



## Research report

# Neighborhood food environment role in modifying psychosocial stress–diet relationships <sup>☆</sup>



Shannon N. Zenk <sup>a,\*</sup>, Amy J. Schulz <sup>b</sup>, Betty T. Izumi <sup>c</sup>, Graciela Mentz <sup>b</sup>, Barbara A. Israel <sup>b</sup>, Murlisa Lockett <sup>d</sup>

<sup>a</sup> Department of Health Systems Science, College of Nursing, University of Illinois at Chicago, 845 South Damen Avenue M/C 802, Chicago, IL 60612, USA

<sup>b</sup> Department of Health Behavior and Health Education, University of Michigan, 1415 Washington Heights, Ann Arbor, MI 48109, USA

<sup>c</sup> School of Community Health, Portland State University, 506 SW Mill St., Portland, OR 97201, USA

<sup>d</sup> Detroit Department of Health and Wellness Promotion, 1151 Taylor Administrative Offices Third Floor, Detroit, MI 48202, USA

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## ABSTRACT

Exposure to highly palatable foods may increase eating in response to stress, but this behavioral response has not been examined in relation to the neighborhood food environment. This study examined whether the neighborhood food environment modified relationships between psychosocial stress and dietary behaviors. Probability-sample survey ( $n = 460$ ) and in-person food environment audit data were used. Dietary behaviors were measured using 17 snack food items and a single eating-out-of-home item. Chronic stress was derived from five subscales; major life events was a count of nine items. The neighborhood food environment was measured as availability of large grocery stores, small grocery stores, and convenience stores, as well as proportion of restaurants that were fast food. Two-level hierarchical regression models were estimated. Snack food intake was positively associated with convenience store availability and negatively associated with large grocery store availability. The measures of chronic stress and major life events were generally not associated with either dietary behavior overall, although Latinos were less likely to eat out at high levels of major life events than African Americans. Stress-neighborhood food environment interactions were not statistically significant. Important questions remain regarding the role of the neighborhood food environment in the stress–diet relationship that warrant further investigation.

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## Introduction

Experimental and observational evidence in animals and humans suggests that consumption of sweet, high-fat, and perhaps

salty foods may increase under stress (Adam & Epel, 2007; Gibson, 2006; Macht, 2008; Oliver, Wardle, & Gibson, 2000; Torres & Nowson, 2007; Torres, Turner, & Nowson, 2010). Much of this research in humans has focused on acute stress in the form of daily hassles or as experimentally induced in the laboratory. One study found, for example, that more daily hassles were associated with increased consumption of snacks high in fat or sugar (O Connor, Jones, Conner, McMillan, & Ferguson, 2008). Research has also linked non-specific measures of perceived stress to intake of salty snacks (Laugero, Falcon, & Tucker, 2011) and intake of sweet foods among diabetics and overweight individuals (Laugero et al., 2011; Sims et al., 2008). Moreover, several studies have found relationships between negative emotions (e.g., depressive symptoms) or emotional eating (tendency to eat in response to negative emotions) and poorer dietary behaviors, including fast food consumption, soft drink consumption, and sweet energy-dense food intake (Beydoun et al., 2009; Crawford, Khedkar, Flaws, Sorokin, & Gallicchio, 2011; Elfhag, Tholin, & Rasmussen, 2008; Jeffery et al., 2009; Kontinen, Mannisto, Sarlio-Lahteenkorva, Silventoinen, & Haukkala, 2010; Macht, 2008). Chronic stress has been the subject of less human research (Torres et al., 2010). One study found that chronic stress was positively associated with highly palatable,

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\* Corresponding author.

E-mail address: [szenk@uic.edu](mailto:szenk@uic.edu) (S.N. Zenk).

nutrient poor food intake (e.g., chips, fried foods, burgers, and sweetened beverages) (Groesz et al., 2011). Intake of highly palatable foods, such as those high in fat, sugar, or salt, may activate the endogenous opioid (reward) system and reduce the hypothalamic–pituitary–adrenal (HPA) axis stress response, thereby alleviating symptoms of stress (Adam & Epel, 2007; Dallman et al., 2003; Warne, 2009). Highly palatable food intake may also reduce stress via sensory pleasure, distraction or escape, and other nutritional or metabolic effects (Gibson, 2006).

Less is known about relationships between stress and diet in racial/ethnic minority and groups of low socioeconomic status (SES). Understanding stress–diet relationships in these populations may be particularly important because they are disproportionately exposed to stressful living conditions and events, such as under-resourced neighborhoods, discrimination, and economic hardship (Israel et al., 2006; Lantz, House, Mero, & Williams, 2005; Logan, Alba, McNulty, & Fisher, 1996; Thoits, 2010), and are often at increased risk for poor diet and related chronic health conditions, such as obesity (Flegal, Carroll, Kit, & Ogden, 2012). Intake of foods high in sugar, fat, or salt may be an environmentally accessible and relatively inexpensive response to stressful life circumstances or events within these populations (Drewnowski, Darmon, & Briend, 2004; Jackson, Knight, & Rafferty, 2010).

Growing research suggests that the food environment – both access to healthy food products and exposure to energy-dense, nutrient poor foods and beverages – varies across neighborhoods and may influence dietary behaviors. While less consistent in other countries, racial/ethnic minority and low SES populations in the US disproportionately reside in neighborhoods with ubiquitous access to foods high in sugar, fat, and/or salt and few healthy alternatives (Beaulac, Kristjansson, & Cummins, 2009; Larson, Story, & Nelson, 2009). Although the evidence is mixed, some research shows that living in a neighborhood with a wide selection of healthy food products is associated with healthier dietary behaviors (e.g., greater fruit and vegetable intake and higher overall dietary quality) (Caspi, Sorensen, Subramanian, & Kawachi, 2012; Giskes, Van Lenthe, Avendano-Pabon, & Brug, 2010). Other research has found that living in neighborhoods with greater availability of energy-dense nutrient poor food is associated with less healthy dietary behaviors (Larson et al., 2009). Many of these studies have used outlet type as a proxy for food availability. Supermarkets and large grocery stores generally have more healthy food options than small grocery stores and convenience stores (Farley et al., 2009; Glanz, Sallis, Saelens, & Frank, 2007; Liese, Weis, Pluto, Smith, & Lawson, 2007; Zenk, 2005). While snack foods and sugar-sweetened beverages are often available across store types (Cameron, Thornton, McNaughton, & Crawford, 2012; Farley, Baker, Futrell, & Rice, 2010; Thornton, Cameron, McNaughton, Worsley, & Crawford, 2012), convenience stores predominately carry energy-dense, nutrient poor snack foods and beverages (Lucan, Karpyn, & Sherman, 2010; Sharkey, Dean, & Nalty, 2012). For example, a US study showed that convenience stores, on average, had the highest proportion of shelf space dedicated to salty snacks, candy, and cookies/pastries and among the highest shelf space for carbonated beverages (Farley et al., 2009). This study also showed that small food stores had relatively high availability of snack foods and carbonated beverages. Nonetheless, while high exposure to snacks and sugar-sweetened beverages may entice impulse purchasing, research testing relationships between the neighborhood food environment and consumption of these food products specifically is scarce. However, one study in New Orleans, Louisiana found that greater neighborhood shelf space for snack foods was positively associated with body mass index of local residents (Rose et al., 2009).

Studies have also examined neighborhood restaurant availability and dietary behaviors. Eating out of home, or consumption of food products purchased or prepared out of home such as at a

restaurant, is associated with energy-dense food selection, higher fat intake, and cravings for snacks (Bezerra, Curioni, & Sichieri, 2012; Lachat et al., 2012; Orfanos et al., 2007; Siwik & Senf, 2006). Frequenting fast food restaurants as compared to full-service or sit-down restaurants may be particularly deleterious for dietary behaviors and health because of large portion sizes and the high energy-dense profiles of foods (Duffey, Gordon-Larsen, Steffen, Jacobs, & Popkin, 2009; Garber & Lustig, 2011; Larson, Neumark-Sztainer, Laska, & Story, 2011). Yet, research has found no consistent evidence that the availability of healthy food options differs by restaurant type (Saelens, Glanz, Sallis, & Frank, 2007). Research on neighborhood restaurant availability, particularly fast food restaurant availability, and dietary behaviors has been mixed, with recent reviews of the literature noting that some research finds greater availability or a higher ratio of fast food to other restaurants is associated with greater consumption of fast food and poorer dietary intakes and others find no association (Caspi et al., 2012; Fleischhacker, Evenson, Rodriguez, & Ammerman, 2011).

The type and variety of foods available and other food cues may alter the stress–diet relationship (Adam & Epel, 2007; Loxton, Dawe, & Cahill, 2011; Torres & Nowson, 2007; Wallis & Hetherington, 2009). Some animal research suggests that stress has larger effects on diet when highly palatable foods are available than when less hedonic foods are present. In a laboratory experiment with humans, one study found that induction of a negative mood was associated with urge to eat when exposed to a desirable food cue (i.e., fast food or confectionary presented in a wrapper and opened by participants) among disinhibited eaters (i.e., those who tend to lose control over eating) (Loxton et al., 2011). In real-world settings, the neighborhood food environment may serve as a cue that alters the stress–diet relationship. Stress may be particularly likely to increase consumption of foods high in sugar, fat, and/or salt when these options are readily accessible and healthy foods are scarce. For example, living in neighborhoods with more convenience stores and restaurants, especially fast food restaurants, and fewer supermarkets or large grocery stores, may trigger or exacerbate effects of psychosocial stress on consumption of foods high in sugar, fat, or salt. These outlets may make these food choices more convenient and healthy alternatives less convenient to purchase for individuals experiencing stress. They may also serve as environmental cues that elicit eating under stress (Cohen & Farley, 2008; Garber & Lustig, 2011). However, the role of the neighborhood food environment in modifying the stress–diet relationship has not been tested. In an effort to understand inconsistent relationships between the neighborhood food environment and diet, one study tested whether weekly stressful events moderated the relationship between neighborhood supermarket and grocery store availability and fruit and vegetable intake in African American and Hispanic women, but found no relationship (Ledoux et al., 2012).

The purpose of the present study was to examine the roles of psychosocial stress and the neighborhood food environment in dietary behaviors – specifically intake of highly palatable snack-type food products high in sugar, fat, or salt (snack foods) and eating out of home – in a multiethnic, relatively low SES urban population. We hypothesized that: (1) stress is positively associated with snack food intake and eating out of home; (2) poorer quality neighborhood food environment (no large grocery store and more small grocery stores, convenience stores, and fast food restaurants) is positively associated with snack food intake and eating out of home; and (3) poorer quality neighborhood food environment exacerbates positive relationships between stress and snack food intake as well as eating out of home.

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