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Original Research

Treatment of Hypoglycemia in Adult Patients with Type 1 Diabetes: An Observational Study



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ABSTRACT

Objectives: 1) To characterize the nutritional treatment of hypoglycemia in adult patients with type 1 diabetes mellitus and 2) to compare the characteristics of participants who follow the recommendations with the characteristics of those who do not.

Methods: A total of 121 adults with type 1 diabetes were included in this cross-sectional analysis. Participants completed a food record and a glycemia and insulin doses logbook to collect data on mild to moderate hypoglycemic events (glycemia <4.0 mmol/L or 4.0 to 5.0 mmol/L with symptoms) and their treatments over a 2-day period. Participants were identified as overcorrecting if they consumed, within 15 minutes after the episode, >20g of carbohydrates for correction. Self-administered questionnaires about fear of hypoglycemia were completed, and cardiometabolic profile variables were measured (glycated hemoglobin, blood pressure, lipid profile and body mass indexes).

Results: Of the 121 participants, 94 (78%) reported at least 1 hypoglycemic event, for a total of 271 events (2.2±2.1 episodes per patient). Of these events, 64% were treated within 15 minutes, and they were treated primarily with fruit juice or sweet beverages (39%) or mixed snacks (29%). Average carbohydrate intake for treatment was 32±24 grams. Of the participants, 73% overtreated their episodes. They were significantly younger and had greater fear of hypoglycemia than those who treated the episodes adequately. No difference was observed for cardiometabolic variables.

Conclusions: The majority of patients in our cohort overtreated their hypoglycemic episodes. These results suggest that hypoglycemia-correction education needs to be reinforced.

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R É S U M É

Objectifs : 1) Décrire le traitement nutritionnel de l'hypoglycémie chez les patients adultes atteints de diabète de type 1; 2) Comparer les caractéristiques des participants qui suivent les recommandations aux caractéristiques de ceux qui ne les suivent pas.

Méthodes : L'analyse transversale comptait 121 adultes atteints de diabète de type 1. Les participants remplissaient un journal alimentaire et un registre de glycémie et de doses d'insuline pour colliger les données des événements hypoglycémiques légers à modérés (glycémie <4,0 mmol/l ou 4,0 à 5,0 mmol/l avec des symptômes) et leurs traitements sur une période de 2 jours. Si les participants consommaient, dans les 15 minutes après l'épisode >20 g de glucides pour corriger leur hypoglycémie, nous considérons qu'ils avaient apporté une surcorrection. Nous avons fait remplir les questionnaires autoadministrés sur la peur de l'hypoglycémie et avons mesuré les variables du profil cardiométabolique (hémoglobine glyquée, pression artérielle, bilan lipidique et indice de masse corporelle).

Mots clés :

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Résultats : Parmi les 121 participants, 94 (78 %) rapportaient au moins 1 événement hypoglycémique, soit un total de 271 événements (2,2±2,1 épisodes par patient). Parmi ces événements, 64 % étaient traités dans les 15 minutes, principalement par des jus de fruits ou des boissons sucrées (39 %), ou encore, par des collations mixtes (29 %). L'apport moyen en glucides du traitement était de 32±24 grammes. Parmi les participants, 73 % surtraient leurs épisodes. Ils étaient plus jeunes et plus préoccupés par la peur de l'hypoglycémie que ceux qui traitaient leurs épisodes adéquatement. Nous n'avons observé aucune différence dans les variables cardiométaboliques.

Conclusions : La majorité des patients de notre cohorte surtraient leurs épisodes hypoglycémiques. Ces résultats montrent qu'il est nécessaire de renforcer l'enseignement portant sur la correction de l'hypoglycémie.

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Introduction

Intensive insulin therapy is the recommended treatment for type 1 diabetes mellitus, and it is associated with significantly reduced risks for microvascular complications, cardiovascular events and mortality (1–3). Achieving recommended glycemic targets (4) is, however, associated with an approximately 3-fold increased frequency of mild to moderate as well as severe hypoglycemia (1–5). Hypoglycemia is a major barrier to achieving glycemic targets (4). Hypoglycemia is defined as blood glucose levels <4.0 mmol/L, and it can be accompanied by adrenergic and/or neuroglycopenic symptoms (e.g. sweating, trembling, confusion, etc.). The symptoms are resolved by the intake of glucose (6). Episodes are considered severe when patients require the assistance of another person to undertake recovery treatment (6).

According to the Canadian Diabetes Association Clinical Practice Guidelines, when a hypoglycemic episode occurs in adults, 15 grams of carbohydrate, preferably in the form of glucose or sucrose tablets or solutions, are recommended to be ingested (4). After 15 minutes, glycemia levels should be retested, and if hypoglycemic states persist, an additional 15 grams of carbohydrate should be ingested, and so on, until recovery of normoglycemia (glycemia ≥4.0 mmol/L). The objective of this protocol is to normalize glycemia promptly while avoiding overtreatment, which could potentially lead to rebound hyperglycemia and weight gain through excessive calorie and carbohydrate intake (4). Few studies have investigated the proportion of patients with type 1 diabetes who adhere to guidelines for hypoglycemia treatment or they have used primarily retrospective questionnaires (7–9). These studies indicate that only 15% to 38% of patients with type 1 diabetes follow the guidelines for hypoglycemia treatment. Patients were more likely to consume more than the recommended amount of carbohydrates to treat their hypoglycemia episodes. However, to our knowledge, no report describes how patients treat their hypoglycemia episodes in real-life conditions and whether differences (e.g. medical histories or anthropometric or cardiometabolic differences) exist among patients who treat the episodes adequately and patients who overtreat them. In addition, because hypoglycemia events can be frequent (10), they could lead to significant caloric intake and, thus, contribute to the rising proportion of patients with type 1 diabetes who are overweight or obese, a state that could be associated with more unfavourable cardiometabolic risk profiles (11).

The purpose of the present study was 1) to characterize treatments in terms of quantity of carbohydrate intake and type of food ingested during mild to moderate hypoglycemia episodes in adult patients with type 1 diabetes in real-life conditions; and 2) to compare the characteristics, including the cardiometabolic profiles, of participants who treat their hypoglycemia episodes adequately to those that do not. We hypothesized that a large proportion of participants overtreat their hypoglycemia episodes and that overtreatment is associated with deteriorated cardiometabolic profiles.

Methods

Study design and subjects

This is a secondary analysis of a cross-sectional observational study that included 124 adults with type 1 diabetes recruited between 2011 and 2013. The main objective was to investigate factors associated with nocturnal hypoglycemia (10,11). All participants were recruited during routine medical visits or through advertisements by the provincial diabetes association, Diabète Québec. Inclusion criteria were being 18 years of age or older, having had a diagnosis of type 1 diabetes for 6 months or longer and being treated with multiple daily injections of rapid and basal insulin analogues or continuous subcutaneous insulin infusion. Ongoing pregnancy and 1 episode of severe hypoglycemia (requiring assistance for treatment) during the previous 3 months or 3 episodes or more during the previous year were exclusion criteria. Prior to testing, all participants provided written consent, and the study was approved by the ethics review boards of the Institut de Recherches Cliniques de Montréal and the Montreal University Hospital Centre.

Data collection

Participants were tested at the Institut de Recherches Cliniques de Montréal clinic during 2 visits scheduled approximately 1 week apart. The visits included measurements of the cardiometabolic risk factors: blood pressure, using an automatic sphygmomanometer following a 5-minute rest period (blood pressure was measured 3 times, and the mean value was used for analysis); glycated hemoglobin (A1C) levels; lipid profiles; and waist circumference measured to the nearest 0.1 cm in standing subjects at the top of the iliac crest. Visit 1 also included measurements of body weight in light clothing without shoes to the nearest 0.1 kg using a calibrated balance and height to the nearest millimetre using a stadiometer. Body mass indexes (BMIs) were calculated (kg/m²). Subjects were also asked to complete a 72-hour food record while completing a glycemia- and insulin-doses logbook. Instructions were given by a registered dietitian concerning how to complete these documents. To ensure similar duration of full data collection in all participants, only 2 complete days (48 hours) were used in this analysis. Participants were instructed to maintain their usual therapeutic, nutritional and physical activity habits. Data on sociodemographic status and usual hypoglycemia frequency (low to moderate and severe episodes) were collected by self-administered questionnaires. Perceptions of hypoglycemia symptoms were assessed using the Clarke method questionnaire, which allows the classification of patients as being aware, unaware or having reduced awareness (12). The Hypoglycemic Fear Survey was self-administered so as to quantify fear of hypoglycemia, including the behaviour subscale and the worry subscale (13). At visit 2, participants brought the glycemia and insulin doses logbooks and the food records. A registered dietitian reviewed the food records with participants and analyzed them using the Food Processor SQL (v. 10.8; ESHA Research, Salem, Oregon,

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