

Overweight Nova Scotia Children and Youth

The Roles of Household Income and Adherence to Canada's Food Guide to Healthy Eating

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ABSTRACT

Objective: Poor diet quality has been observed in Nova Scotia children and youth, characterized by low intake from the traditional four food groups and a high intake from the *Other Foods* category. In this study, we addressed how household income and adherence to Canada's Food Guide to Healthy Eating influenced weight status category in Nova Scotia children and youth.

Methods: During the 2005-06 school year, data were collected from 2,296 students and their parents, across Nova Scotia. Questionnaires and anthropometric measurements were obtained from grades 3, 7 and 11 students. The grade 3 students were excluded from the dietary intake assessment. The information collected from the online 24-hour food recalls and food frequency questionnaires were analyzed for adherence to Canada's Food Guide to Healthy Eating recommendations. A general linear model was employed to examine the relationships between household income, food group and weight status category.

Results: Overall adherence to Canada's Food Guide to Healthy Eating was low among grades 7 and 11 students. Fewer servings from *Grain Products*, *Milk Products* and *Vegetables and Fruit* were observed in at risk of overweight and overweight students. At risk of overweight and overweight were significantly related to lower household income in grades 3 and 11. Our results show that the rates of overweight in Nova Scotia students are double those reported by the 2004 Canadian Community Health Survey.

Conclusion: Household income and dietary intake play significant roles in weight status among Nova Scotia children and youth.

Key words: Child nutrition sciences; overweight; income

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

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The globesity¹ epidemic has had a significant impact on Canadian children and youth.² The 2004 Canadian Community Health Survey (CCHS) showed that the rate of overweight and obesity for 2 to 17 year olds was 18% and 8%, respectively.³ The health risks associated with overweight and obesity are well documented.⁴⁻⁶ The current economic burden⁷ of these comorbidities, coupled with the propensity of overweight and obese children to remain so through to adulthood,^{8,9} speaks to the potential for a severe public health crisis.

Regional differences exist – the Maritime Provinces have repeatedly shown higher prevalence rates of overweight and obesity.^{3,10,11} The combined rate of overweight and obesity in Nova Scotia children and youth, at 32%, is one of the highest in the country.³ Socio-economic differences transcend the regional differences.¹² Socio-economic status and overweight are inversely related for Canadian children, irrespective of province of residence.¹²

Household income is one of the most influential determinants of health¹³ and is a socio-economic variable linked to the incidence of childhood overweight and obesity in Nova Scotia,¹¹ Canada¹² and internationally.^{14,15} In Nova Scotia, 25.6% of families were living below the low income cut-off (LICO) in 2004; a greater proportion of their household income was spent on necessities such as food compared to the average Canadian family.¹⁶ This inability to purchase nutrient-dense foods due to lack of disposable income describes one facet of food insecurity.¹⁷ Food insecurity may result in poor nutritional status and the onset of overweight in children, and is associated with a host of non-nutritional psychosocial implications.^{15,18}

Energy expenditure and energy intake are the components of overweight's two-part equation. In this study, we addressed one of the modifiable factors, dietary intake.¹⁹ Adherence to Canada's Food Guide to Healthy Eating²⁰ has recently been explored as a means to guide healthy public policy and initiatives directed at children.²¹ Nationwide, the majority of children are not meeting the minimum recommended servings for the *Vegetables and Fruit*, *Milk Products* and *Grain Products* food groups,^{2,3,22} while a concomitant increase in servings from the

Other Foods category has been reported.²² This is especially true among children from Nova Scotia. In a province-wide analysis of grade 5 students, 79% consumed less than the five recommended daily servings of *Vegetables and Fruit*, compared with 64% nationally.²¹ It has also been reported that children from Nova Scotia consume approximately 25% of their daily calories from the sugar, fats, and oils that comprise the *Other Foods* category.²²

The provincial and national figures are disconcerting and warrant further study of the factors surrounding childhood obesity. A better understanding of the roles of adherence to Canada's Food Guide to Healthy Eating recommendations and household income in weight status will help shape policy and programs aimed at mitigating rates of overweight in Nova Scotia children and youth.

METHODS

The Physical Activity Levels and Dietary Intake of Children and Youth in the Province of Nova Scotia (PACY) study was conducted on a representative sample of grades 3, 7 and 11 students. The methodologies pertinent to the data analyzed and presented in this manuscript are briefly described here, while the complete methods for the PACY study are outlined in detail elsewhere.²³

Anthropometric measurements were taken from each student using International Society for the Advancement of Kinanthropometry standards for anthropometric assessments.²⁴ The collected height (m) and weight (kg) data served to determine Body Mass Index (BMI) in the grades 3, 7 and 11 students (n=2296) using the sex-specific BMI-for-age method.²⁵ This resulted in a Centers for Disease Control (CDC) percentile ranking for the child's or adolescent's BMI that controlled for age and sex. "Normal weight" individuals included boys and girls whose BMI was equal to or less than the age- and sex-matched 85th percentile. "At risk of overweight" included the subjects whose BMI was greater than the 85th percentile but equal to or less than the 95th age- and sex-matched percentiles. "Overweight" was defined as having a BMI exceeding the 95th age- and sex-matched percentile. It should be noted that the

TABLE I
Percent of Students in Each CDC Weight Status Category by Age and Sex

		n	CDC Weight Status Category		
			Normal Weight	At Risk of Overweight	Overweight
Grade 3	Both sexes	800	55.9%	21.4%	22.8%
	Boys	389	52.7%	21.6%	25.7%
Grade 7	Girls	411	58.9%	21.2%	20.0%
	Both sexes	782	64.7%	19.4%	15.9%
Grade 11	Boys*	355	59.2%	22.0%	18.9%
	Girls*	427	69.3%	17.3%	13.3%
	Both sexes	714	68.3%	19.9%	11.8%
	Boys	310	71.3%	18.1%	10.6%
	Girls	404	66.1%	21.3%	12.6%

* Chi square analysis indicated a different distribution between boys and girls in grade 7 (p=0.011) N.B. values may not equal 100% due to rounding.

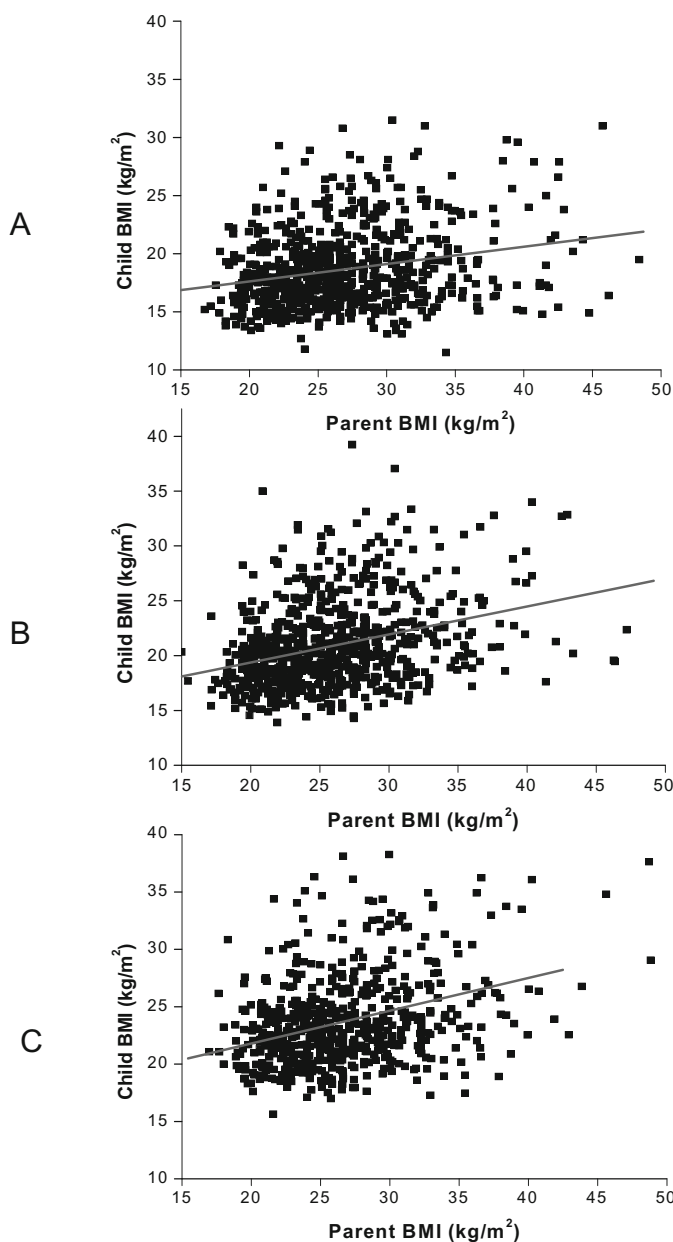


Figure 1. Correlations between parent BMI and child BMI in grades 3 (A), 7 (B) and 11 (C) students
Note: Correlation coefficients were significant in each grade (grade 3, r=0.24, p=0.000; grade 7, r=0.32, p=0.000; grade 11, r=0.35, p=0.000)

TABLE II

Percent of Students in Each CDC Weight Status Category According to Household Income

Income	Percent of Students in Each Weight Status Category								
	Grade 3*			Grade 7			Grade 11†		
	Normal Weight (n=403)	At Risk of Overweight (n=148)	Overweight (n=167)	Normal Weight (n=445)	At Risk of Overweight (n=132)	Overweight (n=108)	Normal Weight (n=418)	At Risk of Overweight (n=123)	Overweight (n=68)
<\$30,000	58.2	17.1	24.7	63.3	19.5	17.2	59.9	28.9	11.3
\$30,000-\$49,999	52.3	16.6	31.1	63.7	16.4	19.9	65.8	18.7	15.5
\$50,000-\$79,999	54.4	24.8	20.8	62.4	23.1	14.5	73.0	16.8	10.3
≥\$80,000	61.4	22.9	15.7	71.1	17.6	11.3	75.6	17.3	7.1

* Chi square test revealed a significant association between weight status and income level in grade 3 students (p=0.015).

† Chi square test revealed a significant association between weight status and income level in grade 11 students (p=0.026).

TABLE III

Differences in Number of Servings from Each Food Group According to CDC Weight Status Category

Food Group*	Mean # Servings (± SD)					
	Grade 7			Grade 11		
	Normal Weight (n=477)	At Risk of Overweight (n=135)	Overweight (n=120)	Normal Weight (n=466)	At Risk of Overweight (n=135)	Overweight (n=77)
Grain Products	4.81 (3.35)	4.35 (3.11)	4.15 (3.33)	5.43† (3.52)	4.86 (3.27)	4.40† (3.10)
Vegetables & Fruit	3.25 (3.06)	2.98 (3.00)	3.02 (3.27)	3.71† (3.68)	3.30 (2.83)	2.60† (2.65)
Milk Products	3.40§ (3.07)	2.61 (2.15)	2.91§ (2.66)	3.29‡ (2.73)	2.49‡ (1.92)	2.77 (2.31)
Meat and Alternatives	2.55 (2.15)	2.38 (2.06)	2.68 (2.68)	2.96 (2.81)	2.78 (2.40)	2.44 (2.92)
Other	5.80 (4.29)	5.51 (4.16)	5.37 (4.77)	7.52 (5.50)	7.35 (5.28)	6.56 (3.97)

* Food group headings are directly from Canada's Food Guide to Healthy Eating.

† Significant difference between normal weight and overweight grade 11 students.

‡ Significant difference between normal weight and at risk of overweight grade 11 students.

§ Significant difference between normal weight and overweight grade 7 students.

terms "at risk of overweight" and "overweight" were chosen to limit the negative connotations associated with the term "obesity".²⁶

From a questionnaire for parents, data were obtained for parental height, weight and household income levels. Parental self-reported weight and height data were used to calculate parent BMI (kg/m²).²⁷ The descriptive statistics revealed that among the entire student subject sample (n=2321), the combined rate of underweight (i.e., BMI less than the age- and sex-specific 5th percentile) for the three grades was a mere 25 students (1.2% of the sample). These students were excluded from the sample and statistical analyses due to the small number and the lack of relevance to the scope of the study.

Nutrition data were not collected from the grade 3 participants due to poor reliability and validity of food intake data in this age group. The grades 7 and 11 students (n=1410) completed an online dietary assessment tool consisting of a 24-hour recall and food frequency questionnaire.²⁸ The data input by the students

were compiled and analyzed in SPSS version 14.0 (SPSS Inc., Chicago, IL). The mean number of servings from each food group were categorized as either "below", "within" or "above" the ranges from Canada's Food Guide to Healthy Eating recommendations from 1992²⁰ and also from Eating Well with Canada's Food Guide released in 2007.²⁹

Descriptive statistics were run on all variables of interest, yielding percentages, mean values and standard deviations (SD). The relations involving household income, food group and weight status category were analyzed using a general linear model, specifically chi square (χ^2) statistics. The differences in mean number of servings from the food groups for weight status category were determined through multivariate analyses of variance. Significance was accepted at p<0.05.

RESULTS

The sample sizes for the random sample of grades 3, 7 and 11 students from Nova Scotia and percent of students in each

weight status category are presented in Table I. The χ^2 analysis revealed that grade 7 males had significantly higher BMIs than their grade 7 female counterparts (p=0.011).

Parental self-reported weight and height data revealed that children in all grades were likely to have a weight status category similar to their parents in all grades (r = 0.24-0.35, p=0.000; see Figure 1).

Table II shows the percent of normal, at risk of overweight and overweight students according to household income level. More overweight students were in the two lower income quartiles (<\$30,000 and \$30,000-\$49,999) than the two upper income quartiles (\$50,000-\$79,999 and ≥\$80,000), a trend noted in all three grades.

The differences in number of servings from the food groups according to weight status category are displayed in Table III. Of particular interest was the mean number of servings from the *Other Foods* category where intake was greater in normal weight, lower in at risk of overweight and lowest in overweight students.

Table IV presents the number of servings from each food group according to the

TABLE IV
Differences in Number of Servings from Each Food Group According to Household Income

Food Group*	Mean # of Servings (± standard deviation)							
	Grade 7				Grade 11			
	<\$30,000 (n=162)	\$30,000- \$49,999 (n=168)	\$50,000- \$79,999 (n=177)	≥\$80,000 (n=155)	<\$30,000 (n=134)	\$30,000- \$49,999 (n=148)	\$50,000- \$79,999 (n=175)	≥\$80,000 (n=125)
<i>Grain Products</i>	3.91† (2.75)	4.42 (2.93)	5.06† (3.28)	5.03† (3.77)	4.85 (3.22)	5.29 (3.48)	5.05 (3.22)	5.64 (3.72)
<i>Vegetables & Fruit</i>	2.87 (2.75)	3.22 (3.23)	3.02 (2.98)	3.34 (3.06)	3.20 (3.11)	3.05 (2.62)	3.59 (3.68)	4.03 (3.39)
<i>Milk Products</i>	2.73 (2.33)	3.06 (2.62)	3.39 (2.90)	3.51 (3.56)	3.06 (2.62)	3.14 (2.63)	2.78 (2.28)	3.55 (2.56)
<i>Meat and Alternatives</i>	2.44 (2.19)	2.43 (2.30)	2.60 (2.07)	2.49 (2.21)	3.24 (3.09)	2.68 (2.40)	2.82 (2.79)	2.95 (2.97)
<i>Other</i>	5.69 (4.17)	6.24 (4.70)	5.39 (3.79)	5.22 (4.28)	6.88 (5.13)	7.76 (5.97)	7.52 (4.94)	7.51 (5.12)

* Food group headings are directly from Canada’s Food Guide to Healthy Eating.
† Chi square test revealed significant difference between <\$30,000 income and both \$50,000-\$79,999 (p=0.006) and ≥\$80,000 (p=0.010) for grade 7 students.

TABLE V
Adherence to Canada’s Food Guide to Healthy Eating According to CDC Weight Status Category

Food Group*	Servings	Grade 7			Grade 11		
		Normal Weight (n=477)	At Risk of Overweight (n=135)	Overweight (n=120)	Normal Weight (n=466)	At Risk of Overweight (n=135)	Overweight (n=77)
		%	%	%	%	%	%
<i>Grain Products</i>	<5	60.5	68.6	71.3	51.4	60.0	66.2
	5-12	35.6	28.5	26.2	44.3	37.8	29.9
	>12	3.8	2.9	2.5	4.3	2.2	3.9
<i>Vegetables & Fruit</i>	<5	77.3	80.3	81.1	72.5	79.3	81.8
	5-10	19.0	16.8	14.8	21.3	17.8	16.9
	>10	3.6	2.9	4.1	6.2	3.0	1.3
<i>Milk Products†</i>	<3	52.8	62.0	59.8	45.4	60.0	55.8
	3-4	15.4	14.6	12.3	26.0	17.0	22.1
	>4	31.8	23.4	27.9	28.6	23.0	22.1
<i>Meat and Alternatives</i>	<2	48.8	51.8	50.8	42.6	43.7	57.1
	2-3	19.2	19.0	16.4	21.3	20.0	13.0
	>3	32.0	29.2	32.8	36.1	36.3	29.9

* Food group headings are directly from Canada’s Food Guide to Healthy Eating.
† Chi square analysis revealed an association for grade 11 students (p=0.029) and no associations were observed in the grade 7 students.

four household income categories. The mean number of servings of *Grain Products*, *Milk Products* and *Vegetables & Fruit* tended to be higher for children in the highest income quartile (≥\$80,000). However, the only statistically significant relation was for *Grain Products* intake among the grade 7 students where there was a significant difference between the lowest income quartile (<\$30,000) and both the \$50,000-\$79,999 (p=0.006) and ≥\$80,000 (p=0.010) income levels.

Table V shows Canada’s Food Guide to Healthy Eating food groups and level of adherence among normal weight, at risk of overweight and overweight students. While normal weight students had slightly higher levels of adherence to Canada’s Food Guide to Healthy Eating recommendations than at risk of overweight and overweight students, the only significant difference found was for *Milk Products*. When the newly released Eating Well with

Canada’s Food Guide recommendations²⁹ were applied to this data set, even fewer students met the recommended number of daily servings from the four food groups.³⁰ For example, the number of students below the recommended daily servings of *Vegetables and Fruit* increased from 80% and 78% with the old recommendations in grades 7 and 11 respectively, to 85% and 91% using the 2007 recommendations.

DISCUSSION

Socio-economic status has been tied to the incidence of overweight and obesity repeatedly in adults^{13,31,32} and, more recently, in children.^{11,18} Low household income is a marker for increased risk of overweight and obesity in Canadian¹² and Nova Scotia¹¹ children alike; our results corroborate this notion. Household income plays an integral role in the variety and frequency of physical activity³³ and the quality of chil-

dren’s dietary intake³⁴ – the two modifiable factors in the aetiology of overweight and obesity. Poor diet quality has been previously observed in elementary students from Nova Scotia and most notably in students from lower socio-economic households.²¹ A similar relation was observed in the current study in the grades 7 and 11 students where adherence to Canada’s Food Guide to Healthy Eating was superior in students from higher income households. One Canadian study found that quantities of food purchased from the four food groups and the *Other Foods* category were positively correlated with income, with the *Vegetables and Fruit* group having the strongest relationship.³⁵ Low intakes from the *Vegetables and Fruit* group in Nova Scotia children and youth were observed in this study. Similar findings have been previously reported,^{21,22} and have been exacerbated by the new food guide recommendations²⁹ which advise a

greater number of servings from the *Vegetables and Fruit* group. This same Canadian study also revealed a negative association between income and energy density.³⁵ *Milk Products* are energy dense and they are an excellent source of calcium and vitamin D, essential to optimal growth and development in children.³⁶ Calcium intake, particularly from *Milk Products*, has been significantly inversely related to BMI in children.³⁷ In the PACY study, *Milk Products* was the only food group where normal weight students' intakes consistently met Canada's Food Guide to Healthy Eating recommendations.²⁰ In the examination of Canadian income-related disparities in nutritional quality, Ricciuto and Tarasuk reported that *Milk Products* was the only food group that had a stronger association in 2001 than in 1992 and 1996. This may reflect Canada's economic environment – increasing income inequality and poverty.³⁵ The number of children from Nova Scotia living in poverty (18.1%) is greater than the national average (17.7%).¹⁶ The scope of the PACY study does not allow for the interpretation of current economic and food policy trends that may be involved in children's access to food groups such as *Grain Products*, *Vegetables and Fruit* and *Milk Products*. Our findings, as well as a paucity of literature in this area of research, warrant further exploration.

The prevalence of childhood overweight has potentially been underestimated by both previous studies^{2,38} and the 2004 Canadian Community Health Survey.³ The rates of overweight (26.2%) and obesity (9.4%) among Nova Scotia children and youth (aged 2-17), as reported in the 2004 Canadian Community Health Survey, were the first measured BMI values since 1978/79.³ While these estimates were more accurate than those extrapolated from self-reported data,^{2,12} the use of IOTF obesity criteria has been criticized.³⁹ It has been suggested that these BMI classification criteria fail to identify almost half the cases of obesity in childhood samples that the CDC reference values detect.³⁹ The prevalence rates of obesity from the PACY data, although not a direct comparison (ages 7-19 vs. 2-17), are more than double what was reported by the 2004 Canadian Community Health Survey.³

A combination of genetic and environmental factors are involved in the inci-

dence of overweight and obesity; parents' weight status, particularly in younger children, plays a significant role in child weight status.⁴⁰⁻⁴³ This reality held true for the PACY subjects. Moreover, childhood weight status category has been shown to be more predictive of weight status category in adulthood than parents' BMI. This is disconcerting as more grade 3 students were at risk of overweight (21.4%) and overweight (22.8%) than grades 7 and 11 students in our random sample of Nova Scotia children and youth. There is an increased risk of being overweight or obese as an adolescent, and again as an early adult, if you are overweight or obese as a child.^{9,44} Our findings identify younger children in Nova Scotia as a public health priority.

To our knowledge, this is the first study to present adherence to Canada's Food Guide to Healthy Eating according to weight status categories in Nova Scotia children and youth. We have reaffirmed the link between socio-economic status, dietary intake and weight status category in children. The PACY study also demonstrated that the magnitude of the childhood obesity epidemic may be far greater than earlier projections. However, limitations in drawing conclusions from this study are encompassed in the social stigma surrounding overweight and obesity.^{15,18} Overweight and obese students tend to under-report their energy intake.² The number of servings from the *Other Foods* category was similar among the weight status categories, and in some cases serving numbers were higher in the normal weight students. This may suggest that the online dietary assessments may not be an accurate portrayal of the overweight students' true diet composition, however the tool has been tested for reliability and validity.⁴⁵ The *Other Foods* category data may also suggest that physical inactivity is playing a larger role in energy balance among these students. Furthermore, the PACY study recruited student volunteers. In grades 7 and 11, at risk of overweight and overweight students may have been less likely to participate than the at risk of overweight and overweight grade 3 students. These conjectures simply serve to highlight the multifaceted nature of the obesity epidemic and reiterate the importance of studying the factors involved in its aetiology.

Our findings are especially relevant today in light of the release of two government documents aimed at addressing overweight and obesity: the Food and Nutrition Policy for Nova Scotia Public Schools⁴⁶ and the revised recommendations for Canada's Food Guide to Healthy Eating.²⁹ We have identified target groups, specific dietary intake modifications and points of further research aimed at improving the health of Nova Scotia children and youth.

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RÉSUMÉ

Objectif : Les enfants et les adolescents de la Nouvelle-Écosse ont une alimentation de mauvaise qualité, caractérisée par de faibles apports en aliments des quatre groupes classiques et un apport élevé en aliments des autres catégories. Notre étude porte sur l'influence du revenu des ménages et du respect des recommandations du *Guide alimentaire canadien pour manger sainement* sur le statut pondéral des enfants et des adolescents néo-écossais.

Méthode : Pendant l'année scolaire 2005-2006, nous avons recueilli des données auprès de 2 296 élèves et de leurs parents dans toute la Nouvelle-Écosse. Nous avons administré des questionnaires et pris les mesures anthropométriques d'élèves de la 3^e, de la 7^e et de la 11^e année. Les élèves de 3^e année ont été exclus de l'évaluation initiale des apports nutritionnels. Les données (provenant de feuilles de rappel des aliments ingérés pendant les 24 dernières heures et de questionnaires sur la fréquence de consommation des produits alimentaires) ont été analysées en fonction des recommandations du *Guide alimentaire canadien pour manger sainement*. Un modèle linéaire général a servi à l'examen des liens entre le revenu du ménage, les groupes d'aliments et la catégorie de statut pondéral.

Résultats : En général, les préceptes du *Guide alimentaire canadien pour manger sainement* étaient peu respectés chez les élèves de 7^e et de 11^e année. Les élèves qui faisaient de l'embonpoint (ou qui étaient à risque d'en faire) consommaient moins de portions de produits céréaliers, de produits laitiers et de légumes et fruits. L'embonpoint et le risque d'embonpoint étaient liés de façon significative à un revenu inférieur du ménage chez les élèves de 3^e et de 11^e année. Les taux d'embonpoint des élèves de la Nouvelle-Écosse étaient le double de ceux déclarés dans l'Enquête sur la santé dans les collectivités canadiennes de 2004.

Conclusion : Le revenu du ménage et l'apport nutritionnel jouent un rôle important dans le statut pondéral des enfants et des adolescents en Nouvelle-Écosse.

Mots clés : sciences de la nutrition de l'enfant; embonpoint; revenu