

Socio-economic Patterns of Obesity Among Aboriginal and Non-Aboriginal Canadians

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ABSTRACT

Objectives: Large disparities exist between Aboriginal and non-Aboriginal Canadians in both obesity and socio-economic status (SES). The purpose of this paper was to assess associations between obesity and three indicators of SES – employment, education and income – in conjunction with demographic and lifestyle factors.

Methods: Using the nationally-representative Canadian Community Health Survey (CCHS) cycle 2.2 (2004), among 334 off-reserve Aboriginal and 6,259 non-Aboriginal Canadians aged 25-64 years in the 10 provinces, obesity status was determined by body mass index derived from measured height and weight. Logistic regression was used to assess the relationships between socio-demographic variables and obesity status.

Results: Controlling for other socio-economic and lifestyle factors, odds for obesity were lower by 80% among Aboriginal men and 64% among Aboriginal women who were employed during the 12 months prior to the survey compared to Aboriginal men and women who were not employed. Employment was not significantly associated with obesity among non-Aboriginal adults. Probability for obesity increased as household income increased among Aboriginal men, but a negative association between income and obesity was observed among Aboriginal women. These associations persisted after adjustment for physical activity level, fruit and vegetable consumption, smoking, and marital status in the models.

Conclusion: Unemployment among obese Aboriginal Canadians warrants attention. The knowledge that both high and low SES Aboriginal Canadians, of varying socio-demographic characteristics and lifestyle, experience high rates of obesity can lead to new hypotheses of how obesity develops in this population and influence how interventions are planned.

Key words: Indigenous population; obesity; socio-economic factors; lifestyle; employment

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

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Aboriginal Canadians* have been recognized as having the highest prevalence of obesity compared to other ethnic groups in Canada.¹ At the same time, Aboriginal Canadians are also among the most socio-economically disadvantaged groups.² Despite the marked disparities between Aboriginal and non-Aboriginal Canadians for both socio-economic status (SES) and obesity, few studies have directly explored socio-economic patterning of obesity in the Aboriginal population. In the context that many Aboriginal Canadians are experiencing rapid socio-economic changes,³ it is important to identify whether obesity is disproportionately affecting certain socio-economic groups so that appropriate intervention and prevention efforts may be developed. The purpose of this paper was to examine the associations between obesity and three indicators of SES – employment, education and income – and related lifestyle variables among Aboriginal Canadians, in comparison with non-Aboriginal Canadians.

METHODS

The Canadian Community Health Survey (CCHS) 2.2 - Nutrition is a cross-sectional survey that collected information related to health status and nutrition information for the Canadian population from

* As described in the *Constitution Act*, 1982, the terminology "Aboriginal peoples of Canada" includes the North American Indian or First Nations, Inuit, and Métis peoples of Canada, three culturally distinct ethnic groups that are recognized as indigenous to Canada. This report focuses on Aboriginal Canadians living in the ten provinces who do not live on First Nations reserves.

January 2004 to January 2005. Details of the survey are available elsewhere.⁴ Data analyzed in this report are for 334 Inuit, Métis and off-reserve First Nations Aboriginal and 6,259 non-Aboriginal, non-pregnant, non-breastfeeding individuals aged 25-64 years living in the 10 provinces with non-missing information on the variables of interest.

Height and weight were measured by trained interviewers. Body mass index (BMI) was calculated by dividing weight in kilograms (kg) by squared height in metres (m). Overweight was defined as a BMI ≥ 25 kg/m² and obesity was defined as a BMI ≥ 30 kg/m².

Socio-economic status variables

For each respondent, Statistics Canada provided a variable representing their relative measure of household income in deciles. Adjusted ratios of household income relative to the low income cut-off and corresponding to their household and community size

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Table 1. Descriptive Characteristics of Sample Aged 25-64 Years, by Aboriginal Identity and Sex, From CCHS 2.2 (2004)

	Males				Difference p
	Non-Aboriginal (n=2848)		Aboriginal (n=114)		
	Mean	95% CI	Mean	95% CI	
Age (years)	43.8	43.3-44.4	42.8	42.0-43.6	0.537
Married	74.1	71.6-76.5	65.0	59.4-70.7	0.093
Employed	90.4	88.8-92.1	70.0	66.8-73.2	<0.001
Smoker (%)	30.2	27.5-32.9	42.9	37.7-48.0	0.039
BMI (kg/m ²)	27.7	27.4-28.0	29.4	28.7-30.1	0.173
Obese (%)	26.4	23.7-29.1	35.3	31.3-39.3	0.210
Overweight (%)	69.6	66.8-72.4	71.8	66.3-77.2	0.673
Physical Activity (kcal/kg/day)	1.6	1.5-1.7	1.6	1.4-1.7	0.800
Fruits and Vegetables (servings/day)	3.9	3.8-4.0	3.1	3.0-3.3	<0.001
≥High School Graduation (%)	68.5	65.5-71.5	49.0	44.0-54.0	0.003
Household Income Level (deciles)	6.0	5.9-6.2	4.8	4.6-5.0	0.012

	Females				Difference p
	Non-Aboriginal (n=3411)		Aboriginal (n=220)		
	Mean	95% CI	Mean	95% CI	
Age (years)	44.3	43.8-44.9	40.0	39.5-40.5	<0.001
Married	73.8	71.5-76.0	68.4	64.9-71.8	0.227
Employed	79.3	77.4-81.3	66.5	63.2-69.8	0.003
Smoker (%)	23.5	21.4-25.7	57.9	54.2-61.6	<0.001
BMI (kg/m ²)	27.1	26.7-27.5	30.1	29.5-30.7	<0.001
Obese (%)	24.9	22.8-27.1	44.5	40.9-48.2	<0.001
Overweight (%)	55.1	52.3-58.0	72.5	69.6-75.3	0.008
Physical Activity (kcal/kg/day)	1.6	1.5-1.7	1.7	1.6-1.8	0.820
Fruits and Vegetables (servings/day)	4.6	4.5-4.7	3.8	3.7-3.9	<0.001
≥High School Graduation (%)	66.4	63.6-69.2	61.8	58.3-65.4	0.374
Household Income Level (deciles)	5.9	5.7-6.0	4.8	4.6-5.0	<0.001

were calculated for all survey respondents (values from 0 to 1). From these ratios, a household income distribution decile measure was derived. Each of the ten categories, from lowest to highest, included approximately the same percentage of residents for each province and provided a relative measure of each respondent's household income to the household incomes of all other respondents.

Whether a respondent was employed the week prior to the survey was a binary variable. Respondents were defined as "employed" if they replied "yes" to having worked at a job or business during the past 12 months including part-time jobs, seasonal work, contract work, self-employment, babysitting and any other paid work, regardless of the number of hours worked.

Lifestyle variables

Respondents who reported smoking cigarettes daily or occasionally were considered smokers. All others were considered non-smokers, including former smokers. Daily consumption of fruits and vegetables was calculated from a series of questions asking respondents how often they consumed juices, fruit, green salad, potatoes, carrots and other vegetables. Participation in leisure-time physical activities over the 3 months prior to the interview was calculated from total energy expenditure (EE) for each activity reported using the equation $EE=N \times D \times MET$ value, where N=number of times a respondent engaged in an activity over 12 months, D=average duration in hours of the activity, and MET value=energy cost of the activity expressed as kilocalories expended per kilogram of body weight per hour of activity (kcal/kg/hour). EE was divided by 365 to convert yearly data into daily data (kcal/kg/day, KKD). One KKD can be interpreted as the energy expenditure equivalent of 20 minutes of walking at a leisurely pace.

Statistical analyses

All analyses were completed using SAS (version 9.2, SAS Institute Inc., Cary, NC). Since the CCHS 2.2 has a complex design, primary sampling units and strata variables were used in PROC

SURVEYMEANS, PROC SURVEYREG, and PROC SURVEYLOGISTIC procedures along with sample weights. Descriptive statistics were compared between groups using t-tests. Logistic regression analyses were used to determine associations between socio-economic characteristics and obesity. Level of statistical significance was $p < 0.05$.

RESULTS

Descriptive characteristics

Close to three quarters of Aboriginal adults were classified as overweight with over one third of Aboriginal males and almost half of Aboriginal females being obese (Table 1). Whereas Aboriginal women were more obese than Aboriginal men ($p=0.003$), more non-Aboriginal men were overweight than non-Aboriginal women ($p < 0.001$). Disparity in education level was more prominent among men. Only half of Aboriginal men in this sample have attained an education level of high school graduation or higher, a proportion that is almost 20% lower than non-Aboriginal men. The household income level of Aboriginal adults was near the fifth decile, while non-Aboriginal adults were more advantaged on average by one decile.

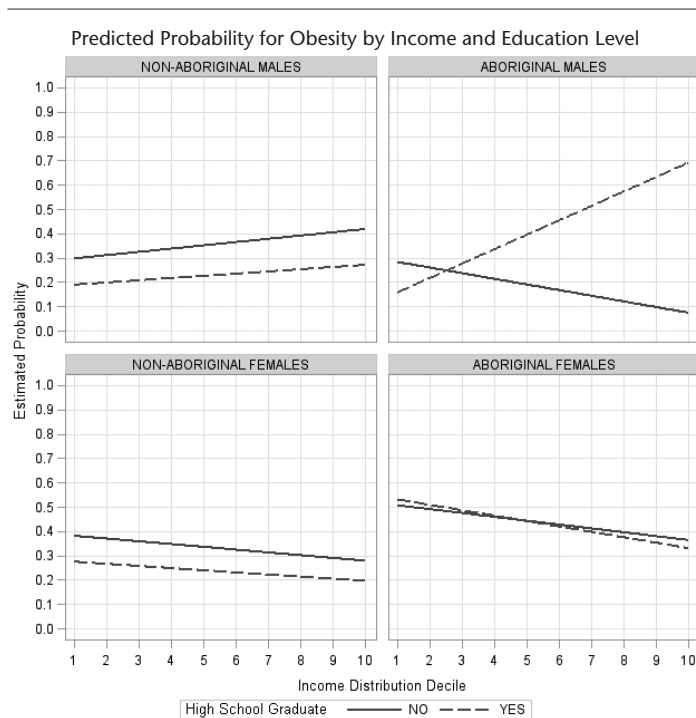
Association of obesity with SES and lifestyle factors

The analyses presented were stratified by sex and Aboriginal identity because initial logistic regression models predicting obesity from SES and socio-demographic variables showed significant interaction between Aboriginal identity groups for education ($p=0.011$) and between males and females for income ($p=0.028$). Controlling for socio-demographic and lifestyle covariates, education was negatively associated with obesity among non-Aboriginal men and women, while household income level was positively associated with obesity among non-Aboriginal men but not non-Aboriginal women (Table 2). Among Aboriginal women, income was negatively associated with obesity, but education level was positively associated with obesity. Since a significant interaction between education and income was apparent among Aboriginal men, linear depiction of the predicted probabilities for obesity were plotted to

Table 2. Multivariate Logistic Regression Estimates Predicting Obesity From Socio-demographic, SES and Lifestyle Factors by Aboriginal Identity and Sex

	Non-Aboriginal					
	Males (n=2844)			Females (n=3398)		
	Estimate	SE	p	Estimate	SE	p
Intercept	-0.609	0.57	0.281	-0.707	0.35	0.046
Age (years)	0.014	0.01	0.044	0.021	0.01	<0.001
Employed (yes/no)	-0.289	0.29	0.311	-0.278	0.15	0.067
High School Graduation (yes/no)	-0.532	0.17	0.001	-0.316	0.14	0.024
Income Level (deciles)	0.074	0.03	0.013	-0.003	0.02	0.913
Smoker (yes/no)	-0.476	0.17	0.006	-0.335	0.14	0.016
Physical Activity Level (KKD)	-0.109	0.05	0.022	-0.236	0.05	<0.001
Fruit and Vegetable Consumption (servings)	-0.112	0.04	0.005	-0.064	0.04	0.075
Married (yes/no)	-0.196	0.17	0.247	-0.303	0.13	0.024
	Aboriginal					
	Males (n=112)			Females (n=220)		
	Estimate	SE	p	Estimate	SE	p
Intercept	0.922	0.38	0.015	-1.368	0.26	<0.0001
Age (years)	-0.013	0.01	0.079	0.046	0.01	<0.0001
Employed (yes/no)	-1.616	0.34	<0.001	-1.010	0.18	<0.0001
High School Graduation (yes/no)	-0.738	0.31	0.019	0.495	0.18	0.005
Income Level (deciles)	-0.002	0.13	0.989	-0.060	0.03	0.032
Smoker (yes/no)	-0.494	0.21	0.021	-0.166	0.17	0.323
Physical Activity Level (KKD)	0.007	0.03	0.824	-0.306	0.05	<0.0001
Fruit and Vegetable Consumption (servings)	-0.224	0.06	<0.001	0.048	0.04	0.218
Married (yes/no)	0.264	0.35	0.455	0.507	0.16	0.001
Education*Income	0.391	0.09	<0.001			

Figure 1. Probability for obesity* among Aboriginal and non-Aboriginal Canadian adults aged 25-64 years from CCHS 2.2 (2004) by household income and education level



* multivariate adjusted for physical activity level, fruit and vegetable consumption, smoking, marital, and employment status.

illustrate how education and income levels interact in their associations with obesity (Figure 1). Among Aboriginal men, probability for obesity increased as income level increased for high school graduates, but among those who did not complete high school, probability for obesity decreased as income level rose.

Employment was not significantly associated with obesity among non-Aboriginal adults, but was highly negatively associated with

obesity among Aboriginal men and women. Controlling for socio-demographic and lifestyle factors, odds for obesity were lower by 80% among Aboriginal men and 64% among Aboriginal women who were employed compared to Aboriginal men and women who were not employed (Table 3).

Married non-Aboriginal women were 26% less likely to be obese compared to those not married, but the opposite association was observed among Aboriginal women, among whom being married or common-law was positively associated with obesity.

Among lifestyle factors, daily or occasional smoking was associated with lower obesity, except among Aboriginal females. Physical activity was not associated with obesity status among Aboriginal men, but was negatively associated with obesity for non-Aboriginal adults and Aboriginal women. Fruit and vegetable consumption was negatively associated with obesity among men but not among women.

DISCUSSION

In the present study, the SES-obesity relationship differed by sex and Aboriginal identity. Consistent with results from one previous analysis of the same CCHS 2.2 data, lower education attainment was associated with increased odds for obesity among non-Aboriginal Canadians, but positively associated with obesity among Aboriginal Canadians.⁵ This study contributes further to current evidence of the SES-obesity relationship among Aboriginal Canadians by reporting the negative relationship between obesity and employment that was not apparent among non-Aboriginal Canadians.

While Aboriginal Canadians were the focus, the comparison with non-Aboriginal Canadians from the same survey was particularly necessary to make inferences about potential differences in the association between obesity and employment, as heterogeneity due to fluctuations in economic cycles and measurement differences could be minimized. In addition, unlike First Nations peoples living on reserves and the large majority of the Inuit population who live in the three territories, the off-reserve Aboriginal population

Table 3. Odds Ratios (OR) and 95% Confidence Intervals (CI) for Obesity for Age, Physical Activity Level, Fruit and Vegetable Consumption, Marital, Smoking, and Employment Status – Adjusted for Education Level and Household Income Level, by Aboriginal Identity and Sex

	Non-Aboriginal			
	Males (n=2844)		Females (n=3398)	
	OR	95% CI	OR	95% CI
Age (years)	1.01	1.00-1.03	1.02	1.01-1.03
Employed (yes/no)	0.75	0.43-1.31	0.76	0.56-1.02
Smoker (yes/no)	0.62	0.44-0.87	0.72	0.54-0.94
Physical Activity Level (KKD)	0.90	0.82-0.99	0.79	0.72-0.87
Fruit and Vegetable Consumption (servings)	0.89	0.83-0.97	0.94	0.87-1.01
Married (yes/no)	0.82	0.59-1.15	0.74	0.57-0.96
	Aboriginal			
	Males (n=112)		Females (n=220)	
	OR	95% CI	OR	95% CI
Age (years)	0.99	0.97-1.00	1.05	1.03-1.06
Employed (yes/no)	0.20	0.10-0.39	0.36	0.26-0.52
Smoker (yes/no)	0.61	0.40-0.93	0.85	0.61-1.18
Physical Activity Level (KKD)	1.01	0.94-1.08	0.74	0.66-0.82
Fruit and Vegetable Consumption (servings)	0.80	0.71-0.90	1.05	0.97-1.13
Married (yes/no)	1.30	0.65-2.60	1.66	1.23-2.25

in the 10 provinces form part of the same labour force alongside their non-Aboriginal counterparts in the same urban or rural environments. The unemployment rate among Aboriginal Canadians is more than two times higher than that of non-Aboriginal Canadians – 14.8% vs. 6.6%, respectively, according to the 2006 census.⁶ Unemployment's association with obesity poses an additional challenge in a population that is already socio-economically disadvantaged and disproportionately burdened by high prevalence of various chronic health conditions.⁷

Since the analyses were cross-sectional, it is unclear whether obesity influences employment or vice versa. Obesity may theoretically contribute to lowered work productivity and absenteeism due to consequent comorbidities.⁸ On the other hand, “wage penalties” on obese persons have been observed.^{9,10} Typically, obese women, and to a lesser extent obese men, earn lower wages for comparable employment.^{11,12} Gender differences in body image perceptions in the workplace may provide some explanation of the differential relationships between men and women related to income. In a study of occupational prestige in relation to BMI, higher-prestige occupations were associated with lower BMI among Canadian women while among men, senior and middle management occupations were positively associated with BMI.¹³ Thus, in occupations of authority, a larger body size may be beneficial in men in terms of establishing power, but not in women. This may at least partially elucidate why Aboriginal men of highest household income deciles were most likely to be obese, while the opposite was the case among Aboriginal women.

The inability of BMI to distinguish between fat and fat-free body mass should be considered. High BMI among males in the present study may plausibly be due to these males having muscular builds rather than to excess fat mass. A recent study of body composition data from the United States found that males with high fat mass actually earned lower wages compared to those with lower body fat, regardless of gender.¹⁴

The multi-faceted SES-obesity relationship suggests the existence of independent effects of each SES indicator.¹⁵ For example, specific characteristics of labour force participation, such as psychosocial benefits of being gainfully employed and job satisfaction, may influence obesity development independent of financial aspects of employment. Income level captures the amount of resources an individual has available to engage in certain lifestyle behaviours,

while education may indicate one's knowledge and awareness of health issues. Yet, employment, income and education are inter-related and it is difficult to distinguish confounding and mediating effects as none exist in isolation. In addition, lifestyle behaviours such as diet, physical activity and smoking habits have been found to be associated with education and income level.^{16,17} As the various associations between SES and obesity persisted despite the inclusion of lifestyle covariates in the analyses, SES likely exerts influence on obesity development independent of lifestyle behaviours.

Some limitations of the employment variable include its inability to capture tenure or type of employment. The relatively small size of the Aboriginal sample did not allow for detailed analyses of the diverse range of occupations. Another limitation of the employment variable was its failure to distinguish between respondents who were unable to work and those who chose not to work. Although these factors were provided in the survey, the small numbers in certain categories did not meet the minimum cell size requirements stipulated by Statistics Canada for confidentiality reasons and reliability of estimates. This study attempted to address employment as only one of three indicators of SES along with health measures and provides a starting point for more detailed analyses in examining the employment-health relationship among Aboriginal Canadians.

The results of this study are consistent with the general observation from two previous comprehensive reviews that the SES-obesity relationship can vary substantially between populations.^{18,19} In order to disentangle these complex associations, one suggestion is to conduct qualitative, ethnographic studies that would be better able to explore aspects of the SES-obesity relationship not practically measurable quantitatively.²⁰ Use of culturally-sensitive approaches can more effectively extract attitudes and social values unique to specific indigenous populations. Of special relevance to obesity is food insecurity, which exists simultaneously with obesity among the Aboriginal population.²¹ Approximately one third of Aboriginal households in the CCHS 2.2 experience moderate to high levels of food insecurity; solutions to alleviate the problem should take into consideration cultural circumstances around food procurement and eating patterns.²² The knowledge that both high and low SES Aboriginal Canadians, of varying socio-demographic characteristics and lifestyle, experience high rates of obesity can

lead to new hypotheses of how obesity develops in this population and influence how interventions are planned.

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RÉSUMÉ

Objectifs : De grandes disparités existent entre les Canadiens autochtones et non autochtones pour ce qui est de l'obésité et du statut socioéconomique (SSE). Le but de cette étude était d'évaluer les associations entre l'obésité et trois indicateurs du SSE – l'emploi, la scolarité et le revenu – en conjonction avec des facteurs démographiques et liés au mode de vie.

Méthode : À l'aide des données représentatives de l'Enquête sur la santé dans les collectivités canadiennes (ESCC), cycle 2.2 (2004), nous avons déterminé le statut d'obésité de 334 Canadiens autochtones vivant hors-réserve et de 6 259 Canadiens non autochtones, âgés de 25 à 64 ans et vivant dans les 10 provinces, selon leur indice de masse corporelle calculé par la mesure de la taille et du poids. Par régression logistique, nous avons évalué les relations entre les variables sociodémographiques et l'obésité.

Résultats : Après avoir apporté des ajustements pour tenir compte d'autres facteurs socioéconomiques et du mode de vie, la probabilité de l'obésité était inférieure de 80 % chez les hommes autochtones et de 64 % chez les femmes autochtones ayant travaillé au cours des 12 mois précédant l'enquête. L'emploi n'était pas significativement associé à l'obésité chez les adultes non autochtones. La probabilité de l'obésité augmentait avec le revenu du ménage chez les hommes autochtones, mais une association négative entre le revenu et l'obésité a été observée chez les femmes autochtones. Ces associations ont persisté après l'ajout d'ajustements pour tenir compte du niveau d'activité physique, de la consommation de fruits et légumes, de l'usage du tabac et de l'état matrimonial dans les modèles.

Conclusion : Le taux de chômage chez les Canadiens autochtones obèses mérite qu'on s'y intéresse. Le fait de savoir que les Canadiens autochtones ont des taux élevés d'obésité, qu'ils soient de SSE faible ou élevé et peu importe leurs caractéristiques sociodémographiques et leur mode de vie, peut conduire à de nouvelles hypothèses sur la façon dont l'obésité se développe dans cette population et influencer la planification des interventions.

Mots clés : Indiens d'Amérique Nord; obésité; facteurs socioéconomiques; mode de vie; emploi