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Contextual correlates of energy-dense snack food and sweetened beverage intake across the day in African American women: An application of ecological momentary assessment

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ABSTRACT

This study examined relationships between contextual factors and within-person variations in snack food and sweetened beverage intake in African American women (n = 79), aged 25–65 years living in metropolitan Chicago. For seven days, participants wore a global positioning system (GPS) logger and were signaled five times per day to complete an ecological momentary assessment (EMA) survey assessing behaviors and environmental, social, and other contextual factors via smartphones. Within-person associations between snack food and beverage intake and contextual factors were analyzed using three-level logistic regressions. Participants reported consuming a snack food at 38.4% of signals and a sweetened beverage at 17.9% of signals. Fast food restaurant and convenience store density within the daily activity space was not associated with either snack food or sweetened beverage intake. However, perceptions of close proximity to fast food restaurants and convenience stores making it easier to eat/drink, while accounting for one's usual proximity, were associated with increased odds of snack intake (O.R. 2.1; 95% C.I. 1.4, 3.0) but not sweetened beverage. We also found engaging in activities such as watching television (O.R. 1.8; 95% C.I. 1.2, 2.7) and talking (O.R. 1.7; 95% C.I. 1.1, 2.6) while eating were associated with higher snack intake. These factors were not related to sweetened beverage intake. Public health interventions addressing fast food restaurant and convenience store accessibility and food offerings and marketing within these outlets may help reduce snack food intake. Additionally, to reduce concurrent activities while eating, real-time interventions using smart technology could be used to enhance attentive eating in this population.

1. Introduction

Nearly half of all American adults, 117 million people, had one or more non-communicable chronic diseases, such as cardiovascular disease (CVD), obesity, hypertension, or diabetes in 2012 (Centers for Disease Control and Prevention [CDC], 2017). Among African American women, this rate was higher compared to other racial/ethnic groups. From 2011 to 2014, the prevalence of CVD, which includes diseases of the heart and blood vessels (National Heart, Lung, and Blood Institute [NHLBI], 2017), was 47.7% in African American women compared to 35.1% in non-Hispanic white women. The prevalence rates of obesity, hypertension and diabetes, which are major risk factors for CVD, were 56.9%, 46.3% and 13.6% among African American women compared to 35.5%, 32.3% and 7.4%, respectively, among non-Hispanic white women (Benjamin et al., 2018).

1.1. Snack food and sweetened beverage intake as risk factors for chronic diseases

One of the causes of these chronic diseases and possibly of related disparities is a suboptimal dietary pattern (Forouzanfar et al., 2015; Mozaffarian, 2016; Poggio et al., 2015). Irrespective of income, African American women have higher intakes of refined carbohydrates, total sugars, saturated fat, and sodium, compared to their white counterparts (United States Department of Agriculture [USDA], 2016). Snack foods and sugar-sweetened beverages are major contributors of these nutrients. Refined carbohydrates are digested quickly and have a high glycemic index, leading to a more rapid rise in blood glucose following

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intake (Anand et al., 2015). These heightened glucose responses are associated with CVD and diabetes, with more adverse outcomes observed among women (Mirrahimi et al., 2012). Moreover, added sugar in energy-dense snack foods (sweets and desserts) and sugar-sweetened beverages compound the problem.

Over the last few decades (1977–2012) there has been a significant increase in intake of salty snacks, sweets, and desserts. African American adults now obtain nearly 500 kilocalories (kcal)/day from energy-dense snack foods (Dunford & Popkin, 2017). On the other hand, intake of sugar-sweetened beverage, which had increased between 1977 and 2006, declined substantially from 2006 to 2012 (Dunford & Popkin, 2017). Despite the overall decline, African American adults continue to have the highest intake as compared to other groups (Dunford & Popkin, 2017). Additionally, African American women obtain 28% of daily calories from snack foods and beverages, compared to 24% for non-Hispanic white women (USDA, 2016). Considering the extent to which African American women consume snack foods and beverages that may increase their risk for chronic diseases, it is imperative to understand different contexts in which energy-dense snack foods and beverages are consumed on a daily basis (Dunton & Atienza, 2009).

1.2. Contextual factors influencing food intake

1.2.1. Environmental context

The environmental context of food intake includes the “objective” food environment in terms of availability of different types of food outlets and individual perceptions of the outlets available (Hargreaves, Schlundt, & Buchowski, 2002). Fast food restaurants and convenience stores predominately sell energy-dense foods and snacks, with few healthful alternatives (Lucan, Karpyn, & Sherman, 2010; D'Angelo, Suratkar, Song, Stauffer, & Gittelsohn, 2011; Fleischhacker, Evenson, Rodriguez, & Ammerman, 2011). These food outlets provide opportunities to purchase, and can even serve as cues to consume, energy-dense foods and beverages (Clary, Matthews, & Kestens, 2017; Cohen & Farley, 2008; Wansink, Painter, & Lee, 2006). Although results have been mixed, some studies have reported an increased intake of unhealthy foods among individuals with greater access to fast food restaurants (Boone-Heinonen et al., 2011; Fraser, Edwards, Cade, & Clarke, 2010; Kestens, Lebel, Daniel, Thériault, & Pampalon, 2010) and convenience stores (Hearst, Pasch, & Laska, 2012; Laska, Hearst, Forsyth, Pasch, & Lytle, 2010; Rummo et al., 2015) in their home neighborhood. Recognizing that non-residential exposures may be important, some studies have moved beyond home neighborhoods to examine the relationship between food intake and availability of food outlets in an individual's broader “activity space,” or area where a person conducts activities and spends time including workplaces, schools, places of worship, and locations of socialization, and the routes a person travels between these locations (Clary et al., 2017; Cromley & McLafferty, 2012; Gesler & Albert, 2000). For example, in a study that monitored individuals' movement over seven days using mobile global positioning system (GPS) trackers, fast food restaurant density in the 7-day activity space was positively associated with fat intake and negatively associated with whole grain intake (Zenk et al., 2011). Similarly, in a recent study of women in the UK, greater number of food outlets (supermarkets, fast food restaurants convenience stores, and take away outlets) in their activity space, accounting for its size, was strongly associated with overall poor food intake (Vogel et al., 2017). Recent research has found that activity space environments can vary day-to-day and proposes that this daily variability may affect food choices (Zenk, Matthews, Kraft, & Jones, 2018).

Subjective measures of the food environment, which is based on individuals’ self-report of perceptions of food outlet availability, are also associated with food intake (Caspi, Sorensen, Subramanian, & Kawachi, 2012). Fast food intake increased significantly as individuals perceived being close to a fast food restaurant in one study (Moore, Diez Roux, Nettleton, Jacobs, & Fracnco, 2009). The odds of eating fast food at least once a week increased by 61% among individuals who perceived greater availability of fast food restaurants nearby (Moore, Diez Roux, Nettleton, Jacobs, & Franco, 2009). Studies that looked at other food outlets such as supermarkets and grocery stores also found a strong association between perceived proximity to the stores and food intake (Rose & Richards, 2004; Sharkey, Johnson, & Dean, 2010). However, in these earlier studies, home neighborhood perceptions of food outlet availability was used to predict food intake. Little is known about perceptions of food outlet availability within the activity spaces of African American women and its influence on snack food and sweetened beverage intake.

1.2.2. Social context

With regard to the social contextual factors, it is well known that eating in the presence of others can influence dietary choices and food intake (Cavazza, Graziani, & Guidetti, 2011; Cruwys, Bevelander, & Hermans, 2015; Mondada, 2009; Vartanian, Spanos, Herman, & Polivy, 2015). Such social influence has a robust effect on food intake that may be explained by modeling. In other words, people tend to follow the lead of an eating companion, irrespective of hunger status (Herman, Roth, & Polivy, 2003; Mondada, 2009; Cavazza et al., 2011; Cruwys et al., 2015). Moreover, modeling dietary behavior is more pronounced when in the presence of people from one's social network such as friends, family or work colleagues, compared to strangers (Higgs & Thomas, 2015). These social models may establish specific eating norms and thereby influence eating behavior (Herman et al., 2003). Another explanation is the need for social acceptance, whereby individuals tend to imitate food intake of their immediate social context (Robinson et al., 2013a). In a meta-analysis, women were much more likely to be influenced by social contexts and demonstrated greater modeling effects than men (Vartanian et al., 2015). Hargreaves et al. (2002) used focus groups to describe social contexts on African American women's food intake and patterns. They found that the participants viewed social occasions, such as meals with family or friends, as “opportunities for increased food intake” (Hargreaves et al., 2002, p. 141) and reported eating more in such instances. These results suggest that eating with someone, particularly people from within one's social networks, can be an important influence on eating behavior among African American women.

1.2.3. Other contextual factors

Eating behaviors are also influenced by other contextual factors (Robinson et al., 2013a), such as eating while engaging in other activities. This can decrease awareness of foods, reducing “attentive eating” and thereby affecting food intake (Robinson et al., 2013a). One such activity that has emerged as a detrimental factor is television viewing. Eating while watching television tends to inhibit one's ability to experience satiety cues and accurately estimate overall food intake. In a pilot study conducted with young adults, 25% of participants under-estimated their food intake while engaged in television watching (Moray, Fu, Brill, & Mayoral, 2007). Additionally, television food commercials promoting unhealthy foods can trigger intake and have a profound negative impact on food choices (Chapman et al., 2014; Pettigrew, Roberts, Chapman, Quester, & Miller, 2012). Thus, eating coupled with television watching may be a predisposing factor for increased calorie and poor food intake. Moreover, because African American women average 3.4 h/day watching television, almost an hour more than time spent by non-Hispanic White women (2.7 h/day) (United States Department of Labor [DOL], 2017), knowing how television viewing influences food intake may help design future interventions.

Few studies have examined the influence of other activities while eating such as listening to radio or music and reading (Robinson et al., 2013a). The results from a meta-analysis (Robinson et al., 2013a) suggest that reduced attention through distractions while eating may