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Practices, perceptions and expectations for carbohydrate counting in patients with type 1 diabetes – Results from an online survey

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ABSTRACT

Aims: Characterize adult patients with diabetes on intensive insulin therapy in terms of: (a) practices and perceived difficulties relative to carbohydrate counting (CC) and diabetes treatment, and (b) their perceptions and expectations relative to CC.
Methods: Participants completed a 30-question web-based questionnaire.
Results: Participants with type 1 diabetes (T1D) and using CC as part of their treatment plan (n = 180) were included in this analysis. Participants were predominantly women (64%), aged 42 ± 13 years old and had diabetes for 22 ± 13 years. A large proportion of participants reported being confident in applying CC (78%) and considered precise CC as being important for glycemic control (91%), while only 17% reported finding CC difficult. Despite the low perceived difficulty associated with CC, many specific difficulties were encountered by patients such as the perception that glycemia fluctuates even with appropriate CC and that CC complicates the management of diabetes. A larger proportion of participants with a lower level of education (<university degree) and current or history of depression reported not feeling confident in applying CC. Most respondents believed that new technologies could facilitate CC (57%) and would be interested in such technology (62%).
Conclusions: Although a majority of participant reported being confident in applying CC, many difficulties and constraints associated with CC have been identified. These results highlight that patients with a lower level of education and with a history or current depression could benefit from specific CC education strategies. Future studies should examine the efficacy of technology tools to facilitate CC.

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1. Introduction

Diabetes treatment aims for optimal glucose control to lower the risk of micro or macrovascular complications [1,2]. Intensive insulin therapy using basal-prandial insulin regimen is the recommended treatment for most patients with type 1 diabetes. Patients are either on multiple daily injections (MDI) and receive basal insulin administered once or twice per day or on continuous subcutaneous insulin infusion (CSII) and have insulin delivered continuously throughout the day. In both types of treatment, a bolus of insulin is generally administered with each food intake.

Postprandial glycemic excursions are a major determinant of overall glycemic control [3]. The aim is, for most patients, to maintain 2-h postprandial glycemia <10.0 mmol/L [4]. Patients need to adjust the insulin dose to the dominant factor of post-prandial glucose excursion that is the quantity of carbohydrate ingested. This method is referred as carbohydrate counting (CC) [5–7]. In the context of intensive insulin therapy, patients need to calculate the quantity of carbohydrates included in their meal or snack and, based on their insulin-to-carbohydrate ratio, determine the appropriate insulin bolus to give. A precise CC is therefore essential to achieve optimal postprandial glucose control and minimize the risk of administrating an insulin dose that is too high or too low, that would result respectively in hypoglycemia or hyperglycemia [3,8]. Indeed, a meta-analysis including 5 studies conducted in the adult population with type 1 diabetes using CC revealed a significantly lower glycated hemoglobin by 0.64 percent point compared to patients using alternative advices [9]. In addition, within patients using CC, an accurate CC is associated with an improved glycemic control [10,11]. However, many other factors can also lead to glycemic variations and can be puzzling for patients, including the effect of other nutrients (e.g. fat, proteins or fiber), recent physical activity practice, alcohol consumption, stress, infections, previous hypoglycemia, etc. [12,13].

Moreover, CC requires a certain knowledge, discipline and precision which implicates identifying carbohydrate containing foods, estimating portion sizes and reading nutrition labels of packaged products. Thus, accurate CC can be a challenging task. A study in adults with type 1 diabetes found a mean error of 15 g of carbohydrate per meal, representing approximately 20% of the meal content [10] while a second study showed a tendency, in children and adolescents, to underestimate the carbohydrate content of larger meals and overestimate snacks [14]. Whether patients voluntarily avoid counting all their carbohydrates, over-simplify the calculation to reduce treatment burden, lack knowledge on the amount of carbohydrates in food or have a difficulty in evaluating it remains unknown.

Very limited data is available about patient's level of confidence and perceived level of difficulty with CC. While Souto et al. showed that a majority (77%) of type 1 diabetic participants reported not having any difficulty with CC [15], Lancaster et al. showed that many patients find CC inconvenient and not fitting with their variable lifestyle [16]. Yet, no study has looked specifically at the difficulties that patients encounter daily. Furthermore, new strategies or technologies (e.g. new insulin pumps or web-based applications) could possibly alleviate or simplify CC and ease the life of patients while improving their glycemic control. However, we have no information about patient's perception and expectations in relation with the potential ability of emerging technologies to simplify this aspect of their treatment.

Identifying specific difficulties and needs from patients would be helpful to improve clinicians' teaching strategies and develop appropriate tools to improve, simplify and facilitate CC. We thus performed a descriptive study that aimed to characterize type 1 diabetes patients, with intensive insulin therapy, in terms of (1) practices and perceived difficulties regarding CC and diabetes treatment, and (2) perceptions and expectations towards CC. We hypothesized that patients would encounter important challenges for CC and have high expectations towards new technologies to reduce CC burden.

2. Subjects, materials and methods

2.1. Participants

Adults with diabetes were invited to complete an online survey in French or English through; (1) the diabetes clinics from the *Institut de Recherches Cliniques de Montréal (IRCM)* and the *Montreal University Hospital Center* during the routine care of patients, (2) the clinical research database of patients from the IRCM and (3) an advertisement via the Website and the social media site (Facebook) of *Diabète Québec*, the provincial diabetes organization. Exclusion criteria were; language or intellectual barriers affecting the ability to complete the questionnaire. Prior to completing the survey, all subjects electronically gave their consent. Ethical approval was obtained from the IRCM ethic review board. As an incentive to participate to the survey, an electronic tablet was drawn between all the participants. To exclude the possibility of having a participant complete the questionnaire more than once, only one questionnaire by IP address was accepted.

2.2. Questionnaire and data collection

This study consists of a web-based questionnaire specifically developed for this study and filled by participants between September 1st, 2015 and March 15th, 2016. The questionnaire was designed by health care professionals and was based on clinical experiences regarding the challenges and barriers faced by patients. The questionnaire was created using the Survey Monkey® Gold platform. It included 30 questions, three of which contained 7, 12 and 5 sub questions each. The questions were closed questions: either multiple choices questions or Likert-type scales with 5 levels (strongly disagree; disagree; neither agree nor disagree; agree; strongly agree). One open-ended question assessed any additional difficulties perceived by patients. The first 6 questions were related to socio-economic status and demographics. Diabetes complications as well as HbA1c values were self-reported by participants. The following 9 questions were related to general diabetes management and practices while the 13 subsequent questions were specifically assessing practices and perceptions towards CC, and finally, the last two questions