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Sweet taste preference in binge-eating disorder: A preliminary investigation

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ABSTRACT

Research suggests that individuals with high liking for sweets are at increased risk for binge eating, which has been minimally investigated in individuals with binge-eating disorder (BED). Forty-one adults (85% female, 83% white) with binge eating concerns completed a sweet taste test and measures of eating disorder behaviors and food cravings. A subset of participants with BED completed an oral glucose tolerance test (OGTT; $N = 21$) and a 24-hour dietary recall ($N = 26$). Regression models were used to compare highest sweet preferers (HSP [$N = 18$]) to other sweet preferers (OSP [$N = 23$]) and were used to assess associations between sweet taste preference and outcome variables. Effect sizes (ηp^2) for differences between HSP and OSP ranged from small (≤ 0.01) to large (≥ 0.24); group differences were statistically nonsignificant except for 24-hour caloric intake ($\eta p^2 = 0.16$, $p = 0.04$), protein intake ($\eta p^2 = 0.16$, $p = 0.04$), and insulin sensitivity index ($\eta p^2 = 0.24$, $p = 0.04$), which were higher in HSP, and postprandial insulin, which was smaller in HSP ($\eta p^2 = 0.27$, $p = 0.03$). Continuous analyses replicated postprandial insulin response. Compared with OSP, HSP reported numerically higher binge-eating frequency ($\eta p^2 = 0.04$), over-eating frequency ($\eta p^2 = 0.06$), and carbohydrate intake ($\eta p^2 = 0.14$), and they exhibited numerically smaller postprandial glucose AUC ($\eta p^2 = 0.16$). Sweet taste preference may have implications for glucose regulation, binge-eating frequency, and nutrient intake in BED.

Binge-eating disorder (BED) is characterized by recurrent episodes of binge eating, during which an individual consumes an unusually large amount of food in a short period of time (i.e., about 2 h) and experiences a loss of control over eating (American Psychiatric Association [APA], 2000, 2013). Typically, individuals will binge eat on foods high in fats, sugars, or often both (Yanovski et al., 1992). Frequent intake of high calorie and high sucrose foods can lead to increased postprandial glucose and insulin levels, which stimulate hunger (O'Keefe & Bell, 2007) and may further affect vulnerability to binge eating. Furthermore, binge-eating episodes that are characterized by a high-fat, high-sugar composition may contribute to health risks in BED (Avena, Rada, & Hoebel, 2009) such as diabetes mellitus, metabolic syndrome, hypertension, psychological distress, impaired glucose tolerance, and other conditions (Hudson et al., 2010; Mitchell et al., 2015; Raevouri et al., 2015; Roehrig, Masheb, White, & Grilo, 2008; Thornton et al., 2017). Thus, a preference for sweet tasting foods may place someone at greater risk for binge eating and its associated health outcomes; however, little is known about the interactions between sweet liking, craving, and metabolic functions in individuals with BED.

The available literature suggests that preferring sweet tastes may increase the risk for overeating or binge eating in non-eating disorder (ED) populations and in those with BED (Dalton & Finlayson, 2014; Finlayson, Arlotti, Dalton, King, & Blundell, 2011; Greeno, Wing, & Shiffman, 2000; Kampov-Polevoy, Alterman, Khalitov, & Garbutt, 2006). Sweet preference may impact binge eating in several ways. First, individuals with a strong sweet preference are more likely than individuals with a less strong sweet preference to have difficulty regulating their intake of sweet foods and report consuming sweet foods to decrease depressed mood (Kampov-Polevoy et al., 2006). Thus, individuals with sweet taste preference may be at risk for developing BED as using food intake to regulate negative affect increases risk for overeating (Leibenluft, Fiero, Bartko, Moul, & Rosenthal, 1993).

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Second, sweet preference may impact not only the motivation and/or amount one eats, but also what one eats. Several studies have found that individuals who prefer sweet foods tend to consume more sugars, sweet foods (Duffy, 2007; Turner-McGrievy, Tate, Moore, & Popkin, 2013) and alcohol (Kampov-Polevoy, Garbutt, & Janowsky, 1997; Kampov-Polevoy, Garbutt, & Khalitov, 2003; Kampov-Polevoy, Tsoi, Zvartau, Neznanov, & Khalitov, 2001; Kranzler, Sandstrom, & Van Kirk, 2001). Thus, sweet preference may increase vulnerability to overeating or binge eating foods that are commonly reported in binge-eating episodes (Yanovski et al., 1992).

Specific taste preferences and perceptions also appear to be associated with weight status and may thus have implications for the association between sweet liking and BED. For example, Arlt, Smutzer, and Chen (2017) found that overweight individuals with BED perceived three different types of taste (quinine hydrochloride, sucrose, and 6-*n*-propylthiouracil) as less intense than normal weighted individuals with BED and overweight healthy controls. A higher propensity for sweet and creamy tastes has also been associated with longitudinal weight gain among Pima Indians (an obesity-prone population; Salbe, DelParigi, Pratley, Drewnowski, & Tataranni, 2004). Furthermore, women in a non-clinical sample who gained weight over six months tended to have hypo-functioning reward neural circuitry after consuming palatable foods than those who did not gain weight (Stice, Yokum, Blum, & Bohon, 2010). Thus, it is important to examine weight status when investigating the complexities of sweet taste in individuals with BED.

Although sweet taste preference may place an individual at greater risk for binge eating, several key questions remain regarding the association between sweet taste preference's association with BED symptoms, such as binge-eating frequency, food cravings, metabolic functions, and macronutrient composition of foods consumed. The present study is preliminary and provides an investigates of sweet taste preference in BED to add to the limited extant literature (Arlt et al., 2017); thus, the statistical aims are to (1) estimate effect size and variability of sweet preference status on outcome variables and (2) to test proof-of-concept to justify fuller pursuit of sweet taste preference in BED. Specifically, this study aims to compare the highest sweet preferers (HSP; those who prefer the highest concentration of sucrose) and other sweet preferers (OSP; those who prefer all other levels of sucrose concentration) on binge-eating frequency, over-eating episodes, BMI, food cravings, nutrient intake, and insulin-glucose regulation in a sample of participants with BED. Although we did not predict significant differences with our small sample size, we expect to see results in predicted directions. We expect that participants would evidence observably higher levels of sweet taste preference and that binge-eating frequency would show positive associations with sweet taste preference. We also proposed that HSP would show evidence of more binge-eating episodes than OSP. To clarify associations among sweet taste preference and binge-eating, we also analyzed associations between over-eating episodes that do not meet criteria for binge-eating and sweet taste. Again, we expected that HSP would show evidence of food cravings, no matter what type, more than OSP. Given our secondary aim to explore potential nutrient intake differences depending on sweet preference status, we also explored whether HSP would consume more calories overall as well as more calories from fat and carbohydrates than OSP. We also predicted that HSP show evidence of greater postprandial change in insulin and glucose levels (after ingesting a glucose solution) than OSP. A third aim of the study was to examine if HSP and OSP differ on diabetic status based on responses to an oral glucose tolerance test.

1. Method

Participants in this study comprised individuals from the Binge Eating and Chromium (BEACh) study (see Brownley, Von Holle, Hamer, La Via, & Bulik, 2013). Of the 220 individuals who were self-referred and pre-screened for the BEACh study, 41 completed formal screening, which included sweet taste testing, a structured clinical interview for BED, and evaluation of inclusion and exclusion criteria. Inclusion criteria were a Diagnostic and Statistical Manual Fourth Edition (DSM-IV; APA, 2000) BED criteria determined using the Structured Clinical Interview for DSM-IV (SCID-I/P, with Psychotic Screen; First, Spitzer, Gibbon, & Williams, 2010) and a BMI between 25 and 45 kg/m^2. Exclusion criteria included: use of any medication that controls/influences glucose metabolism, insulin, appetite, or weight; fasting glucose level > 126 mg/dL; use of psychotropic medication except for stable monotherapy on citalopram, escitalopram, fluoxetine, fluvoxamine, paroxetine, or sertraline. Of these 41 individuals who completed formal screening, 31 met criteria for BED but 3 declined to participate and 2 did not complete further testing to establish baseline measures, leaving 26 study participants. The Institutional Review Board at the University of North Carolina at Chapel Hill (UNC-CH) approved this study.

1.1. Study design

This study represents a secondary investigation of the parent BEACh study (Brownley et al., 2013), which is described in detail elsewhere. The 26 individuals with BED all completed sweet taste testing following an overnight fast in the Clinical and Translational Research Center at UNC-CH. Approximately 1–2.5 months later, subjects completed baseline testing including a 24-hour dietary recall (N = 26), food craving questionnaire (n = 25) and an oral-glucose tolerance test (n = 21).

1.2. Sweet taste test

To assess sweet taste liking, each participant, after an overnight fast and prior to the oral glucose tolerance test, tasted five concentrations of sucrose solution (0.05, 0.10, 0.21, 0.42, and 0.83 M) five times in a pseudorandom order (25 total tastings). For comparison, Coca-Cola® is a 0.33 M solution. After tasting then spitting out each solution and rinsing, the participant rated its intensity and pleasantness on a 200-mm analogue scale by responding to two questions: (1) “How sweet was the taste?” (intensity = “Not sweet at all” to “Extremely sweet”), and (2) “How much do you like the taste?” (pleasantness = “Disliked very much” to “Liked very much”). Average scores for each solution were used to calculate a sweet taste slope score (i.e., standardized beta). Higher slopes indicate greater pleasantness ratings as sweet concentrations increased. To determine the preferred concentration, we averaged the five pleasantness scores for each tested solution; the solution with the highest average score was considered a preferred solution. Based on previously established criteria (Damiano et al., 2014; Kampov-Polevoy et al., 2003), HSP were defined as giving the highest pleasantness rating to the highest sucrose concentration (0.83 M: N = 18); all others were defined as OSP (N = 23).

1.3. Oral glucose tolerance test

Each participant consumed a glucose solution standardized for body weight at 1.75 g/kg (Clinical and Translational Science Institute, 2012). Blood samples were obtained via an intravenous catheter at minute 0 (fasted) and then minutes 30, 60, 90, and 120 after ingestion of the glucose solution. At McLendon Clinical Laboratories (UNC Hospitals), plasma glucose was assayed using a Vitros 5,1 FS Chemistry System (Ortho Clinical Diagnostics). Insulin was measured using a competitive radioimmunoassay (Diagnostic Systems Labs, Webster, TX) at the UNC Endocrine Lab. Assay sensitivity was 1.3 uIU/mL with a standard range of 5–300 μIU/mL.

1.4. 24-Hour dietary recall

A trained interviewer from the UNC-CH Nutrition Obesity Research Center Diet and Physical Activity Core contacted each participant by phone on three occasions within a maximum 2-week period to conduct