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Pathways of the relationships among eating behavior, stress, and coping in adults with type 2 diabetes: A cross-sectional study

Minsun Park^a, Laurie Quinn^{a,*}, Chang Park^b, Pamela Martyn-Nemeth^a

^a Department of Biobehavioral Health Science, College of Nursing, University of Illinois at Chicago, United States
^b Department of Health Systems Science, College of Nursing, University of Illinois at Chicago, United States

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ABSTRACT

Stress is related to eating behavior, and eating behavior is important in diabetes treatment. The aim of this study was to examine the relationships among perceived stress, diabetes-related stress, coping strategies, and eating behaviors in adults living with type 2 diabetes (T2DM). Adults with type 2 diabetes (n = 183) were recruited from a large metropolitan area in the Midwest United States. Stress factors and coping strategies associated with eating behaviors were measured using validated questionnaires. Structural equation modeling was used to investigate the relationships among perceived stress, diabetes-related stress, coping strategies, and eating behaviors. The final model showed that emotion-oriented coping partially mediated the effect of stress on eating behaviors. Specifically, emotion-oriented coping partially mediated the effect of diabetes-related stress on restrained eating behavior (r = 0.318, p < .001) and emotional eating behavior (r = 0.399, p < .001); emotion-oriented coping was found to be a partial mediator in the path model between stress and eating behaviors in people with type 2 diabetes. Knowledge of the association of stress with eating behaviors may prove important for health care providers in treatment and care of people with type 2 diabetes.

1. Introduction

Currently an estimated 371 million people are living with diabetes worldwide (International Diabetes Federation [IDF], 2012), of which type 2 diabetes (T2DM) accounts for approximately 90% (World Health Organization [WHO], 2013). Prevalence rates for T2DM in the U.S. have risen sharply over the past three decades for all age groups, in both men and women, and in members of all racial and ethnic groups (Centers for Disease Control and Prevention, 2013). Death rates for heart disease and the risk of stroke are 2-4 times higher among adults with diabetes than among those without diabetes (American Diabetes Association, 2013). Diabetes also can lead to other complications, such as vision loss, kidney failure, nervous system disease, and amputations of legs or feet (WHO, 2013). The average medical expenses for a person with diabetes are more than twice as high as for a person without diabetes (IDF, 2012). Although nutrition therapy is considered a cornerstone of T2DM treatment, most studies of dietary treatment in T2DM focused on how the type and amount of food eaten can affect glucose control and lipid metabolism (Carter, Gray, Troughton, Khunti, & Davies, 2010; de Munter, Hu, Spiegelman, Franz, & van Dam, 2007; Murakami, Okubo, & Sasaki, 2005), not on *how* people with T2DM eat and *why* they eat.

1.1. Concepts

Definitions of each concept are shown in Table 1.

1.2. Eating behavior, stress, and coping

1.2.1. Eating behavior and stress

Van strien and colleagues (van Strien, Fritjers, Bergers, & Delfares, 1986) defined three different eating behaviors derived from three prevailing eating behavior theories that may help in understanding the psychological aspects of eating behaviors: restrained, external, and emotional eating behavior. People who exhibit restrained eating, derived from restraint theory (Herman & Mack, 1975), tend to restrict food or calorie intake to control one's self-image or prohibit weight gain (Cohen et al., 1983). Whereas, individuals who engage in external eating, derived from externality theory (Bruch, 1964), tend to overeat in the presence of food or sensory cues (i.e., smell, sight; Braet & Van

E-mail address: lquinn1@uic.edu (L. Quinn).

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^{*} Corresponding author. Department of Biobehavioral Health Science, University of Illinois at Chicago, 845 S. Damen Ave. (MC 802), Chicago, IL, 60612, United States.

List of abbreviations		DEBQ PSS	Dutch Eating Behavior Questionnaire, Perceived Stress Scale
BMI	Body Mass Index	RBG	Random Blood Glucose Measure
CCI	Charlson Comorbidity Index	RMSEA	Root Mean Square Error of Approximation
CFI	Comparative Fit Index	T2DM	Type 2 Diabetes
CISS	Coping Inventory for Stressful Situations	TMSC	Transactional Model of Stress and Coping
DDS	Diabetes Distress Scale		

Table	1
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Definitions of each concept.

Concept	Definition	
Eating Behavior	Restrained eating behavior	To restrict food or calorie intake to control one's self-image or prohibit weight gain (Cohen, Kamarck, & Mermelstein, 1983)
	External eating behavior	To overeat in the presence of food or sensory cues (i.e., smell, sight) (Braet & Van Strien, 1997)
	Emotional eating behavior	To overeat in response to negative emotions (Bruch, 1964)
Stress	Perceived stress	Individual appraisals of one's life as stressful (Cohen et al., 1983)
	Diabetes-related stress	The emotional stress related to diabetes self-management, relationships with health care providers, and interpersonal
		relationships (Cohen & Williamson, 1988)
Coping Strategy	Task-oriented coping	An active strategy that involves behaviors aimed at managing the problem and includes active coping, problem solving, and
		seeking information (Endler & Parker, 1994)
	Emotion-oriented coping	A way of regulating emotions associated with a stressor (Endler & Parker, 1994)
	Avoidance-oriented coping	It involves avoiding stress by distracting oneself (Endler & Parker, 1994)

Strien, 1997). People who exhibit emotional eating, derived from psychosomatic theory (Kaplan & Kaplan, 1957), tend to overeat in response to negative emotions (Bruch, 1964).

A previous study indicated that the general population, people with T2DM, and those newly diagnosed with T2DM had similar eating behaviors (van de Laar et al., 2006). External and emotional eating behavior are associated with high calorie intake; restrained eating behavior is associated with low calorie intake. Those authors also reported that people with T2DM had significantly decreased external eating behavior and increased restrained eating behavior four years after being diagnosed with T2DM (van de Laar et al., 2006). However, emotional eating behavior did not change. In addition, according to Ryan and colleagues (Ryan, Gallanagh, Livingstone, Gaillard, & Ritz, 2008), people with T2DM had more restrained eating behavior than people with type 1 diabetes.

It is not clear which factors influence eating behavior in people with T2DM. Data in this area are scarce. However, stress plays an important role in determining eating behavior. According to the theory of stress-induced eating (Heatherton & Baumeister, 1991), the cognitive load of coping with a stressor may overwhelm self-regulatory resources so that people focus on eating rather than focusing on the stressor. Stress appears to alter overall food intakes in two ways, resulting in under-eating or overeating (American Psychological Association, 2007; Torres & Nowson, 2007; Wallis & Hetherington, 2009). Relationships between stress and eating have been studied in the general population (Greeno & Wing, 1994; Macht, 2008; Newman, O'Connor, & Conner, 2008;

Renner, Sproesser, Strohbach, & Schupp, 2012). Stress is associated with both increased (Liu et al., 2007; Newman et al., 2008; Ng & Jeffery, 2003) and/or decreased (Newman et al., 2008; Stone & Brownell, 1994) food intake and/or eating behavior (Bekker, van de Meerendonk, & Mollerus, 2004; Greeno & Wing, 1994; Torres & Nowson, 2007) in the general population.

In T2DM, stress potentially comes from two cumulative sources: (1) specific, diabetes-related management stress associated with repetitive intrusive treatment regimens or disabling chronic complications and (2) the daily psychological stress of living with a chronic disease (Fisher, Hessler, Polonsky, & Mullan, 2012; Naranjo, Fisher, Areán, Hessler, & Mullan, 2011). Though people living with T2DM experience daily psychological stress (Surwit & Williams, 1996; van Son et al., 2013) and diabetes-related stress (Rubin & Peyrot, 2001; Surwit & Williams, 1996), research is limited on the impact of stress on eating behavior in this population. One research study reported that high levels of diabetes-related stress predicted future unhealthy eating behavior (e.g., fast foods, sodas, sweet tea) in people with T2DM (Fisher et al., 2012). Tak and colleagues (Tak et al., 2015) found that diabetes-related stress was associated with restrained, external, and emotional eating behavior in people with diabetes. Diabetes itself and its daily self-management can seriously burden people, resulting in diabetes-related stress (Rubin & Peyrot, 2001), depression (Solowiejczyk, 2010), and reduced quality of life (Fisher et al., 2012; Pouwer, 2009). Because people with T2DM experience higher levels of psychological stress than people without diabetes (Levy, 2014), people with T2DM may eat more or less due to



Fig. 1. The hypothesized path model for relationships among stress, coping strategies, and eating behavior.

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