An Investigation of the Role of Hunger on Mental Health and Well-Being in Canadian Adolescents

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June 2020

A thesis submitted to McGill University in partial fulfillment of the requirements of the degree of Master of Science in Psychiatry

Table of Contents

Abstract

Food insecurity is a condition stemming from poverty and defined as the lack of consistent access to adequate food. It is a growing problem for Canadian youth and is associated with adverse mental health outcomes. Due to increasing rates of food insecurity, research on protective factors for its effect on mental health is crucial. The central goals of this study were to examine how hunger is associated with the mental health and well-being of Canadian adolescents and whether family support functions as a moderator between reported hunger and mental health outcomes. Secondary aims of the study were to investigate the relationship between material deprivation and hunger, to examine the nature of the pathways between hunger and adverse mental health outcomes, and to investigate the relationship between hunger and diet quality. Using a nationally representative sample of 21,750 respondents from the 2017/2018 Canadian Health Behavior in School-Aged Children (HBSC) survey, the current study sought to examine the role of food insecurity as a social determinant of mental health and well-being in Canadian adolescents. Regression analyses were conducted in order to examine associations of hunger with material deprivation, internalizing and externalizing behaviors, family support, and food consumption. Participant reports of hunger were positively related to material deprivation and to adverse mental health outcomes and were negatively related to well-being. However, no significant moderating effect of family support was found on associations between hunger and mental health and well-being outcomes. Additionally, different patterns of food consumption were found for participants who reported hunger versus those who never reported hunger. Finally, after controlling for material deprivation, all associations remained significant, indicating the presence of a primarily psychosocial, as opposed to material, pathway between food insecurity and the various outcomes studied. The results of this study contribute to the

literature by raising awareness about the negative mental health and dietary consequences associated with food insecurity in the scarcely studied population of adolescents.

Résumé

L'insécurité alimentaire est une condition découlant de la pauvreté et définie comme l'absence d'accès régulier à une alimentation adéquate. C'est un problème croissant pour les jeunes Canadiens et il est associé avec des conséquences négatives pour la santé mentale. En raison de la croissance de la prévalence de l'insécurité alimentaire, la recherche sur les facteurs de protection pour ses effets sur la santé mentale est cruciale. Les objectifs principaux de cette étude sont d'examiner comment la faim est associée à la santé mentale et au bien-être des adolescents Canadiens et si le soutien familial sert à modérer les effets de la faim sur la santé mentale. Les objectifs secondaires de l'étude sont d'étudier la relation entre la privation matérielle et la faim, d'examiner la nature des liens entre la faim et les problèmes de santé mentale, et d'étudier la relation entre la faim et la qualité de l'alimentation. En utilisant un échantillon représentatif au niveau national de 21 750 répondants de l'étude "*Health Behavior in School-Aged Children*" (HBSC) de 2017/2018, cette étude a examiné le rôle de l'insécurité alimentaire comme déterminant social de la santé mentale et du bien-être des adolescents Canadiens. Des analyses de régression ont été effectuées afin d'examiner les associations entre la faim et la privation matérielle, les comportements d'intériorisation et d'externalisation, le soutien familial et la consommation alimentaire. La faim était positivement corrélée à la privation matérielle et aux problèmes de santé mentale, et était négativement corrélée avec le bien-être. Cependant, le soutien familial n'a eu aucun effet de modération sur les associations entre la faim et la santé mentale ou le bien-être. De plus, différentes habitudes de consommation alimentaire ont été observées entre les participants déclarant la faim et ceux qui ne la déclarent jamais. Enfin, après avoir contrôlé pour la privation matérielle, toutes les associations demeuraient significatives, indiquant la présence d'un lien principalement psychosocial, par opposition à matériel, entre

l'insécurité alimentaire et les différents problèmes étudiés. Les résultats de cette étude contribuent à la littérature en informant sur les conséquences négatives de l'insécurité alimentaire sur la santé mentale et sur l'alimentation dans la population d'adolescents peu étudiée.

Acknowledgements

I would like to express my sincere appreciation to all of the individuals who have supported me in my graduate studies in McGill's department of Psychiatry.

First and foremost, I would like to extend my deepest gratitude to my research supervisor, Dr. Frank Elgar, for his professional guidance and constant encouragement throughout the completion of my thesis and over the course of my entire M.Sc. Psychiatry degree. I am fortunate to have had an attentive and knowledgeable advisor who eagerly supported my studies over the past year. The knowledge and research skills I have gained as his student will undoubtedly help me to succeed in my future studies and career.

I also wish to thank my thesis committee members, Dr. Norbert Schmitz and Dr. Srividya Iyer, for their assistance and valuable contributions throughout the preparation of this thesis.

Furthermore, I must extend my thanks to all adolescents who participated in the Health Behavior in School-Aged Children survey, and to the Health Behavior in School-Aged Children Network for the use of their data for this thesis.

Lastly, I am exceptionally grateful to my family and friends for their continued support throughout my academic journey. In particular, I would like to acknowledge my parents, John and Carole, my sister, Stephanie, and my roommate and friend, Meredyth Dwyer, for their unrelenting encouragement and their profound belief in my abilities.

Contribution of Authors

I, Alexandra Maduro, am the primary author of this thesis. I was responsible for the formation of the research questions, the review of the literature, the data analyses, the interpretation of the results, and the writing of this document. Dr. Frank Elgar, my advisor, provided me with assistance throughout all phases of the research process and reviewed the completed document.

Introduction

Food insecurity, the lack of consistent access to adequate food, has been named one of 14 social determinants of health in Canada (Mikkonen & Raphael, 2010). Consistent access to healthy food is a fundamental human right and lack of access impedes children's healthy physical, social, and emotional development and well-being (World Food Programme, 2007). Despite this, household food insecurity in Canada is a growing population health concern due to its long-lasting health consequences and associations with chronic disease. In 2014, 12% of Canadian households reported experiencing food insecurity in the previous 12 months, and 17.2% of Canadian children lived in these households (Tarasuk et al., 2016). This is a significant increase from the 7.7% of households reporting food insecurity in 2008 (Statistics Canada, 2008). Households with children are at greater risk of food insecurity than those without children, and households headed by a single female parent are at greatest risk (Tarasuk et al., 2016).

Food insecurity is linked to hunger via the absence of a consistent food supply in the home (Food and Agriculture Organization, 1996). A recent national study demonstrated that hunger is a common concern for Canadian youth, with up to 25% of youth going to sleep hungry, at least occasionally, due to lack of food in the home (Pickett et al., 2015). However, manifestations of hunger are not always evident and have been infrequently studied in youth, resulting in less data regarding outcomes of persistent hunger in this vulnerable population (World Food Programme, 2007).

Hunger and mental health

The experience of childhood hunger appears to stem from poverty and can lead to poor mental and physical health outcomes. Poverty has an established association with the rate of

occurrence of mental health problems in children and adolescents (Burns, 2015; McLeod & Shanahan, 1996). In fact, a linear association between household income and psychopathology exists in which lower levels of income are correlated with increased risk for internalizing and externalizing problems in youth (Goodman, 1999). Material deprivation, a circumstance defined by a lack of access to basic necessities and reflected in cases of extreme poverty, is also associated with an increased risk of psychopathology (McLaughlin, Costello, et al., 2012; Slopen et al., 2010). Severe deprivation of resources may be a primary pathway thorough which poverty adversely affects health. Exploring the contribution of individual social determinants of mental health is imperative to understanding the link between poverty and psychopathology.

Currently, household income as an indicator of poverty is associated with risk for psychopathology in youth. However, there is a gap in the literature pertaining to the role of food insecurity as an independent social determinant of mental health. Although food insecurity is rooted in inadequate income and stems from severe material deprivation, evidence supports its future study as a separate risk factor for mental health. Food insecurity has been associated with adverse mental health outcomes in children and adolescents independently of other facets of socioeconomic status ([SES], Nord, 2009). Food-insecure youth are more likely to report social, emotional, and conduct problems, decreased psychosocial functioning, and are more likely than their food-secure peers to present internalizing and externalizing behaviors (Casey et al., 2004; Poole-Di Salvo et al., 2016). Even after controlling for effects of extreme poverty, food-insecure youth are at increased risk of developing mood, anxiety, behavior, and substance use disorders (Kirk et al., 2015; Slopen et al., 2010). The severity of food insecurity is also associated with progressively higher odds of having a mental disorder (Burke et al., 2016). Results from a large sample of adolescents showed a 14% increase in the odds of having one of the aforementioned

mental health disorders for every standard deviation increase in food insecurity (McLaughlin, Green, et al., 2012). Similar results from Canadian samples of adolescents and adults indicate that the experience of household food insecurity in childhood has a graded effect on mental health outcomes including depressive thoughts, major depressive episodes, suicidal ideation, anxiety and mood disorders, and reduced mental health status (Jessiman-Perreault & McIntyre, 2017; McIntyre et al., 2013). Overall, youth living in food-insecure households are at increased risk of mental illness and are between 82% and 89% more likely than their peers to have seen a mental health professional. (Alaimo et al., 2001; Martin et al., 2016).

Promising findings suggest that a decrease in the reporting of mental health problems would occur as food-insecure individuals move into food security (Jessiman-Perreault & McIntyre, 2017). Similar research findings have demonstrated reductions in individuals' symptoms of psychopathology upon experiencing financial gain or assistance and moving out of poverty (Costello et al., 2003; Ljungqvist et al., 2016). However, it remains unclear if household income acts alone in explaining the association between hunger and risk for youth psychopathology, and to what extent psychosocial components are involved in this relationship.

Hunger and nutrition

The association between hunger and nutrition is an important line of inquiry for understanding the impact of food insecurity on physical health outcomes. In studies of low-income adults, food insecurity is associated with poorer diet quality as measured by the Healthy Eating Index (Basiotis et al., 2002; Champagne et al., 2007; Guenther et al., 2007; Leung et al., 2014). Food-insecure adults are more likely to consume high-fat dairy products, salty snacks, sugar-sweetened beverages, and fewer vegetables than food-secure adults (Leung et al., 2014). Similarly, children and adolescents from food-insecure households are less likely to be meeting

the nutritional recommendations in Canada's Food Guide (Kirk et al., 2015). In general, food-insecure youth consume less fruits, vegetables, and milk than their food-secure peers, as well as more total energy, fat, and sugar (Fram et al., 2015; Kirkpatrick & Tarasuk, 2008). Eating patterns also differ between food-secure and food-insecure adolescents. Food-insecure youth are more likely to eat fast food, partake in fewer family meals, to perceive healthy foods as not tasting good, and to perceive eating healthfully to be inconvenient (Widome et al., 2009). Moreover, multiple Canadian studies have found that youth from food-insecure households are more likely to have a higher body mass index and to be overweight than their peers from food-secure households (Broughton et al., 2006; Dubois et al., 2006; Widome et al., 2009).

Notably, the necessity to consume ample energy and essential nutrients increases during adolescence (Dwyer, 1993). However, adolescence is also cited as the developmental stage where food insecurity has the most potential to negatively impact dietary intake (Eicher-Miller & Zhao, 2018). Although food-insecure children appear to consume more energy overall, their diet quality in terms of nutritional intake tends to be poorer than that of children who are food-secure. Failure to achieve adequate caloric intake and nutrient requirements can lead to negative physical and mental health outcomes (McIntyre, 2003).

The evidence shows a link between poor diet quality and increased externalizing behaviors among youth. Cross-national data have revealed a significant association between diet quality and physical fighting in 38 countries (Jackson & Vaughn, 2018). In comparison to youth with better quality diets, those with poorer quality diets were 40% more likely to engage in physical fighting and 68% more likely to engage in frequent physical fighting. It is suggested that the more frequent experience of hunger and more frequent intake of junk foods increases the

risk of psychological strain and of violent behavior (Zahedi et al., 2014). Research regarding the link between diet and behavioral outcomes in youth is still limited and in need of further study.

Pathways between food security and nutrition

The association between food insecurity and nutrition may be in part due to stress. The experience of stress leads to activation of the hypothalamic-pituitary-adrenal axis, increasing levels of cortisol in the blood (Gillespie & Nemeroff, 2007). Prolonged elevation of circulating cortisol has been found to increase appetite and accumulation of visceral fat, independently of dietary intake (Adam & Epel, 2007; Björntorp, 2001). A systematic review of studies determined that individuals of lower SES tended to have higher stress levels, unhealthier patterns of food consumption, and higher body weight than individuals of higher SES (Moore & Cunningham, 2012). Moreover, during the experience of chronic stress, a state commonly experienced by food-insecure individuals, eating increased amounts of foods high in energy density, fat, or sugar is common, potentially due to their propensity to reduce negative effects of stress on the brain (Adam & Epel, 2007; Dallman et al., 2003; Laraia et al., 2006; Moore & Cunningham, 2012). Thus, coping with chronic psychological stress is often manifested through increased energy intake, which is linked to the etiology of obesity and other metabolic disorders (Björntorp, 2001; Huhman, 2006; McEwen, 1998). It is important to note that children and adolescents are also vulnerable to experiencing stress and its effects due to household food insecurity; they are likely to be cognitively, emotionally, and physically aware of food insecurity and may also take responsibility for managing food resources in the household (Fram et al., 2011; Fram et al., 2015).

Another potential explanation for the link between food security status and diet quality is the cost associated with maintaining an optimal diet. In a sample of low-income food-insecure

families in Toronto, food-purchasing decisions were found to be influenced primarily by price. This focus on price was emphasized as food insecurity increased. Food preference, quality, and health were also considered in food-purchasing decisions, but to a lesser extent (Dachner et al., 2010). Relatedly, a study consisting of data from 10 countries revealed a positive association between household per capita expenditures and diet diversity (Hoddinott & Yohannes, 2002). Generally, individuals living in households with limited incomes tend to have diets with little variety and consisting of excessive saturated and total fat (Frazão, 1999). Highly nutritious foods, such as fruits and vegetables, tend to be more expensive and less available in low-income communities (Connell et al., 2012; Drewnowski & Darmon, 2005). On the other hand, processed foods tend to be readily available in these neighborhoods and less expensive. However, they are also high in fats, sugar, and salt, easy to consume, and have addictive qualities (Gearhardt et al., 2011). An increased appetite due to prolonged elevation of cortisol, paired with the highly palatable yet unhealthy low-cost food options typically available to food-insecure individuals, might explain poorer quality diets observed in this population.

Protective factors for mental health

Rising rates of food insecurity in Canada call for research on protective factors that may buffer against its links to mental health (Statistics Canada, 2016). In addition to the significant associations that exist between poverty, hunger, and diet quality, associations also exist between hunger and family characteristics including structure, communication patterns, and meal practices, independently of SES (Pickett et al., 2015). Research findings have established that adequate social support is crucial to the mental health and well-being of adolescents and that the benefits of support from family, peer groups, or other significant adults are cumulative (Davison et al., 2015). Because high perceived social support has been found to benefit adolescents'

mental health status, social support may be a potential protective factor for food-insecure youth (Wight et al., 2006). These research findings highlight a need for further research regarding the psychosocial circumstances surrounding youth hunger and emphasize the importance of improving family practices in households with insufficient food in order to address the consequences of hunger on youth health (Pickett et al., 2015).

The present study

Given the known health consequences of food insecurity, its origins and manifestation into these negative outcomes are worthy of being further explored. Additionally, the lack of information pertaining to the effects of hunger in youth creates an opportunity to identify health outcomes, patterns, and potential protective factors specific to this subset of the population. The purpose of the present study is to study the role of food insecurity as a social determinant of mental health and to examine the mechanisms by which hunger impacts mental health outcomes in Canadian youth.

The key objectives of this study are as follow:

1. To examine the associations of hunger with internalizing behaviors, externalizing behaviors, and well-being in adolescents. I hypothesize that there will be a positive association between hunger and both internalizing and externalizing behaviors, and a negative association between hunger and well-being.
2. To investigate the moderating role of family support in the association between hunger and these mental health outcomes. I hypothesize that family support will function as a moderator of the association between hunger and mental health and well-being outcomes in such a way that hunger will have a stronger positive effect on internalizing and externalizing behaviors when family support is low than

when family support is high, in addition to a stronger negative effect on well-being when family support is low than when it is high.

Additional objectives of the study are:

3. To examine the association between material deprivation and hunger. I hypothesize that material deprivation and hunger are positively associated.
4. To determine whether the pathways to mental health and well-being are material or psychosocial in origin. I hypothesize that a psychosocial pathway between hunger and mental health and well-being will exist after controlling for the effect of material deprivation.
5. To identify the nutritional profile of adolescents reporting hunger in Canada. I hypothesize that youth reporting hunger will consume fewer fruits and vegetables and more sweets and soft drinks than youth not reporting hunger.

Methods

HBSC survey

In order to address the research objectives, data from the Canadian Health Behavior in School-aged Children (HBSC) 2017/2018 dataset were used. The HBSC is a World Health Organization collaborative research study with the goal of understanding adolescent health and well-being within their social context. This survey is a school-based and self-report questionnaire that is administered to 11- to 15- year-olds in a classroom setting. Questions from the HBSC international survey encompass a variety of health indicators, health-related behaviors, and life circumstances of adolescents. The Canadian HBSC survey contains mandatory questions required to be included in the international dataset, optional packages of questions on specific topic areas, and country-specific questions related to issues of national importance. The

Canadian HBSC study received ethical approval from the Institutional Review Board of Queen's University, where this study is based.

Data collection

A stratified two-stage cluster sample design was used, first identifying schools within each province and territory, followed by classes within these schools. A combination of active and passive consent procedures was used depending on provincial jurisdictions. When possible, active consent was obtained by students prior to completing the survey. If this was not possible, passive consent was obtained by school administrators, parents or guardians, and the student participant. Surveys were administrated by a teacher or trained research assistant and completed in classroom settings. The response rate at the student level was 75%. Participants were not paid.

Participants

Participants in this study were drawn from the Canadian sample of the 2017/2018 cycle HBSC survey (n = 21,750). This sample is nationally representative and uses weights to ensure a balanced representation of school types and rural and urban areas in all provinces and territories. The Canadian HBSC survey was completed with students in grades 5-11 (M = 7.99, SD = 1.39). Participants ranged from 10-18 years old (M=13.8, SD = 1.44) and 46.5% of the sample was male. With regard to ethnic characteristics, 68.6% of the sample identified as white, 4.9% as black, 3.5% as east Indian or south Asian, 3.2% as indigenous, 3.2% as east or southeast Asian, 1.9% as Arab and west Asian, 1.4% as Latin American, and 12.2% as 'other'.

Measures

This study used data on gender, grade, material deprivation, hunger status, internalizing behaviors, externalizing behaviors, well-being, food consumption, family support, and family structure. Descriptive statistics for all variables are reported in Table 1.

Family Affluence Scale

Material deprivation was assessed using the Family Affluence Scale (FAS; Currie et al., 1997; Currie et al., 2008; Torsheim et al., 2016). The FAS is a six-item measure of material indicators of family wealth, and a valid measurement of family affluence across Europe and North America. The FAS contains the six following items: "Do you have your own bedroom for yourself?", "How many bathrooms are in your home?", "Does your family own a car, van, or truck?", "How many times did you and your family travel out of Canada for a holiday/vacation last year?", "Does your family have a dishwasher at home?", and "How many computers does your family own?". A summary score of these items were reverse scored and converted to a proportional rank ridit score ranging from 0 (least deprived) to 1 (most deprived).

Hunger

Hunger was assessed using the question "Some young people go to school or to bed hungry because there is not enough food at home. How often does this happen to you?". Response options included "always", "often", "sometimes", or "never". This item has been validated within the HBSC and is applicable to the concepts of food insecurity (Molcho et al., 2007).

Internalizing behavior

The question used to assess the internalizing outcome variable was "During the past 12 months, did you ever feel so sad or hopeless almost every day for two weeks or more in a row that you stopped doing some usual activities?". Response options included "yes" or "no".

Externalizing behavior

The question used to assess the externalizing outcome variable was "During the past 12 months, how many times were you in a physical fight?". Response options included "I have not

been in a physical fight in the past 12 months", "1 time", "2 times", "3 times", and "4 times or more". Frequency of physical fighting is a reliable and well-validated measure of aggression that has been used as a marker of problem behaviors in adolescent health surveys (Brener et al., 1995; Pickett et al., 2015).

WHO-5 Well-Being Index

Participants' well-being was assessed using the WHO-5 Well-Being Index (World Health Organization, 1998), a five item measure containing the following questions: "Over the last two weeks, how often have you: felt cheerful and in good spirits?; felt calm and relaxed?; felt active and energetic?; woken up feeling fresh and rested?; had your daily life filled with things that interest you?". Response options included "all of the time", "most of the time", "more than half of the time", "less than half of the time", "some of the time", and "at no time". A scale variable derived from participants' raw scores on the WHO-5 Well-Being Index was used in analyses.

Food consumption

In order to asses participants' nutrition, their food consumption habits were assessed using the question "How often do you usually eat or drink: fruits (not including juice); vegetables; sweets (candy or chocolate); coke or other soft drinks". Response options included "never", "less than once a week", "once a week", "2-4 days a week", "5-6 days a week", "once a day, every day", and "every day, more than once".

Family support

Family support was measured by asking participants to rate how much they agree or disagree with the following statements: "My family really tries to help me", "I get the emotional help and support I need from my family", "I can talk about my problems with my family", and "my family is willing to help me make decisions". Response options were on a scale from "very

strongly disagree" to "very strongly agree", with five numerical options (from 2-6) in between these answers. This item measures perceived social support from family and was adapted from the Multidimensional Scale of Perceived Social Support (Zimet et al., 1988). A variable collapsing participants' raw scores into tertiles representing "low", "medium", or "high" family support was used in analyses.

Family structure

Family structure was assessed by asking participants to select the individual with whom they live all or most of the time. Response options included "mother", "father", "stepmother", "stepfather", "brother or stepbrother", "sister or stepsister", "I live in a foster or children's home", and "someone else".

Statistical analyses

Data from this sample were adjusted to ensure proportional representation by province. In order to analyze the data, some variables from the original HBSC Canada dataset were recoded. Hunger was recoded into a variable with a binary outcome, ("never" or "always, often, or sometimes") due to the small number of positive responses within the "always" and "often" response options. Next, response options for the externalizing behavior outcome variable were recoded to represent either "no participation in physical fighting", or "participation once or more in physical fighting" in the past 12 months. These categories were chosen due to physical fighting being the behavior used to represent externalizing behaviors in this study. Lastly, nutrition variables (fruit, vegetable, sweets, and soft drink consumption) were recoded to have two response options: "never to 5-6 days a week" and "daily". The decision to dichotomize this variable was based on Canadian dietary guidelines recommending daily consumption of fruit and

vegetables (Health Canada, 2019). It is of note that sensitivity analyses were conducted for food consumption data using the full range of possible responses.

Binary logistic regressions were used for analyses of categorical variables with dichotomous outcomes and linear regressions were used for analyses of continuous variables. More specifically, in following with the list of objectives, binary logistic regressions were used to analyze associations of hunger with both internalizing behaviors and externalizing behaviors in adolescents. A linear regression was used to analyze the association of hunger and well-being in adolescents. Next, moderation analyses were used to explore the association of family support with hunger and mental health. Specifically, the interaction of hunger and family support was tested in their associations with internalizing behavior, externalizing behavior, and well-being. In order to examine the association between material deprivation and hunger, a linear regression was used. In order to examine the origin of the pathways to mental health and well-being, all analyses were conducted and compared before and after controlling for the effect of material deprivation. Lastly, binary logistic regressions were performed to analyze associations between hunger and food consumption in order to identify the nutritional profile of Canadian adolescents reporting hunger. Covariates included in most regression analyses were ‘gender’, ‘grade’, and ‘material deprivation’.

A first sensitivity analysis was conducted in order to account for any potential effect of family structure on the results obtained. This analysis consisted of splitting the dataset in order to compare results of all analyses between two groups: participants living in two-parent households and participants living in any other type of household structure. Further sensitivity analyses were performed using ordinal regressions on food consumption variables to discover whether

significant differences existed in results when using the original response categories for food consumption as opposed to the recoded ones.

Results

The primary objective of this study was to examine the associations between hunger and internalizing behaviors, externalizing behaviors, and well-being. A first logistic regression was performed to analyze associations between hunger internalizing behavior (see Table 2). The presence of internalizing behavior significantly related to hunger after controlling for gender, grade, and material deprivation. The odds ratio of presenting internalizing behaviors was 2.69 for youth indicating they went to school or to bed hungry as opposed to youth who never went to school or to bed hungry. The odds ratio of presenting internalizing behaviors was also greater for females in comparison to males and increased with grade level and with material deprivation. Another logistic regression was performed to analyze associations between hunger and the presence of externalizing behaviors (see Table 3). All independent variables except material deprivation contributed significantly to the model. The odds ratio of presenting externalizing behaviors was 1.69 for youth reporting they went to school or to bed hungry as opposed to youth who never went to school or to bed hungry. Notably, the odds ratio of presenting externalizing behaviors for males in comparison to females was 2.70. For every singular increase in grade level, the odds of presenting externalizing behaviors decreased significantly. Lastly, a linear regression was calculated to predict well-being based on hunger status (see Table 4). The model accounted for 12.1% of the variation in well-being scores, with adjusted R^2= 12.0%. A significant regression equation was found, $F(4, 18078) = 619.85$, $p < 0.001$, and all independent variables significantly predicted well-being. Well-being negatively related to hunger, grade level, and material deprivation, and positively related to male gender. Regarding the magnitude of the

associations, well-being scores were approximately 2 points lower in the hunger group than in the non-hunger group, and approximately 2.3 points lower for the most materially deprived compared to the least materially deprived participants.

The second objective of this study was to investigate the role of family support as a moderator of the association between hunger and behavioral outcomes. Family support was negatively related to internalizing behaviors (see Table 5) and externalizing behaviors (see Table 6), and positively related to well-being (see Table 7). However, family support did not significantly moderate any of the associations between hunger and externalizing behaviors, externalizing behaviors, or well-being.

An additional objective of this study was to examine the association between material deprivation and hunger. A linear regression was run to predict material deprivation based on hunger status (see Table 8). The model accounted for 1.2% of the variation in material deprivation score. A significant regression equation was found, $F(3, 18567) = 76.416$, $p < 0.001$, with hunger and female gender positively predicting material deprivation.

Another goal of this study was to determine whether the pathways to mental health behaviors and well-being are psychosocial or material in origin. The inclusion of material deprivation as a covariate allowed for speculation regarding the source of the pathways between hunger and mental health and well-being outcomes. All associations remained significant after controlling for material deprivation, indicating the probable existence of psychosocial pathways between hunger and these outcomes.

The final objective of this study was to examine the nutritional profile of adolescents reporting hunger in Canada. Logistic regressions were performed to analyze associations between hunger and fruit, vegetable, sweets, and soft drink consumption. Fruit consumption was

negatively related to hunger, and all independent variables contributed significantly to the model (see Table 9). The odds ratio of consuming fruit for youth indicating they went to school or to bed hungry versus youth who never went to school or to bed hungry was 0.52. The odds ratio of consuming fruit was positively related to female gender and was negatively associated with grade level and with material deprivation. Vegetable consumption was also negatively related to hunger, and all independent variables contributed significantly to vegetable consumption (see Table 10). The odds ratio of consuming vegetables for youth indicating they went to school or to bed hungry versus youth who never went to school or to bed hungry was 0.53. Similar to the fruit consumption model, the odds ratio of consuming vegetables was greater for females compared to males and decreased with every increase in grade level and with material deprivation. No statistically significant association was found between hunger and sweets consumption (see Table 11). In the final model of food consumption, soft drink consumption was found to be positively related to hunger (see Table 12). All independent variables contributed significantly to the model except material deprivation. The odds ratio of consuming soft drinks for youth indicating they went to school or to bed hungry versus youth who never went to school or to bed hungry was 1.34. Soft drink consumption was positively associated with the male gender and with grade level.

Sensitivity analyses

After splitting the dataset based on family structure and re-running all analyses, some significant effects of family structure were found between results of participants living in two-parent households versus participants living in any other household composition (See Appendix A). With regard to the regression analysis of the moderating effect of family support on the association between hunger and externalizing behaviors (see Table A1), the main effects of

'family support' and 'material deprivation' were significant only for participants living in two-parent households. However, the interaction of family support and hunger was not related to externalizing behaviors in either group. The effect of 'hunger' on soft drink consumption was significant only for participants living in two-parent households (See Table A2). Moreover, soft drink consumption and material deprivation were positively correlated in two-parent households and negatively correlated in all other types of households. These findings suggest that there may be some added disadvantage for adolescents residing in households composed of family structures other than two parents. Given the lack of parental data on household income within the HBSC questionnaire, it is difficult to discern whether the differences between family structure are financial or social in nature.

As shown in Appendix B, the results of the ordinal regression analyses of fruit, vegetable, sweets, and soft drink consumption data show that the effects of hunger on food consumption choices were not sensitive to the chosen cut-point of daily consumption. Tables B1 to B4 show that the same pattern of results emerged for associations between hunger and food consumption when using the full range of response options as when using the original chosen cut-point of daily consumption.

Discussion

Summary

The primary goals of the current study were to examine associations of hunger with internalizing behaviors, externalizing behaviors, and well-being in adolescents, and to investigate family support as a moderator in the association between hunger and these mental health outcomes. Additional research objectives included examining the direction of the association between material deprivation and hunger, investigating the origin of the pathways to mental

health and well-being, and identifying a nutritional profile of Canadian adolescents reporting hunger.

As hypothesized, hunger was positively associated with the presentation of both internalizing behaviors and externalizing behaviors. Youth who went to school or to bed hungry were more likely to report experiencing depressive symptoms and to have engaged in physical fighting over the past year than youth who never went to school or to bed hungry. Furthermore, youth reporting hunger had significantly lower well-being than youth who never reported hunger. In line with previous research findings, results from this study showed that females were more likely than males to present internalizing behaviors, whereas males were more likely than females to present externalizing behaviors (Tolin & Foa, 2006). Interestingly, although material deprivation positively related to internalizing behavior and negatively related to well-being, it did not relate to externalizing behavior. Although these results are only partially in line with previous research findings negatively linking household income and internalizing and externalizing behaviors (Goodman, 1999), perhaps this is due to the use of only a single measure of behavioral outcomes as opposed to multiple possible different internalizing and externalizing behaviors. Regarding the measure of externalizing behavior, it is possible that socially desirable responding compromised the validity of the results. Furthermore, males are more likely to engage in frequent physical fighting than females (Elgar et al., 2015). Inquiring about forms of externalizing behavior other than physical fighting may increase reliability and validity of self-reports and provide more opportunity for respondents to select a form of externalizing behavior in which they may participate. The results of the current study regarding the associations between hunger and mental health add important meaning to the literature on food insecurity in

youth. Adolescents who report hunger 'occasionally', 'sometimes', or 'always', show significantly adverse outcomes in regard to their mental health and overall well-being.

Family support was related to internalizing, externalizing, and well-being outcomes in the expected directions. However, it did not significantly moderate the associations between hunger and these outcomes, contrary to what was hypothesized. It is possible that these results can be explained by findings from Wight et al. (2006); although high perceived social support was found to benefit adolescents' mental health status, it appeared to be less protective in low-SES environments than in high-SES environments. Even though the effect of material deprivation was controlled for, it is possible that there was an important effect of socioeconomic environment that may have contributed to family support producing no significant moderation effect.

Although family support did not significantly moderate associations between hunger and mental health outcomes, this line of inquiry has the potential to shed light on other potential protective factors for mental health. Adolescence is known to be the developmental stage where there is a shift in the relative importance of parents and peers. By receiving increased exposure to social influences beyond the family and establishing a sense of independence, peer influences become increasingly important for adolescents, while parental influence declines (Berndt, 1979). It is possible that the investigation of peer or other forms of social support as a moderator of the association between hunger and mental health outcomes during this developmental stage would produce more significant results compared to the examination of family support. Moreover, the accumulation of multiple forms of support, such as support from family, peers, and other influential adults, may be worthy of exploration as a protective factor for adverse mental health outcomes (Davison et al., 2015).

With regard to the associations found between hunger and diet quality and between hunger and mental health outcomes in this study, in addition to previous research linking diet quality to mental health outcomes, further investigation of relationships between these variables is warranted. It may be worth exploring whether participation in subsidized school-based food assistance programs moderates the relationship between food insecurity and mental health. These programs typically offer breakfast and lunch to students and have been deemed essential in some communities due to the negative consequences associated with childhood food insecurity (Alaimo et al., 2001; Ke & Ford-Jones, 2015). However, despite promising findings indicating a diminishing link between food insecurity and adverse outcomes among youth who benefitted from school food assistance programs, Canada does not yet offer a subsidized national food supplementation program in schools (Ke & Ford-Jones, 2015; Roustit et al., 2010). The discovery of subsidized food assistance programs in school as a moderating variable between food insecurity in childhood and mental health in adolescence could have important implications for the creation of future health and social policy.

Importantly, material deprivation and reported hunger were positively associated. Interestingly however, hunger only accounted for a small proportion of variation in material deprivation. In order to determine the origin of the pathways from hunger to mental health and well-being outcomes, an attempt was made to isolate psychosocial from material pathways. Because the associations remained significant after controlling for material deprivation, this suggests that there is a psychosocial effect of hunger that is not explained by poverty. These results support the hypothesis that the pathway from hunger to mental health and well-being is primarily psychosocial in nature. More research is needed before concluding that this pathway is

exclusively a psychosocial one. Specifically, exhaustive measures of household income and SES should be included in analyses before any conclusion can be made.

Lastly, as hypothesized, a dietary difference was found between youth reporting hunger and youth not reporting hunger; youth who reported going to school or to bed hungry were found to have poorer quality diets, consuming significantly fewer fruits and vegetables and more soft drinks. In line with results reported by Kirk et al. (2015), adolescents reporting hunger in the current study were less likely to be meeting nutritional recommendations in Canada's Food Guide in terms of daily consumption of fruits and vegetables than those not reporting hunger. The findings from the present study support results from studies of low-income and food-insecure youth and adults and add to the literature on food consumption differences between food-secure and food-insecure youth in Canada (Fram et al., 2015; Kirkpatrick & Tarasuk, 2008; Leung et al., 2014). Future research may seek to explore a moderation effect of diet quality on the association between hunger and mental health outcomes in youth. This is of particular importance due to adolescence being the developmental stage where consumption of essential nutrients increases, yet also when food insecurity has the most potential to negatively impact dietary intake (Dwyer, 1993; Eicher-Miller & Zhao, 2018).

Strengths and limitations

A fundamental strength of this study is its large sample size and wide representation of Canadian youth. The HBSC survey captured a nationally representative sample of adolescents in Canada, which allowed for a thorough investigation of hunger and mental health outcomes in this population. This study also focused on food security as a social determinant of health in adolescents. Whereas this topic is understudied and often overshadowed by the issue of poverty in policy discussion, it holds great public health relevance. However, limitations of this study

should also be noted. The HBSC survey uses a cross-sectional methodology, which does not allow for the examination of causality among variables. Future research in this area of study should seek to use a longitudinal design in order to examine the associations between hunger and mental health outcomes. This type of design would also have the potential to detect interesting changes in outcomes between youth who remain in food insecure households versus those who move into food security, or out of poverty. The HBSC survey also uses brief self-report measures to collect data, which are associated with numerous limitations when compared to the use of other types of measures. The inclusion of additional data provided by parents or guardians and teachers in this survey would be helpful in corroborating students' responses. Moreover, this study used only a single measure of internalizing behavior and a single measure of externalizing behavior as mental health outcomes. The inclusion of multiple measures of these outcome variables as well as the addition of other components of mental health would allow for a more thorough investigation of specific patterns of mental health outcomes related to youth hunger. Lastly, because the sample used includes only data from Canadian youth, the generalizability of the results beyond this population is unclear. Due to the design of the HBSC, there is also a lack of investigation of regional and ethnic group differences within Canada, and therefore no possibility for comparison with northern and Indigenous groups.

Conclusions

The overarching purpose of this study was to examine the relationship between food insecurity and mental health outcomes. Although poverty is strongly associated with risk for adverse mental health outcomes in youth, this study aimed to address and examine food insecurity as an independent social determinant of mental health. Furthermore, the lack of previous research regarding potential protective factors for food insecurity in childhood incited

an investigation into the role of family support as a possible moderator of the association between hunger and mental health outcomes. The present study contributed valuable knowledge to the research on food insecurity and mental health in Canadian adolescents and raised important questions to be addressed in future research.

In combination with future research on the topic of food insecurity, the results of this study may hold practical importance for the growing population of children and youth whom are food-insecure by raising awareness of their vulnerability and health needs. Considering that dramatic rise in food insecurity in Canada in recent years, the goal of future research should be to contribute to the development of health and social policy formation for food-insecure youth in Canada.

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Table 1

Descriptive statistics and frequencies

Variable	Category	*N* (%)	*M* (*SD*)
Gender	Female	11164 (51.3)	
	Male	10117 (46.5)	
	Neither term describes me	303 (1.4)	
	Missing cases	165 (0.8)	
Grade			7.99 (1.39)
Family structure	Two parent household	15785 (72.6)	
	Other	5486 (25.2)	
	Missing cases	479 (2.2)	
Hunger	Never	17908 (82.3)	
	Always, sometimes, or often	3687 (17.0)	
	Missing cases	155 (0.7)	
Material deprivation			0.50 (0.29)
Internalizing behavior	No	14274 (65.6)	
	Yes	6292 (28.9)	
	Missing cases	1184 (5.4)	

Variable	Category	*N* (%)	*M* (*SD*)
Externalizing behavior	Never	14523 (66.8)	
	Once or more	5655 (26.0)	
	Missing cases	1573 (7.2)	
Well-being			20.86 (5.34)
Fruit consumption	Never to 5-6 times weekly	10417 (47.9)	
	Daily	11132 (51.2)	
	Missing cases	201 (0.9)	
Vegetable consumption	Never to 5-6 times weekly	9952 (45.8)	
	Daily	11377 (52.3)	
	Missing cases	421 (1.9)	
Sweets consumption	Never to 5-6 times weekly	18019 (82.8)	
	Daily	3367 (15.5)	
	Missing cases	364 (1.7)	
Soft drink consumption	Never to 5-6 times weekly	20179 (92.8)	
	Daily	1222 (5.6)	
	Missing cases	349 (1.6)	

Variable	Category	*N* (%)	*M* (*SD*)
Family support	Low	6688 (30.7)	
	Medium	6553 (30.1)	
	High	7039 (32.4)	
	Missing cases	1470 (6.8)	

Table 2

Logistic regression of internalizing behaviors

Variable	*B*	*SE*	*P*	Odds ratio (95% CI)
Hunger[a]	0.99	0.04	<0.001	2.69 (2.48, 2.93)
Gender[b]	-0.78	0.04	<0.001	0.46 (0.43, 0.49)
Grade[c]	0.19	0.01	<0.001	1.21 (1.18, 1.24)
Material deprivation	0.35	0.06	<0.001	1.41 (1.26, 1.59)

[a]Reference category for hunger is 'never'. [b]Reference category for gender is 'female'. [c]Reference category for grade is 'grade 6'.

Table 3

Logistic regression of externalizing behaviors

Variable	*B*	*SE*	*P*	Odds ratio (95% CI)
Hunger[a]	0.53	0.04	<0.001	1.69 (1.55, 1.84)
Gender[b]	1.00	0.04	<0.001	2.70 (2.53, 2.89)
Grade[c]	-0.13	0.01	<0.001	0.87 (0.85, 0.90)
Material deprivation	-0.02	0.06	0.688	.98 (0.87, 1.10)

[a]Reference category for hunger is 'never'. [b]Reference category for gender is 'female'. [c]Reference category for grade is 'grade 6'.

Table 4

Linear regression of well-being

Variable	*B* (95% CI)	*SE*	β	*P*
Hunger[a]	-2.05 (-2.25, -1.86)	0.10	-0.14	<0.001
Gender[b]	1.89 (1.74, 2.03)	0.07	0.18	<0.001
Grade[c]	-0.83 (-0.88, -0.77)	0.03	-0.22	<0.001
Material deprivation	-2.34 (-2.60, -2.09)	0.13	-0.13	<0.001

[a]Reference category for hunger is 'never'. [b]Reference category for gender is 'female'. [c]Reference category for grade is 'grade 6'.

Table 5

Logistic regression of the moderating effect of family support on the association between hunger and internalizing behaviors

Variable	*B*	*SE*	*P*	Odds ratio (95% CI)
Hunger[a]	0.73	0.11	<0.001	2.07 (1.67, 2.56)
Gender[b]	-0.76	0.04	<0.001	0.47 (0.44, 0.50)
Grade[c]	0.15	0.01	<0.001	1.16 (1.13, 1.19)
Material deprivation	0.19	0.06	0.002	1.21 (1.07, 1.37)
Family support[d]	-0.70	0.07	<0.001	0.50 (0.43, 0.57)
Hunger * family support	0.04	0.06	0.460	1.04 (0.93, 1.17)

[a]Reference category for hunger is 'never'. [b]Reference category for gender is 'female'. [c]Reference category for grade is 'grade 6'. [d]Reference category for family support is 'low'.

Table 6

Logistic regression of the moderating effect of family support on the association between hunger and externalizing behaviors

Variable	*B*	*SE*	*P*	Odds ratio (95% CI)
Hunger[a]	0.53	0.11	<0.001	1.71 (1.38, 2.12)
Gender[b]	1.05	0.03	<0.001	2.86 (2.67, 3.07)
Grade[c]	-0.17	0.01	<0.001	0.84 (0.82, 0.87)
Material deprivation	-0.09	0.06	0.127	0.91(0.81, 1.03)
Family support[d]	-0.29	0.07	<0.001	0.75 (0.65, 0.86)
Hunger * family support	-0.08	0.06	0.176	0.92 (0.82, 1.04)

[a]Reference category for hunger is 'never'. [b]Reference category for gender is 'female'. [c]Reference category for grade is 'grade 6'. [d]Reference category for family support is 'low'.

Table 7

Linear regression of the moderating effect of family support on the association between hunger and well-being

Variable	*B* (95% CI)	*SE*	β	*P*
Hunger[a]	-1.38 (-1.84, -0.91)	0.24	-0.10	<0.001
Gender[b]	1.73 (1.59, 1.87)	0.07	0.16	<0.001
Grade[c]	-0.68 (-0.73, -0.63)	0.03	-0.18	<0.001
Material deprivation	-1.87 (-2.11, -1.63)	0.12	-0.10	<0.001
Family support[d]	1.98 (1.69, 2.27)	0.15	0.31	<0.001
Hunger * family support	0.04 (-0.20, 0.28)	0.12	0.01	0.725

[a]Reference category for hunger is 'never'. [b]Reference category for gender is 'female'. [c]Reference category for grade is 'grade 6'. [d]Reference category for family support is 'low'.

Table 8

Linear regression of material deprivation

Variable	*B* (95% CI)	*SE*	β	*P*
Hunger[a]	0.08 (0.07, 0.09)	0.00	0.11	<0.001
Gender[b]	-0.02 (-0.03, -0.01)	0.00	-0.04	<0.001
Grade[c]	0.00 (0.00, 0.00)	0.00	0.01	0.090

[a]Reference category for hunger is 'never'. [b]Reference category for gender is 'female'. [c]Reference category for grade is 'grade 6'.

Table 9

Logistic regression of fruit consumption

Variable	*B*	*SE*	*P*	Odds ratio (95% CI)
Hunger[a]	-0.65	0.04	<0.001	0.52 (0.48, 0.57)
Gender[b]	-0.29	0.03	<0.001	0.75 (0.71, 0.80)
Grade[c]	-0.12	0.01	<0.001	0.89 (0.87, 0.90)
Material deprivation	-0.73	0.05	<0.001	0.48 (0.43, 0.53)

[a]Reference category for hunger is 'never'. [b]Reference category for gender is 'female'. [c]Reference category for grade is 'grade 6'.

Table 10

Logistic regression of vegetable consumption

Variable	*B*	*SE*	*P*	Odds ratio (95% CI)
Hunger[a]	-0.64	0.04	<0.001	0.53 (0.49, 0.58)
Gender[b]	-0.26	0.03	<0.001	0.77 (0.73, 0.82)
Grade[c]	-0.06	0.01	<0.001	0.94 (0.92, 0.96)
Material deprivation	-0.46	0.05	<0.001	0.63 (0.57, 0.70)

[a]Reference category for hunger is 'never'. [b]Reference category for gender is 'female'. [c]Reference category for grade is 'grade 6'.

Table 11

Logistic regression of sweets consumption

Variable	*B*	*SE*	*P*	Odds ratio (95% CI)
Hunger[a]	-0.05	0.06	0.370	0.95 (0.85, 1.06)
Gender[b]	0.08	0.04	0.053	1.08 (1.00, 1.17)
Grade[c]	0.04	0.02	0.016	1.04 (1.01, 1.07)
Material deprivation	-0.44	0.07	<0.001	0.65 (0.56, 0.74)

[a]Reference category for hunger is 'never'. [b]Reference category for gender is 'female'. [c]Reference category for grade is 'grade 6'.

Table 12

Logistic regression of soft drink consumption

Variable	*B*	*SE*	*P*	Odds ratio (95% CI)
Hunger[a]	0.29	0.08	<0.001	1.34 (1.14, 1.58)
Gender[b]	0.79	0.07	<0.001	2.20 (1.92, 2.52)
Grade[c]	0.08	0.02	0.001	1.08 (1.03, 1.14)
Material deprivation	0.11	0.12	0.351	1.12 (0.89, 1.41)

[a]Reference category for hunger is 'never'. [b]Reference category for gender is 'female'. [c]Reference category for grade is 'grade 6'.

Appendix A

Table A1

Split-file logistic regression of the moderating effect of family support on the association between hunger and externalizing behaviors

Family structure	Variable	*B*	*SE*	*P*	Odds ratio (95% CI)
Two-parent household					
	Hunger[a]	0.40	0.14	0.005	1.48 (1.13, 1.95)
	Gender[b]	1.06	0.04	<0.001	2.88 (2.65, 3.13)
	Grade[c]	-0.14	0.02	<0.001	0.87 (0.84, 0.89)
	Material deprivation	-0.18	0.08	0.017	0.84 (0.72, 0.97)
	Family support[d]	-0.36	0.09	<0.001	0.70 (0.59, 0.83)
	Hunger * family support	-0.02	0.07	0.755	0.98 (0.85, 1.12)
Other					
	Hunger[a]	0.71	0.19	<0.001	2.04 (1.41, 2.95)
	Gender[b]	1.09	0.07	<0.001	2.97 (2.60, 3.40)
	Grade[c]	-0.28	0.03	<0.001	0.76 (0.72, 0.80)
	Material deprivation	-0.17	0.12	0.145	0.84 (0.67, 1.06)
	Family support[d]	-0.13	0.14	0.326	0.87 (0.67, 1.14)
	Hunger * family support	-0.17	0.11	0.112	0.84 (0.68, 1.04)

[a]Reference category for hunger is 'never'. [b]Reference category for gender is 'female'. [c]Reference category for grade is 'grade 6'. [d]Reference category for family support is 'low'.

Table A2

Split-file logistic regression of soft drink consumption

Family structure	Variable	*B*	*SE*	*P*	Odds ratio (95% CI)
Two-parent household					
	Hunger[a]	0.38	0.10	<0.001	1.46 (1.19, 1.79)
	Gender[b]	0.81	0.09	<0.001	2.25 (1.90, 2.66)
	Grade[c]	0.07	0.03	0.012	1.08 (1.02, 1.14)
	Material deprivation	0.59	0.15	<0.001	1.81 (1.35, 2.42)
Other					
	Hunger[a]	0.11	0.15	0.451	1.12 (0.84, 1.49)
	Gender[b]	0.75	0.12	<0.001	2.12 (1.67, 2.69)
	Grade[c]	0.52	0.04	0.238	1.05 (0.97, 1.15)
	Material deprivation	-1.12	0.20	<0.001	0.33 (0.22, 0.48)

[a]Reference category for hunger is 'never'. [b]Reference category for gender is 'female'. [c]Reference category for grade is 'grade 6'. [d]Reference category for family support is 'low'.

Appendix B

Table B1

Ordinal regression of fruit consumption

Variable	Estimate (95% CI)	*SE*	*P*	Odds ratio (95% CI)
Hunger[a]	-0.64 (-0.71, -0.57)	0.04	<0.001	0.53 (0.49, 0.56)
Gender[b]	-0.27 (-0.33, -0.22)	0.03	<0.001	0.76 (0.72, 0.80)
Grade[c]	-0.12 (-0.13, -0.10)	0.01	<0.001	0.89 (0.87, 0.91)
Material deprivation	-0.75 (-0.84, -0.66)	0.05	<0.001	0.47 (0.43, 0.52)

[a]Reference category for hunger is 'never'. [b]Reference category for gender is 'female'. [c]Reference category for grade is 'grade 6'.

Table B2

Ordinal regression of vegetable consumption

Variable	Estimate (95% CI)	*SE*	*P*	Odds ratio (95% CI)
Hunger[a]	-0.67 (-0.74, -0.60)	0.04	<0.001	0.51 (0.48, 0.55)
Gender[b]	-0.26 (-0.31, -0.21)	0.03	<0.001	0.77 (0.73, 0.81)
Grade[c]	-0.05 (-0.07, -0.03)	0.01	<0.001	0.95 (0.93, 0.97)
Material deprivation	-0.59 (-0.68, -0.50)	0.05	<0.001	0.55 (0.51, 0.61)

[a]Reference category for hunger is 'never'. [b]Reference category for gender is 'female'. [c]Reference category for grade is 'grade 6'.

Table B3

Ordinal regression of sweets consumption

Variable	Estimate (95% CI)	*SE*	*P*	Odds ratio (95% CI)
Hunger[a]	-0.05 (-0.12, 0.02)	0.04	0.156	0.95 (0.89, 1.02)
Gender[b]	0.03 (-0.03, 0.08)	0.03	0.338	1.03 (0.97, 1.08)
Grade[c]	0.07 (0.05, 0.09)	0.01	<0.001	1.07 (1.05, 1.09)
Material deprivation	-0.34 (-0.44 -0.25)	0.05	<0.001	0.71 (0.65, 0.78)

[a]Reference category for hunger is 'never'. [b]Reference category for gender is 'female'. [c]Reference category for grade is 'grade 6'.

Table B4

Ordinal regression of soft drink consumption

Variable	Estimate (95% CI)	*SE*	*P*	Odds ratio (95% CI)
Hunger[a]	0.28 (0.21, 0.35)	0.04	<0.001	1.32 (1.23, 1.42)
Gender[b]	0.70 (0.65, 0.76)	0.03	<0.001	2.02 (1.92, 2.13)
Grade[c]	0.06 (0.04, 0.08)	0.01	<0.001	1.06 (1.04, 1.08)
Material deprivation	0.13 (0.04, 0.22)	0.05	0.005	1.14 (1.04, 1.25)

[a]Reference category for hunger is 'never'. [b]Reference category for gender is 'female'. [c]Reference category for grade is 'grade 6'.