

ORIGINAL RESEARCH

Diabetes and Related Metabolic Conditions in an Aboriginal Cree Community of Quebec, Canada

Marie-Ludivine Chateau-Degat^{1,2} PhD, Daria Pereg² PhD, Grace M Egeland¹ PhD, Evert Nieboer^{3,4} PhD, Yv Bonnier-Viger⁵ MD MSc FRCPC, Elhadji A Laouan-Sidi² MSc, David Dannenbaum⁵ MD, Eric Dewailly² MD PhD

¹School of Dietetics and Human Nutrition, McGill University, Ste-Anne de Bellevue, Quebec, Canada

²Axe Santé des Populations et Environnement, Centre de Recherche du CHUQ, Centre hospitalier de l'Université Laval, Quebec, Canada

³McMaster University, Department of Biochemistry and Biological Science, Hamilton, Ontario, Canada

⁴University of Tromsø, Institute of Community Medicine, Tromsø, Norway

⁵Cree Board of Health and Social Services of James Bay, Chisasibi, Quebec, Canada

ABSTRACT

OBJECTIVE: We evaluated the prevalence of type 2 diabetes, obesity and metabolic syndrome according to International Diabetes Federation criteria in the First Nations Cree community of Mistissini, Quebec.

METHODS: A cross-sectional study of 172 adults was performed as part of a broader regional environmental study.

RESULTS: Type 2 diabetes, hyperinsulinemia and abdominal obesity were documented in 20%, 70% and 91% of participants, respectively. The prevalence of metabolic syndrome was 54%, with the main profile including abnormal plasma glucose levels (60%) associated with high triacylglycerol (40%). Women displayed the highest prevalence of abdominal obesity (99%). In both sexes, waist circumference was clearly associated with other metabolic parameters, such as blood glucose and lipid profile ($p < 0.0001$). However, a significant proportion of the population (13%), especially women, showed high waist circumference with no metabolic disturbances.

CONCLUSION: Among the Cree population of Mistissini, the results suggest that the high prevalence of abdominal obesity occurs most frequently in women, and earlier in women than in men. Subsequent metabolic disturbances associated with metabolic syndrome develop with age, supporting the core role of abdominal obesity in the cascade of events leading to diabetes and cardiovascular disease.

KEYWORDS: adiposity, cardiovascular risk, diabetes, metabolic syndrome, North American Indians, obesity

RÉSUMÉ

OBJECTIF : Nous avons évalué la prévalence du diabète de type 2, de l'obésité et du syndrome métabolique en fonction des critères de la Fédération internationale du diabète dans la communauté cri de Mistissini, au Québec.

MÉTHODES : Une étude transversale a été menée auprès de 172 adultes dans le cadre d'une plus vaste étude environnementale régionale.

RÉSULTATS : Le diabète de type 2, l'hyperinsulinémie et l'obésité abdominale étaient présents chez respectivement 20, 70 et 91 % des participants. La prévalence du syndrome métabolique était de 54 %, le principal profil comprenant un taux anormal de glucose dans le plasma (60 %) associé à un taux élevé de triacylglycérols (40 %). C'est chez les femmes que la prévalence de l'obésité abdominale était la plus élevée (99 %). Dans les deux sexes, le tour de taille était clairement associé à d'autres paramètres métaboliques, dont la glycémie et le bilan lipidique ($p < 0,0001$). Toutefois, dans une proportion significative de la population (13 %), surtout chez les femmes, le tour de taille était élevé, mais il n'y avait pas de perturbations métaboliques.

CONCLUSION : Les résultats obtenus dans la population cri de Mistissini donnent à penser que la prévalence de l'obésité abdominale est particulièrement élevée chez les femmes et que l'obésité abdominale survient plus tôt chez elles que chez les hommes. Les perturbations métaboliques subséquentes qui sont associées au syndrome métabolique apparaissent avec l'âge, ce qui démontre le rôle important que joue

Address for correspondence:

Marie-Ludivine Chateau-Degat, Axe Santé des Populations et Environnement

Centre de Recherche du CHUQ, Centre hospitalier de l'Université Laval, 2875 boulevard Laurier, Suite 600,

Quebec, Quebec, Canada G1V 2M2

E-mail: marie-ludivine.chateau-degat@crchul.ulaval.ca

l'obésité abdominale dans la cascade des événements qui mènent au diabète et à la maladie cardiovasculaire.

MOTS CLÉS : adiposité, diabète, Indiens de l'Amérique du Nord, obésité, risque cardiovasculaire, syndrome métabolique,

INTRODUCTION

Type 2 diabetes mellitus and obesity are major health threats of the 21st century, with a rapidly increasing yearly rate in developed and developing countries (1-4). Canadian Aboriginal communities, including the First Nations Cree, are not protected against the epidemic, and the prevalence of type 2 diabetes in this population is among the highest in the world (5-8).

The growing global interest in type 2 diabetes, obesity and related metabolic disturbances, such as dyslipidemia, high blood pressure (BP) and insulin resistance, is driven by their strong links to microvascular complications (3,5), cardiovascular morbidity and mortality. Indeed, all of these pathophysiological processes, considered alone or clustered into a condition currently labelled as metabolic syndrome, are prospectively associated with increased cardiovascular mortality (9-14).

In several Aboriginal populations, the recent transition from traditional to Westernized lifestyle habits, characterized by reduced physical activity and a diet high in refined carbohydrates, saturated fats and trans fats, has been observed, along with a concomitant increase in metabolic disturbances (15-17). Recently, several studies have highlighted high rates of type 2 diabetes and a sex disparity with respect to metabolic disturbances in Oji-Cree communities in Ontario (5,18-20). The influence of genetic background, in addition to known environmental and/or lifestyle factors, may partially explain these findings (18,19).

Our aim was to analyze the data gathered in the context of the Nituuchischaayihitaa Aschii (learn about us and our earth) study on environmental contaminants to estimate the prevalence of diabetes and related metabolic abnormalities in the Cree community of Mistissini, Quebec, and to establish a portrait of cardiovascular risk factors.

METHODS

Study design and sample population

A cross-sectional investigation was carried out in the Cree community of Mistissini, Quebec, in July 2005. Originating from a larger collaborative research effort between the Cree Board of Health and Social Services of James Bay (CBHSSJB) and McMaster, Laval and McGill universities, the study focused on a comprehensive environmental health study involving all 9 Cree communities of Quebec. All of the study's components were accepted by the ethics commit-

tees of 3 of the participating institutions McMaster, Laval and McGill universities. Community consent was obtained through formal resolutions, and all individual participants provided informed written consent.

A stratified random sampling design was used for recruitment, and 172 of 278 adults (≥ 18 years) chosen to participate were included, giving a participation rate of 62%.

Clinical interview and biological sample collection

The enrolled individuals responded to a series of questionnaires documenting lifestyle issues, dietary habits and diagnosed health conditions, including diabetes. Subsequently, a series of tests were conducted during a clinical session and biological specimens were collected. All participants were in a fasting state for at least 8 hours prior to venipuncture.

Laboratory analyses

Triacylglycerol levels were measured using standard enzymatic methods with a Vitros 950 Chemistry Station (Ortho-Clinical Diagnostics, Raritan, New Jersey), including the manufacturer's reagents. Calibration was achieved with the Vitros Chemistry Prototype Calibrator Kit 2 (Ortho-Clinical Diagnostics) and Vitros Performance Verifier fluids. High-density lipoprotein cholesterol (HDL-C) concentrations were quantified by the Vitros direct HDL-C slide assay (Ortho-Clinical Diagnostics), based on the precipitation of apolipoprotein B-containing lipoproteins by sulfate dextran/magnesium chloride and magnetic beads.

Fasting plasma insulin was measured by immunoassay with chemiluminescent detection (ADVIA Centaur® CP immunoassay system, Bayer HealthCare, Toronto, Ontario). Blood glucose was assessed by spectrophotometric assay (Vitros 950, Ortho-Clinical Diagnostics). All analyses were performed by the clinical biochemistry laboratory of the Centre hospitalier de l'Université Laval (CHUL).

Anthropometric and clinical measures

Height (to the nearest centimetre) and body weight were measured without shoes, using a stadiometer. These data were then combined to obtain body mass index (BMI) in kg/m^2 . The presence of obesity was determined using internationally recommended cutoff points (i.e. $\text{BMI} \geq 30 \text{ kg}/\text{m}^2$) (21). Waist circumference (WC) was estimated at the end of exhalation with a graduated inelastic tape located horizontally midway between the last floating rib and the iliac crest. If a subject's waist was not sufficiently defined, WC was measured at slightly below the last floating rib (22). Hip circumference (HC) was also obtained using a measuring tape placed around the hips at the pubic symphysis and the most prominent parts of the buttocks. WC and HC were recorded to the nearest half centimetre. BP was assessed 3 times with a manual mercury sphygmomanometer, a 15-inch stethoscope and a cuff

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