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Associations of television viewing, physical activity and dietary behaviours with obesity in aboriginal and non-aboriginal Canadian youth

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Abstract

Objective: To determine associations of diet, physical activity and television (TV) viewing time with obesity among aboriginal and non-aboriginal youth in conjunction with socio-economic variables.
Design: Cross-sectional study of differences between aboriginal and non-aboriginal groups and associations between lifestyle and socio-economic factors with obesity were examined.
Setting: Population data from the Canadian Community Health Survey Cycle 2·2 conducted in 2004 in the ten provinces of Canada.
Subjects: A total of 198 aboriginal and 4448 non-aboriginal Canadian youth aged 12–17 years.
Results: Compared to non-aboriginal youth, physical activity participation among aboriginal youth was higher, but consumption of vegetables and dairy products was lower, and more aboriginal youth were 'high' TV watchers. Low income adequacy was associated with decreased odds for obesity among aboriginal youth in contrast to higher odds among non-aboriginal youth. Non-aboriginal 'high' TV watchers consumed more soft drinks and non-whole-grain products than did 'low' TV watchers. Physical activity participation did not differ between 'high' and 'low' TV watchers for both groups, and was associated with lowered odds for obesity only among aboriginal youth.
Conclusions: Sociodemographic and lifestyle risk factors associated with obesity differ between aboriginal and non-aboriginal youth. These findings may be useful for guiding intervention efforts.

Keywords
Indigenous population
Obesity
Youth
Diet
Lifestyle
Television
Physical activity

According to the Canadian Community Health Survey Cycle 2·2 (CCHS 2·2) conducted in 2004, the prevalence of obesity among Canadians aged 12–17 years has tripled over 25 years from 3 % in 1979 to 9 % in 2004, while the prevalence of overweight has doubled from 14 % to 29 % over the same time period[1]. Estimates of the off-reserve aboriginal (First Nations, Métis and Inuit) population in the ten provinces indicate that aboriginal youth within this age group have the highest prevalence of overweight (41 %) and obesity (20 %), approximately 2·5 times higher than the national average. Poor dietary habits, low physical activity and high sedentary behaviours have been shown to be important determinants of obesity among aboriginal youth living in select communities[2–6]. However, such studies do not have direct comparison groups, and therefore it is unclear whether lifestyle behaviours of aboriginal youth, particularly those not living in First Nations communities, are comparable to levels among non-aboriginal youth. Differential associations between obesity risk and diet, physical and sedentary activity variables may also exist among aboriginal and non-aboriginal youth. The objectives of the present study were to determine associations of diet, physical activity and television (TV) viewing time with obesity among aboriginal and non-aboriginal youth in conjunction with socio-economic factors in a nationally representative sample of youth aged 12–17 years.

Methods

Study population

The CCHS 2·2 is a cross-sectional survey that collected information related to health status and nutrition information for

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the Canadian population from January 2004 to January 2005. Detailed survey methodology is available elsewhere[7]. Briefly, the target population was respondents from all age groups living in private occupied dwellings in the ten provinces. Residents of the three territories, persons living on Indian reserves or Crown lands, persons living in institutions, full-time members of the Canadian Forces, and residents of some remote regions were excluded. The overall response rate was 76·5 %. Data for 4646 non-pregnant, non-breast-feeding youth aged 12–17 years with valid dietary information were available for analysis. Permission from the parent/guardian was obtained for interviews with all youth. Interviews were completed with the youth directly but the parent/guardian provided information on socio-economic status variables.

Ethnicity

Respondents were asked the question, 'People living in Canada come from many different cultural and racial backgrounds. Are you: White? Chinese? South Asian (e.g. East Indian, Pakistani, Sri Lankan, etc.)? Black? Filipino? Latin American? Southeast Asian (e.g. Cambodian, Indonesian, Laotian, Vietnamese, etc.)? Arab? West Asian (e.g. Afghan, Iranian, etc.)? Japanese? Korean? Aboriginal Peoples of North America (North American Indian, Métis, Inuit)?' An 'Other–specify' category was also included. Respondents were permitted to select more than one category. For the present study, all respondents who selected the category 'Aboriginal Peoples of North America' (including those who may have selected additional categories) were classified as aboriginal and all others as non-aboriginal.

Anthropometric measurements

Height and weight were measured by trained interviewers using a portable scale and measuring tape. Weight was recorded to the nearest 0·01 kg. Height was recorded to the nearest 0·5 m. Measured height and weight information was available for only 3506 youth. Obesity status was determined using the age- and sex-specific BMI cut-off points established by the International Obesity Task Force[8].

Daily energy expenditure

Respondents were asked to report participation in leisure-time physical activities over the 3 months previous to the interview. Energy expenditure (EE) for each activity was calculated using the equation EE = ($N \times D \times$ MET value)/365, where N = number of times a respondent engaged in an activity over a 12-month period, D = average duration in hours of the activity and MET (metabolic equivalent) value = energy cost of the activity expressed as kcal (1kcal=4·184 kJ) expended per kg of body weight per hour of activity (kcal/kg per h)/365 to convert yearly data into daily data (kcal/kg per d, KKD). For example, 1 KKD can be interpreted as the energy expenditure equivalent of 20 min of walking at a leisurely pace. Independently established MET values[9] corresponding to the low-intensity value for each activity were used as intensity level was not asked of respondents[10]. Leisure activities included walking for exercise, gardening or yard work, swimming, bicycling, dance, home exercises, hockey, skating, in-line skating, running, golfing, exercise class, skiing or snowboarding, bowling, baseball, tennis, weight training, fishing, volleyball, basketball and soccer. 'Other' activities were assigned a MET value of 4, which is the mean value of all listed activities excluding running. Respondents were classified as 'active' if EE is $\geq 3{\cdot}0$ KKD.

Socio-economic measures

Household income status was determined by two categories based on total household income and on the number of people living in the household. Low income adequacy was defined as <$15 000 for one or two people, <$20 000 for three or four people and <$30 000 for five or more people. Middle or high income adequacy was ≥$15 000 for one or two people, ≥$20 000 for three or four people and ≥$30 000 for five or more. Household education status was classified into secondary school graduation (yes/no) using the highest level of education attained by any member of the household. Although more detailed income and education categories were available, some categories yielded insufficient cell sizes and were collapsed in order to meet the minimum cell sizes set by Statistics Canada.

Television watching

Respondents were asked how many hours per week during the previous 3 months they usually spent watching TV. Although this variable was categorised into three groups: 0–5, 6–14 and 15–20 or more h/week, the two lowest categories were collapsed due to the low number of children in the lowest category. For the present study, the two levels of TV watching were 'high' TV watchers for those who watched ≥15 h of TV per week and 'low' TV watchers who watched TV for ≤14 h/week, approximately corresponding to the American Academy of Pediatrics recommendation of ≤2 h/d[11].

Daily dietary intakes

Dietary information was collected using a 24 h dietary recall of all foods and beverages consumed during the 24 h period before the interview, from midnight to midnight, using the computer-based automated multiple-pass method (AMPM) developed by the United States Department of Agriculture (USDA) and adapted for Canada. The AMPM was programmed to automatically probe the respondent for all required information. Trained interviewers also recorded information about the time the food was consumed, the eating occasion and the location where it was prepared. The Nutrition Survey

System (NSS) food and nutrient database system developed by the Bureau of Nutritional Sciences (BNS) and the Bureau of Biostatistics and Computer Applications at Health Canada was used to assign food descriptions and nutrient values to all foods and beverages reported. For the present study, the specific food groupings used were fats/butter/oils, whole grains, non-whole grains, meats, milk, dairy (includes milk), fruits, vegetables, soft drinks, salty snacks and sweets (i.e. candy and chocolate). These groupings were developed by the BNS at Health Canada in the early 1990s on the basis of the British and American food group systems. Because not all youth consumed soft drinks, salty snacks, candy and chocolate in the 24 h before the interview, these foods were collapsed into one 'junk foods' category on the basis of their high energy content and low nutrient value.

Statistical analyses

Since the CCHS 2·2 has a complex sampling design, sample weights, primary sampling units and stratification information specific to the CCHS 2·2 provided by Statistics Canada were used in all analyses. Statistical analyses were completed using the survey procedures available in the SAS for Windows statistical software package version 9·2 (SAS Institute Inc., Cary, NC, USA). To obtain population-specific estimates, analyses were stratified by aboriginal identity. All proportions, including prevalence of obesity, high TV watching, physical activity level and socio-economic variables, were determined by aboriginal identity using PROC SURVEYFREQ. Rao–Scott χ^2 tests available within PROC SURVEYFREQ, which applies a design effect correction to the Pearson χ^2 statistic, were used to determine whether proportions were significantly different between aboriginal and non-aboriginal youth. Mean age, physical activity levels and dietary intakes of nutrients and foods were determined using PROC SURVEY-MEANS, and differences were tested for statistical significance using t values determined with PROC SURVEYREG. The overall significance level was set at $\alpha = 0{\cdot}05$. For differences between aboriginal and non-aboriginal groups in which multiple comparisons were performed, a Bonferroni-adjusted significance level was set at $\alpha = 0{\cdot}002$.

For analyses involving obesity status, specific sample weights adjusted for non-response in measured height and weight were used. Logistic regression (PROC SURVEYLOGISTIC) was used to predict obesity from combinations of demographic, socio-economic and behavioural factors.

Results

Aboriginal identity was self-ascribed by 198 youth (51·4 % male). The characteristics of the aboriginal and non-aboriginal samples are summarised in Table 1. Almost half of the aboriginal youth were from households with an education level of less than high-school graduation compared with just 15 % of non-aboriginal youth. Similarly, more than one-third of the aboriginal youth were from low income adequacy households compared with just one-tenth of the non-aboriginal sample.

Among lifestyle behaviours, a higher proportion of aboriginal youth were 'high' TV watchers compared to non-aboriginal youth, but aboriginal youth were more physically active ($P < 0{\cdot}05$). After adjustment for multiple comparisons, aboriginal and non-aboriginal youth did not differ in the average amount of energy consumed per day, but aboriginal youth consumed less dairy products and vegetables. No differences in the intake of other nutrients or food groups were apparent.

Measured height and weight information was available for 3568 non-aboriginal and 138 aboriginal youth. In general, a significant proportion of the youth were considered overweight for both groups; however, higher prevalences were observed for both overweight (> 11 %, $P = 0{\cdot}02$) and obesity (> 8 %, $P = 0{\cdot}01$) among aboriginal youth.

Logistic regressions predicting obesity are presented in Table 2. Unadjusted OR for sociodemographic and lifestyle variables indicate that for aboriginal youth, 'high' TV watching and physical activity level were significant predictors of obesity. Watching TV for ≤ 14 h/week was associated with 32 % lowered odds for obesity, while an increase of 1 KKD of physical activity was associated with 19 % lowered odds. For non-aboriginal youth, unadjusted OR was significant for sex, income adequacy and TV watching level. Females and youth from high income adequacy level households were less likely to be obese. Similar to aboriginal youths, 'low' TV watching was associated with approximately one-third lowered odds for obesity among non-aboriginal youth, but no significant relationship with physical activity level was apparent.

Various combinations of the sociodemographic (i.e. sex, age, education and income) and lifestyle (i.e. TV watching and physical activity level) variables were entered into logistic regression models. Since similar estimates were obtained across models and the Akaike information criterion was the lowest for the models with all six covariates, indicating the best model fit out of all the combinations attempted, the final models including all six variables are presented for each group (Table 2). In these multivariate-adjusted analyses, 'low' TV watching was associated with lowered odds for obesity independent of age, sex, income, education and physical activity level for both aboriginal and non-aboriginal groups. Among aboriginal youth, physical activity level remained a significant predictor for obesity, while strong associations between obesity and both education and income adequacy level emerged. Lower household education was associated with over two times greater odds, while low income adequacy level was associated with almost half lowered odds for obesity. Among non-aboriginal youth, multivariate-adjusted OR was similar to unadjusted analysis.

Table 1 Sociodemographic and lifestyle characteristics of Canadian youth aged 12–17 years, by aboriginal identity

	Aboriginal (*n* 198)		Non-aboriginal (*n* 4448)	
Sample characteristics	%	95 % CI	%	95 % CI
Male	51·4	48·3, 54·5	52·8	50·8, 54·9
'High' TV watching (≥15 h/week)**	46·6	43·2, 50·0	23·7	22·0, 25·4
Household education (≥ high school)**	56·6	53·3, 60·0	84·5	83·2, 85·8
Income adequacy (middle or high)**	63·7	47·6, 79·8	91·1	90·0, 92·2
Active (≥ 3·0 kcal/kg per d)†	52·1	43·1, 61·1	42·4	40·5, 44·3
	Mean	95 % CI	Mean	95 % CI
Age (years)	14·0	13·6, 14·3	14·4	14·3, 14·5
Physical activity (kcal/kg per d)†,*	4·2	3·9, 4·5	3·3	3·1, 3·4
Total energy (kcal)†	2377·2	2243·4, 2511·0	2440·6	2398·6, 2482·6
Energy protein (%)	14·7	12·6, 16·8	14·6	14·4, 14·8
Energy carbohydrate (%)	53·2	49·3, 57·2	54·3	54·0, 54·7
Energy fat (%)	32·0	30·1, 33·9	30·9	30·6, 31·2
Energy saturated fat (%)	9·7	9·5, 10·0	10·6	10·4, 10·7
Fibre (g)	14·9	14·1, 15·8	16·3	15·9, 16·6
Sugar (g)	143·4	137·1, 149·6	151·4	147·8, 155·1
Sodium (mg)	3393·9	3139·1, 3648·6	3497·0	3428·0, 3566·0
Calcium (mg)	926·0	870·7, 981·3	1145·9	1113·2, 1178·6
Meats (g)	142·9	78·4, 207·5	123·4	117·7, 129·1
Fruit and vegetables (g)	186·1	168·7, 203·4	258·2	248·0, 268·3
Vegetables (g)**	99·4	90·5, 108·4	138·4	132·0, 144·9
Fruits (g)	86·6	72·1, 101·1	119·7	111·9, 127·5
Milk (g)	277·9	254·3, 301·5	392·3	373·8, 410·7
Dairy (g)**	315·5	295·4, 335·5	452·2	433·3, 471·0
Fats, butter, oils (g)	54·6	43·6, 65·6	55·0	52·7, 57·2
Whole grains (g)	52·1	44·6, 59·6	25·3	22·9, 27·6
Non-whole grains (g)	86·3	81·1, 91·5	101·2	97·7, 104·7
Regular and diet soft drinks (g)	307·8	250·6, 365·1	257·7	242·0, 273·5
Salty snacks and sweets (g)	94·6	88·2, 101·0	55·8	51·3, 60·4
'Junk' foods (g)	384·4	329·1, 439·7	288·6	272·7, 304·6
	Aboriginal (*n* 138)		Non-aboriginal (*n* 3368)	
	%	95 % CI	%	95 % CI
Obese	17·7	14·7, 20·6	9·7	8·6, 10·9
Overweight	41·0	37·3, 44·6	29·8	27·7, 31·8

TV, television.
Significant difference between aboriginal and non-aboriginal: *$P < 0·05$, **$P < 0·001$.
†1 kcal = 4·184 kJ.

Since TV watching level was a strong predictor of obesity among both aboriginal and non-aboriginal youth, associations between TV watching and dietary intakes and physical activity levels were assessed. Tables 3 and 4 present associations between daily intakes of select nutrients and foods by TV watching among aboriginal and non-aboriginal youth, respectively. After adjustment for multiple comparisons, no statistically significant differences in dietary intakes between 'low' and 'high' TV watchers were observed among aboriginal youth. Non-aboriginal 'high' TV watchers consumed more non-whole-grain foods and soft drinks compared to 'low' TV watchers.

Physical activity participation did not differ between 'high' and 'low' TV watchers in both aboriginal (high TV: 4·2 KKD (95 % CI 3·3, 5·0) *v.* low TV: 4·3 KKD (95 % CI 4·2, 4·4), $P = 0·92$) and non-aboriginal groups (high TV: 3·0 KKD (95 % CI 2·9, 3·2) *v.* low TV 3·3 KKD (95 % CI 3·2, 3·5), $P = 0·08$). Among aboriginal youth, 51·5 % (95 % CI 48·1, 54·8) were considered 'active' in the 'low' TV watching group compared to 52·7 % (95 % CI 28·4, 77·1) in the 'high' TV watching group ($P = 0·93$). No difference was also apparent among the non-aboriginal youth (high TV: 39·9 % (95 % CI 37·3, 42·5) *v.* low TV: 43·2 % (95 % CI 41·1, 45·3), $P = 0·16$).

Discussion

The prevalence of overweight and obesity among off-reserve aboriginal Canadian youth is significantly higher than among non-aboriginal youth. This explorative study attempted to identify risk factors for this disparity by directly comparing the socio-economic, lifestyle and dietary factors between aboriginal and non-aboriginal youth. There is currently no other available evidence simultaneously describing such relationships in a nationally representative sample of off-reserve aboriginal Canadian youth.

Direct comparisons with the non-aboriginal population are useful for providing the Canadian context for lifestyle behaviours and can help illustrate the magnitude of

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Table 2 Logistic regression analysis of the associations between sociodemographic and lifestyle factors and prevalence of obesity among Canadian youth aged 12–17 years, OR and 95 % CI

	Unadjusted		Multivariate adjusted†	
	OR	95 % CI	OR	95 % CI
Aboriginal (*n* 138)				
Sex (ref. = male)	0·97	0·59, 1·60	1·04	0·61, 1·75
Age (years)	0·99	0·86, 1·13	0·98	0·86, 1·11
Household education (ref. = ≥ high-school graduation)	1·39	0·95, 2·02	2·00	1·46, 2·73
Income adequacy (ref. = high)	0·86	0·63, 1·12	0·69	0·50, 0·97
TV watching level (ref. = high)	0·68	0·48, 0·95	0·54	0·33, 0·88
Physical activity level (kcal/kg per d)‡	0·81	0·73, 0·90	0·77	0·69, 0·86
Non-aboriginal (*n* 3368)				
Sex (ref. = male)	0·64	0·48. 0·84	0·60	0·45, 0·81
Age (years)	1·08	0·99, 1·12	1·08	0·99, 1·18
Household education (ref. = ≥ high-school graduation)	1·22	0·85, 1·74	1·06	0·73, 1·54
Income adequacy (ref. = high)	1·70	1·24, 2·34	1·80	1·29, 2·52
TV watching level (ref. = high)	0·67	0·50, 0·89	0·69	0·52, 0·93
Physical activity level (kcal/kg per d)‡	0·98	0·94, 1·02	0·97	0·92, 1·01

TV, television.
†Multivariate adjusted for age, sex, household education, income adequacy, TV watching and physical activity levels.
‡1 kcal = 4·184 kJ.

Table 3 Mean daily dietary intakes of nutrients and foods by TV watching level – aboriginal Canadian youth aged 12 to 17 years

	Low TV (≤14 h/week), *n* 133		High TV (≥15 h/week), *n* 65	
Aboriginal	Mean	95 % CI	Mean	95 % CI
Total energy intake (kcal)†	2443·6	2319·4, 2567·7	2301·0	2080·9, 2521·0
Energy protein (%)	13·6	12·4, 14·7	15·9	12·7, 19·1
Energy carbohydrate (%)	52·8	50·9, 54·7	53·7	47·2, 60·2
Energy fat (%)	33·5	32·6, 34·5	30·4	27·0, 33·7
Energy saturated fat (%)	10·0	9·6, 10·4	9·4	9·0, 9·9
Fibre (g)	16·4	15·3, 17·5	13·2	12·1, 14·4
Sugar (g)	150·1	138·2, 162·1	135·6	125·6, 145·5
Sodium (mg)	3421·0	3197·2, 3644·9	3362·7	3003·2, 3722·2
Calcium (mg)	1014·6	948·6, 1080·5	824·3	755·7, 892·9
Meats (g)	131·8	89·3, 174·2	155·7	64·8, 246·7
Fruit and vegetables (g)	235·2	211·7, 258·8	129·6	108·3, 150·9
Vegetables (g)	115·2	103·3, 127·2	81·3	61·2, 101·5
Fruits (g)	120·0	105·9, 134·1	48·3	30·5, 66·0
Milk (g)	349·0	327·0, 371·0	196·3	154·5, 238·0
Dairy (g)	391·1	368·9, 413·4	228·6	195·0, 262·1
Fats, butter, oils (g)	60·5	51·2, 69·8	47·8	33·3, 62·3
Whole grains (g)	90·8	80·5, 101·1	7·7	5·5, 10·0
Other grains (g)	91·0	81·1, 100·9	80·9	66·0, 95·7
Soft drinks (g)	257·7	232·5, 282·8	365·4	229·1, 501·8
Salty snacks and sweets (g)	62·2	58·3, 66·1	131·8	116·5, 147·0
Junk foods (g)	301·5	276·4, 326·7	479·5	352·3, 606·8

TV, television.
†1 kcal = 4·184 kJ.

health disparities that plague aboriginal Canadians[12]. In addition, the gaps identified may be used for setting specific targets for improvement. In the present study, almost half of the aboriginal youth watched TV for ≥15 h/week – two times the proportion estimated among the non-aboriginal youth. TV viewing has been consistently linked to obesity in cross-sectional and longitudinal studies than to other sedentary behaviours such as video game playing and computer use[13]. The present study confirms the independent relationship between TV viewing and obesity and highlights this behaviour as a key area for intervention among aboriginal youth.

TV viewing may contribute to obesity by negatively influencing food consumption. Although non-aboriginal high TV watchers were found to consume more soft drinks, no significant differences were observed among aboriginal youth, but this was most likely due to low statistical power. The aboriginal sample, juxtaposed against the non-aboriginal, appeared comparatively weaker because they consist of only 2 % of the survey population. On average, each aboriginal respondent in the present study represented about 300 youth. In comparison, each non-aboriginal respondent represented over 600 youth. Thus, the aboriginal group is arguably a

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Table 4 Mean daily dietary intakes of nutrients and foods by TV watching level – non-aboriginal Canadian youth aged 12–17 years

	Low TV watching (≤14 h/week), *n* 3340		High TV watching (≥15 h/week), *n* 1108	
Non-aboriginal	Mean	95 % CI	Mean	95 % CI
Total energy intake (kcal)†	2422·6	2374·8, 2470·4	2498·7	2422·0, 2575·4
Energy protein (%)	14·7	14·4, 15·0	14·2	13·7, 14·6
Energy carbohydrate (%)	54·4	53·9, 54·8	54·2	53·4, 55·0
Energy fat (%)	30·8	30·4, 31·1	31·5	30·9, 32·1
Energy saturated fat (%)	10·5	10·3, 10·7	10·7	10·5, 11·0
Fibre (g)	16·4	15·9, 16·8	16·1	15·5, 16·6
Sugar (g)	149·7	145·6, 153·8	157·0	149·8, 164·2
Sodium (mg)	3464·4	3385·8, 3543·0	3601·6	3466·4, 3736·9
Calcium (mg)	1154·2	1117·3, 1191·1	1119·2	1052·4, 1185·9
Meats (g)	122·7	115·8, 129·6	125·8	117·3, 134·2
Fruit and vegetables (g)	262·5	251·1, 273·9	244·2	222·9, 265·4
Vegetables (g)	140·4	133·0, 147·8	132·1	118·1, 146·0
Fruits (g)	122·1	113·9, 130·3	112·1	93·4, 130·8
Milk (g)	393·3	373·4, 413·3	388·8	344·3, 433·3
Dairy (g)	456·1	435·6, 476·6	439·6	395·0, 484·2
Fats, butter, oils (g)	55·4	52·8, 58·1	53·5	49·2, 57·7
Whole grains (g)	27·2	24·4, 29·9	19·2	14·9, 23·5
Other grains (g)‡	96·7	93·0, 100·5	115·5	107·3, 123·6
Soft drinks (g)‡	242·9	225·1, 260·8	305·4	274·6, 336·2
Salty snacks and sweets (g)	54·6	49·6, 59·5	59·9	50·6, 69·2
Junk foods (g)	275·4	257·1, 293·7	331·2	301·0, 361·5

TV, television.
†1 kcal = 4·184 kJ.
‡Significant difference between 'high' and 'low' TV watchers, $P < 0·003$.

finer survey sample than is made apparent by the unweighted sample size. In addition, though the confidence intervals around the estimates of nutrient and food intakes are wide, they create points of reference that were previously non-existent. The current estimates of intakes help fill a long-standing knowledge gap in information on dietary patterns of off-reserve aboriginal youth.

Physical activity has previously been reported as an important predictor of obesity among aboriginal youth using these same data[14]. The present study adds the finding that this is not the case in non-aboriginal Canadian youth. Taken together, these results suggest that obesity status may affect physical activity participation differentially between aboriginal and non-aboriginal youth. Obese aboriginal youth in the present study were significantly less likely to participate in leisure-time physical activity than their non-obese peers. Identification of this high-risk group has important implications as obese youth are at a greater need of increased energy expenditure through physical activity participation. As a component of any successful body weight reduction strategy, it may be useful to identify barriers to physical activity participation in this group and subsequently promote culturally appropriate activities that are appealing and inclusive. The lack of a relationship between TV viewing and physical activity participation as measured in the present study suggests the independence of these behaviours.

As expected, lower household education status was associated with increased risk for obesity among aboriginal youth. With over 40 % of aboriginal households having less than high-school graduation as the highest education level attained, improvement of access to educational opportunities can significantly help close the health disparity gap. Education level can affect food choices[15] and physical activity opportunities[16]. Specific intervention strategies that have been found to be effective in promoting lifestyle change among lower-education groups include programmes that enhance self-efficacy[17]. Innovative family-based programmes delivered by aboriginal health counsellors that empower youth and their families with increased knowledge of healthy lifestyle practices can evoke positive changes in diet and physical activity behaviours[18].

The opposite income–obesity relationship found between aboriginal and non-aboriginal youth may be partly attributed to the limitations of the income adequacy variable. While other income-based variables were available, household income adequacy is a standard variable commonly reported across major Statistics Canada surveys and it was used here to allow for comparisons despite its limitations. In the context of the present study, the failure of this variable to capture location of residence (e.g. urban or rural) requires that the income–obesity relationship be interpreted with caution. Aboriginal Canadians tend to reside in rural or remote areas where the cost of living may differ significantly from other locations. Thus, the seemingly paradoxical positive relationship between income and obesity observed among aboriginal youth may actually be an artefact of lowered purchasing power for the same amount of income as their non-aboriginal counterparts. One potential consequence is increased food insecurity among aboriginal households[19] and perhaps undernutrition, precluding development of obesity for some. Further, the diversity of the aboriginal Canadian population

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complicates interpretation of the income–obesity relationship as food practices, and very likely other lifestyle behaviours, can vary widely between different aboriginal cultures[20]. The present study was unable to explore access to or availability and utilisation of food or physical activity environments. Future research is needed to more closely examine the impact of income on health-promoting lifestyle behaviours and obesity development.

The conflicting relationships with obesity among aboriginal youth between the household education attainment and income adequacy suggest that these two variables are not interchangeable. Socio-economic issues have consistently been identified as important contributing factors for health disparities between aboriginal and non-aboriginal Canadians[21] and undoubtedly merit further study. A detailed discussion of socio-economic status as a determinant of aboriginal health is beyond the scope of the present study. Complex socio-economic relationships that are difficult to interpret often emerge because of diverse historical experiences and distinct cultural variations within aboriginal communities[22]. As a national survey, the CCHS 2·2 was not designed for community-level analyses, but results can be used to draw attention to general disparities that may exist. Despite the small sample size of the aboriginal group, significant differences among several key variables still emerged, indicative of large disparities between aboriginal and non-aboriginal groups.

Additional limitations of the present study include the cross-sectional nature of the analyses, from which no cause and effect relationships may be derived. In addition, all information regarding aboriginal identity, TV watching, physical activity, diet, education and income level were self-reported. Because of the small sample of the aboriginal youth, analyses could not be further stratified by sex or age. In order to preserve statistical power and confidentiality, more detailed socio-economic or food groups could not be used. Education and income levels were only divided into two groups due to low numbers in certain categories. The mean dietary intakes reflect the 24 h before the interview and may not be appropriate indicators of usual intakes. For these analyses, no individual level extrapolations can be made as analyses were performed at the population level. In addition, many aboriginal Canadians were not part of the sampling frame primarily due to geographical reasons, and therefore cautious interpretation of the associations described in the present study is required and should be restricted to the sample intended.

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