



Research report

Disinhibited eating and weight-related insulin mismanagement among individuals with type 1 diabetes ☆

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ABSTRACT

Objective: Withholding insulin for weight control is a dangerous practice among individuals with type 1 diabetes; yet little is known about the factors associated with this behavior. Studies of nondiabetic individuals with weight concerns suggest that eating in a disinhibited manner (e.g., binge eating) predicts the use of maladaptive compensatory strategies (e.g., self-induced vomiting). The purpose of this study was to test whether individuals with type 1 diabetes are less restrained in their eating when they think their blood glucose (BG) is low and whether this contributes to insulin omission for weight control purposes and subsequently higher hemoglobin A1c (HbA1c). **Methods:** Two-hundred and seventy-six individuals with type 1 diabetes completed an online survey of eating behaviors, insulin dosing and most recent HbA1c. We used structural equation modeling to test the hypothesis that disinhibited eating when blood sugar is thought to be low predicts weight-related insulin mismanagement, and this, in turn, predicts higher HbA1c. **Results:** The majority of participants endorsed some degree of disinhibition when they think their blood glucose is low (e.g., eating foods they do not typically allow) and corresponding negative affect (e.g., guilt/shame). The frequency of disinhibited eating was positively associated with weight-related insulin mismanagement. Controlling for age, sex, education, and insulin pump use, the model explained 31.3% of the variance in weight-related insulin mismanagement and 16.8% of the variance in HbA1c. **Conclusion:** Addressing antecedents to disinhibited eating that are unique to type 1 diabetes (e.g., perceived BG level), and/or guilt or shame for unrestrained eating when hypoglycemic may reduce weight-related insulin omission.

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Introduction

Insufficient insulin dosing among individuals with diabetes leads to higher hemoglobin A1c (HbA1c) (Morris et al., 1997; Zisser, Rivera, & Lane, 2013), increased hospitalizations (Morris et al., 1997), early and severe diabetes-related medical complications (Takii et al., 2008), and a three-fold increase in premature death (Goebel-Fabbri et al., 2008). Intentional insulin omission is common among 20% of diabetic patients (Peyrot et al., 2010), and particularly among young women with type 1 diabetes with prevalence estimates ranging from

30% to 57% (Goebel-Fabbri et al., 2008; Jones et al., 2000; Nielsen, 2002; Peyrot et al., 2010; Schober et al., 2011; Young-Hyman & Davis, 2010). Recent studies have indicated that diet non-adherence (Peyrot et al., 2010) and dissatisfaction with body weight are associated with the most extreme and purposeful insulin omission (Takii et al., 2008) among individuals with type 1 diabetes. This is in contrast to individuals with type 2 diabetes, for whom age, income, pain, and the embarrassment of injections have been found to be better predictors (Peyrot et al., 2010).

Insulin omission, while exceedingly dangerous, is an effective weight control strategy. Administering insufficient insulin results in excretion of glucose into the urine (i.e., glycosuria) (Consultation, 1999; Forman, Goldstein, & Genel, 1974). Thus, rather than this sugar being absorbed by muscle and fat cells, it is essentially “purged,” allowing the individual to eat without the impact of additional unwanted calories (Kelly et al., 2005). While this may seem like a convenient method of weight control, withholding insulin is potentially life-threatening and may lead to diabetic ketoacidosis or cause additional irreparable nerve damage (Goebel-Fabbri et al., 2008; Pinhas-Hamiel et al., 2013). The prevalence of intentional insulin

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omission among individuals with type 1 diabetes suggests that there might be unique features of this chronic illness that increase the risk for engaging in maladaptive weight control strategies. One factor may be increased body dissatisfaction among individuals with type 1 diabetes due to the weight gain associated with insulin therapy, combined with a highly effective method for weight loss (Goebel-Fabbri et al., 2011). However, interventions that effectively decrease body dissatisfaction among individuals with type 1 diabetes fail to improve diabetes management and glycemic control (e.g., HbA1c) (Goebel-Fabbri, 2009; Olmsted et al., 2002; Rodin et al., 2002), suggesting the presence of other factors that influence the decision to withhold insulin on a particular day, or for a particular meal or snack. Identifying these factors might allow for the development of sensitive and specific interventions for this patient population.

Among individuals *without* type 1 diabetes, attempting to restrain eating in a rigid or extreme manner paradoxically increases the risk of disinhibited eating (eating more than one intends to in an *uncontrolled way*) (Polivy & Herman, 1985). This is particularly likely to happen when there is an elimination of foods that are enjoyed. For example, in typical populations, an individual who attempts to adhere to the dietary rule “*I must not eat cake*” is more likely to overeat when cake is consumed (referred to as the *abstinence-violation effect*) (Collins & Witkiewitz, 2013; Grilo & Shiffman, 1994). Of importance, even imagining one will have to restrain eating (e.g., start a diet) in the future results in otherwise healthy individuals eating in a disinhibited manner in anticipation of the deprivation that is to come (Urbaszat, Herman, & Polivy, 2002). Among typical populations, disinhibited eating is associated with guilt and shame, and for some individuals without type 1 diabetes, attempts to reduce the risk of weight gain via self-induced vomiting, excessive exercise or other problematic strategies (Stice et al., 2000). Although strategies such as vomiting and intense exercise would be expected to be less common among diabetic patients due to an increased risk for hypoglycemia, breaking dietary restraint in this manner may lead to insulin omission as a way to minimize the impact of excess calories on weight and re-establish a sense of control (by controlling weight).

Individuals with type 1 diabetes must be more cognizant of food choices than their non-diabetic counterparts, and must carefully plan food intake and insulin administration to ensure that sufficient insulin is available to meet their body's needs (Kovacs et al., 1992; Nathan, 1993). Although flexible eating and insulin dosing is currently recommended (e.g., allowing occasional desserts, but dosing insulin adequately for these desserts) (Association, 2011; Group, 2002), the restraints imposed by type 1 diabetes may lead some individuals to approach their condition as a strict diet, adopting rigid dietary rules that leave them feeling deprived (e.g., “no eating between meals,” “no sweets”). At the same time, diabetes might also set up conditions to violate self-imposed dietary rules (e.g., consuming “junk food”) when BG is low or rapidly declining. Although it is necessary to respond to BG decline by consuming fast-acting carbohydrate (and in some situations this may include highly processed foods or desserts), in some cases, this may lead to eating more of these foods than one intends and may generate psychological distress (feeling a loss of control or guilt and shame), increasing risk of weight-related insulin omission as a maladaptive compensatory strategy. If this occurred regularly (for example, when BG is only relatively low compared to an individual's average BG) it could have a significant negative impact on HbA1c.

In the current study, we administered an online survey to individuals diagnosed with type 1 diabetes. The survey assessed the experience of eating and insulin dosing and diabetes management. We hypothesized that disinhibited eating when BG is thought to be low and associated psychological sequelae would predict weight-related insulin omission, which in turn would predict higher HbA1c.

Research design and methods

Participants and procedure

The sample was drawn from two major medical centers in the Southeastern United States. Participants learned about the study through email announcements and flyers displayed in patient areas. The study was described to participants as an online survey related to eating attitudes and diabetes management for individuals with type 1 diabetes. No other information was provided about the content of the questions in the advertising materials. Participants had to voluntarily access the survey online. Participants provided demographic information and completed questions about their eating behavior, diabetes regimen, history of complications, and most recent HbA1c. They also completed the Diabetes Eating Problems Survey-Revised (DEPS-R) (Markowitz et al., 2010). The survey was conducted from 2010 to 2012 and delivered using Qualtrics.com®, an online survey platform. All procedures were approved by the respective institutional review boards.

Measures

Disinhibited eating when BG is perceived to be low

There are no established self-report measures that query the experience of eating when BG is thought to be dropping or low. Thus, we developed and administered four individual items; two behavioral and two emotional indicators of disinhibited eating. To assess behavioral indicators of *Disinhibited Eating*, participants were asked whether they relinquished control over food type and food amount when they think their BG is low: “*When you think your blood sugar is low, do you eat foods that you do not normally “allow” yourself to have (e.g., chips, candy, etc.)?*” (Allow Foods: Q2); and “*When you think your blood glucose is low, do you continue to eat until you feel better, rather than waiting 15 minutes or so between servings to see if your symptoms remit?*” (Continue to Eat: Q3). For emotional indicators of disinhibited eating, participants were asked the following: “*Do you feel like you lose control over your eating when your blood sugar is low?*” (Loss of Control: Q1); and “*Does eating in a way that is out of your normal routine, for example, having a snack in between meals, when your blood sugar is low, make you feel guilty, shameful or regretful?*” (Guilt/Shame: Q4). Of note, participants were not asked whether they checked their blood sugar at these times, or whether they were below 70 mg/dL. Thus, this construct is best described as *Disinhibition* in response to perceived (rather than actual) low BG.

Item responses were on 6-point Likert scales, ranging either from 0 (*Never*) to 5 (*Always*), or from 0 (*Not at All*) to 5 (*Very Much*). For each of the four items, if individuals endorsed the presence of the behavior or experience (i.e., responded with a 1 or greater), they were asked the subsequent item assessing the frequency at which this behavior or experience occurred (1 = *Less than once a month*; 6 = *Daily*). If the participant responded with 0 (*Never*) the subsequent frequency item was not asked. This method shortened the survey administration time for individuals for whom items were not relevant. If this subsequent frequency item was not asked, individuals received a 0 (*Never*) for the frequency item, rather than it being coded as “missing.” The recoded frequency items of each variable (i.e., Loss of Control: Q1; Allow Foods: Q2; Continue to Eat: Q3; and Guilt/Shame: Q4) were used in subsequent analyses.

Weight-related insulin mismanagement

Although there is not an established measure that specifically assesses weight-related insulin mismanagement, there is a scale that assesses diabetes-specific eating disorder symptomatology (i.e., DEPS-R, Markowitz et al., 2010), which includes relevant items that may function as indicators of this form of insulin omission. The DEPS-R

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