food insecure subjects in comparison to the food secure one, the crude and adjusted multiple regression models were used. The covariates included in the adjusted analyses were sex, grade, BMI, birth order, as well as parental age and education. Categorical variables were presented as frequency and percentage, while the numerical data were reported as mean, standard deviation (SD), beta coefficient ( $\beta$ ), odds ratio (OR), and 95% confidence interval (CI). Significance level was considered as a p-value less than 0.05.

## Results

A total of 315 students (51% males) participated in the study. The mean age of study participants was  $10.55 \pm 1.007$  years. The prevalence of mild, moderate, and severe HFI in the total sample were 30.5%, 20.3%, and 5.7%, respectively. Also, about 14% of the students had a low FNLIT score, while the percentages of moderate and high FNLIT scores in the total study sample were 62.7% and 23.2%, respectively. As it is shown in Table 1, the distribution of BMI, birth order and parental education were significantly different between the food-secure and food-insecure subjects ( $p < 0.05$ ). Although, there were no significant differences between the two groups in terms of age, sex, grade and parental age.

Table 1  
General characteristics of study participants.

| Variable                  | HFI status                |                            | p-value <sup>a</sup> |
|---------------------------|---------------------------|----------------------------|----------------------|
|                           | Food-secure<br>(n = 137)  | Food-insecure<br>(n = 178) |                      |
| Age (year)                | 10.49 ± 1.02 <sup>b</sup> | 10.58 ± 0.98               | 0.44 <sup>c</sup>    |
| Sex                       | Male                      | 73 (53.3) <sup>c</sup>     | 0.56                 |
|                           | Female                    | 64 (46.7)                  |                      |
| Grade                     | Fourth                    | 50 (36.5)                  | 0.73                 |
|                           | Fifth                     | 43 (31.4)                  |                      |
|                           | Sixth                     | 44 (32.1)                  |                      |
| BMI z-score               | Underweight               | 8 (5.8)                    | 0.02*                |
|                           | Normal                    | 76 (55.5)                  |                      |
|                           | Overweight                | 20 (14.6)                  |                      |
|                           | Obese                     | 33 (24.1)                  |                      |
| Birth order               | 1                         | 81 (59.1)                  | < 0.001*             |
|                           | ≥ 2                       | 56 (40.9)                  |                      |
| Father age tertile (year) | 30–37                     | 31 (22.8)                  | 0.15                 |
|                           | 38–44                     | 69 (50.7)                  |                      |
|                           | ≥ 45                      | 36 (26.5)                  |                      |
| Mother age tertile (year) | 23–34                     | 43 (31.4)                  | 0.56                 |

<sup>a</sup> p-values obtained from Chi-square test unless indicated

<sup>b</sup> Data are shown as Mean ± standard deviation

<sup>c</sup> P-value obtained from Independent-samples t test.

<sup>c</sup> Data are shown as Frequency (Percentage)

\* Significant at the level of p < 0.05

**Abbreviations:** HFI, Household food insecurity; BMI, Body mass index.

| Variable  |                               | HFI status |            | p-value <sup>a</sup> |
|---|-------------------------------|------------|------------|----------------------|
|   | 35–39                         | 57 (41.6)  | 67 (38.3)  |                      |
|   | ≥ 40                          | 37 (27)    | 57 (32.6)  |                      |
| Father education  | ≤ 5 years education           | 2 (1.5)    | 39 (22.4)  | < 0.001*             |
|   | 6 to 9 years or diploma       | 37 (27.2)  | 103 (59.2) |                      |
|   | Associate's degree and higher | 97 (71.3)  | 32 (18.4)  |                      |
| Mother education  | ≤ 5 years education           | 1 (0.7)    | 28 (16)    | < 0.001*             |
|   | 6–9 years or diploma          | 38 (27.7)  | 125 (71.4) |                      |
|   | Associate's degree and higher | 98 (71.5)  | 22 (12.6)  |                      |
| <sup>a</sup> p-values obtained from Chi-square test unless indicated        |                               |            |            |                      |
| b Data are shown as Mean ± standard deviation                               |                               |            |            |                      |
| c P-value obtained from Independent-samples t test.                         |                               |            |            |                      |
| c Data are shown as Frequency (Percentage)                                  |                               |            |            |                      |
| * Significant at the level of p < 0.05                                      |                               |            |            |                      |
| <b>Abbreviations:</b> HFI, Household food insecurity; BMI, Body mass index. |                               |            |            |                      |

The crude linear regression (Table 2) showed that each unit increase in HFI score was inversely significantly associated with a decrease in total FNLIT score ( $\beta = -0.29$ ,  $p < 0.001$ ) as well as its subscales including understanding of food and nutrition information ( $\beta = -0.20$ ,  $p < 0.001$ ), nutritional health knowledge ( $\beta = -0.22$ ,  $p < 0.001$ ), functional FNLIT ( $\beta = -0.12$ ,  $p = 0.03$ ), food choice literacy ( $\beta = -0.19$ ,  $p = 0.001$ ), and food label literacy ( $\beta = -0.36$ ,  $p < 0.001$ ). However, after adjusting for covariates, these associations remained significant for total FNLIT ( $\beta = -0.12$ ,  $p = 0.006$ ), nutritional health knowledge ( $\beta = -0.08$ ,  $P = 0.01$ ), and food label literacy ( $\beta = -0.15$ ,  $p < 0.001$ ).

Table 2

Crude and adjusted association between HFI and total FNLIT scores and its subscales obtained from multiple linear regression analysis.

| Variable  | Crude analysis |          | Adjusted analysis <sup>a</sup> |          |
|---|----------------|----------|--------------------------------|----------|
|   | $\beta$        | p-value  | $\beta$                        | p-value  |
| Total FNLIT score   | - 0.29         | < 0.001* | - 0.12                         | 0.006*   |
| Understanding of food and nutrition information                                     | - 0.20         | < 0.001* | - 0.08                         | 0.05     |
| nutritional health knowledge  | - 0.22         | < 0.001* | - 0.11                         | 0.01*    |
| functional FNLIT  | - 0.12         | 0.03*    | - 0.03                         | 0.49     |
| interactive FNLIT   | - 0.09         | 0.09     | - 0.05                         | 0.21     |
| food choice literacy  | - 0.19         | 0.001*   | - 0.06                         | 0.13     |
| critical FNLIT  | - 0.07         | 0.2      | - 0.01                         | 0.73     |
| Food label literacy   | - 0.36         | < 0.001* | - 0.15                         | < 0.001* |
| <sup>a</sup> Adjusted for sex, grade, BMI, birth order, parental age and education. |                |          |                                |          |
| * Significant at the level of $p < 0.05$  |                |          |                                |          |
| <b>Abbreviations:</b> CI, Confidence interval; FNLIT, Food and nutrition literacy.  |                |          |                                |          |

Based on the results of logistic regression analysis shown in Table 3, the food-insecure group had a higher likelihood of having low FNLIT compared to the food-secure group (OR = 2.86, 95% CI = 1.35, 6.05;  $p = 0.006$ ). Also, this association remained significant after adjusting for potential covariates (OR = 2.89, 95% CI = 1.03, 8.09;  $p = 0.04$ ).

Table 3  
Crude and adjusted odds of having low FNLIT according to the HFI status obtained from logistic regression analysis (n = 315)

|   | Crude analysis   |         | Adjusted analysis <sup>a</sup> |         |
|---|------------------|---------|--------------------------------|---------|
|   | OR (95% CI)      | p-value | OR (95% CI)                    | p-value |
| Low FNLIT   |                  |         | Low FNLIT                      |         |
| HFI status  |                  |         |                                |         |
| Food secure   | Reference        |         | Reference                      |         |
| Food insecure   | 2.86 (1.35–6.05) | 0.006 * | 2.89 (1.03–8.09)               | 0.04 *  |
| <sup>a</sup> Adjusted for sex, grade, BMI, birth order, parental age and education.   |                  |         |                                |         |
| * Significant at the level of p < 0.05  |                  |         |                                |         |
| <b>Abbreviations:</b> FNLIT, Food and nutrition literacy; OR, Odds ratio; CI, Confidence interval; HFI, Household food insecurity |                  |         |                                |         |

## Discussion

To our knowledge, this is the first study investigating the association between HFI and FNLIT in a sample of school-aged children in Iran. We found that children living in the food-insecure households had higher odds of having overall FNLIT compared to the food-secure children. Also, HFI was associated with poor FNLIT behaviors including nutritional health knowledge and food label literacy.

Findings of the present study are in consistent with the earlier studies, mainly performed in the adults' population. In a study by Begley et al. among a sample of Australian adults, all domains of the Australian food literacy model including planning and management, shopping, preparation, and cooking were independently associated with food insecurity (9). Also, In another study that assessed the relationship between cooking self-efficacy and food preparation behaviors with food security status among college students, Knol et al found very low food secure students had significantly lower cooking self-efficacy and food preparation scores compared with food secure students (11). Similarly, Mercille et al demonstrated that showed severe household food insecurity was inversely associated with healthy food preparation and self-efficacy among Canadian aboriginal women (14). Despite the consistent results, there have been a considerable heterogeneity between the studies in terms of the type of measurement tools for assessment of food insecurity and different aspects of FNLIT. Also all the previous studies were conducted in the adults from developed countries that should be considered when the interpretation of the results.

As expected, these findings indicate students experiencing HFI had a lower level of nutritional knowledge and were less able to understand food and nutrition information. Also, the food choice literacy scores was lower in the food-insecure subjects. This result is consistent with several studies demonstrated HFI

are associated with unfavorable eating behaviors and consequently low dietary quality, particularly among children (15–18). Landry et al. reported food insecure children had poor diet quality and lower scores for greens and beans, seafood and plant proteins, and added sugar compared to the food-secure ones (15). Similarly, in a study conducted on 3790 food-insufficient, low-income families, children consumed fewer calories, total carbohydrates and fruits, but higher cholesterol intake (16).

Moreover, children experiencing different degrees of food insecurity had higher tendency to purchase foods from stores that contain less-healthy foods particularly the convenience ones, and also making unfavorable food choices such as purchasing unhealthy snack foods and sugar sweetened beverages (19, 20). Although food literacy as a key component of shaping eating behaviors can improve food choices by helping food insecure children to develop their skills, many unmodifiable factors contribute to make poor food choices such as household income level, poor food access and availability and the high prices of healthy food.

The results also suggest that HFI was inversely associated with food label literacy. Consistent with our observation Butcher et al found Australian households with low or very low HFI status less tend to find, use or be influenced by nutrition information on food labels when making dietary decisions (10). Similarly, Gittelsohn et al reported the lowest food label reading and food knowledge scores among food-insecure households in Baltimore City in the USA (12). Although there is a growing body of evidence suggested that food label literacy may lead to healthier food purchases(21, 22), the less use of food labels in food-insecure households probably due to families' priorities. In confronting with financial constraints, food purchasing decisions of families are based on price and family food preferences rather than nutrition considerations (23).

## **Conclusion**

In summary, we found that HFI is associated with children's food and nutrition literacy. There was also a negative association between HFI and two-dimension of food literacy including nutrition knowledge and food label literacy. We suggested HFI status was a strong predictor of low FNLIT in primary schoolchildren. However, more research is needed to clarify the relationship between food security and food literacy in children to inform Policymaking.

## **Limitations**

There are a few limitations that need to be acknowledged. This is a cross-sectional study that can only establish an association between HFI and food literacy and cannot show causality. Therefore, future prospective studies are needed to confirm our results. The generalizability of the study findings to other populations and different age groups needs to be considered.

## **Abbreviations**

**HFI**

Household Food Insecurity

**FNLIT**

Food and Nutrition Literacy

**BMI**

Body Mass Index

**SD**

standard deviation

**HFIAS**

Household Food Insecurity Access Scale

**CVR**

Content Validity Ratio

**CVI**

Content Validity Index

**ICC**

Interclass coefficients

**OR**

odds ratio

**CI**

confidence interval

## **Declarations**

### **Ethics approval and consent to participate**

This study was approved by the Ethics Committee of Mashhad University of Medical Sciences. The objectives of the study were fully explained to the children's parents/guardians. Those who wished to participate in the study signed the written informed consent.

### **Consent to publish**

Not applicable.

### **Availability of data and materials**

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

### **Competing interests**

The authors declare that they have no competing interests.

### **Funding**

This study was approved and funded by Mashhad University of Medical Sciences (MUMS).

## Authors' Contributions

**Conceptualization:** [Fateme Khorram Rouz & Maryam Khosravi & Azam Doustmohammadian];  
**Methodology:** [Fateme Khorram Rouz & Azam Doustmohammadian & Omid Eslami & Majid Khadem Rezaiyan]; **Formal analysis and investigation:** [Fateme Khorram Rouz & Majid Khadem Rezaiyan & Maryam Amini & Parisa Pourmohammadi]; **Writing - original draft preparation:** [Fateme Khorram Rouz];  
**Writing - review and editing:** [Azam Doustmohammadian & Omid Eslami & Maryam Amini & Maryam Khosravi & Majid Khadem Rezaiyan]; **Funding acquisition:** [Maryam Khosravi]; **Supervision:** [Maryam Khosravi],

## Acknowledgments

This study is the result of research project No. 961287 of Mashhad University of Medical Sciences. The authors hereby express their gratitude to a Mashhad University of Medical Sciences (MUMS), and all coordinators, interviewers, and all the students participated in this study.

## References

1. Gundersen C, Ziliak JP. Food insecurity and health outcomes. *Health Aff.* 2015;34(11):1830–9.
2. Evans A, Banks K, Jennings R, Nehme E, Neme C, Sharma S, et al. Increasing access to healthful foods: a qualitative study with residents of low-income communities. *International Journal of Behavioral Nutrition Physical Activity.* 2015;12(1):5.
3. Ma X, Liese AD, Hibbert J, Bell BA, Wilcox S, Sharpe PA. The association between food security and store-specific and overall food shopping behaviors. *Journal of the Academy of Nutrition Dietetics.* 2017;117(12):1931–40.
4. Olabiyi OM, McIntyre L. Determinants of food insecurity in higher-income households in Canada. *Journal of Hunger & Environmental Nutrition.* 2014.
5. Gartaula H, Patel K, Shukla S, Devkota R. Indigenous knowledge of traditional foods and food literacy among youth: Insights from rural Nepal. *Journal of Rural Studies.* 2020;73:77–86.
6. Vidgen HA, Gallegos D. Defining food literacy and its components. *Appetite.* 2014;76:50–9.
7. Kalkan I. The impact of nutrition literacy on the food habits among young adults in Turkey. *Nutrition research practice.* 2019;13(4):352–7.
8. Krause C, Sommerhalder K, Beer-Borst S, Abel T. Just a subtle difference? Findings from a systematic review on definitions of nutrition literacy and food literacy. *Health Promot Int.* 2018;33(3):378–89.
9. Begley A, Paynter E, Butcher LM, Dhaliwal SS. Examining the association between food literacy and food insecurity. *Nutrients.* 2019;11(2):445.
10. Butcher LM, Ryan MM, O'Sullivan TA, Lo J, Devine A. Food-insecure household's self-reported perceptions of food labels, product attributes and consumption behaviours. *Nutrients.*

2019;11(4):828.

11. Knol LL, Robb CA, McKinley EM, Wood M. Very low food security status is related to lower cooking self-efficacy and less frequent food preparation behaviors among college students. *J Nutr Educ Behav.* 2019;51(3):357–63.
12. Suratkar S, Gittelsohn J, Song H-J, Anliker JA, Sharma S, Mattingly M. Food insecurity is associated with food-related psychosocial factors and behaviors among low-income African American adults in Baltimore City. *Journal of Hunger Environmental Nutrition.* 2010;5(1):100–19.
13. Salarkia N, Abdollahi M, Amini M, Eslami Amirabadi M. Validation and use of the HFIAS questionnaire for measuring household food insecurity in Varamin-2009. *Iranian Journal of Endocrinology Metabolism.* 2011;13(4):374–83.
14. Mercille G, Receveur O, Potvin L. Household Food Insecurity and Canadian Aboriginal Women's: Self-efficacy in Food Preparation. *Canadian Journal of Dietetic Practice Research.* 2012;73(3):134–40.
15. Landry MJ, van den Berg AE, Asigbee FM, Vandyousefi S, Ghaddar R, Davis JN. Child-Report of Food Insecurity Is Associated with Diet Quality in Children. *Nutrients.* 2019;11(7):1574.
16. Casey PH, Szeto K, Lensing S, Bogle M, Weber J. Children in Food-Insufficient, Low-Income Families: Prevalence, Health, and Nutrition Status. *Archives of Pediatrics Adolescent Medicine.* 2001;155(4):508–14.
17. French SA, Tangney CC, Crane MM, Wang Y, Appelhans BM. Nutrition quality of food purchases varies by household income: the SHoPPER study. *BMC Public Health.* 2019;19(1):231.
18. Bernal J, Frongillo EA, Rivera JA. Food insecurity reported by children, but not by mothers, is associated with lower quality of diet and shifts in foods consumed. *Matern Child Nutr.* 2016;12(3):546–57.
19. Dennisuk LA, Coutinho AJ, Suratkar S, Surkan PJ, Christiansen K, Riley M, et al. Food Expenditures and Food Purchasing Among Low-Income, Urban, African-American Youth. *Am J Prev Med.* 2011;40(6):625–8.
20. Ma X, Liese AD, Bell BA, Martini L, Hibbert J, Draper C, et al. Perceived and geographic food access and food security status among households with children. *Public Health Nutr.* 2016;19(15):2781–8.
21. Cowburn G, Stockley L. Consumer understanding and use of nutrition labelling: a systematic review. *Public Health Nutr.* 2005;8(1):21–8.
22. Mhurchu CN, Eyles H, Jiang Y, Blakely T. Do nutrition labels influence healthier food choices? Analysis of label viewing behaviour and subsequent food purchases in a labelling intervention trial. *Appetite.* 2018;121:360–5.
23. Dachner N, Ricciuto L, Kirkpatrick SI, Tarasuk V. Food purchasing and food insecurity: among low-income families in Toronto. *Canadian Journal of Dietetic Practice Research.* 2010;71(3):e50-e6.