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Examining the effects of cigarette smoking on food cravings and intake, depressive symptoms, and stress

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ABSTRACT

Purpose: This study examined the relationships among smoking status and total and specific types of food cravings (i.e., high-fats, sweets, fast-food fats, and complex carbohydrates/starches) and the influence of demographic, clinical, and psychological factors on this relationship.
Methods: Seven-hundred and twelve adults completed measures of food cravings, dietary intake, and smoking history. Heights and weights were measured. Data were analyzed using univariate and multivariate analyses while adjusting for demographic, clinical, and psychological covariates.
Results: Compared to never smokers, current smokers reported more frequent cravings for high-fat foods and fast-food fats, after controlling for depression, stress, BMI and demographic factors. Current smokers also reported consuming more high-fat foods and fast-food fats. The association between cigarette smoking and total food craving was no longer significant after accounting for depression and stress, suggesting that depression and stress may account for the relationship between smoking and total food craving. Smoking did not moderate the relationship between food cravings and food intake. Nicotine dependence was positively correlated with the frequency of general food cravings and cravings for high fats, sweets, and carbohydrates/starches.
Conclusions: Cigarette smokers, and especially those with higher nicotine dependence, may have greater difficulties in addressing food craving and changing eating habits, particularly in the context of depression and stress.

1. Introduction

Cigarette smoking is a leading cause of morbidity and mortality. In addition to the independent risks related to cigarettes, smoking is highly associated with obesity-related behaviors including unhealthy diet (Chiolero, Wietlisbach, Ruffieux, Paccaud, & Cornuz, 2006). Smoking reduces appetite and increases satiety (Audrain-McGovern & Benowitz, 2011). Smokers generally weigh 4–5 kg less than non-smokers (Klesges, Meyers, Klesges, & LaVasque, 1989). It is commonly believed that smoking is an effective weight control strategy (French, Perry, Leon, & Fulkerson, 1994), however there is some evidence that smokers misjudge the effectiveness of smoking in suppressing weight (White, McKee, & O'Malley, 2007). Fifty percent of female smokers and 26% of male smokers express concerns about post-smoking cessation weight gain (Clark, Hurt, Croghan, 2006; Cooper, Dundon, Hoffman, & Stoever, 2006). Indeed, 49% of smokers gain weight following cessation (Scherr, Seifert, Kuster, 2015). Among those who have a smoking relapse, 52% of females and 32% of males cite weight gain as a reason (Pisinger & Jorgensen, 2007). However, individuals who smoke consume more fat and calories than nonsmokers (Palaniappan, Starkey, O'Loughlin, & Gray-Donald, 2001; Dallongeville, Marécaux, Fruchart, & Amouyel, 1998). Heavy smokers weigh more than light and moderate smokers (Dare, Mackay, & Pell, 2015). Smoking is associated with greater central adiposity and increased risk of cardiovascular disease, type 2 diabetes, and metabolic syndrome (Canoy, Wareham, Luben, et al., 2005; Chiolero, Faeh, Paccaud, & Cornuz, 2008; Sun, Liu, & Ning, 2012). The clustering of smoking with obesity-related behaviors has multiplicative effects on health, heightening disease risk and decreasing life expectancy (Pischon, Boeing, Hoffmann, 2008; Peeters et al., 2003). Despite the public health significance, little is known about mechanisms underlying with the paired relationship of smoking and unhealthy dietary behaviors.

An emerging body of evidence has demonstrated cross-substance craving among smokers. Nicotine increases alcohol craving and alcohol-motivated behaviors (Verplaetse & McKee, 2016). Similar cross-

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substance cravings have been suggested to occur for highly palatable foods (Pepino, Finkbeiner, & Mennella, 2009; Pepino & Mennella, 2014); however, studies examining these associations are sparse. In the present study, we examined the relationships among smoking status and food cravings in a sample of adults recruited from the community. We hypothesized that current smokers would have more frequent food cravings compared to never and former smokers. Past research has shown that negative emotional states, such as stress and depression, are strongly related to smoking and eating behaviors (Kassel, Stroud, & Paronis, 2003; Christensen & Pettijohn, 2001). Our exploratory aim was to test if stress and depressive symptoms accounted for the associations between smoking status and food cravings.

2. Materials and methods

2.1. Participants

Participants were 712 adult volunteers recruited from the community using online and print advertisements. Inclusion criteria were that participants were between 18 and 50 years of age and able to read English at the sixth-grade level. Exclusion criteria were pregnancy, dependence on drugs other than nicotine, use of prescribed medications for any psychiatric disorders, and serious medical conditions.

2.2. Procedures

Eligibility was determined using an initial screening over the phone or in person. Participants completed an assessment battery of self-report questionnaires and measurements over four to five sessions. Participants were compensated $20 for each visit. Studies were approved by the Yale University Institutional Review Board and all participants provided informed consent.

2.3. Measures

2.3.1. Demographics/BMI

A demographic data form was used to collect information on age, sex, race, and education. BMI was calculated from measured heights and weights.

2.3.2. Smoking history

Historical and current tobacco use was assessed via self-report. Current smokers completed the six-item Fagerstrom Test for Nicotine Dependence (FTND) (Heatherton, Kozlowski, Frecker, & Fagerstroem, 1991). Scores on the FTND range from 0 to 10 with lower scores indicating lower dependence. The FTND has adequate reliability and internal consistency (Pomerleau et al., 1994).

2.3.3. Food cravings

The 28-item Food Craving Inventory (FCI) (White, Whisenhunt, Williamson, Greenway, & Netemeyer, 2002) was used to assess food cravings, an intense desire to consume a particular food (or food type) that is difficult to resist. Participants rated how often each food was craved over the past month using a 5-point Likert scale ranging from ranging from 1 (never) to 5 (always/almost every day). Four subscales measured specific types of food cravings: high-fat foods (e.g., sausage, bacon, hot dog), sweets (e.g., brownies, candy, chocolate), complex carbohydrates/starches (e.g., pancakes/waffles, sandwich bread), and fast-food fats (e.g., hamburger, French fries, chips, pizza). Foods in the high-fat and fast-food fats subscales both have high fat and calorie contents. However, the four items on the fast-food fat are easily accessible and classified as junk foods, which make them theoretically distinct from the foods that are part of the high-fat foods subscale. The FCI has demonstrated adequate internal reliability, and content, discriminant, and concurrent validity in diverse community and clinical samples (White et al., 2002; White & Grilo, 2005).

2.3.4. Perceived stress

Perceived stress was measured using the 14-item Perceived Stress Scale (PSS) (Cohen, Kamarck, & Mermelstein, 1983). Items were rated on a 5-point Likert scale ranging from 0 to 4. The scores were summed to obtain the total score, with a higher score indicating more perceived stress.

2.3.5. Depressive symptoms

The Center for Epidemiological Studies Depression Scale (CES-D) (Devins & Orme, 1985) was used to measure depressive symptoms. This instrument was designed to measure depressive symptoms in the general population. The scale included 20 items, which were scored on a 4-point Likert scale. A total score was generated with a range of 0 to 60. The standard cutoff score for the CES-D is >16.

2.3.6. Dietary assessment

Dietary information was collected from a 104-item semi-quantitative food frequency questionnaire (FFQ). This questionnaire was modified from the previously validated FFQ used in the Nurses' Health Study (Willett, Sampson, MJ, 1985; Rimm et al., 1992; Salvini, Hunter, Sampson, 1989). It evaluated average consumption of standard portions of foods during the previous year by using 9 response categories ranging from "never or less than once a month" to "6 or more per day." These items were matched to the FCI items to form corresponding FFQ subscales for sweets, high-fats, carbohydrates/starches, and fast-food fats as has been used previously (Chao, Grilo, White, & Sinha, 2014). Daily energy intake was calculated by multiplying the frequency of consumption of each food by the caloric content (Nutrition HSoPH, 2016).

2.4. Data analysis

Data analyses were performed using SPSS version 24. Chi-squared and analysis of variance tests were used to examine differences in variables by smoking status. Effects of smoking status on total and specific food cravings were assessed using univariate and multivariate general linear models. Independent variables were entered in two blocks. Model A included demographic covariates (age, race, sex, years of education), BMI, and smoking status. Model B included Model A variables and psychological factors (perceived stress and depressive symptoms). Partial correlation coefficients, controlling for BMI, were used to evaluate the relationships between nicotine dependence and food cravings. Two-tailed p-values of <0.05 were considered statistically significant.

3. Results

The mean age was 29.7 ± 9.1 years and BMI was 27.3 ± 5.5 kg/m^2. On average, participants had 15.2 ± 2.4 years of education. A little more than half of the sample (54.8%) was female. The majority of the sample (69.9%) identified as White, 22.2% as Black, and 7.7% as other race/ethnicity. There was 24.3% of the sample who were current smokers and 22.6% who were former smokers. Current smokers had smoked for an average of 13.8 ± 10.2 years and used an average of 8.8 ± 7.9 cigarettes per day. Among smokers, the average score on the FTND was 2.8 ± 2.7.

Table 1 summarizes differences in demographic characteristics by smoking status. Current smokers reported a higher daily energy intake compared to former smokers ($p = 0.02$; Table 1). Current smokers reported consuming more high-fat foods compared to never smokers ($p = 0.02$) and more fast-food fats compared to former ($p < 0.001$) and never smokers ($p = 0.001$). Intake of sweets and carbohydrates/starches did not differ by smoking status ($ps > 0.05$). Compared to never and former smokers, current smokers had higher perceived stress and depression symptoms ($ps < 0.001$).

In unadjusted analyses, there were significant differences in total food cravings ($p = 0.001$; Table 1) by smoking status. Current smokers had more frequent total food cravings, compared to former ($p = 0.008$)