

Contents lists available at [ScienceDirect](#)

Canadian Journal of Diabetes

journal homepage:
www.canadianjournalofdiabetes.com

Original Research

Dietary Patterns in Adults with Type 2 Diabetes Predict Cardiometabolic Risk Factors

Nonsikelelo Mathe PhD^a, Pedro T. Pisa PhD^b, Jeffrey A. Johnson PhD^a, Steven T. Johnson PhD^{a,c,*}^a Alliance for Canadian Health Outcomes Research in Diabetes, School of Public Health, 2-040 Li Ka Shing Centre for Health Research Innovation, University of Alberta, Edmonton, Alberta, Canada^b Wits Reproductive Health & HIV Institute, University of Witwatersrand, Johannesburg, South Africa^c Centre for Nursing and Health Studies, Faculty of Health Disciplines, Athabasca University, Alberta, Canada

ARTICLE INFO

Article history:

Received 27 July 2015

Received in revised form

12 October 2015

Accepted 10 November 2015

Keywords:

cardiometabolic risk

diet patterns

type 2 diabetes

ABSTRACT

Objectives: Examining the diets of people living with type 2 diabetes may improve understanding of how diet affects disease progression. We derived dietary patterns in adults living with type 2 diabetes and explored associations among patterns, sociodemographic variables and cardiometabolic risk factors.

Methods: Dietary patterns were derived from food frequency questionnaires (FFQs) in 196 adults with type 2 diabetes using principal components analysis (PCA). Multilinear regression models were fitted for the differing dietary pattern scores so as to estimate the marginal contribution of each variable explaining variations in diet. Differences in clinical variables across dietary patterns, adjusting for sex, smoking and total energy intake, were assessed.

Results: Three principal components (PCs), or patterns, were identified, explaining 56.5% of the total variance in diet: (PC1) fried foods, cakes and ice cream; (PC2) fish and vegetables; and (PC3) pasta, potatoes and breads. Female sex, current smoker and total energy were significant associated with patterns. Total energy accounted for the greatest amount of variance in each pattern (11.2% for fried foods, cakes and ice cream, 3.89% for fish and vegetables and 9.21% for pasta, potatoes and breads). After adjustment for sex, smoking and total energy, the pasta, potatoes and breads pattern was inversely associated with systolic blood pressure and low-density lipoprotein-cholesterol.

Conclusions: Of the 3 distinct diet patterns characterized, the carbohydrate-based pattern was most closely associated with cardiometabolic risk factors. To better understand and improve self-management by people living with type 2 diabetes through dietary modifications, further improvements in measuring and assessing diet using comparable instruments and comparisons with apparently healthy populations is required.

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R É S U M É

Objectifs : L'étude des régimes alimentaires des personnes vivant avec le diabète de type 2 peut améliorer la compréhension sur la manière dont le régime alimentaire influe sur la progression de la maladie. Nous avons extrait les modèles de consommation alimentaire et exploré les associations entre les modèles, les variables sociodémographiques et les facteurs de risque cardiométabolique.

Méthodes : Nous avons extrait les modèles de consommation alimentaire des questionnaires sur la fréquence de consommation des aliments (QFCA) de 196 adultes souffrant du diabète de type 2 à l'aide de l'analyse en composantes principales (ACP). Nous avons ajusté les modèles de régression multilinéaire aux différents scores des modèles de consommation alimentaire pour estimer la contribution marginale de chaque variable expliquant les variations dans les régimes alimentaires. Nous avons évalué les différences entre les variables cliniques de tous les modèles de consommation alimentaire, l'ajustement sur le sexe, le tabagisme et l'apport énergétique total.

Mots clés :

risque cardiométabolique

modèles de consommation alimentaire

diabète de type 2

* Address for correspondence: Steven T. Johnson, PhD, Faculty of Health Disciplines, Centre for Nursing and Health Studies, Athabasca University, 1 University Drive, Athabasca, Alberta T9S-3A3, Canada.

E-mail address: sjohnson@athabascau.ca

Résultats : Nous avons déterminé 3 composantes principales (CP), ou modèles, qui expliquent 56,5 % de la variance totale dans les régimes alimentaires : (CP1) aliments frits, gâteaux et crème glacée; (CP2) poisson et légumes; (CP3) pâtes, pommes de terre et pain. Le sexe féminin, le fumeur actuel et l'énergie totale étaient significativement associés aux modèles. L'énergie totale expliquait le plus grand pourcentage de variance de chaque modèle (11,2 % pour les aliments frits, les gâteaux et la crème glacée, 3,89 % pour le poisson et les légumes, 9,21 % pour les pâtes, les pommes de terre et le pain). Après l'ajustement sur le sexe, le tabagisme et l'énergie totale, le modèle basé sur les pâtes, les pommes de terre et le pain était inversement associé à la pression artérielle systolique et le cholestérol à lipoprotéines de faible densité.

Conclusions : Entre les 3 modèles de consommation alimentaire distincts définis, le modèle basé sur les glucides était le plus étroitement associé aux facteurs de risque cardiométabolique. Pour mieux comprendre et améliorer la prise en charge autonome des modifications alimentaires des personnes vivant avec le diabète de type 2, il est nécessaire d'améliorer davantage les mesures et l'évaluation du régime alimentaire à l'aide d'instruments comparables et de comparaisons avec des populations apparemment en santé.

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Introduction

Diet modification is a key element of diabetes self-management (1,2). Dietary advice for people living with diabetes focuses on promoting consumption of low glycemic index (GI) foods (3), which have been shown to be effective in glycemic control (1). Diets that include fish and poultry, plant foods, vegetable oils and low-fat dairy products are associated with the most health benefits and can be protective against disease progression (4–6). In exploring the relationships between diet and disease, it has been conventional to examine the relationship between a single nutrient, such as fat or carbohydrate, and a particular disease state. However, single nutrients or foods may not be responsible for the diet-disease relationships (7). For instance, the effect of a single nutrient may be too small to detect, whereas the cumulative effect of multiple nutrients within a diet pattern may be large enough to detect (7).

Dietary pattern analysis detects groups of foods that tend to cluster (i.e. consumed together), and their combined effects on the risk for diseases or their effects in disease progression can be determined (7).

Type 2 diabetes increases the risk for cardiovascular complications (1). Interventions encouraging weight loss, lowering blood glucose and blood pressure and improving lipid profile reduce cardiovascular disease (CVD) risk in people living with type 2 diabetes (1). However, there is limited evidence of an optimal dietary approach for reduction of CVD risk in people living with type 2 diabetes. Thus, exploring the dietary patterns of people living with type 2 diabetes may strengthen the dietary recommendations for diabetes self-management. We aimed to characterize the dietary patterns and report the associations between distinct dietary patterns and cardiometabolic risk factors for CVD among adults living with type 2 diabetes.

Methods

Study population and setting

Data were obtained from adults living with type 2 diabetes who participated in the Healthy Eating And Active Living For Diabetes (HEALD) study (8). Briefly, HEALD was a pragmatic controlled trial designed to evaluate implementation of a novel, evidence-based self-management program for patients with type 2 diabetes within a primary care network (PCN) environment in Alberta, Canada. The intervention was an exercise-specialist led, group-based education program aimed at increased physical activity and improved low-glycemic index diets (8). The primary outcome was physical activity determined by self-report and pedometers. Eligible participants (>18 years old, living with type 2 diabetes; patients with PCNs; patients who had received basic diabetes education since diagnosis and were

proficient in the English language) were allocated to the intervention or control group through a time series alternation pattern. Those unable to provide informed consent; unable to read, understand and converse in English; having significant cardiovascular contraindications; having current depression or enrolled in another study were excluded (8). For the purposes of this analysis, baseline data (regardless of study arm allocation) were pooled for 196 participants who had viable dietary data. The Health Research Ethics Board at the University of Alberta granted study approval (study number: Pro00008427, approved September 22, 2009), and participants gave written informed consent. Trial registration number: Health Eating and Active Living with Diabetes: ClinicalTrials.gov identifier: NCT00991380. Date registered: October 7, 2009.

Dietary assessment

Dietary intake was assessed using the Block Fat/Sugar/Fruit/Vegetable screener, a 55-item food frequency questionnaire (FFQ) adapted from a longer version that has been shown to have good reliability and validity (9,10). The FFQ was modified to suit a Canadian population. The modification included deleting American foods or substituting them (or descriptive examples) with their Canadian equivalents. This 55-item tool took about 10 to 12 minutes to complete and included portion size descriptions for 39 food items to assist respondents in estimating quantities of foods and beverages consumed. The remaining 16 questions asked about usual intake of low-fat/trans-fat free or low-carbohydrate/low-sugar versions of various foods. Dietary data were analyzed by using the US Department of Agriculture nutrient file by NutritionQuest (Berkeley, California, USA) (11).

Clinical and physical measures

Fasting capillary blood samples were collected to assess glycated hemoglobin (A1C) levels (DCA Vantage, Siemens Canada Limited, Oakville, Ontario, Canada) and lipid profiles (Cholestech LDX, Health Management Systems, Plano, Texas, USA). Resting heart rate and blood pressure (BP) were collected (BpTRU, BpTRU Medical Devices, Coquitlam, British Columbia). Smoking status was determined by questionnaire. Anthropometric measurements, including weights, heights and waist circumferences were completed, and body mass indexes (BMIs) were calculated as kg/m².

Statistical analysis

Analyses were performed using STATA SE 10.1 (StataCorp, College Station, Texas, USA). Descriptive analysis of demographic characteristics, including age, sex, ethnicity, household income, marital status and education were undertaken.

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