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Review

The Ethnoepidemiology of Obesity

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ABSTRACT

The prevalence of overweight and obesity varies significantly across ethnic groups and among aboriginal people in Canada and appears to be increasing overall in children and youth, which will have significant health consequences in the future. Individual health behaviours, genetic predisposition, and community-level factors all contribute to the high burden of overweight and obesity across communities in Canada. Preliminary studies indicate that individuals who live in neighbourhoods in Canada with increased walkability, fewer fast food outlets, and higher socioeconomic status have lower rates of overweight/obesity when compared with other neighbourhoods. However, more research is required to understand the impact of community level factors on overweight/obesity trends in Canadian ethnic groups, including children and youth, and aboriginal people.

RÉSUMÉ

La prévalence de la surcharge pondérale et de l'obésité varie considérablement d'un groupe ethnique à l'autre et parmi les peuples autochtones du Canada, et semble dans l'ensemble augmenter chez les enfants et les jeunes, ce qui entraînera plus tard des conséquences importantes sur la santé. Les comportements individuels en matière de santé, la prédisposition génétique et les facteurs communautaires concourent au fardeau élevé de la surcharge pondérale et de l'obésité des communautés du Canada. Des études préliminaires montrent que les individus qui vivent dans des quartiers du Canada ayant une meilleure accessibilité piétonnière, moins de comptoirs de commandes à emporter et un statut socioéconomique plus élevé ont des taux plus faibles de surcharge pondérale et d'obésité comparativement à ceux qui vivent dans d'autres quartiers. Davantage de recherches sont toutefois nécessaires pour comprendre l'effet des facteurs communautaires sur les tendances de la surcharge pondérale et de l'obésité des groupes ethniques canadiens, y compris les enfants et les jeunes, ainsi que les peuples autochtones.

Epidemiology and Trends in Obesity

In 2011, the Global Burden of Metabolic Risk Factors of Chronic Diseases Collaborating Group reported global population-level changes in body mass index (BMI) over 3 decades and showed that among adult men and women, obesity is increasing in all regions of the world.[1] In 2008, 1.46 billion adults were overweight (BMI $\geq$ 25 kg/m^2), including 500 million who were obese (BMI $\geq$ 30 kg/m^2). The BMI was substantially higher in high-income countries (mean BMI, 24.7 kg/m^2 in 1980 and 26.6 kg/m^2 in 2008) and in middle-income countries (23.6 kg/m^2 in 1980 and 26.1 kg/m^2 in 2008) compared with that in low-income countries (20.7 kg/m^2 in 1980 and 22.3 kg/m^2 in 2008). Over time, the BMI has increased in all regions so that it is now similar in high-income and middle-income countries.[1] Currently, more than 2 billion people worldwide are overweight or obese, with the highest rates observed in the Middle East and North Africa, where nearly 60% of men and 65% of women are overweight or obese.[2] In Canada, increases in overweight and obesity rates have been similar to those in other high-income countries.[1,3] Recent population statistics from the Canada Community Health Survey (2001/2003) indicate that among whites, the overall prevalence of overweight is 52% and obesity is 17% (Table 1).[3] Given Canada's ethnic diversity and the predilection of certain ethnic groups to experience early metabolic consequences of overweight and obesity,[5,6] it is important to consider how the prevalence of overweight and obesity varies across diverse groups. Using the conventional

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Table 1. Prevalence of overweight and obesity in Canada by ethnic group

Ethnic group	Overweight (BMI ≥ 25) (%)			Obese (BMI ≥ 30) (%)		
	Overall	Men	Women	Overall	Men	Women
White	52	60	42	17	18	16
Southeast Asian*	22	28	17	3	3	3
South Asian*	40	43	33	8	7	8
Black	48	50	48	13	10	18
Latin American	53	62	43	13	15	13
West Asian/Arab	45	50	36	11	9	12
Off-reserve aboriginal	63	67	59	28	27	28

*The cutoff for BMI in South Asians and Southeast Asians for overweight and obesity is likely lower, and thus these figures represent an underestimate of overweight and obesity in these ethnic groups.[4]

overweight and obesity criteria, the group at highest risk of overweight and obesity are Canada's aboriginal peoples, followed by individuals of Latin American and African ancestry.[3] Although South Asian and Southeast Asians may appear to have a lower prevalence of overweight and obesity, it is well accepted that cutoffs used to define overweight and obesity are likely lower in these ethnic groups,[7] and current statistics likely underestimate the true prevalence of overweight and obesity associated with deleterious metabolic consequences in these ethnic groups. The prevalence of obesity and type 2 diabetes is also increasing in children and adolescents, which will have important consequences in the future.[8,9]

Ethnic Variation in Abdominal Obesity

As discussed in the literature, BMI is a poor measure of adiposity and may over- or underestimate adiposity in different ethnic groups. Abdominal adiposity is a risk factor for cardiometabolic abnormalities, diabetes, and cardiovascular disease (CVD).[10,11] Even individuals with abdominal obesity who show no signs of abnormal cardiometabolic risk factors, such as those who are metabolically healthy with abdominal obesity, appear to be at higher risk of mortality compared with their metabolically healthy counterparts who are not abdominally obese (mortality risk for individuals who are metabolically healthy with abdominal obesity is 1.40-fold higher).[10,12] Certain ethnic groups have a higher prevalence of abdominal adiposity, including South Asians, individuals of African origin, and aboriginal individuals. Some studies also suggest that Southeast Asians also have greater abdominal and visceral adiposity compared with whites.[10,13] Among various ethnic populations in Canada, the mean waist circumference for men is highest among aboriginal peoples, followed by South Asians and whites, and is lowest among Chinese individuals (Table 2).[14-17] Ethnic-specific thresholds have been developed to define normal waist circumference in nonwhite populations and are generally based on a cut point, which is associated with the development of abnormalities in cardiometabolic risk factors.

Comparisons in which detailed measures of visceral fat area using computed tomography or magnetic resonance imaging suggest that South Asian men and women have particularly high amounts of visceral fat compared with other ethnic groups,[18,19] although more data using direct comparisons with similar measurement techniques are required. Visceral fat is strongly related to the presence of fatty liver, which is associated with cardiometabolic risk factors and CVD.[10] Sex differences in visceral adipose tissue (VAT) consistently show that men have greater VAT than women. However, more research to identify the VAT (in square centimeters) thresholds above which metabolic risk factors develop specific to each ethnic group, as well as variations by sex, are required because the cut points may differ.[10,20]

The pathophysiological mechanism linking abdominal obesity to cardiometabolic risk factors implicates reduced capacity to store free fatty acids in subcutaneous adipose tissue depots.[21] This then results in redirection of free fatty acids from subcutaneous to ectopic fat depots. Abdominal obesity indicates that adipose tissue is present in the abdominal viscera, including the omentum and the liver. Once ectopic fat is present in the liver, fatty liver results, and cardiometabolic risk factors—including elevated triglyceride levels, low high-density lipoprotein (HDL) cholesterol levels, increased apolipoprotein B levels, and elevated glucose levels—develop.[21] In addition, adiponectin, a protein hormone secreted by adipocytes, is reduced and is associated with lower insulin sensitivity in the presence of abdominal obesity.[10,19] The reasons that certain ethnic groups are more prone to have abdominal obesity are currently the subject of population-based investigations. Among the possible explanations are dietary differences (high carbohydrate and lower protein diets), genetic predisposition, epigenetic variations, and interactions

Table 2. Variation in waist circumference (cm) by ethnicity

Author, year	Study name	Location	Sample size		South Asian Mean ± SD	Chinese Mean ± SD	European Mean ± SD	Aboriginal peoples Mean ± SD
Anand, 2000/2001[15]	SHARE/SHARE-AP	Hamilton, Toronto, Edmonton, Six Nations	Aboriginal: 301 South Asian: 328 European: 321 Chinese: 306	Men* Women*	94.6 ± 9.1 86.7 ± 10.4	89.9 ± 9.4 76.3 ± 8	100.6 ± 11.3 84.6 ± 12.1	109.2 ± 13.8 99.0 ± 15.5
Lear, 2009[17]	M-CHAT	Vancouver	Aboriginal: 196 South Asian: 208 European: 202 Chinese: 222	Men* Women*	93.6 ± 11.8 83.6 ± 10.7	86.6 ± 8.1 80.4 ± 9.7	93.3 ± 11.6 85.4 ± 12.28	97.2 ± 9.9 92.1 ± 12.8
Foulds, 2012[14]	NA	Various rural and urban areas in British Columbia	Aboriginal: 991 South Asian: 228 European: 3650 East Asian: 466	Men* Women*	93.6 ± 9.7 85.4 ± 12.2	87 ± 10.2 76.6 ± 9.2	96.5 ± 12.6 85.1 ± 14.1	104.3 ± 14.9 99.9 ± 17

M-CHAT, Multicultural Community Health Assessment Trial; NA, not available; SD, standard deviation; SHARE, Study of Health Assessment and Risk in Ethnic groups; SHARE-AP, Study of Health Assessment and Risk Evaluation in Aboriginal Peoples.

*$P < 0.001$ for between-group analysis of variance.