

Associations between family eating behaviours and body composition measures in peri-adolescents: Results from a community-based study of school-aged children

Samantha Hajna, MSc,¹ Paul J. LeBlanc, PhD,² Brent E. Faught, PhD,² Anwar T. Merchant, ScD, DMD,³ John Cairney, PhD,^{2,4,5} John Hay, PhD,² Jian Liu, MD, PhD²

ABSTRACT

OBJECTIVES: To identify key eating behaviours in children and their parents and to determine the associations between these behaviours and measures of body composition in children.

METHODS: Data were collected on a sample of 431 peri-adolescent children (12.4±0.3 years) and their parents from the Niagara Region. Body composition was assessed by trained research assistants. Eating behaviours were assessed using a revised version of the Family Eating and Activity Habits Questionnaire. Principal component analyses were used to identify key eating behaviours among children, mothers and fathers. Linear regression models were used to assess their associations with body mass index (BMI), waist-to-height ratio, waist-to-hip ratio, waist girth, and hip girth measures in children.

RESULTS: Emotional/uncontrolled eating and eating by the television in children and their mothers were positively associated with measures of body composition in children. Other eating behaviours that were associated with larger measures of body composition in children included low frequency of eating meals with parents, frequent sweet beverage consumption and snacking and eating “on-the-go” in children, eating “on-the-go” in mothers, and emotional eating and eating by the television/late at night in fathers.

CONCLUSIONS: The eating behaviours of children and mothers, and to a lesser degree fathers, are important predictors of children’s body composition. Public health interventions designed to help mothers and children reduce the frequency of emotional/uncontrolled eating and eating by the television may be effective means of facilitating positive weight outcomes in children.

KEY WORDS: Child; parents; behaviour; body composition

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

Can J Public Health 2014;105(1):e15-e21.

The prevalence of childhood overweight and obesity in Canada is alarmingly high.¹ Both conditions place children at risk for both short- and long-term health complications, including hypertension, type 2 diabetes and poor psychological health.^{2,3} In order to reduce the risk of these complications, identifying the factors that influence diet and physical activity, the two key behavioural determinants of excess body weight, is important.

The determinants of childhood diet and physical activity include a complex array of factors operating at individual, social and environmental levels.^{4,5} Of all the potential determinants of diet and physical activity, factors within the home environment may play an especially important role.⁶⁻⁹ Some home factors shown to be important determinants of the dietary and physical activity habits of children include parental modeling of healthful eating,⁹⁻¹⁴ regularity of meals,¹⁵⁻¹⁷ and parental participation in regular physical activity.^{12,18} While a large number of studies have been conducted on the role of child eating behaviours and parental feeding practices on obesity risk in children¹⁹⁻²¹ and a few studies have been conducted on the role of mothers’ and fathers’ own eating behaviours,^{22,23} to our knowledge, no studies have simultaneously assessed the role of child, mother and father eating behaviours – something that is necessary to understand

the relative impacts of these behaviours. To address this gap in knowledge and further inform the development of family-based interventions designed to reduce the risk of childhood overweight and obesity, the objectives of this study were to identify key eating behaviours among peri-adolescent children and their parents and to estimate the associations between these behaviours and five measures of body composition in children, including body mass index, waist-to-height ratio, waist-to-hip ratio, waist girth, and hip girth.

Author Affiliations

1. Department of Epidemiology, Biostatistics and Occupational Health, McGill University, Montréal, QC
2. Department of Health Sciences, Brock University, St. Catharines, ON
3. Department of Epidemiology and Biostatistics, Arnold School of Public Health, University of South Carolina, Columbia, SC, USA
4. Department of Family Medicine, McMaster University, Hamilton, ON
5. Department of Psychiatry & Behavioural Neurosciences, McMaster University, Hamilton, ON

Correspondence: Samantha Hajna, Royal Victoria Hospital, V Pavilion, Division of Clinical Epidemiology, 687 Pine Avenue West, Montréal, QC H3A 1A1, Tel: 514-934-1934, Ext. 44832, E-mail: samantha.hajna@mail.mcgill.ca

Acknowledgements: This study was funded by the Canadian Institutes of Health Research (CIHR) (#171577) and the Social Sciences and Humanities Research Council of Canada (#410-2007-1770). SH was supported by funding through CIHR Masters (2008-2010) and Doctoral Research Awards (2012-2015). Dr. Cairney is supported by an endowed professorship through the Department of Family Medicine at McMaster University. The authors thank the District School Board of Niagara, students and their parents for their support of the study.

Conflict of Interest: None to declare.

METHODS

Body composition measures were collected between September 2007 and June 2008 on 2,304 children (12.4±0.3 years) who were enrolled in public schools in the Niagara region (Ontario, Canada) and who agreed to participate in a larger study designed to identify the cardiovascular risk profile of school-aged children living with and without significant motor coordination problems.²⁴ For the current study, data on child, mother, and father eating behaviours were collected from a subset of children and their primary caregivers (n=894), with complete eating behaviour data available for 433 child-parent dyads and complete eating behaviour and covariate data available for 431 children. A subset of these participants (n=250) also had complete data available on parental education and the number of parents in the household. Ethics approval was obtained from Brock University's Research Ethics Board and the District School Board of Niagara's Research Committee.

Measures of body composition

Children's weight and height were measured using a Tanita electronic scale and a Seca portable stadiometer, respectively. Waist girth was measured at the umbilicus and hip girth was measured around the widest portion of the buttocks using a flexible measuring tape. Measures were recorded three times to the nearest 0.1 cm or 0.1 kg and the average of these used as the final measurement. Body mass index (BMI), waist-to-height ratio, and waist-to-hip ratio were calculated based on the final measurements of weight, height, waist girth and hip girth.

Eating behaviours

The eating behaviours of children and their parents were assessed using a revised version of the Family Eating and Activity Habits Questionnaire (FEAHQ; Appendix A).²⁵ Primary caregivers completed the FEAHQ on behalf of themselves, their spouse and their child. A Likert-type scale was used to assess the quality of each item, with a higher score representing a less optimal eating behaviour. The responses to these items were used in the principal component analyses to identify key eating behaviours in children and their parents.

Covariates

Age and gender were recorded upon entry into the study. Birth order and total physical activity were derived from the children's responses to the Participation Questionnaire.²⁶ A higher total physical activity score represented a higher level of physical activity. Parental education and the number of parents in the household were assessed using a parental questionnaire.

Statistical analyses

Analyses were conducted using SAS 9.2 (SAS Institute Inc., Cary, NC, USA). Principal component analyses with varimax rotations were used to identify the key child, mother and father eating behaviours assessed by the FEAHQ. Items with factor loadings greater than or equal to 0.5 were retained and used in the interpretation of the rotated solutions. Eating behaviour scores were calculated for each component by summing the responses to the retained items. Spearman correlation coefficients (r) were used to assess the correlations between comparable child, mother

Table 1. Characteristics of the study population (n=433)

	Mean (SD)
Age (years)	12.4 (0.3)
BMI (kg/m ²)	20.1 (4.1)
Waist-to-height ratio	0.5 (0.1)
Waist-to-hip ratio	0.9 (0.1)
Waist girth (cm)	71.0 (11.4)
Hip girth (cm)	78.1 (10.6)
Total physical activity score [Range: 0-64]	15.3 (6.4)
	Frequency (%)
Male gender	206 (47.6)
First-born child*	270 (62.7)
University-educated parent*	71 (28.1)
Two-parent household*	235 (93.6)

* First-born child (n=431), university education (n=253), two-parent household (n=251).

and father eating behaviours. Linear regression models adjusted for age, gender, birth order, and total physical activity were used to assess the associations between the eating behaviours identified in the principal component analyses with the childhood body composition measures (i.e., BMI, waist-to-height ratio, waist-to-hip ratio, waist girth, and hip girth). For analytical purposes, each of the eating behaviour scores were dichotomized, with values below the median representing more optimal eating behaviours and values above the median representing poorer eating behaviours. The interpretation of results was based on 95% confidence intervals. Sensitivity analyses were conducted on the subsample of children and parents in order to determine if the observed associations remained after additional adjustment for parental education and the number of parents in the household.

RESULTS

The basic characteristics of the study population are presented in Table 1. Based on the BMI cut-offs set for children by the International Obesity Task Force,^{27,28} 28.2% of the children in this sample were overweight or obese. The majority of the respondents to the FEAHQ were mothers (96.1%).

Family eating behaviours

Seven eating behaviours were identified among children, five eating behaviours were identified among mothers, and four eating behaviours were identified among fathers, accounting for 50.4%, 58.9%, and 51.5% of the total variance in the observed variables, respectively. The child, mother and father eating behaviour components and the factor loadings of each of the items assessed by the FEAHQ are presented in Tables 2-4.

With the exception of the "unregulated eating" (i.e., eating when not hungry, fast eating pace, taking second helpings, and/or eating in the study) components identified in children, mothers and fathers, components of the same name were comprised of the same items. Low to high correlations were observed between comparable eating behaviours in children, mothers and fathers (R=0.21 to R=0.69). The lowest correlations (R, 95% CI) were observed between the unregulated eating components (children vs. mothers: 0.25, 0.16-0.34; children vs. fathers: 0.22, 0.13-0.31; mothers vs. fathers: 0.21, 0.12-0.30) and the highest correlations were observed between the eating by the television components (children vs. mothers: 0.69, 0.64-0.74; children vs. fathers: 0.56, 0.49-0.62; mothers vs. fathers: 0.60, 0.54-0.66). Results of the correlation analyses are presented in the text only.

Table 2. Eigenvalues (EV) and factor loadings from the principal component analysis of the child-related items that were assessed in the revised Family Eating and Activity Habits Questionnaire (n=433)

	Component One Eating meals with parent(s) (EV 3.31)	Component Two Emotional eating (EV 1.71)	Component Three Sweet beverage consumption and snacking (EV 1.40)	Component Four Eating by the television (EV 1.31)	Component Five Unregulated eating (EV 1.21)	Component Six Eating in the bedroom/ study (EV 1.09)	Component Seven Eating 'on-the-go' (EV 1.05)
Sweet beverage consumption	0.05	0.18	0.64*	0.02	0.14	-0.03	-0.07
Fast food consumption	0.02	-0.06	0.35	0.33	0.07	-0.07	0.27
Snacks without permission	0.14	0.04	0.61*	0.13	0.03	0.12	-0.14
Purchases own snacks	-0.02	0.08	0.61*	0.20	-0.06	-0.01	0.10
Told to eat when not hungry at mealtime	-0.04	0.19	-0.07	-0.18	-0.60*	-0.11	0.25
Eating pace	0.05	0.05	0.04	-0.11	0.69*	-0.07	0.13
Second helpings	0	0.18	-0.02	0.03	0.69*	0.06	0.17
Eats breakfast with parent	0.69*	0.06	0.18	0.20	0	0.08	0.12
Eats lunch with parent	0.77*	-0.02	-0.01	0.14	0.05	0	-0.04
Eats afternoon snack with parent	0.77*	0.05	0.06	-0.09	0.03	-0.03	0.01
Eats dinner with parent	0.09	0	0.53*	-0.08	-0.03	0.24	0.18
Eats while standing	0.08	0.07	0.03	0.06	0.07	-0.02	0.73*
Eats directly from pot/pan	-0.04	0.09	0.08	-0.03	0.07	0.28	0.56*
Eats while watching television	0.14	0.16	0.09	0.81*	0	0.01	-0.02
Eats when bored	0.15	0.75*	0.08	0.14	-0.02	0.01	-0.07
Eats when angry/in a negative mood	0	0.69*	0.01	-0.04	-0.05	0.16	0.18
Disorderly eating between meals	-0.12	0.61*	0.18	0.13	0.16	0.02	0.08
Eats at night	0.17	0.33	0.17	0.21	0.19	0.31	-0.18
Eats in the living room/TV room	0.06	0.09	0.12	0.78*	0.03	0.14	0.04
Eats in the bedroom	-0.01	0.03	0.16	0.22	-0.04	0.68*	0.17
Eats in the study	0.01	0.13	0.01	-0.07	0.08	0.77*	-0.05

* Factor loadings ≥ 0.50 ; Due to an insufficient number of items loading on the eighth identified component, this component and its corresponding item (not hungry when snacking) were excluded.

Table 3. Eigenvalues (EV) and factor loadings from the principal component analysis of the mother-related items that were assessed in the revised Family Eating and Activity Habits Questionnaire (n=433)

	Component One Emotional and uncontrolled eating (EV 2.86)	Component Two Eating by the television (EV 1.44)	Component Three Eating 'on-the-go' (EV 1.27)	Component Four Eating in the bedroom/study (EV 1.05)	Component Five Unregulated eating (EV 1.02)
Eats when not hungry at mealtime	0.24	-0.37	0.20	-0.10	-0.66*
Eating pace	0.24	-0.20	0.18	-0.05	0.68*
Second helpings	0.52*	-0.09	-0.01	-0.10	0.28
Eats while standing	0.06	0.04	0.80*	0.05	-0.02
Eats directly from pot/pan/bowl	0.09	0.17	0.71*	0.06	0.04
Eats while watching television/reading/working	0.18	0.83*	0.16	0.04	0.07
Eats when bored	0.72*	0.14	0.14	0.04	-0.07
Eats when angry/in a negative mood	0.67*	0.07	0.23	0.11	0.14
Disorderly eating between meals	0.71*	0.13	0.03	0.14	-0.06
Eats late at night	0.55*	0.33	-0.25	0.10	-0.11
Eats in the living room/TV room	0.14	0.83*	0.11	0.06	-0.07
Eats in the bedroom	0.14	0.17	0	0.68*	-0.09
Eats in the study	0.02	-0.06	0.11	0.80*	0.09

* Factor loadings ≥ 0.50 .

Table 4. Eigenvalues (EV) and factor loadings from the principal component analysis of the father-related items that were assessed in the revised Family Eating and Activity Habits Questionnaire (n=433)

	Component One Eating by the television and late night eating (EV 2.93)	Component Two Eating 'on-the-go' (EV 1.42)	Component Three Emotional eating (EV 1.23)	Component Four Unregulated eating (EV 1.11)
Eat when not hungry at mealtime	-0.09	0.01	0.03	0.60*
Eating pace	-0.05	0.50	0.10	-0.37
Second helpings	0.08	0.27	0.24	-0.50*
Eats while standing	0.10	0.71*	0.4	0.13
Eats directly from pot/pan/bowl	0.10	0.78*	0.07	-0.07
Eats while watching television/reading/working	0.83*	0.12	0.01	-0.05
Eats when bored	0.27	-0.01	0.79*	0.04
Eats when angry/in a negative mood	-0.02	0.08	0.80*	-0.02
Disorderly eating between meals	0.12	0.42	0.53*	-0.03
Eats late at night	0.64*	-0.03	0.29	-0.03
Eats in the living room/TV room	0.78*	0.11	0.05	-0.05
Eats in the bedroom	0.32	0.32	0.05	0.27
Eats in the study	0.11	0.38	0.17	0.51*

* Factor loadings ≥ 0.50 .

Table 5. Regression estimates (b, 95% CI) for the associations between family eating behaviours and children's body composition measures (n=431)*

	Measures of body composition				
	BMI (kg/m ²)	Waist-to-height ratio	Waist-to-hip ratio	Waist girth (cm)	Hip girth (cm)
Child Eating Behaviours					
Low frequency of eating meals with parent(s)	1.0 (0.2-1.8)	0.02 (0.002-0.03)	0.002 (-0.01-0.02)	2.7 (0.5-5.0)	2.8 (0.7-4.9)
Emotional eating	1.6 (0.8-2.4)	0.03 (0.01-0.04)	0.02 (0.004-0.03)	5.3 (3.1-7.4)	4.1 (2.1-6.2)
Frequent sweet beverage consumption and snacking	0.8 (0.1-1.6)	0.01 (0.001-0.03)	0.01 (-0.004-0.02)	2.7 (0.6-4.9)	2.4 (0.4-4.4)
Eating by the television	1.5 (0.7-2.3)	0.02 (0.01-0.04)	0.01 (-0.001-0.03)	4.3 (2.1-6.6)	3.7 (1.6-5.8)
Unregulated eating	-0.3 (-1.1-0.6)	-0.01 (-0.02-0.01)	-0.004 (-0.02-0.01)	-0.8 (-3.1-1.5)	-0.5 (-2.7-1.7)
Eating in the bedroom and/or study	0.5 (-0.3-1.3)	0.01 (-0.01-0.02)	-0.002 (-0.2-0.01)	1.3 (-0.9-3.5)	1.7 (-0.4-3.7)
Eating "on-the-go"	1.0 (0.1-1.8)	0.01 (-0.004-0.02)	0.002 (-0.01-0.02)	2.3 (0.002-4.5)	2.4 (0.3-4.5)
Mother Eating Behaviours					
Emotional and uncontrolled eating	1.7 (0.9-2.5)	0.02 (0.01-0.03)	0.02 (0.003-0.03)	4.3 (2.1-6.5)	3.2 (1.1-5.3)
Eating by the television	1.4 (0.6-2.3)	0.02 (0.01-0.03)	0.003 (-0.1-0.02)	3.5 (1.2-5.0)	3.6 (1.4-5.8)
Unregulated eating	-0.8 (-1.9-0.3)	-0.01 (-0.3-0.01)	0.0004 (-0.02-0.02)	-1.4 (-4.3-1.6)	-1.5 (-4.3-1.3)
Eating in the bedroom and/or study	0.01 (-0.8-0.8)	0.002 (-0.1-0.02)	0.01 (-0.01-0.02)	0.8 (-1.5-3.0)	0.2 (-1.9-2.4)
Eating "on-the-go"	1.1 (0.2-2.1)	0.02 (0.001-0.03)	-0.01 (-0.02-0.01)	3.7 (1.1-6.3)	4.4 (2.0-6.9)
Father Eating Behaviours					
Emotional Eating	0.9 (0.1-1.7)	0.02 (0.003-0.03)	0.01 (-0.01-0.02)	3.0 (0.8-5.2)	2.6 (0.6-4.7)
Eating by the television and late at night	1.1 (0.3-1.9)	0.02 (0.003-0.03)	0.001 (-0.01-0.01)	3.0 (0.8-5.1)	3.0 (1.0-5.0)
Unregulated eating	-0.7 (-1.6-0.1)	-0.01 (-0.02-0.01)	-0.01 (-0.02-0.01)	-1.1 (-3.4-1.3)	-0.6 (-2.8-1.6)
Eating "on-the-go"	0.7 (-0.2-1.6)	0.01 (-0.01-0.02)	0.004 (-0.01-0.02)	1.6 (-0.7-4.0)	1.4 (-0.9-3.6)

* Child, mother and father eating behaviour variables were dichotomized by splitting each variable at its median. Values below the median represented more optimal eating behaviours (e.g., high parental involvement) and values above the median represented poorer eating behaviours (e.g., low parental involvement).

The parameter estimates represent the difference in body composition measure for children/parents with scores above the median (i.e., poorer eating behaviours) compared to children/parents with scores below the median (i.e., more optimal eating behaviours). For example, children who had an emotional eating score above the median for that behaviour (i.e., had a greater propensity to eat when bored, when in a negative mood and in a disorderly manner between meals) had a 1.0 kg/m² larger BMI compared to children who had an emotional eating score below the median (i.e., a lower propensity to eat when bored, when in a negative mood and in a disorderly manner between meals).

Bold text indicates statistically significant results.

All models were adjusted for age, gender, birth order and total physical activity.

Associations between family eating behaviours and measures of child body composition

Low frequency of eating meals with parents, emotional eating, frequent sweet beverage consumption and snacking, eating by the television, and eating "on-the-go" by children; emotional and uncontrolled eating, eating by the television and eating "on-the-go" by mothers; and emotional eating and eating by the television/late at night by fathers were associated with larger body composition measures in children. With the exception of waist-to-hip ratio, for which significant associations were only observed for emotional and uncontrolled eating in children and mothers, associations were present across all of the five assessed measures of body composition (Table 5).

Subsample analyses

Among the subsample of children for whom additional data were available on parental education and the number of parents in the household, many of the child, mother and father eating behaviours remained predictive of children's body composition measures even after adjustment for these variables. Emotional eating in children was associated with larger measures of BMI (b, 95% confidence interval [CI]); 1.7 kg/m², 0.6-2.8 kg/m²), waist-to-height ratio (0.03, 0.01-0.05), waist-to-hip ratio (0.02, 0.003-0.04), waist girth (5.7 cm, 2.8-8.6 cm), and hip girth (4.2 cm, 1.4-6.9 cm). Emotional and uncontrolled eating in mothers was associated with larger measures of BMI (1.8 kg/m², 0.8-2.9 kg/m²), waist-to-height ratio (0.02, 0.01-0.04), waist girth (4.5 cm, 1.6-7.5 cm) and hip girth (3.4 cm, 0.6-6.1 cm). Similarly, eating "on-the-go" in mothers was associated with larger measures of BMI (1.6 kg/m², 0.3-2.9 kg/m²), waist-to-height ratio (0.02, 0.003-0.05), waist girth (5.2 cm, 1.6-8.7 cm, and hip girth (6.3 cm, 3.1-9.6 cm) in children. In addition, eating by the

television in mothers was associated with larger hip girth measures in children (3.2 cm, 0.1-6.3 cm) and eating by the television/late night eating in fathers was associated with larger measures of BMI (1.4 kg/m², 0.3-2.5 kg/m²), waist-to-height ratio (0.02, 0.0002-0.04), waist girth (3.5 cm, 0.5-6.5 cm), and hip girth (3.2 cm, 0.5-6.0 cm) in children. Results of subsample analyses are reported in the text only.

DISCUSSION

While previous research has examined the influence of parental feeding practices (e.g., parental pressure to eat, parental restriction of snacking, and regularity of family meals) on children's body weight,^{9,11,15,29} this is the first study to assess the relative effects of children's, mothers' and fathers' own eating behaviours on measures of body composition in children. Although understanding the influence of parental feeding practices is important, the modification of children's and parents' own eating behaviours may represent an alternate and arguably easier point of intervention to encourage positive weight behaviour change in children.

In this study, we identified similar eating behaviour patterns among family members. The highest correlations were observed for the "eating by the television" component, suggesting that eating by the television is a habit shared by all members of the family. The lowest correlations were observed for the "unregulated eating" components. Rather than being reflective of heterogeneity in unregulated eating behaviours, the lower correlations are likely a result of different items comprising each of the "unregulated eating" components.

Emotional/uncontrolled eating and eating by the television in children and mothers were associated with larger measures of children's body composition. Specifically, children who had an

Appendix A. Overview of the items that were assessed in the revised Family Eating and Activity Habits Questionnaire

Respondent(s)	Item	Response option
Child	Servings of sweet beverages consumed by child in a typical day.	≤1, 2, 3, 4, ≥5
Child	Frequency child eats traditional fast food in a typical week.	≤1, 2, 3, 4, ≥5
Child	Frequency child eats snacks/sweets without parental permission.	Never, Almost never, Sometimes, Frequently, Always
Child	Frequency child buys his/her own snacks/sweets.	Never, Almost never, Sometimes, Frequently, Always
Child	Does child claim to be hungry when asking for snacks/sweets?	Yes/No
Child	Parental response when child not hungry at mealtime.	Irrelevant/child is always hungry, Eat later, Sit at table and not eat, Sit at table and eat less, Convince to eat
Mother/Father	When mealtime and you are not hungry, what do you do?	Never happens, Not eat, Eat less, Eat the same
Child/Mother/Father	Compared to people your age, how fast do you eat?	Slow, Average, Fast
Child/Mother/Father	How often do you ask for a second helping?	Never, Almost never, Sometimes, Frequently, Always
Child	How often do you/your spouse eat breakfast with the child?	Always, Frequently, Sometimes, Almost never, Never
Child	How often do you/your spouse eat lunch with the child?	Always, Frequently, Sometimes, Almost never, Never
Child	How often do you/your spouse eat an afternoon snack with the child?	Always, Frequently, Sometimes, Almost never, Never
Child	How often do you/your spouse eat dinner with the child?	Always, Frequently, Sometimes, Almost never, Never
Child/Mother/Father	How often do you eat while standing?	Never, Almost never, Sometimes, Frequently, Always
Child/Mother/Father	How often do you eat straight from the pot/pan/bowl?	Never, Almost never, Sometimes, Frequently, Always
Child/Mother/Father	How often do you eat while watching television/reading/working?	Never, Sometimes, Frequently, Always
Child/Mother/Father	How often do you eat when bored?	Never, Sometimes, Frequently, Always
Child/Mother/Father	How often do you eat when angry/in a negative mood?	Never, Sometimes, Frequently, Always
Child/Mother/Father	How often do you eat in a disordered way between meals?	Never, Sometimes, Frequently, Always
Child/Mother/Father	How often do you eat late in the evening or at night?	Never, Sometimes, Frequently, Always
Child/Mother/Father	How often do you eat in the living room/TV room?	Never, Almost never, Sometimes, Frequently, Always
Child/Mother/Father	How often do you eat in the bedroom?	Never, Almost never, Sometimes, Frequently, Always
Child/Mother/Father	How often do you eat in the study?	Never, Almost never, Sometimes, Frequently, Always

emotional eating score above the median for that behaviour (i.e., had a greater propensity to eat when bored, when in a negative mood and in a disorderly manner between meals) had at least a 0.8 kg/m² larger BMI, a 0.01 unit larger waist-to-height ratio, a 0.004 unit larger waist-to-hip ratio, a 3.1 cm larger waist girth, and a 2.1 cm larger hip girth compared to children who had an emotional eating score below the median. Similarly, emotional and uncontrolled eating in mothers was associated with at least a 0.9 kg/m² larger BMI, a 0.01 unit larger waist-to-height ratio, a 0.003 larger waist-to-hip ratio, a 2.1 cm larger waist girth and a 1.1 cm larger hip girth; eating by the television in children was associated with at least a 0.7 kg/m² larger BMI, a 0.01 unit larger waist-to-height ratio, a 2.1 cm larger waist girth and a 1.6 cm larger hip girth; and eating by the television in mothers was associated with at least a 0.6 kg/m² larger BMI, a 0.01 unit larger waist-to-height ratio, a 1.2 cm larger waist girth and a 1.4 cm larger hip girth. In fathers, emotional eating and eating by the television and late at night were also associated with larger childhood body composition measures but these effects were less pronounced. A possible explanation for this is that fathers may be present at mealtimes less often than mothers and so the effects of their eating behaviours on children's eating behaviours and body composition may be lower.³⁰ Statistically significant results were also observed between measures of children's body composition and a low frequency of eating meals with parents, frequent sweet beverage consumption and snacking, and eating "on-the-go" in children and between measures of children's body composition and eating "on-the-go" in mothers; however, given that the lower bounds of the confidence intervals included changes in body composition measures that may not be considered clinically important, further studies are needed to better estimate the magnitude of these effects. To address the issue of potential confounding by socio-economic status, we also conducted analyses on a subsample of child-parent dyads for whom data on parental education and number of parents in the household were available. After adjusting for these factors, important associations remained for emotional/uncontrolled eating in children and mothers, "on-the-go" eating in mothers, and late night eating

and television viewing in fathers, suggesting that these eating behaviours are indeed associated with larger measures of body composition in children.

The results of this study suggest that the most important determinants of children's body composition are the degree to which they and their mothers engage in emotional/uncontrolled eating and how often they eat by the television. This is consistent with previous studies that have shown that children who engage in emotional eating and eat while watching television are at increased risk of obesity.^{31,32} This study adds to the current body of knowledge by demonstrating that emotional and uncontrolled eating and eating by the television by mothers may be just as important in predicting childhood adiposity as those behaviours in children.

Several study limitations must be acknowledged. The cross-sectional nature of this study precludes drawing conclusions regarding causality, and bias may have been introduced as a result of the FEAHQ respondents acting as proxies for their spouses and children. To validate parental reports as proxies for child dietary behaviours, we assessed the concordance between child and parent responses to a food frequency questionnaire in a comparable sample of children from the Niagara Region. In this analysis, we found moderate agreement between child and parent responses ($r=0.40$ to 0.69), suggesting that use of child reports would perhaps have yielded similar results.³³ Nevertheless the possibility remains that differences in findings might have been observed had the children completed the FEAHQ on their own. The agreement between spousal reporting has been reported previously to be high across all items assessed in the FEAHQ ($r=0.81$ to 0.94), suggesting that having one spouse respond to the survey on behalf of the other was also appropriate.²⁵

The strengths of this study are threefold. First, given that this is the first study to simultaneously examine the role of child, mother and father eating patterns on children's measures of adiposity, it provides a novel piece of information regarding the relative effects of these behaviours. It also provides unique data on the associations between fathers' own eating behaviours and obesity risk in children – something that has not been adequately examined in the literature to date. Second, the use of multiple

indicators of adiposity allowed for a thorough assessment of the role of eating behaviours on the outcome of interest. Third, given that no clinically significant differences were observed in age, physical activity, body composition and eating behaviours of the children who were included and excluded from this study, the findings may be generalized to the entire cohort of children who participated in the study.

In conclusion, this is the first study to concurrently assess the eating behaviours of children, their mothers and their fathers and to estimate their associations with measures of body composition in children. The results indicate that the eating behaviours of children and mothers, and to a lesser degree fathers, are important predictors of children's body composition. Of all the identified eating behaviours, emotional/uncontrolled eating and eating by the television in children and mothers were the most important predictors of adiposity, suggesting that public health interventions designed to help mothers and children reduce the frequency of these behaviours may be an effective means to facilitate positive weight outcomes in children. Given that the eating behaviours of children and the effects of these behaviours may change throughout childhood and that family environments may influence girls and boys differently, gender-specific research on the role of family eating behaviours at varying stages of childhood development is encouraged.

REFERENCES

- Roberts KC, Shields M, de Groh M, Aziz A, Gilbert JA. Overweight and obesity in children and adolescents: Results from the 2009 to 2011 Canadian Health Measures Survey. *Health Rep* 2012;23(3):37-41.
- Reilly JJ, Methven E, McDowell ZC, Hacking B, Alexander D, Stewart L, et al. Health consequences of obesity. *Arch Dis Child* 2003;88(9):748-52.
- Must A, Strauss RS. Risks and consequences of childhood and adolescent obesity. *Int J Obes Relat Metab Disord* 1999;23 Suppl 2:S2-11.
- Public Health Agency of Canada. Curbing Childhood Obesity: A Federal, Provincial and Territorial Framework for Action to Promote Healthy Weights. Ottawa, ON: PHAC, 2012.
- Raine KD. Overweight and Obesity in Canada: A Population Health Perspective. Ottawa: Canadian Institute for Health Information, 2004.
- Strauss RS, Knight J. Influence of the home environment on the development of obesity in children. *Pediatrics* 1999;103(6):e85.
- Golan M. Parents as agents of change in childhood obesity—from research to practice. *Int J Pediatr Obes* 2006;1(2):66-76.
- Birch LL, Davison KK. Family environmental factors influencing the developing behavioral controls of food intake and childhood overweight. *Pediatr Clin North Am* 2001;48(4):893-907.
- Ostbye T, Malhotra R, Stroo M, Lovelady C, Brouwer R, Zucker N, et al. The effect of the home environment on physical activity and dietary intake in preschool children. *Int J Obes (Lond)* May 20, 2013.
- Hanson NI, Neumark-Sztainer D, Eisenberg ME, Story M, Wall M. Associations between parental report of the home food environment and adolescent intakes of fruits, vegetables and dairy foods. *Public Health Nutr* 2005;8(1):77-85.
- Stang J, Loth KA. Parenting style and child feeding practices: Potential mitigating factors in the etiology of childhood obesity. *J Am Diet Assoc* 2011;111(9):1301-05.
- Bauer KW, Neumark-Sztainer D, Fulkerson JA, Hannan PJ, Story M. Familial correlates of adolescent girls' physical activity, television use, dietary intake, weight, and body composition. *Int J Behav Nutr Phys Act* 2011;8:25.
- Cooke LJ, Wardle J, Gibson EL, Sapochnik M, Sheiham A, Lawson M. Demographic, familial and trait predictors of fruit and vegetable consumption by pre-school children. *Public Health Nutr* 2004;7(2):295-302.
- Fisher JO, Mitchell DC, Smiciklas-Wright H, Birch LL. Parental influences on young girls' fruit and vegetable, micronutrient, and fat intakes. *J Am Diet Assoc* 2002;102(1):58-64.
- Taveras EM, Rifas-Shiman SL, Berkey CS, Rockett HR, Field AE, Frazier AL, et al. Family dinner and adolescent overweight. *Obes Res* 2005;13(5):900-06.
- Neumark-Sztainer D, Hannan PJ, Story M, Croll J, Perry C. Family meal patterns: associations with sociodemographic characteristics and improved dietary intake among adolescents. *J Am Diet Assoc* 2003;103(3):317-22.
- Antonogeorgos G, Panagiotakos DB, Papadimitriou A, Piftis KN, Anthracopoulos M, Nicolaidou P. Breakfast consumption and meal frequency interaction with childhood obesity. *Pediatr Obes* 2012;7(1):65-72.
- Moore LL, Lombardi DA, White MJ, Campbell JL, Oliveria SA, Ellison RC. Influence of parents' physical activity levels on activity levels of young children. *J Pediatr* 1991;118(2):215-19.
- Faith MS, Scanlon KS, Birch LL, Francis LA, Sherry B. Parent-child feeding strategies and their relationships to child eating and weight status. *Obes Res* 2004;12(11):1711-22.
- Lin M, Pan L, Tang L, Jiang J, Wang Y, Jin R. Association of eating speed and energy intake of main meals with overweight in Chinese pre-school children. *Public Health Nutr* August 16, 2013;1-8 [Epub ahead of print].
- Vik FN, Bjornara HB, Overby NC, Lien N, Androustos O, Maes L, et al. Associations between eating meals, watching TV while eating meals and weight status among children, ages 10-12 years in eight European countries: The ENERGY Cross-sectional Study. *Int J Behav Nutr Phys Act* 2013;10(1):58.
- Mallan KM, Nothard M, Thorpe K, Nicholson JM, Wilson A, Scuffham PA, et al. The role of fathers in child feeding: Perceived responsibility and predictors of participation. *Child Care Health Dev* July 31, 2013 [Epub ahead of print].
- Johannsen DL, Johannsen NM, Specker BL. Influence of parents' eating behaviors and child feeding practices on children's weight status. *Obesity (Silver Spring)* 2006;14(3):431-39.
- Cairney J, Hay J, Veldhuizen S, Faught BE. Trajectories of cardiorespiratory fitness in children with and without developmental coordination disorder: A longitudinal analysis. *Br J Sports Med* 2011;45(15):1196-201.
- Golan M, Weizman A. Reliability and validity of the Family Eating and Activity Habits Questionnaire. *Eur J Clin Nutr* 1998;52(10):771-77.
- Hay J. Adequacy in and predilection for physical activity in children. *Clin J Sport Med* 1992;2:10.
- Cole TJ, Bellizzi MC, Flegal KM, Dietz WH. Establishing a standard definition for child overweight and obesity worldwide: International survey. *BMJ* 2000;320(7244):1240-43.
- de Onis M, Onyango AW, Borghi E, Siyam A, Nishida C, Siekmann J. Development of a WHO growth reference for school-aged children and adolescents. *Bull World Health Organ* 2007;85(9):660-67.
- Hendy HM, Williams KE, Camise TS, Eckman N, Hedemann A. The Parent Mealtime Action Scale (PMAS). Development and association with children's diet and weight. *Appetite* 2009;52(2):328-39.
- Bianchi SM. Family change and time allocation in American families. In: Focus on Workplace Flexibility. Washington, DC: Alfred P. Sloan Foundation, November 29-30, 2010.
- Tanofsky-Kraff M, Yanovski SZ, Wilfley DE, Marmarosh C, Morgan CM, Yanovski JA. Eating-disordered behaviors, body fat, and psychopathology in overweight and normal-weight children. *J Consult Clin Psychol* 2004;72(1):53-61.
- Tremblay MS, LeBlanc AG, Kho ME, Saunders TJ, Larouche R, Colley RC, et al. Systematic review of sedentary behaviour and health indicators in school-aged children and youth. *Int J Behav Nutr Phys Act* 2011;8:98.
- Hajna S, Wade TJ, LeBlanc PJ. Concordance between child and parent responses to a brief dietary intake survey. *Am J Epidemiol* 2009;169(11):S121.

Received: July 16, 2013

Accepted: December 17, 2013

RÉSUMÉ

OBJECTIFS : Cerner les principaux comportements alimentaires des enfants et de leurs parents et déterminer les associations entre ces comportements et les indicateurs de la composition corporelle des enfants.

MÉTHODE : Nos données ont été recueillies auprès d'un échantillon de 431 enfants péri-adolescents (12,4±0,3 ans) et de leurs parents dans la région de Niagara. La composition corporelle des enfants a été évaluée par des adjoints de recherche formés. Les comportements alimentaires ont été évalués à l'aide d'une version révisée de l'outil *Family Eating and Activity Habits Questionnaire*. Des analyses en composantes principales ont servi à identifier les principaux comportements alimentaires des enfants, des mères et des pères. Nous avons utilisé des modèles de régression linéaire pour évaluer les associations entre ces comportements et l'indice de masse corporelle (IMC), le rapport tour de taille/taille, le rapport tour de taille/hanches, le tour de taille et le tour de hanches mesurés chez les enfants.

RÉSULTATS : L'alimentation incontrôlée ou sous l'effet de l'émotion et l'alimentation devant la télévision, chez les enfants et leurs mères, étaient

des comportements associés positivement avec les indicateurs de la composition corporelle des enfants. Les autres comportements alimentaires associés aux principaux indicateurs de la composition corporelle des enfants étaient, chez les enfants : la faible fréquence des repas avec les parents, la consommation fréquente de boissons sucrées et de collations et l'alimentation « sur le pouce »; chez les mères : l'alimentation « sur le pouce » et l'alimentation sous l'effet de l'émotion; et chez les pères : l'alimentation devant la télévision ou tard le soir.

CONCLUSIONS : Les comportements alimentaires des enfants et des mères, et dans une moindre mesure ceux des pères, sont d'importants prédicteurs de la composition corporelle des enfants. Les interventions de santé publique conçues pour aider les mères et les enfants à réduire la fréquence de l'alimentation incontrôlée ou sous l'effet de l'émotion et de l'alimentation devant la télévision pourraient être efficaces pour donner des résultats positifs en ce qui a trait au poids des enfants.

MOTS CLÉS : enfant; parents; comportement; composition corporelle