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# Association Between Fruit and Vegetable Consumption in Mothers and Children in Low-Income, Urban Neighborhoods

Marie-Pierre Sylvestre, MSc  
Jennifer O'Loughlin, PhD  
Katherine Gray-Donald, PhD  
James Hanley, PhD  
Gilles Paradis, MD, MSc, FRCPC

To understand factors influencing fruit and vegetable (F&V) consumption in children, the authors studied the association between F&V consumption in mothers and children in a sample of 1,106 boys and girls in Grades 4-6 in 24 elementary schools in low-income, multiethnic neighborhoods in Montreal, Canada. Approximately 10% of girls and 19% of boys reported not having eaten any vegetables in the week prior to questionnaire administration; 53% of girls and 63% of boys did not consume whole fruits daily. Each unit increase in F&V consumption in mothers was associated with a 10% to 20% increase in F&V consumption in children. Interventions to improve F&V consumption should aim to improve awareness among parents of the importance of fruits and vegetables and of the impact of their own behavior on their children's F&V consumption.

**Keywords:** children; nutrition; fruits and vegetables consumption; multiethnic population

Low fruit and vegetable (F&V) consumption represents a preventable risk factor for several chronic diseases including coronary heart disease, stroke, cataract formation, chronic obstructive pulmonary disease, and diverticulosis (Ness & Powles, 1997; Van Duyn & Pivonka, 2000). In addition, although the underlying mechanisms are not clearly

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Marie-Pierre Sylvestre and Jennifer O'Loughlin, Department of Epidemiology, Biostatistics and Occupational Health, McGill University, Montreal, Canada. Katherine Gray-Donald, School of Dietetics & Human Nutrition, Macdonald Campus, McGill University, Montreal, Canada. James Hanley and Gilles Paradis, Department of Epidemiology, Biostatistics and Occupational Health, McGill University, Montreal, Canada.

*Address correspondence to* Marie-Pierre Sylvestre, Department of Epidemiology, Biostatistics and Occupational Health, McGill University, 1020 Pine Avenue West, Montreal, Qc, Canada H3A 1A2; phone: (514) 934-1934, ext. 44726; fax: (514) 934-8293; e-mail: marie-pierre.sylvestre@mail.mcgill.ca.

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understood, there is evidence that frequent consumption of F&V prevents oesophageal, stomach, pancreatic, bladder, and cervical cancers (Van Duyn & Pivonka, 2000). The World Cancer Research Fund estimated that “diets high in vegetables and fruits could prevent at least 20% of all cancer incidence” (Crawford, Obarzanek, Morrison, & Sabry, 1994).

Although clinical manifestations of these diseases appear during adulthood, attitudes about foods, acceptance of specific foods, and eating habits develop during childhood and are likely to track into adulthood (Kelder, Perry, Klepp, & Lytle, 1994; Resnicow et al., 1998). Despite widespread campaigns promoting F&V consumption (Dietitians of Canada, n.d.; Health Canada, n.d.; Produce for Better Health Foundation, n.d.), children from developed countries do not eat enough F&V (Currie, Hurrelmann, Settertobulte, Smith, & Todd, 1999; Wolfe & Campbell, 1993). Effective interventions require increased understanding of the determinants of F&V consumption in children, so that barriers to and facilitators of higher F&V consumption can be identified.

We studied F&V consumption in young school children, in relation to their mothers' F&V consumption. Qualitative evidence from focus group discussions with students in Grades 4-6 shows that children reported modeling their F&V consumption on the eating behaviour of their parents (Cullen, Baranowski, Rittenberry, & Olvera, 2000). This finding is supported by empirical evidence showing that for selected F&V, the main correlate of F&V consumption in children was parental usage of these F&V (Woodward et al., 1996). In addition, parents control the availability of F&V at home (Kratt, Reynolds, & Shewchuk, 2000), which will influence what children eat, because children often have no direct control over foods purchased or served at home or school. Their decision making is usually restricted to whether or not they eat the foods that are served.

We hypothesized that F&V consumption in children is positively associated with F&V consumption in parents because children model their dietary behaviors on those of their parents and because parents control the availability of F&V at home. Investigation of parental F&V consumption was restricted to mothers because they are most often the family member in charge of food purchases and preparation (Gibson, Wardle, & Watts, 1998) and therefore are likely to have the greatest influence on F&V consumption in children.

## METHOD

### Sample

Data were collected in the context of an evaluation of a 5-year school and community-based heart health promotion program targeted at elementary school children. Data were collected in eight intervention schools located in a multiethnic, economically disadvantaged neighborhood in Montreal (O'Loughlin, Paradis, Renaud, Meshefedjian, & Gray-Donald, 1998). Sixteen comparison schools, also located in Montreal, were matched to intervention schools based on students' mother tongue and a composite poverty index ranking each of the 330 elementary schools in Montreal in 1993 (O'Loughlin et al., 1998). All schools in the sample were in the lowest quartile of the poverty index. Data were collected each spring from 1993 to 1997 via in-class surveys of all children in Grades 4-6. The current analysis used baseline data collected in May/June 1993, prior to implementation of the program. Students provided data on their sociodemographic characteristics and lifestyle habits including smoking, physical activity, and dietary habits. Parents provided data on their own sociodemographic

characteristics, smoking habits, physical activity, and diet only at baseline in 1993, in self-administered questionnaires sent home and returned to school with the child. A detailed description of the study methods is provided elsewhere (O'Loughlin et al., 1998).

### Study Variables

Data on mothers' dietary habits were collected using Ammerman's Dietary Risk Assessment, a short food frequency questionnaire comprising 32 items designed for, and validated in, low-income populations (Ammerman et al., 1991). Mothers responded to one question on each of F&V consumption, using a scale from 0 to 5 or more times per day.

Children reported the frequency of consumption of 35 food items during the week preceding questionnaire administration; four items were related to fruit or vegetable consumption, including one item on each of fruit juice, whole fruit, raw vegetable, and cooked vegetable consumption. The question on vegetables did not specify whether potatoes were included or not, so the decision to include them was left to respondents. Responses to questions on the frequency of F&V consumption were coded 0 (*never*), 1 (*once or a couple of times*), or 2 (*every day*). To facilitate comparison of F&V consumption between mothers and children, the two questions on fruit consumption in the student questionnaire were combined into a single fruit consumption variable. Similarly, the two questions on vegetable consumption were combined into a single variable. Results were ordered into consumption categories ranging from 0 (*low consumption*) to 4 (*high consumption*). The two lowest categories of fruit consumption were collapsed because of the small number of children who never consumed fruit juice or whole fruit. To be included in the data set, children must have responded to at least one question on fruit and one question on vegetable consumption. Children whose mothers did not complete the questionnaire were excluded.

According to the literature, F&V consumption is associated with sex, age, income, parental education, and family origin (Giskes, Turrell, Patterson, & Newman, 2002; Hupkens, Knibbe, Van Otterloo, & Drop, 1998; Irala-Estevez et al., 2000; Melnik, Rhoades, Wales, Cowell, & Wolfe, 1998; Neumark-Sztainer, Story, Resnick, & Blum, 1996; Shatenstein & Ghadirian, 1998; Thompson et al., 1999; Wang, Bentley, Zhai, & Popkin, 2002; Wardle, Parmenter, & Waller, 2000; Wolfe & Campbell, 1993). Socioeconomic status (SES) affects parental purchasing power, which may in turn affect the availability of F&V at home and the F&V consumption in parents (Giskes et al., 2002; Irala-Estevez et al., 2000) and children (Neumark-Sztainer et al., 1996; Wang et al., 2002). In addition, some studies suggest that parental education may influence parental nutritional knowledge and F&V consumption habits (Thompson et al., 1999; Wardle et al., 2000) in addition to influencing the dietary rules that parents impose on their children (Hupkens et al., 1998). Empirical findings also indicate that family origin is likely to influence food choice and preparation (Shatenstein & Ghadirian, 1998). By controlling for these variables in our analysis of the association between children's and mothers' F&V consumption, we ensure that our results do not merely reflect the effect of these variables but capture an association that can be interpreted irrespective of income, education, and family origin.

Several studies indicate that the correlates of F&V consumption differ in boys and girls (Melnik et al., 1998; Neumark-Sztainer et al., 1996; Wolfe & Campbell, 1993). Therefore, we also added sex to the analyses as a potential effect modifier of the F&V consumption association between children and mothers.

Level of education was assessed by asking mothers to indicate the highest grade or level of education that they had ever completed and was categorized into three categories (did not complete secondary school, completed secondary school only, completed postsecondary school degree). Employment status was categorized as employed or unemployed. Family origin was determined on the basis of an algorithm that used countries of birth of the mother, father, and child, and language(s) spoken at home. Family origin was grouped into seven categories: Canada, Europe, Asia, Arabic-speaking countries, South America, Central America/Caribbean, Other. These categories reflect the distribution of family origins in the study population. We also included a variable indicating if the mother was born in Canada.

### Data Analysis

Characteristics of the sample, and comparisons between children with and without data on mothers, were analyzed using chi-square tests. Means and interquartile ranges were used to describe F&V consumption in mothers. Comparisons of F&V consumption in children and in mothers in relation to sociodemographic characteristics were studied using chi-square tests for categorical variables and *t* tests and *F* tests for continuous variables. Crude and adjusted associations between F&V consumption in children and mothers were investigated using the proportional odds model. Unlike logistic regression that dichotomizes the dependent variable, the proportional model considers all successive incremental cut points possible in an ordinal variable and produces an odds ratio (OR) estimate for each of them, as well as an overall OR (Greenland, 1998). The overall OR is valid for all levels of the outcome (Scott, Goldberg, & Mayo, 1997) assuming that the ORs for each cut point are homogeneous (Armstrong & Sloan, 1989). We tested this assumption for each model using the score test for the proportional odds assumption (Shatenstein & Ghadirian, 1998; Armstrong & Sloan, 1989). The interpretation of the results is similar to logistic regression. Consider a proportional odds model regressing the vegetable consumption in children on that of mothers. The overall OR obtained represents the odds of children moving to a higher vegetable consumption category for a one-unit change in vegetable consumption of mothers, irrespective of the child's vegetable consumption category. Treating the outcome as a continuous variable and using linear regression could lead to bias (SAS Institute, 2001) if the underlying assumptions of linearity or homogeneous variance of the residuals are violated.

The effect of clustering of children within schools was examined using intraclass correlation coefficients (ICCs) computed by estimating a mixed model with schools as clusters and treating the F&V consumption in children as a continuous variable. ICCs measure the extent to which responses from children within a single school resemble each other more than they resemble responses from children in other schools (clusters) (Last, Abramson, & International Epidemiological Association, 1995). In the context of the current study, a potential effect of clustering of children within schools is to artificially increase the precision of the estimates.

Statistical analyses were conducted using the SAS statistical package (SAS Institute, 2001). For the proportional odds model analysis, the SAS macro ORDINAL (SAS Institute, 2001) was used. The St-Louis du Parc intervention evaluation study received ethical approval from the Public Health Unit of the Montreal General Hospital on April 22, 1992.

Table 1. Frequency of Past-Week Consumption of Fruits and Vegetables Among Elementary School Children in Multiethnic, Low-Income, Inner-City Neighborhoods in Montreal, Canada, 1993

	Girls	Boys	<i>p</i> Value*
	( <i>N</i> = 581)	( <i>N</i> = 525)	
	% (95% CI)	% (95% CI)	
Past-week consumption			
Whole fruits			< .001
Never	2 (1 to 3)	5 (3 to 7)	
Once or a couple of times	51 (46 to 55)	58 (54 to 62)	
Daily	47 (43 to 51)	37 (33 to 41)	
Fruit juice			.471
Never	6 (4 to 8)	7 (5 to 10)	
Once or a couple of times	42 (38 to 46)	39 (35 to 44)	
Daily	52 (48 to 56)	53 (49 to 58)	
Cooked vegetables			< .001
Never	2 (24 to 31)	34 (30 to 38)	
Once or a couple of times	48 (44 to 52)	46 (42 to 51)	
Daily	27 (24 to 31)	20 (16 to 23)	
Raw vegetables			.027
Never	31 (27 to 35)	37 (33 to 41)	
Once or a couple of times	42 (38 to 46)	42 (38 to 46)	
Daily	27 (24 to 30.7)	21 (18 to 25)	

NOTE: CI = confidence interval.

\**p* value for difference by sex computed based on the chi-square test.

## RESULTS

Among 2,840 students eligible to participate, 143 students (5.0%) were absent on the day of data collection, 411 (14.5%) did not participate because their parents did not provide consent, and 56 (2.4%) were excluded because of missing data on F&V consumption. Parental questionnaires were completed by 1,106 mothers of the 2,236 students included in the analysis (49.5%).

Children whose mothers did not complete questionnaires were younger and were more likely to be female, to live in smaller families, to be of Canadian family origin, and to have spent a higher percentage of their lifetime in Canada. Children with parental data had a higher frequency of whole fruit consumption than children without parental data (data not shown).

Half (53%) of study participants were female. Participants ranged in age from 8 to 14 years; one third was aged 11 years. Most parents were born outside Canada, although nearly 70% of students had spent their entire lifetime in Canada. More than 60% of mothers and 80% of fathers were employed.

More than half of girls and two thirds of boys reported not eating fruit every day (Table 1). Whole fruits were consumed daily by 47% of girls and 37% of boys; the majority of children reported consuming fruit juice daily. Overall, 10% of girls and 19% of boys reported not consuming any cooked or raw vegetables in the past week. Only

Table 2. Frequency of Past-Week Consumption of Fruits and Vegetables Among Elementary School Children in Multiethnic, Low-Income, Inner-City Neighborhoods in Montreal, Canada, 1993

Variable	Number of Servings of					
	Fruits			Vegetables		
	M	SD	<i>p</i> Value*	M	SD	<i>p</i> Value*
	2.5	1.5		2.1	1.4	
Age quartile			.491			.255
25-34	2.7	1.6		2.3	1.5	
34-39	2.5	1.6		2.2	1.4	
39-43	2.5	1.5		2.0	1.2	
43+	2.5	1.5		2.1	1.3	
Born in Canada			< .0001			< .001
Yes	1.9	1.5		1.7	1.2	
No	2.7	1.5		2.2	1.4	
Family origin			< .0001			< .0001
Canada	2.0	1.5		1.8	1.2	
Europe	2.5	1.5		1.9	1.2	
Asia	2.7	1.6		2.7	1.4	
Arabic-speaking countries	2.8	1.5		2.5	1.4	
South America	2.5	1.6		1.8	1.4	
Central America/Caribbean	3.2	1.4		2.6	1.5	
Other	2.9	1.5		2.4	1.5	
Education			.828			.475
Did not complete secondary school	2.5	1.6		2.1	1.4	
Completed secondary school only	2.6	1.6		2.1	1.3	
Completed postsecondary school degree	2.5	1.5		2.2	1.3	
Employed			.098			.0752
Yes	2.5	1.5		2.1	1.3	
No	2.6	1.6		2.2	1.4	

\**p* value for difference by sex computed based on the chi-square test.

65% of girls and 55% of boys consumed cooked and raw vegetables daily during the past week. A higher proportion of girls than boys ate raw or cooked vegetables frequently.

Mothers consumed 2.5 servings of fruits (IQR 1-4) and 2.1 (IQR 1-3) servings of vegetables on average daily (Table 2). Only 44% of mothers met the basic recommendation of five servings of F&V daily (Health Canada, n.d.). F&V consumption in mothers did not vary according to age, employment status, or education level, but mothers born outside Canada consumed a higher number of servings of F&V daily than mothers born in Canada.

F&V consumption in mothers was associated with F&V consumption in both boys and girls, and the strength of the association was similar in boys and girls (Tables 3 and 4). Neither age of child nor employment status of the mother or father was associated with F&V consumption in children (Tables 3 and 4). Boys and girls whose mothers were born

Table 3. Variation in Vegetable Consumption Among Elementary School Children in Relation to Maternal Vegetable Consumption and Other Characteristics in Multiethnic, Low-Income, Inner-City Neighborhoods of Montreal, Canada, 1993

Variable	OR <sup>a</sup> (95% CI)		
	All ( <i>N</i> = 1,106)	Girls ( <i>n</i> = 581)	Boys ( <i>n</i> = 525)
Mother's vegetable consumption			
Crude OR	1.14 (1.05, 1.23)	1.14 (1.02, 1.27)	1.12 (0.99, 1.26)
Adjusted OR <sup>b</sup>	1.17 (1.08, 1.28)	1.22 (1.08, 1.36)	1.11 (0.98, 1.26)
Child's age (years)	1.01 (0.98, 1.04)	0.95 (0.83, 1.10)	1.01 (0.99, 1.04)
Mother born in Canada	1.76 (1.40, 2.21)	1.96 (1.43, 2.69)	1.62 (1.17, 2.24)
Mother employed	1.00	1.00	1.00
Family origin			
Canada	0.50 (0.37, 0.68)	0.43 (0.28, 0.66)	0.61 (0.40, 0.93)
Europe	0.80 (0.56, 1.15)	0.70 (0.43, 1.12)	0.84 (0.48, 1.48)
Asia	0.68 (0.37, 1.26)	0.51 (0.21, 1.23)	0.82 (0.34, 1.94)
Arabic-speaking countries	0.72 (0.43, 1.18)	0.76 (0.40, 1.46)	0.62 (0.28, 1.37)
South America	0.63 (0.45, 0.89)	0.51 (0.32, 0.81)	0.78 (0.48, 1.29)
Central America/Caribbean	0.74 (0.49, 1.11)	0.71 (0.39, 1.30)	0.85 (0.49, 1.47)
Other	1.17 (0.93, 1.47)	1.27 (0.93, 1.73)	1.11 (0.80, 1.54)
Mother's education			
Did not complete secondary school	1.00	1.00	1.00
Completed secondary school only	1.02 (0.81, 1.35)	1.13 (0.78, 1.64)	1.00 (0.70, 1.44)
Completed postsecondary school degree	1.39 (1.05, 1.79)	1.41 (0.99, 2.02)	1.35 (0.91, 2.00)

a. Entries are odds ratios based on the proportional odds model regressing vegetable consumption in children on the variables in the left-most column.

b. OR is adjusted for other factors shown in table.

outside Canada had higher F&V consumption than those whose mothers were born in Canada. Children whose mothers had completed a postsecondary degree reported higher vegetable consumption, but this result was not robust in analyses stratified by sex. Girls whose mothers had completed a postsecondary degree reported higher fruit consumption. Adjusted ORs differed only marginally from crude ORs, suggesting that the crude results were not confounded by any of the variables tested (Tables 3-4).

The assumption of proportional odds was not violated in any of the models. Results stratified by age, family origin, and whether or not the mother was born in Canada did not suggest any effect modification by these variables. This hypothesis was supported by testing interaction terms in the multivariate models. Finally, an analysis undertaken to investigate the effect of clustering of children within schools suggested no significant clustering of F&V consumption patterns across schools (data not shown).

## DISCUSSION

The first objective of this analysis was to describe F&V consumption by elementary school children in multiethnic, low-income, inner-city neighborhoods in Montreal,

Table 4. Variation in Fruit Consumption Among Elementary School Children in Relation to Maternal Fruit Consumption and Other Characteristics in Multiethnic, Low-Income, Inner-City Neighborhoods of Montreal, Canada, 1993

Variable	OR <sup>a</sup> (95% CI)		
	All (N = 1,106)	Girls (n = 581)	Boys (n = 525)
Mother's fruit consumption			
Crude OR	1.11 (1.03, 1.19)	1.09 (0.99, 1.21)	1.13 (1.01, 1.25)
Adjusted OR <sup>b</sup>	1.13 (1.04, 1.21)	1.11 (1.00, 1.24)	1.16 (1.04, 1.30)
Child's age (years)	0.99 (0.96, 1.02)	1.06 (0.92, 1.23)	0.99 (0.97, 1.02)
Mother born in Canada	1.03 (0.82, 1.3)	1.06 (0.77, 1.46)	1.18 (0.77, 1.08)
Mother employed	1.22 (0.97, 1.54)	1.08 (0.79, 1.49)	1.40 (1.00, 1.95)
Family origin			
Canada	1.00	1.00	1.00
Europe	1.44 (1.06, 1.96)	1.21 (0.78, 1.86)	1.77 (1.14, 2.73)
Asia	0.88 (0.61, 1.27)	0.74 (0.46, 1.21)	1.00 (0.56, 1.78)
Arabic-speaking countries	0.78 (0.42, 1.45)	0.78 (0.32, 1.91)	0.73 (0.30, 1.76)
South America	1.03 (0.62, 1.71)	0.72 (0.37, 1.40)	1.58 (0.71, 3.52)
Central America/Caribbean	1.06 (0.75, 1.49)	0.96 (0.60, 1.53)	1.16 (0.70, 1.93)
Other	1.15 (0.76, 1.74)	1.08 (0.58, 1.99)	1.31 (0.75, 2.30)
Mother's education			
Did not complete secondary school	1.00	1.00	1.00
Completed secondary school only	0.98 (0.75, 1.28)	0.96 (0.66, 1.41)	1.02 (0.70, 1.47)
Completed postsecondary school degree	1.21 (0.93, 1.59)	1.47 (1.02, 2.13)	0.96 (0.64, 1.43)

a. Entries are odds ratios based on the proportional odds model regressing fruit consumption in children on the variables in the left-most column.

b. ORs are adjusted for other factors shown in table.

Canada. Our results suggest that many children did not meet recommendations for daily F&V servings (Department of Health and Human Services of the U.S. Department of Agriculture, 1996; Health Canada, n.d.); only one fifth reported eating either a fruit or vegetable daily.

Consistent with a recent World Health Organization (WHO) study (Currie et al., 1999), fewer than half of children ate raw or cooked vegetables daily. The proportion of girls who ate vegetables daily in our sample was similar to that reported for American girls, whereas the proportion of boys who ate vegetables daily was approximately 5% lower than that reported for American boys (Neumark-Sztainer et al., 1996). About 68.3% of boys and 73.2% of girls reported at least one serving of fruit or fruit juice every day. These percentages are similar to those reported for Canadian children in the WHO study (Neumark-Sztainer et al., 1996).

Fruit juice was consumed daily by more than half of girls and boys—a greater percentage than for daily whole fruit consumption. More frequent fruit juice consumption compared to whole fruit consumption was also observed by Cavadini, Siega-Riz, & Popkin (2000), who reported a secular decline in fruit consumption and a concomitant

secular increase in fruit juice consumption during the past 30 years in American children. This trend is of considerable concern because during processing, fruit juice loses components such as fiber and vitamins A and C, and therefore does not provide the same nutritional benefit as whole fruits (Cavadini et al., 2000). In addition, the public may confuse fruit juice with fruit beverages, which have lower fruit content and high refined sugar content (Mayo Clinic, 2002).

Mothers in this sample consumed 2.5 vegetable servings and 2.1 fruit servings on average daily, an estimate similar to the 4.9 F&V servings daily estimated from the Canadian Community Health Survey (Perez, 2002) and the 4.3 F&V servings daily estimated by the U.S. 5-A-Day baseline survey (Stables et al., 2002). The reported daily average of F&V servings is slightly below the basic recommendation of 5 servings daily (Health Canada, n.d.).

Consistent with previous reports (Longbottom, Wrieden, & Pine, 2002; Wolfe & Campbell, 1993), our results suggest that children of mothers with high F&V consumption were more likely to consume F&V frequently than children of mothers with low fruit consumption. Assuming that mothers with high F&V consumption eat F&V at home during meals shared with children, this finding underscores the importance of F&V availability at home. However, we need to verify if this association simply reflects the control that mothers have over foods available at home or if they relate to shared nutritional knowledge about the benefits of F&V. The former hypothesis underscores the importance of controlling foods available at home and at school, whereas the latter hypothesis suggests that we need to make children more nutritionally aware and autonomous in their food choices.

None of the variables related to SES influenced the association of interest. Although not a confounder, mothers' level of education was the only SES-related variable that was associated with F&V consumption in children, substantiating previous reports that only SES indices that include the level of education of mothers are significantly associated with F&V consumption in children (Gibson et al., 1998; Melnik et al., 1998). However, the mechanism by which mothers' education affects F&V consumption in children is not clear. It has been reported that mothers with more education controlled foods served to their children more often for health reasons than mothers with less education (Hupkens et al., 1998). Mothers with more education have also higher incomes, which in turn likely influences the availability of F&V at home and, ultimately, F&V consumption in children. In comparison with other foods, vegetables are expensive for the calories they provide and do not contribute substantially to children achieving satiety. Thus, mothers with low income might not serve vegetables to their children as often as mothers with higher income.

Family origin influences food choice and preparation (Shatenstein & Ghadirian, 1998). Our study suggests that the frequency of F&V consumption in both mothers and children differs according to country of origin, but the results do not provide evidence that family origin influences the relationship between F&V consumption in mothers and children, as no interactions between family origin and F&V consumption were found.

Limitations of this study include that 19.5% of eligible children and 50.5% of eligible parents did not participate. However, external generalizability of the results is likely acceptable because there is no a priori reason to believe that children who participated differed from those who refused with respect to factors affecting the association of interest. Use of self-report methods to assess F&V consumption in children and mothers might have resulted in misclassification. Cognitive research indicates that after the age of 8 years, children rapidly develop the ability to self-report food intake and that by age 10, they can reliably report food intake (Food Share Education & Research Office of Toronto, n.d.).

However, self-reports rely on memory and are prone to error (Willett, 1990), causing misclassification of respondents in F&V consumption categories. We believe that misclassification was most probably nondifferential, resulting in a measure of the association that was attenuated but not biased (Hennekens, Buring, & Mayrent, 1987). Within-person variation in F&V consumption may affect the standard errors of regression coefficients and OR when the reported F&V consumption is significantly different from the long-term average consumption of the individual (Willett, 1990). This problem is frequent when one or a few 24-hour dietary recalls are used to measure F&V consumption. In our study, mothers were asked to report their usual F&V intake, and children were asked to report their F&V consumption in the previous week. Therefore, we believe that our estimated F&V consumption in mothers and children is not likely to differ significantly from their long-term average F&V consumption. Another potential concern is that our data were limited to 1993. Although the frequency of F&V consumption reported in 1993 might differ from that of today, we believe that it is unlikely that a decade has changed the association observed between mother's and children's consumption patterns. In fact, using recent U.S. data, Young, Fors, and Hayes (2004) reported that perceived parent modeling was an independent correlate of F&V consumption in children.

In conclusion, our findings corroborate previous reports in suggesting that F&V consumption in mothers is associated with F&V consumption in children. However, important issues remain to be addressed. Is it the availability of food that influences what children eat, or do the dietary behaviors of other family members have a greater influence? In particular, we need to understand the level of decision making that children have with respect to their diets. This should help in the conceptualization of diet-related interventions targeted directly to children. This study suggests that efforts to increase F&V consumption in children should not be targeted solely to them but also to their families, and perhaps even to communities in general. Increasing the availability of, and accessibility to, F&V as well as increasing awareness of the health benefits related to F&V consumption may also increase F&V consumption in children.

Our findings also suggest that in 1993, children in low-income neighborhoods did not consume F&V at levels sufficient to meet current recommendations. These findings need to be further confirmed and may be important to assess secular trends of changes in F&V consumption. Given the obesity epidemic, it will be interesting to understand how patterns of F&V consumption have changed over time in various populations.

### IMPLICATIONS FOR PRACTICE

School-based interventions to increase nutritional knowledge in children may have little impact on F&V consumption in children if F&V availability is limited at home or if parents do not consider F&V to be important. Because most children view eating as a way to satisfy hunger and not necessarily to maximize good health (Livingstone & Robson, 2000), it is important that F&V availability be increased wherever children eat. Community programs can be implemented to remove barriers related to access to fresh F&V, including high prices, lack of F&V in neighborhood stores, and lack of nutritional knowledge of the benefits of F&V. An example is the Good Food Box program (Food Share Education & Research Office of Toronto, n.d.), a self-help program that delivers fresh produce packages to low-income families once a month at reduced cost, accompanied by a nutrition newsletter.

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