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Original Research

The contribution of excess weight to prevalent diabetes in Canadian adults

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Summary *Objective:* To determine the contribution of excess weight to prevalent diabetes based on data from a representative Canadian population.
Methods: This analysis was based on data from 72,627 subjects aged 20–64 years who participated in the Canadian Community Health Survey 2000–2001. Diabetes, body weight and height were self-reported. Stratified analysis and multivariate logistic regression models were conducted to adjust for confounding factors. Population attributable risk (PAR) was calculated.
Results: Approximately half of the respondents were either overweight (33.4%) or obese (15.7%). The prevalence of diabetes was 3.4% for men and 2.9% for women, compared with 7.2% and 9.1% for obese men and women in the study. After adjusting for age, physical activity and income, the multiple logistic regression models showed that the odds ratios for diabetes associated with overweight and obesity were 1.8 [95% confidence intervals (CI) 1.4–2.2] and 3.6 (95% CI 2.9–4.5), respectively, for men, and 2.0 (95% CI 1.6–2.6) and 5.9 (95% CI 4.7–7.4) for women. The respective PARs were 18.7% and 25.5% for men, and 14.7% and 38.0% for women.
Conclusions: Approximately 50% of diabetes risk is attributable to excess body weight in the Canadian population. This study suggests that control of body weight is the most important priority in diabetes prevention and control.

Introduction

Diabetes mellitus is rapidly becoming one of the most common chronic diseases worldwide. In Canada, the prevalence of physician-diagnosed

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diabetes is approximately 5% among adults, and the 4-year cumulative incidence is 1.4%.[1] Higher rates have been reported among adult populations in many other countries including the USA,[2] Italy[3] and Singapore.[4] The economic burden of diabetes in Canada was estimated at $1.6 billion in 1998.[1]

Although partly determined by genetics, overweight and obesity are fundamentally related to sugar imbalance, reflecting the excess of energy intake over energy expenditure. Trends in both developed and developing countries suggest that the prevalence of overweight and obesity is increasing at an alarming rate worldwide.[5,6] Decreasing physical activity and increasing caloric intake are likely to be the major contributing factors.[7] Between 1981 and 1996, the prevalence of overweight in Canada increased from 48% to 57% among men and from 30% to 35% among women, while the prevalence of obesity increased from 9% to 14% among men and from 8% to 12% among women.[8]

Data from the UK have shown that adult weight gain, the degree of obesity and the duration of obesity are all independent and strong predictors of the risk of type 2 diabetes.[9] Research from Denmark has estimated that 80–95% of the increase in diabetes in European countries can be attributed to obesity and overweight with abdominal fat distribution.[10] The present study estimated the population attributable risk (PAR) of excess body weight associated with diabetes among Canadians. Estimates of the contribution of overweight and obesity to diabetes prevalence, controlling for important covariates, can be used to communicate the importance of weight control and to evaluate progress in curbing the increase in diabetes.

Methods

The 2000–2001 Canadian Community Health Survey (CCHS) provides cross-sectional information related to health status, healthcare utilization and health determinants for the Canadian population. The CCHS uses a multistage stratified sampling design to select households. Excluded from the sampling frame are individuals living on Indian reserves or Crown lands, institutional residents, full-time members of the Canadian armed forces, and residents of certain remote regions. One person from each household is selected at random for the in-depth health survey.[11] Between September 2000 and November 2001, data were collected from over 130,000 individuals aged 12 years or older, living in private dwellings in one of 136 health regions, covering all provinces and territories. This represents a national response rate of 84.7%. Data from subjects aged 20–64 years were included in this analysis.

Respondents who answered the following question affirmatively were considered to have diabetes: 'Do you have diabetes diagnosed by a health professional?' Thirteen men and 19 women who answered 'don't know' to this question were excluded from the analysis. No distinction was made between type 1 and type 2 diabetes.

Body mass index [BMI; weight (kg)/height $(m)^2$] was calculated from self-reported data. Overweight was defined as $25.0 \leqslant BMI < 30.0$ and obesity was defined as $BMI \geqslant 30.0$.[12] The reference category was $BMI < 25.0$. BMI is not calculated for pregnant women.

Important covariates[8,13] included in this analysis were age, physical activity and income. Each factor was categorized into three levels. Subjects were grouped into age groups of 20–34, 35–49 and 50–64 years. Regular exercisers were those who undertook physical activities lasting more than 15 min at least 12 times per month, occasional exercisers were those who exercised 4 to 11 times per month, and infrequent exercisers were those who exercised 3 times per month or less. Subjects were classified into low-, middle- and high-income groups based on total household income, adjusted for the number of household members.[11] Low income was defined as $\leqslant$$14,999 for one- or two-person households, $\leqslant$$19,999 for three- or four-person households or $\leqslant$$29,999 for five-person households or more. Middle income was defined as $15,000–29,999 for one- or two-person households, $20,000–39,999 for three- or four-person households, or $30,000–59,999 for five-person households or more. High income was defined as $\geqslant$$30,000 for one- or two-person households, $\geqslant$$40,000 for three- or four-person households, or $\geqslant$$60,000 for five-person households or more. Subjects who did not respond to the questions about physical activity (3303 men and 1139 women) or income (2992 men and 3936 women) were excluded from the analysis.

The prevalence of diabetes and 95% confidence intervals (CI) were calculated. The prevalence of diabetes in the overweight and obesity groups was compared with that in the $BMI < 25\,kg/m^2$ group, and odds ratios (OR) with 95% CIs were calculated using the CCHS bootstrap weights. All analyses were weighted to the Canadian population. Logistic regression analyses were used to control for confounding factors.

The PAR and the preventable case number were calculated to estimate the proportion of diabetes