RELIABILITY AND VALIDITY OF THE HUMBOLDT FOOD ADDICTION QUESTIONNAIRE

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Abstract

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Current research shows that foods high in sugar, salt, and fat can illicit addictive responses (Pursey, Stanwell, Gearhardt, Collins, & Burrows, 2014). Although measures of overeating pathology exist, only a few are dedicated to food addiction. Two of these measures are the Yale Food Addiction Scale (YFAS; Gearhardt, Corbin, & Brownell, 2009b) and the Eating Behaviors Questionnaire (EBQ; Merlo, Klingman, Malasanos, & Silverstein, 2009). Given the shortage of food addiction measures, the Humboldt Food Addiction Questionnaire (HFAQ) was developed to supplement the need for additional tools. Recruited from both a university and online, 626 participants completed this study. Reliability of the HFAQ was excellent at .95. Strong relationships were found between the HFAQ and two other measures of food addiction, the YFAS and EBQ. A measure of eating pathology, the Eating Attitudes Test (EAT-26), and a measure of impulsivity, the Delaying Gratification Inventory (DGI short form with food subscale) were used to measure convergent validity. There was a moderate relationship between the HFAQ and the two convergent measures. Discriminant validity was also established between the HFAQ and a measure of alcohol and drug use. An exploratory factor analysis showed that DSM substance criteria were present within a five-factor solution.

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Chapter One: Introduction

Obesity rates have risen in the past 30 years. Over one-third of adults in the U.S. are obese (Hales, Carroll, Fryar, & Ogden, 2017). The health implications of obesity are often devastating. An obese person has a greater chance of developing cardiovascular disease, diabetes, stroke, and cancer (CDC, 2017). An increased consumption of high calorie, highly processed, nutritionally unbalanced foods such as fast food, sugared beverages, and convenience foods have been implicated in the obesity epidemic (Steele, Popkin, Swinburn, & Monteiro, 2017; Wylie-Rosett, Segal-Isaacson, & Segal-Isaacson, 2004). From an evolutionary perspective, humans have evolved to consume more calories than needed in order to safeguard against times of famine (de Ridder & van den Bos, 2006). For the ancestors of humans, though it was scarce, foods high in carbohydrates and fat provided the biggest caloric payoff. Foods high in sugar, salt, and fat excite the brain's pleasure centers.

Studies with humans and animals have examined the physiological mechanisms involved in eating and pleasure. Evidence supports addictive-like functioning towards palatable foods. Like cocaine and heroin, palatable foods stimulate the brain's dopamine systems (Davis, Loxton, Levitan, Kaplan, Carter, & Kennedy, 2013; DiNicolantonio, O'Keefe, & Wilson, 2017). The notion of food addiction is controversial (Ziauddeen & Fletcher, 2013) but a growing body of research supports the food addiction hypothesis (Gearhardt & Brownell, 2013; Lennerz & Lennerz, 2018). In addition to physiological evidence, measures of food addiction have also demonstrated addictive eating behaviors.

Substance dependence criteria in the Diagnostic and Statistical Manual of Mental Disorders, fifth edition (DSM-5: American Psychiatric Association, 2013) can be adapted to measure food addiction/dependence (FA/FD; Gearhardt, Corbin, & Brownell 2009b; Merlo, Klingman, Malasanos, & Silverstein, 2009). Participants have endorsed dependence criteria such as feeling out of control, unintentionally overeating, and repeatedly failing at attempts to cut back (Worledge & Reynolds, 2011). Studies using FA/FD measures have shown shared variance between FA/FD and binge eating. FA/FD may play a role in binge eating, however, not everyone who is addicted to food binge eats and vice versa (Cassin & von Ranson, 2007; Taylor & Reynolds, 2012). The study of food addiction is growing, although measures of this construct are scarce. Because there is a need for psychometrically sound measures of FA/FD, the Humboldt Food Addiction Questionnaire (HFAQ) was developed.

The current study will examine the psychometric properties of the HFAQ. With data from over 600 participants, (HSU students and online participants) reliability and validity will be assessed. Internal consistency, item-to-total correlations, and test-retest outcomes will be analyzed for evidence of reliability. Correlations between the HFAQ and criterion, convergent, and discriminant measures will be used to confirm validity. Because items in the HFAQ were generated from dependence criteria in the DSM, a factor analysis will also be conducted. This study consists of questionnaires, thus carrying minimal risk to the participants. A resource page with information on eating disorders and counseling services will be provided to the subjects. Pilot studies have

shown the HFAQ to be a viable measure of FA/FD and more evidence is needed to verify its utility with adults.

Chapter Two: Literature Review

Excessive calorie intake is the most common cause of obesity (Howell & Krones, 2017; Wright & Aronne, 2012). In the United States, it is estimated that 39% of adult men and women are obese (Hales et al., 2017). Obesity poses serious health risks and contributes to approximately 18% of all U.S. deaths, annually (Masters, Reither, Powers, Yang, Burger, & Link, 2013). Medical conditions associated with obesity include coronary heart disease, type II diabetes, dyslipidemia, hypertension, stroke, osteoarthritis, and cancer (Burton, Foster, Hirsch, & Van Itallie, 1985; Pi-Sunyer, 1993). From 1980 to 2000, obesity rates dramatically increased 16 percent (Flegal, Carroll, Kuczmarski, & Johnson, 1998; Flegal Carroll, Ogden, & Johnson, 2002). Since the year 2000, obesity rates have climbed another astonishing 13.9%, affecting almost four out of 10 adults (Hales et al., 2017).

The sharp rise in obesity beginning in the 1980s has been attributed to trends including greater consumption of cheap, processed, high-fat, high-sugar foods (junk food), and sedentary lifestyle (Centers for Disease Control, 2007; Rolls, 2003). Other factors contributing to the development of obesity include genetics, physiology, environment, psychology, sociology, and economics (Aronne, Nelinson, & Lillo, 2009). For Western populations, the level of access to junk food is historically novel, and spreading to poorer countries (Ford, Patel, & Narayan, 2017; Prentice, 2006). Much of the heavily marketed, nutritionally deficient junk foods and fast foods are chemically altered to increase palatability and thus boost profit (Hawkes, 2006). Human evolution

has not been able to keep up with the influx of modern junk food, rendering scores of people overweight and obese (Jew, AbuMweis, & Jones, 2009; Pijl, 2011). Still, not all who have access to junk food overeat. A growing body of research suggests that the neural mechanisms involved in the development and progression of addiction can contribute to the excessive consumption of palatable foods.

The Food Addiction/Dependency Hypothesis

The conceptualization of food addiction as a type of eating pathology has been gaining momentum among researchers. While this idea is not new, (food addiction has been recognized since at least 1956 [Randolph, 1956]), advances in technology have allowed researchers greater insight into the physiological mechanisms that drive overeating. Researchers have specifically studied the relationship between hyperpalatable foods (foods high in sugar, salt, and fat) and the brain's dopaminergic reward system (Cocores & Gold, 2009). Consumption of hyperpalatable foods have been shown to produce pleasurable feelings, likened to the high users experience while taking heroin and cocaine. Behaviors and changes in the brain that are traditionally observed with drug abuse have also been cited in rodent and human studies (Gearhardt, Grilo, DiLeone, Brownell, & Potenza, 2011; Novelle & Diéguez, 2018). Mirroring drug abuse, indications of overeating include consuming more of the food than anticipated, loss of control, tolerance, and withdrawal. Through studies with humans and animals, researchers have learned that basal dopamine (DA), acting within the brain's reward system, is predictive of food intake.

Studies have shown that overweight rats have lower levels of DA, less D2 receptors, and induced DA delivery to regions of the brain's pleasure center including the nucleus accumbens, dorsal striatum, and medial prefrontal cortex (Cook, Hendrickson, Garwood, Toungate, Nania, & Morikawa, 2017; Fetissov, Meguid, Sato, & Zhang, 2002; Geiger et al., 2008). In one particular study with rats, it was discovered that excessive intake of energy-dense foods lead to similar nueroadaptive responses also found with drug addiction (Johnson & Kenny, 2010). Along with their regular chow, some rats were also fed highly palatable foods such as bacon, cake, and chocolate. This resulted in the rats not only overeating, but also maintaining their excessive eating habits despite the consequence of receiving unpleasant electric shocks. By contrast, the rats that were not exposed to the junk food stopped eating when electric shocks were anticipated. Further, when access to the junk food was restricted and replaced with healthier options, the overweight rats refused to eat for two weeks. For the rats that developed obesity, their Type 2 dopamine receptors became less sensitive, resulting in a diminished reward pathway. Similar results involving DA and overeating have also been found in humans.

Compared to normal-weight counterparts, obese people have less striatal D2 receptors (Volkow et al., 2008; Volkow, Wise, & Baler, 2017). Compromised DA signaling has predicted weight gain in individuals with this genetic risk (Stice, Spoor, Bohon, & Small, 2008). In a study examining the neural correlates of food addiction, addictive eating activated similar neural patterns seen in substance dependence (Gearhardt et al., 2011). Participants with elevated food addiction scores had more activity in the cingulate cortex, medial orbitofrontal cortex, and the amygdala while

anticipating consuming chocolate milkshakes. These areas of the brain serve as reward circuits that reinforce eating (Volkow & Fowler, 2000). Likewise, when the participants actually consumed the junk food, they had less activation in the inhibitory region of the brain (lateral orbitofrontal cortex) suggesting an increased need for satiation. Measures of palatable food consumption in the context of the addiction framework have been developed.

Criterion Measures Review and Critique

Citing a lack of psychometrically validated measures of food addiction, the creators of the Yale Food Addiction Scale (YFAS) sought to explore this phenomenon (Gearhardt et al., 2009b). Using a stratified sample, 353 people initiated this preliminary investigation. Of the original 353 participants, 233 completed the measures used to establish validity. The average age of the participant was 20.2 (*SD* =138). Ethnicity of the participants included 72.5% Caucasian, 18.5% Asian-American, and 9% African American. Women comprised 64.2% of the sample and were more likely to complete all of the measures. BMI was self-reported at an average of 22.58 (*SD* =3.18). Most participants were within a normal weight range (73.5%) and some were overweight (18.7%), obese (2.7%) or underweight (4.7%). Six relevant validity measures were used.

Convergent validity measures included the Binge Eating Scale (BES), Eating Troubles Module (EAT-26), and Emotional Eating Scale (EES). Sixteen items of the BES asked participants about their behaviors and feelings during binge episodes. Questions in the BES measured the severity of binge eating patterns including none,

moderate, and severe. Reliability of the BES was excellent, α = .93. Measuring eating disorder symptoms, the EAT-26 is a 20-item scale that classifies scores over 20 as highly indicative of an eating disorder. Cronbach's alpha for the EAT-26 was high, α = .91. Used to assess overeating provoked by emotional state, the 25-item EES asks participants if certain emotions make them want to eat more, less, or the same. EES had excellent internal consistency, α = .91. Discriminant measures of were also used to establish validity.

Discriminant validity measures included in this study were the Rutgers Alcohol Problem Index (RAPI), the Daily Drinking Questionnaire (DDQ), and the Gray's Behavioral Inhibition (BIS) and Behavioral Approach Systems (BAS). The RAPI consists of 23 items that briefly assess young adult and adolescent drinking problems. Internal consistency for the RAPI was good, α = .88. A revised version of the DDQ asked additional questions about daily drinking including days per week and number per day. Reliability of the DDQ was good, α = .83. Twenty questions comprised the BIS/BAS, calculating a global BIS score and BAS subscale scores: Drive (DRV), Fun Seeking (FS), and Reward Responsiveness (RR). Internal consistency for the BIS and BAS was acceptable, α = .78 and .71, respectively. Items generated for the YFAS were largely based on adaptations of the DSM-5 substance dependence criteria, and scales measuring gambling, exercise, and sex addiction.

Questions from the DSM-5 substance dependence criteria and other addiction scales were modified with an emphasis on the consumption of foods high in fat and sugar. The seven DSM-5 dependence criteria include (1) Substance taken in larger

amount and for longer period than intended, (2) Persistent desire or repeated unsuccessful attempt to quit, (3) Much time/activity to obtain, use, recover, (4) Important social, occupational, or recreational activities given up or reduced, (5) Use continues despite knowledge of adverse consequences (e.g., failure to fulfill role obligation, use when physically hazardous (6) Tolerance (marked increase in amount; marked decrease in effect) and (7) Characteristic withdrawal symptoms; substance taken to relieve withdrawal. After the original items were generated, the researchers consulted eating pathology experts and binge eating patients for feedback. Based upon responses, two to four questions pertaining to each of the DSM-5 criteria were kept. Examples of the questions include, "My behavior with respect to food and eating causes significant stress", and "I spend a lot of time feeling sluggish or lethargic from overeating". Item response for the YFAS includes dichotomous and frequency scoring. Results of the preliminary analysis showed promise for the efficacy of the YFAS as a measure of FA/FD.

Data from this study yielded information about diagnostic criteria thresholds, factor structure, reliability and convergent, discriminant, and incremental validity. Cutoffs related to increased risk for eating pathology were determined. Based on these cutoffs, 11.4% of the sample qualified as having met the criteria for food dependence, 13.2% for binge eating, and 13.4% for an eating disorder. An exploratory factor analysis using the dichotomous data resulted in four factors based on eigenvalues over one (11.12, 1.99, 1.46, and 1.07), however, plotting the factors narrowed the structure down to a single factor. Reliability of the YFAS resulted in single factor loadings all above .50 and

an overall alpha, $\alpha = .86$. Convergent validity was demonstrated through correlations between the convergent measures and the YFAS ranging from .46 to .61. Discriminant validity was partially supported with no significant correlations found between a measure of alcohol consumption and the YFAS; however, small correlations between alcohol problems and the YFAS were observed (.16 and .17). There were also small correlations between the BIS and the YFAS. BAS scores were not significantly related to the YFAS. In a hierarchical multiple regression analysis to predict binge eating pathology (BES), EAT-26, and EES scores were entered in step one and YFAS scores were entered into block two. Together, EAT-26 and EES scores predicted 49.9% of the variance in BES. An additional 14.8% of BES was explained by the YFAS scores. Results and limitations of this study were discussed.

Overall, the authors of the preliminary investigation of the YFAS were pleased with their results, citing good reliability and validity. Establishment of discriminant validity is questionable, as two of the discriminant measures showed small but significant correlations with the YFAS. As discussed above, the positive correlation between alcohol consumption and FA/FD may be partially explained by the high carbohydrate content and added sugars in some alcoholic beverages. Use of a dichotomous answer style may have also limited insight into the degree of item endorsement, thus contributing to the small factor structure. Although it was a preliminary analysis, the authors concluded that the YFAS was a useful tool to screen those with food addiction tendencies. The authors also hoped for future projects to explore food addiction using the YFAS as a proven assessment instrument. In a discussion of limitations, the authors

acknowledged that the sample consisted of college students and the validity needed to be examined with samples that are more representative. Lack of obese participants was also cited as potentially limiting the understanding of food addiction within the obese population. Self-report of weight was considered a limitation and the authors suggested further research use direct measurement of height and weight. Since its preliminary validation, more research with the YFAS has supported its reliability and validity.

Another study compared scores from the YFAS and the Food Cravings Questionnaire - Trait (FCQ-T; Meule & Kubler, 2012). The sample was comprised of 616 participants (75.8% female) with a mean age of 24.5 (*SD* ± 4.0) who were mostly students (80.9%) and German citizens (95.5%). Thirty-nine items in the FCQ-T ask participants how frequently they experience food cravings. Internal consistency of the FCQ- T ranges from α = .81 to .94. Individuals were diagnosed with food addiction based on the YFAS cutoff criteria. Those diagnosed with food addiction scored higher on the FCQ-T total score supporting YFAS validity. Internal consistency of the YFAS was reported as good, α = .83. In another study with 72 participants (49 female) aged 25-46 years and from North America, the YFAS again proved to be valid and reliable. Using the YFAS for the diagnostic criteria, those who qualified as having food addiction had higher rates of binge eating, depression, and attention-deficit disorder. Reliability of the YFAS was reported excellent, α = .92. Overall, the YFAS appears to be a reasonably good measure of FA/FD. Another FA/FD measure is the Eating Behaviors Questionnaire (EBQ; Merlo et al., 2009)

Exploring food addiction in pediatric patients, Merlo et al. (2009) developed a food addiction scale and conducted a preliminary investigation. Fifty children (64% female) between the ages of 8 and 19 years were recruited from the Pediatric Lipid Clinic in a southeast teaching hospital. Ethnicity included 60% Caucasian, 24% African American, 6% Hispanic, 2% Asian, 2% American Indian/Alaska Native, and 6% identifying as "other". This clinical sample had problems related to obesity or other metabolic conditions including hyperlipidemia and type II diabetes. Children BMIs ranged from 19.0 to 51.5 with a mean BMI of 35.6 (*SD* = 10.6). Parents/guardians of the children were also recruited with ages ranging from 30 to 65 years (*M* = 43.2, *SD* = 7.0) and BMIs ranging from 15.5 to 57.3 (*M* = 33.0, *SD* = 9.4). The EBQ was developed by adapting the DSM-5 substance abuse and dependence criteria for FA/FD.

With face validity in mind, the authors included 20 questions related to the "3 C's" of addiction: Compulsive use, attempts to Cut down, and continued use despite Consequences. A 6-point Likert-type scale was used with ranges from 1 = "Never" to 6 = "Always". Sample questions include, "Do you spend more time eating than you mean to?", and "Have you gotten into trouble because of your eating?". Two forms of the EBQ were adapted for child and adult readability. Internal consistency was good with $\alpha = .84$ for the parent sample and $\alpha = .88$ for the child sample. Additional validity measures were used.

Included validity measures were the EAT-26, Children's Eating Attitudes Test (ChEAT), Three Factor Eating Questionnaire (TFEQ), and Inventory of Overeating Situations (IOS). As mentioned previously, the EAT-26 is a reliable and valid measure

of attitudes about food and personal eating behaviors. Binging, purging, use of diuretics and eating disorder treatment history are included in the questions. An overall score as well as Dieting, Food Preoccupation, and Oral Control subscale scores are given. ChEAT is a modified version of the EAT-26, adapted for use with children. Merlo, et al. (2009), reported good psychometric properties for the ChEAT. The TFEQ consists of 18 items that assess eating patterns associated with cognitive restraint, uncontrolled eating, and emotional eating. This scale is scored using a 4-point Likert-type and can be used with children and adults. Sample items of the TFEQ include "I deliberately take small helpings as a means of controlling my weight," and "Sometimes when I start eating, I just can't seem to stop". Good psychometric properties were reported for the TFEQ. With permission, the IOS was adapted from the Inventory of Drinking Situations (IDTS). Questions in the IOS assess situations that trigger overeating. From the original IDTS questions, words that described drinking were replaced in the IOS with words that described overeating (e.g., "I drank when I had trouble sleeping" became "I overate when I had trouble sleeping"). Internal consistency for the IOS was reported as excellent, α = .99 for the parent sample and α = .98 for the child sample. Results from this study provided evidence for the prevalence of FA/FD in children and adults.

Fifteen percent of the children in this sample endorsed the belief that they often, usually, or always think they are addicted to food. An additional 17.4 % answered that they sometimes feel addicted to food. EBQ scores range from 27 to 104. The average child EBQ score was 51.6 (*SD* = 15.6). Children and their parents/guardians shared similar eating behaviors and attitudes. Positive correlations between child and parent

scores on the IOS, TFEQ, and CHEAT/EAT were significant (r = .54, p = .001, r = .28, p = .05, and r = .39, p = .009, respectively). BMI significantly correlated between the two subset samples (r = .32, p = .05). Child BMI and scores from the EBQ did not reach statistical significance, though a moderate positive correlation was observed (r = .31, p = .06). Overall EBQ scores positively correlated with total IOS and TFEQ scores (r = .64, p <.001, and r = .57, p < .001), respectively. The authors discussed the implications of their findings.

Citing the significant correlations between the EBQ and uncontrolled eating, emotional eating, food preoccupation, body size concerns, and attempts at calorie control, Merlo et al. concluded that the EBQ demonstrated good concurrent validity. Most and least endorsed items were listed, however, item to total correlation values were not reported. Still, the EBQ showed overall good reliability for the adult and child versions, α = .84 and α = 88, respectively. In their discussion, the authors noted that while the EBQ showed promise as a valid and reliable measure, more research was needed to evaluate its psychometric properties. Limitations of this study included a small sample size and restriction of range (clinical sample). The authors suggested that future research should replicate and extend this study to include a broader sample. As growing research continues to investigate the food addiction hypothesis, there is a greater call for theoretical clarity between FA/FD and its related terms and constructs, including compulsive eating and binge eating.

Theoretically Related Constructs: Criterion, Convergent, or Both?

Teasing out the murky differences between FA/FD, compulsive eating, and binge eating can prove difficult. Still, researchers have pointed out that conceptual differences do exist (Cassin & von Ranson, 2007; Davis, 2017; Rogers & Smit, 2000) and greater clarification is warranted (Carlisle, Buser, & Carlisle, 2012). Compulsive eating is a behavioral descriptor that has been observed to exist within both FA/FD and binge eating (Corsica & Pelchat, 2010; Faber, Christenson, Zwaan, & Mitchell, 1995). Cassin and von Ranson (2007) noted that patients described their binge eating as "compulsive overeating" or "food addiction". In their discussion of binge eating as a separate construct, the terms compulsive eating and food addiction were used synonymously. While Cassin and von Ranson differentiate compulsive eating/food addiction from binge eating, Wardle (1987) explains that compulsive eating and binge eating have both described patterns of disturbed overeating, abnormal hunger, and satiation. Nirenberg and Waters (2006) defined compulsive eating as "uncontrollable consumption of a larger amount of food than normal, in excess of that necessary to alleviate hunger." They then defined binge eating as "compulsive eating that occurred over a short period of time." An examination of compulsive eating scale items yields additional insight into the operational definition.

Kagan and Squires (1984) created the Compulsive Eating Scale (CES) to measure uncontrolled eating. The CES consists of 8-items that include the questions: "How often do you eat too much because you are upset or nervous?", "Eat because you are feeling

lonely", "Feel completely out of control when it comes to food", "Eat so much that your stomach hurts", and "Go out with friends just for the purpose of over-stuffing yourselves with food". Item response includes never, once or twice a year, once a month, once a week, and more than once a weak. Reliability of the CES is acceptable, $\alpha = .75$. These questions are applicable to both the DSM-5 BED criteria (American Psychiatric Association, 2013) and the DSM-5 substance dependence criteria (e.g., lack of control, continued use despite negative consequences [Appendix A]). Compulsive eating is not necessarily a separate construct from FA/FD and binge eating, but rather appears to be a term used to describe the overeating behaviors found within these two constructs. While addictive-like mechanisms have been implicated in binge eating, evidence suggests that FA/FD and binge eating occupy unique variance.

Binge eating is listed as a psychiatric disorder in the DSM-5. A table comparing the DSM criteria for BE and substance dependence is located in Appendix A. Similarities between BE and substance dependence include overeating, loss of control, continued use despite negative consequences, and time. Gold, Frost-Pineda, and Jacobs (2003) asked if binge eating should be classified as an addiction. In their discussion, Gold et al. note that both constructs involve pathological attachment to agents that result in harm, risk factors that lead to excessive reward after consumption, evidence of biological susceptibility, denial, and possible early death. Still, not all who qualify for binge eating also qualify for food addiction and vice versa.

When using the DSM-IV substance dependence criteria, Cassin and von Ranson (2007) found that 92% of participants who had BE qualified for a food addiction. Using

a more conservative measure of food addiction (Goodman's addictive disorder criteria), only 40.5% with BE qualified for a food addiction. In a regression analysis, Gearhardt et al. (2009b) found that the diagnostic version of the YFAS accounted for 14.8% of the unique variance in BE. Another recent study using the YFAS found that 57% of BED patients met the food addiction criteria (Gearhardt, White, Masheb, Morgan, Crosby, & Grilo, 2012). The DSM-5 criteria for BE defines a binge eating episode as 1) eating, in a discrete period of time (for example, within any 2-hour period), an amount of food that is definitely larger than most people would eat in a similar period of time under similar circumstances and 2) a sense of lack of control over eating during the episode. Individuals who endorse food addiction may not necessarily partake in binging episodes. For example, a person addicted to food might not consume huge portions within a discrete period of time or eat more rapidly than usual. Instead, someone with a food addiction but without BE might graze on hyperpalatable foods frequently throughout the day or eat normal portioned meals more often than intended. People with BE have been shown to consume more calories in an eating episode than those who are obese without BE (Wonderlich, Gordon, Mitchell, Crosby, & Engel, 2009). BE has also been associated with greater levels of psychopathology than food addiction and obesity.

In a study examining food dependency and its correlates (Taylor & Reynolds, 2012), BE had a greater relationship with psychopathological variables than FA/FD. Depression was more positively related to BE, r = .45 than to FA/FD, r = .33. Self-esteem was more inversely related to BE r = .63 than FA/FD r = .43. Another study found higher rates of comorbidity with major depression, panic attacks, and generalized

anxiety among those who had BED than those who were obese without BED (Grucza, Przybeck, & Cloninger, 2007). The separate classification of BE and FA/FD seems to be appropriate given the important differences between the two conceptualized phenomena (i.e., binging behavior and level of comorbid pathology). Though it appears that BE has greater rates of comorbidity than FA/FD alone (Gearhardt et al., 2012), positive correlations between FA/FD and other psychopathologies do exist.

The negative health implications of obesity are serious and even deadly. With obesity climbing to unprecedented rates, investigation into its causes remains crucial. Evidence in support of the food addiction/food dependency hypothesis provides justification for further analysis from the addiction framework. Physiological evidence suggests that the overconsumption of palatable foods high in carbohydrates may result from deficits in dopaminergic system functioning. Addictive eating behaviors also comprises a large component of binge eating. Although BE and FA/FD share similar qualities, FA/FD has been shown to occupy a unique variance. For that reason, valid and reliable tools of measurement are needed to assess and conceptualize FA/FD. Several measures of FA/FD have been developed including the Humboldt Food Addiction Questionnaire. To confirm validity and reliability of the HFAQ, its psychometric properties need to be evaluated.

Chapter Three: Statement of the Problem

Food addiction/dependency (FA/FD) is not explicitly defined in the Diagnostic and Statistical Manual of Mental Disorders, fifth edition (DSM-5; American Psychiatric Association, 2013), however, certain types of foods illicit addictive responses (Gearhardt, Corbin, & Brownell, 2009a; Pelchat, 2002). These responses can be adapted to fit the diagnostic criteria for substance dependence. The parallels between FA/FD and drug/alcohol addiction are numerous (Pelchat, 2009). Studies with humans and animals have examined the physiological effects of palatable foods within the brain's reward system (Gearhardt et al., 2011; South & Huang, 2006). Biological processes in the brain act favorably in response to foods that are high in carbohydrates, salt, and fat (Cocores, & Gold, 2009). Despite controversy (Rogers & Smit, 2000), mounting evidence supports the food addiction hypothesis (e.g., Avena & Gold, 2011; Gold, Graham, Cocores, & Nixon, 2009).

The existence of FA/FD has been validated through empirical evidence and endorsed by researchers. Reliable and valid measures of this construct are necessary to the investigation of FA/FD. Although measures of overeating pathology exist (including compulsive eating and binge eating [BE]), only a few are dedicated to FA/FD (Meule, 2011). Two of these scales are the Yale Food Addiction Scale and the Eating Behaviors Questionnaire. Given the shortage of FA/FD scales, the Humboldt Food Addiction Questionnaire (HFAQ) was developed to supplement the need for additional measures.

From pilot studies, the HFAQ appears to be a viable FA/FD measure, with strong psychometric characteristics – more data is needed to confirm this.

Using data from college students and adults participating in online forums, the current study focused on validating the psychometric properties of the HFAQ and analyzing its factor structure as pertaining to the criteria of substance dependence.

Reliability

Hypothesis 1a. The HFAQ will demonstrate high internal consistency with an alpha around .90.

In a pilot study examining initial reliability and validity (Worledge & Reynolds, 2011), the HFAQ had strong reliability, $\alpha = .94$. A second pilot study was conducted after the HFAQ was revised to meet a 5th grade reading level (Taylor & Reynolds, 2012). The revised HFAQ was also reliable, $\alpha = .94$.

Hypothesis 1b. Test-retest reliability of the HFAQ will yield an $r > .85$.

Test-retest reliability in the two initial pilot studies resulted in reliabilities of .94 and .92. It is expected that the high reliability test-retest of the HFAQ will be replicated.

Validity

Hypothesis 2a. The HFAQ will be moderately to strongly correlated with criterion measures, YFAS and EBQ ($r > .50$).

The YFAS was a criterion measure in the first pilot study. A Pearson Correlation, $r = .54$, was found between the HFAQ and the YFAS. Although the statistical

relationship between the EBQ and HFAQ is unknown, as theoretical criterions, the two are expected to yield a moderate to strong correlation. Both criterion measures have demonstrated good reliability and validity (Gearhardt et al., 2009b; Merlo et al., 2009).

Hypothesis 2b. A moderate positive correlation ($r > .40$) will be found between the HFAQ and convergent measures: EAT-26, and DGI (with food subscale).

In an initial pilot study, the Eat-26 moderately correlated with the HFAQ ($r = .39$). The DGI strongly correlated with the HFAQ in the second pilot study ($r = .60$).

Hypothesis 2c. There will be a low relationship ($r < .30$) between the HFAQ and a discriminant measure of substance use (measured with the CSUS).

The CSUS was used as a discriminant measure in the first pilot study of the HFAQ. There was not a statistically significant relationship between the CSUS and the HFAQ ($r = -.091$, $p = .519$). A measure of substance use was also used to establish discriminant validity in an initial examination of reliability and validity for the criterion measure, YFAS (Gearhardt et al., 2011).

Factor Analysis

Research Question 3a. Will a factor analysis of the HFAQ reveal a factor structure comparable to the seven specific dependence criteria listed in the DSM-5?

The second pilot study using the revised HFAQ resulted in a factor analysis extracting seven components. The HFAQ was developed following the DSM-IV-TR seven criteria of substance dependence. It is anticipated that factors will corroborate with the specific criteria. A larger sample size is needed to detect significant factors.

Chapter Four: Methodology

Participants

A total of 626 people participated in this study (451 women; 166 men, 9 missing) with an average age of 23.54 (*SD* = 8.57). In addition to basic demographics, weight and diet related questions were also asked. Body Mass Index (BMI) was calculated and, according the Centers for Disease Control (CDC, 2018) guidelines, the majority of participants were considered overweight or obese (*M* = 26.38, *SD* = 6.43). Participants also reported eating junk food an average of 4.24 times per week (*SD* = 4.01). Over one-third of participants (*n* = 234) disclosed that they binge ate. When asked if they were currently dieting, twenty-two percent answered yes (*n* = 135) with thirty-seven percent of them (*n* = 65) describing it as "serous" dieting. The total sample was broken out into two subsets.

Table 1 provides descriptive information in the Humboldt State University (HSU) and Online Sample. HSU students who were registered with the Psychology Department's Research Participation Pool made up the first subset and represented most of the study sample (*n* = 519). A second subset of participants (*n* = 107) were online users recruited using survey tools provided by Survey Monkey from web forums and social media groups dedicated to health and eating/weight related topics. Though both samples had more women than men, the HSU student sample had twenty percent more

Table 1

Participant Demographics

	HSU Students		Online Participants		Total	
Demographic	*n*	%	*n*	%	N	%
Sex: Men	155	30.4	11	10.3	166	26.9
Women	355	69.6	96	89.7	451	73.1
College grade level						
Sophomore	113	35.6	1	11.1	114	35.0
Junior	95	30.0	2	22.2	97	29.7
Senior	97	30.6	1	11.1	98	30.1
Graduate	12	3.8	5	55.6	17	5.2
Education level						
Less than high school	-	-	3	2.8	3	2.8
High school	-	-	16	15.0	16	15.0
Some College/associates	-	-	46	43.0	46	43.0
Bachelor's degree	-	-	21	19.6	21	19.6
Master's degree	-	-	13	12.1	13	12.1
PhD	-	-	8	7.5	8	7.5
Ethnicity						
African American	35	6.8	2	1.9	37	6.0
Asian	26	5.0	2	1.9	28	4.5
Hispanic	191	37.1	9	8.6	200	32.3
Native American	7	1.4	1	1.0	8	1.3
White	213	41.4	81	77.1	294	47.4
Bi-racial/multiracial	29	5.6	8	7.6	22	5.0
Other	14	2.7	2	1.9	31	3.5

Note. Percent values do not include missing data.

men than the online sample (χX^2 (1, N = 617) = 18.19, p < .001, ϕ = .17). The online sample had a higher average age (M = 37.37, SD = 11.62) than the HSU students (M = 20.62, SD = 3.43), t(612) = 27.37, p <.001, d = 1.95. Race/ethnic makeup of the online participants included thirty-three percent more White participants than the HSU student sample (χ^2 (1, N = 620) = 44.79, p < .001, ϕ = .27). A higher percentage (73%) of online participants had BMI's that indicated overweight or obese (M = 30.64, SD 8.79) compared with the HSU students (48%), (M = 25.49, SD = 5.43), t(613) = 7.86, p <.001, d = 0.70. Over one-half of the online participants disclosed that they binge ate and compared to 34% of the HSU student sample (χ^2 (1, N = 619) = 16.54, p < .001, ϕ = .16). There were no significant differences in those who were currently dieting between the online and HSU student samples (χ^2 (1, N = 518) = 1.59, p = .21).

Instrumentation

A total of six scales were used to measure our participants on the constructs of food addiction/food dependency, eating disturbance, binge eating, substance use, and delay of gratification. The primary eating disturbance measure was the Humboldt Food Addiction Questionnaire (HFAQ; Worledge & Reynolds, 2011; Appendix B). The 33 items on the HFAQ were generated from the seven specific criteria qualifying substance dependence as defined in the DSM-IV-TR. The DSM-IV-TR requires that at least three of the seven patterns of substance use occur at any time during the same twelve-month period to qualify. These criteria include 1) Tolerance, 2) withdrawal, 3) substance taken

in larger amounts or for longer than intended, 4) persistent desire or unsuccessful attempts to cut the substance use down, 5) a great deal of time spent to obtain, use, or recover from the substance, 6) important social, occupational, or recreational activities compromised because of the substance, and 7) the substance is used despite negative physical or psychological problems it likely causes.

Sample questions in the HFAQ include, “My eating habits do not cause problems for me” and “I feel that I am addicted to fast food or junk food.” A four-point Likert-type scale ranging from “strongly disagree” to “strongly agree” is used to answer the thirty-three questions with a possible total score of 132 points. A pilot study was conducted to investigate the reliability and validity of the HFAQ with preliminary results indicating good reliability and validity, warranting further investigation. Criterion, convergent, and discriminant measures were used to establish validity of the HFAQ.

Criterion measures in this study include the Yale Food Addiction Scale (YFAS; Gearhardt et al., 2009b; Appendix C) and the Eating Behaviors Questionnaire (EBQ; Merlo et al., 2009; Appendix D). Both scales are similar to the HFAQ in that the questions were developed by adapting the DSM-5 substance abuse and dependence criteria for FA/FD. The YFAS consists of 16 items using a frequency scale ranging from “Never” to “4+ times daily”. Sample questions in the YFAS include, “I find that when I start eating certain foods, I end up eating much more than planned” and “I eat to the point where I feel physically ill.” Questions 17 through 24 pertain to the past twelve months and include items such as, “My food consumption has caused significant psychological problems such as depression, anxiety, self-loathing, or guilt.” An additional twenty-fifth

question is asked, “How many times in the past year did you try to cut down or stop eating certain foods altogether?” Several food types are also listed where the participant is asked to circle which foods they find most problematic for them. The EBQ includes 20 questions using a 6-point Likert-type scale ranging from 1 = “Never” to 6 = “Always”. Sample questions include, “Do you spend more time eating than you mean to?”, and “Have you gotten into trouble because of your eating?” Both criterion measures have been shown to be reliable and valid (Meule & Kubler, 2012; Santos, Cadieux, & Ward, 2018).

Convergent measures included the EAT-26 (Garner, Olmsted, Bohr, & Garfinkel, 1982; Appendix E), and the Delaying Gratification Inventory (DGI short form with food subscale; Hoerger, Quirk, & Weed, 2011; Appendix F). The EAT-26 is a reliable and valid measure of attitudes about food and personal eating behaviors. Binging, purging, use of diuretics and eating disorder treatment history are included in the questions. Questions are answered on a 6-point Likert-type scale ranging from “Always” to “Never.” Reliability and validity has also been demonstrated with the short form version of the DGI with food subscale. This scale includes fifteen items related to impulse control in general as well as pertaining to food. A five-point scale ranging from “Strongly Disagree” to “Strongly Agree” is used with questions such as, “I can resist junk food when I want to” and “Sometimes I eat until I make myself sick.” Given the shared nature of these surveys, moderate relationships were expected between the convergent measures and the HFAQ.

Lastly, the College Substance Use Scale (CSUS; Reynolds, 2002; Appendix G) was used as a discriminant measure of the HFAQ. Eight questions pertaining to the use of alcohol and drugs in the past year comprise the CSUS. Substances are listed and answered on a six-point frequency scale ranging from "Never or almost never" to "Several times a day." A low relationship between the CSUS and HFAQ was expected.

In addition to the measures, participants also filled out a demographic form (Appendix H). Demographic information included questions such as location, age, race, ethnicity, height and weight, etc.

Procedure

HSU students. Humboldt State University students were recruited from the Research Participation Pool and received approximately three units of participation credit. Current guidelines require one unit per every quarter hour spent. It took participants approximately 45 minutes to complete the study. For test-retest reliability, students were given the option to complete the survey again one week after they first took it. Those who participated a second time received an additional three units of credit. The survey was completely anonymous. A paper-and-pencil survey packet containing the measures and demographic questions were administered to participants by research assistants in a laboratory room setting. Participants were read informed consent along with instructions (Appendix I). Data packets were locked and will be saved for at least five years. At the end of the survey was a page listing psychological resources that participants were able to take with them (Appendix J).

Online participants. Using Survey Monkey, participants were recruited from online forums and social networking sites. Survey Monkey is an independent web service that charges for its online survey tools. An electronic version of the survey packet was created using the custom survey design tool. Research has supported the utility of online-survey methods as valid and reliable (Yun & Trumbo, 2000). Participants were recruited from several health and eating/weight related website forums including, weight-loss.fitness.com, obesityhelp.com, and dailystrength.org. Facebook groups focused on health, weight loss, overeating, and fitness were also used to solicit participation in the study. Only non-identifying information was collected (IP addresses were not recorded).

Data Analysis

Data was analyzed using the statistical software program, IBM SPSS 21. Prior to statistical testing, data was cleaned, recoded, computed, and checked for assumption criteria. For missing measure data, average values were entered where at least 80 percent of the items for specific measures were completed.

Hypotheses

Hypothesis 1a statistical test. Cronbach's coefficient alpha was analyzed to determine internal consistency. Item-to-total correlations for each item was also examined.

Hypothesis 1b statistical test. Scores from time one and time two were analyzed using a Pearson Correlation.

Hypothesis 2a statistical test. Scores from the HFAQ, YFAS, and EBQ were compared using a Pearson Correlation.

Hypothesis 2b statistical test. Scores from the HFAQ, convergent measures, Eat-26, and DGI were compared using a Pearson Correlation.

Hypothesis 2c statistical test. Scores from the HFAQ and CSUS were analyzed using a Pearson Correlation.

Research Question 3a factor analysis. An exploratory factor analysis (principal axis factoring with oblique rotation) was used to detect factors.

Benefits, Potential Risks, and Management of Risk

Benefits to participants were likely minimal. For some, the act of taking the study may have provided insight into their own eating behaviors and thoughts, prompting them to seek out further information and help. Given the benign nature of surveys, the potential risk to participants was negligible. For online participants, IP addresses were not recorded and user e-mails were not linked to survey data. At the end of each survey was a psychological resource page (Appendix J) with information that participants could save.

Chapter Five: Results

Preliminary Analyses

Significant differences in mean composite scores of the HFAQ between the HSU student and online participant sample were found (see Table 2), $t(624) = 3.76$, $p < .001$, $d = 0.38$. See Table 3 for means and standard deviations of the HFAQ and validity measures by sex.

Reliability

Hypothesis 1a analysis. The HFAQ was found to be highly reliable, $\alpha = .95$, for the total sample. Corrected item-total correlations were between .35 and .75. Reliability for the HSU sample was $\alpha = .94$. Reliability for the online sample was $\alpha = .96$. Reliability for men was $\alpha = .93$. Reliability for women was $\alpha = 95$.

Hypothesis 1b analysis. Test-retest reliability ($n = 81$) of the HFAQ over a one-week period between time one ($M = 72.31$, $SD = 18.14$) and two ($M = 69.01$, $SD = 17.60$) was high ($r(80) = .89$). A paired-samples t-test between HFAQ means scores at time one and time two was not statistically significant, $t(80) = 0.95$, $p = .35$, $d = 0.05$.

Table 2

Means and Standard Deviations of the HFAQ and Validity Measures by Sample Group and the Total Sample

	HSU Students			Online Participants			Total		
Measures	*n*	*M*	*SD*	*n*	*M*	*SD*	*N*	M	*SD*
HFAQ	519	71.09	17.35	107	78.26	20.68	626	72.32	18.14
YFAS	516	15.34	11.21	87	17.47	13.79	603	15.65	11.63
EBQ	516	53.78	16.52	75	57.57	18.19	591	54.26	16.77
Eat-26	514	59.42	18.72	69	60.55	18.12	583	59.55	18.63
DGI	515	36.59	7.71	76	39.46	9.51	591	36.96	8.01
CSUS	514	4.60	4.03	60	4.78	4.03	574	4.62	4.02

Note. HFAQ = Humboldt Food Addiction Questionnaire; YFAS = Yale Food Addiction Scale; EBQ = Eating Behaviors Questionnaire; EAT-26 = Eating Attitudes Test; DGI = Delaying Gratification Inventory; CSUS = College Substance Use Scale.

Table 3

Means and Standard Deviations of the HFAQ and Validity Measures by Sex

	Men			Women		
Measures	*n*	*M*	*SD*	*n*	*M*	*SD*
HFAQ	166	67.07	15.21	451	74.33	18.90
YFAS	162	12.99	9.21	432	16.74	12.35
EBQ	160	49.78	15.15	422	56.01	17.13
Eat-26	160	52.95	17.07	414	62.31	18.68
DGI	160	36.66	7.80	422	37.15	8.13
CSUS	158	5.68	4.29	407	4.23	3.77

Note. HFAQ = Humboldt Food Addiction Questionnaire; YFAS = Yale Food Addiction Scale; EBQ = Eating Behaviors Questionnaire; EAT-26 = Eating Attitudes Test; DGI = Delaying Gratification Inventory; CSUS = College Substance Use Scale.

Validity

Hypothesis 2a Analysis. The HFAQ was strongly correlated with the two criterion validity measures: the YFAS ($r(601) = .78$, $p < .001$, 95% CI [.75, .81]) and EBQ ($r(589) = .76$, $p < .001$, CI [.73, .79]). See Table 4 for measure intercorrelations.

Hypothesis 2b Analysis. Moderate correlations were found between the HFAQ and the two convergent measures: the EAT-26 ($r(581) = .40$, $p < .001$, 95% CI [.32, .45]) and DGI ($r(589) = .66$, $p < .001$, 95% CI [.62, .71]).

Hypothesis 2c Analysis. There was a low, nonsignificant correlation of $r(572) = .06$ ($p = .13$) between the HFAQ and the discriminant validity measure of substance use, the CSUS.

Research Question 3a Factor Analysis. An exploratory factor analysis (principal axis factoring with oblique rotation) was used to examine the factor structure of the HFAQ. The minimum sample size assumption was adequately met, with a final sample size of 626 and a ratio of over 18 participants per item. Reasonable factorability was presented as all 33 items correlated .3 and above with at least one other item. Sampling adequacy was met as the Kaiser-Meyer-Olkin measure was .96, greater than the suggested value of .6 and Bartlett's test of sphericity was significant (χ^2 (528) = 10720.71, $p < .001$). Every item shared common variance with others as all communalities were above .3. Overall indicators suggested that factor analysis was appropriate for the 33 items.

Table 4

Summary of Measure Reliability and Intercorrelations

Measures	1	2	3	4	5	6
1. HFAQ	(.95)	.78	.76	.39	.66	**.06**
2. YFAS		(.91)	.79	.47	.62	.09
3. EBQ			(.92)	.49	.57	.09
4. EAT-26				(.89)	.17	.11
5. DGI					(.79)	.13
6. CSUS						(.89)

Note. Non-significant relationships are in bold. All other correlations are significant at $p < .05$. Reliability coefficients are shown in diagonal. HFAQ = Humboldt Food Addiction Questionnaire; YFAS = Yale Food Addiction Scale; EBQ = Eating Behaviors Questionnaire; EAT-26 = Eating Attitudes Test; DGI = Delaying Gratification Inventory; CSUS = College Substance Use Scale.

Initial eigenvalues revealed that the first two factors explained 39%, and 6%, of the variance. The third, fourth, and fifth factors had eigenvalues greater than 1, and each account for 4-5% of the variance. Factor analyses with three, four, and five factors were explored using Direct Oblimin rotation. A five-factor analysis was chosen based on eigen values that leveled out on the scree plot beginning with the sixth factor (see Appendix K), as well as the inadequate number of loadings. The factor loading matrix of the rotated factor analysis is shown in Table 5.

Items with the highest factor loadings were grouped into the five factors, accordingly. The first factor consisted of 9 items with the following 3 items sharing the strongest factor loadings: 1) "I often can't help eating more of these foods than I originally wanted to.", 15) "I eat these foods even though it may be bad for me (i.e., weight gain).", and 6) "I often have the urge to eat these foods."

Factor two consisted of 12 items with the following showing the highest factor loadings: 31) "I feel anxious or jittery when I do not regularly eat these foods.", 29) "It seems I have to eat more of these foods to feel good.", and 13) "There have been times I've missed activities, work, or doing things with others because of my need to eat."

The three remaining factors include items relating to single substance dependence criteria. Factor three consists of 3 items: 9) "I spend a lot of time thinking about my next meal.", 11) "I feel that I think too much about food.", and 10) "I will go out of my way to get the foods that I want to eat." Factor four consists of 5 items with the following 3 having the highest factor loadings: 18) "I am afraid of what people will think of my over-eating but I still continue to do it.", 16) "I feel guilty after I overeat.", and 19) "My eating

Table 5

Factor Loadings of the HFAQ (N = 619)

Item	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Communality
1	**.65**	-.01	.09	-.03	.10	.59
15	**.63**	.00	.02	-.13	-.02	.43
6	**.62**	-.10	.22	.19	.02	.53
4	**.58**	-.02	.14	.02	.04	.44
20	**.56**	-.02	-.12	-.14	.01	.37
7	**.53**	-.11	.17	-.10	.10	.62
2	**.47**	-.04	.23	.03	.13	.51
8	**.43**	-.12	.17	-.23	.14	.63
5	**.40**	-.06	.31	.11	.12	.45
31	.04	**-.83**	-.03	.16	.02	.55
29	.03	**-.61**	.09	-.04	.14	.57
13	-.17	**-.59**	.27	-.20	-.14	.60
12	-.14	**-.59**	.24	-.26	-.06	.64
22	.08	**-.56**	-.02	.08	.06	.41
30	.35	**-.46**	-.01	.07	.10	.55
25	.25	**-.45**	-.12	-.30	.18	.66
33	.30	**-.44**	-.05	-.05	.21	.57
32	.12	**-.37**	.16	-.23	.07	.51
21	.34	**-.36**	.02	-.08	.09	.51
14	-.01	**-.32**	.30	-.03	.02	.32
23	.26	**-.32**	.03	-.20	.03	.43
9	.10	-.01	**.71**	-.05	.07	.54
11	.11	-.05	**.59**	-.21	.10	.59
10	.14	-.12	**.50**	.10	.09	.41
18	.23	-.24	.11	**-.48**	.07	.62
16	.27	.13	.16	**-.47**	.02	.39
19	.00	-.16	-.04	**-.43**	.36	.45
24	.39	-.18	-.07	**-.39**	.14	.60
27	.04	-.36	.07	**-.39**	.19	.58
28	-.12	.03	-.03	-.15	**.78**	.40
3	-.06	.03	.11	.07	**.58**	.27
26	.22	-.04	-.08	-.02	**.48**	.39
17	.09	-.04	.02	.08	**.44**	.24
Eigenvalues	12.8	2.1	1.6	1.4	1.2	
% Variance	38.9	6.2	4.8	4.1	3.7	

Note. Principle Axis Factoring with Oblimin rotation. Factors explain 57.80% of the total variance.

habits do not cause problems for me." Factor five consists of 4 items with the following 3 having the highest factor loadings: 28) "Once I start eating these foods, it is easy for me to stop.", 3) "Most of the time I can eat a single serving of these foods and feel satisfied.", and 26) "It is easy for me to avoid desserts, fast food, or junk food."

Secondary Analyses

Food Addiction Score Results. There was a positive correlation between HFAQ scores and BMI, $r = .26$, $p < .001$, 95% CI [.18, .33]). YFAS scores were also positively correlated with BMI, $r = .26$, $p = < .001$, 95% CI [.18, .33]. Those who reported currently dieting had significantly higher scores ($M = 75.53$, $SD = 21.17$) on the HFAQ than those who did not ($M = 71.44$, $SD = 17.48$), $t(623) = 2.33$, $p < .05$, $d = 0.22$. Similarly, YFAS scores between those who were currently dieting ($M = 19.22$, $SD = 13.44$) were higher than those who were not ($M = 14.67$, $SD = 10.87$), $t(600) = 4.03$, $p < .001$, $d = 0.37$.

Binge Eating Results. Participants who reported binge eating had significantly higher scores ($M = 82.02$, $SD = 17.61$) on the HFAQ than those who did not ($M = 66.20$, $SD = 15.62$), $t(617) = 11.64$, $p < .001$, $d = 0.95$. The same pattern was observed in YFAS scores between those who binge ate ($M = 21.92$, $SD = 12.57$) and those who did not ($M = 11.77$, $SD = 9.05$), $t(594) = 11.42$, $p < .001$, $d = 0.93$. BMI was higher among those who reported binge eating ($M = 27.34$, $SD = 6.99$) versus those who did not ($M = 25.76$, $SD = 5.99$), $t(617) = 2.96$, $p < .004$, $d = 0.24$.

Sex Difference Results. Women had higher HFAQ mean scores (M = 74.33, SD = 18.91) than men (M = 67.07, SD = 15.21), $t(615) = 4.45$, $p < .001$, $d = 0.42$. On the YFAS, women also had higher mean scores (M = 16.74, SD = 12.35) than men (M = 12.99, SD = 9.21), $t(592) = 3.51$, $p < .001$, $d = 0.32$. Fourteen percent more women reported binge eating than men (χ^2 (1, 610) = 10.87, $p = .019$, $\phi = .13$). A difference in 9% of more women than men reported to be currently dieting (χ^2 (1, 616) = 6.34, p = .012, $\phi = .13$).

Chapter Six: Discussion

Introduction

The purpose of this study was to investigate the psychometric properties of the Humboldt Food Addiction Questionnaire (HFAQ). With the ever-increasing national and global rise in obesity leading to devastating health outcomes and increased medical costs, it is vitally important to investigate the reasons behind this epidemic (Biener, Cawley, & Meyerhoefer, 2017). In the U.S., beginning in the 1980's, there was a sharp rise in obesity rates and it has continued to rise to unprecedented levels (Robinson, Keyes, Utz, Martin, & Yang, 2013). This phenomenon in largely attributed to the oversaturation of nutritionally deficient processed foods high in carbohydrates that are increasingly pervading the standard American diet (Schor & Ford, 2007).

Cheap, processed foods that are high in sugar, salt, and fat account for more than three-fourths of total energy intake in U.S. households (Tamanna & Mahmood, 2015). Unfortunately, this dietary assault on the American public, peddled by giant food corporations who profit from the government-imposed subsidies on corn and wheat, has contributed to a staggering 39% of Americans being overweight or obese (Brownell & Horgen, 2004; Siegel, Bullard, Imperatore, Kahn, Ali, & Narayan, 2016; Tilloston, 2004). Food manufactures purposefully engineer their processed food to be highly palatable despite the absence of nutritional value (Steele, Baraldi, Louzada, Moubarac, Mozaffarian, & Monteiro, 2016). Research has shown that foods high in sugar, salt, and

fat are exceedingly addictive and activate the same reward pathways in the brain as other pleasure inducing drugs such as cocaine and heroin (Carlier, Marshe, Cmorejova, Davis, & Muller, 2015; Ifland et al., 2009).

Studies with animals and humans have provided biological evidence that repeated ingestion of hyperpalatable foods mimic the same neural and behavioral mechanisms seen with other substances, long-regarded as additive (Gearhardt et al., 2011; Novelle & Diéguez, 2018). Overconsumption of sweet, salty, and fatty foods has been shown to desensitize dopamine receptors (Blackburn, Phillips, Jakubovic, & Fibiger, 1986; Johnson & Kenny, 2010). Dopamine is a powerful neurochemical that produces feelings of pleasure and its dysregulation has been implicated in the addiction model framework. The DSM substance abuse criteria include tolerance and withdrawal that can be applied to the food addiction model. As more hyperpalatable food is consumed, the less sensitive dopamine receptors become. This eventually leads to more cravings and increased consumption in order to produce satiation. Physically, overconsumption of hyperpalatable foods can lead to tolerance and withdrawal. Behaviorally, tolerance and withdrawal prompt individuals to seek these foods. A vicious cycle is established where the physical, behavioral, and psychosocial ramifications of food addiction can be devastating. To understand food addiction, tools that capture the nature of this construct are necessary. For this reason, the HFAQ was created.

Development of the HFAQ was based on the seven DSM substance criteria that define substance abuse. These seven criteria encompass the physical, behavioral and psychosocial aspects involved in addiction including tolerance and withdrawal, taking in

larger amounts and more frequently than intended, continued use despite negative consequences, preoccupation and increased time spent using and procuring the substance, inability to reduce or stop use despite the desire to, and important social, occupational, and recreational activities given up or reduced because of problematic use. Thirty-three items, based on the seven DSM substance abuse criteria, are included in the HFAQ. To establish the validity of the HFAQ, adult participants were recruited to take this questionnaire along with several other related measures.

A total of 626 participants who were recruited from Humboldt State University and online forums/social media related to health and weight loss were included in this study. Most of the participants were young, with an average age of 23, though the range included adults aged 18 to 70. The majority of participants were female and White or Hispanic, though other racial and ethnic makeups included African American, Asian, and Native American. Some participants identified as Bi-racial, Multi-racial, or "Other". Self-reported height and weight were used to calculate BMI. Over half of the participants were considered overweight or obese and about one-third of them disclosed binge eating. HSU students comprised most of the sample and around 17% made up the online sample. Online participants had higher BMIs than HSU students and over one-half of them disclosed that they binge ate compared to one-third of HSU students participating in the study. Along with demographic data, participants also completed measures that informed the reliability and validity of the HFAQ.

Internal Consistency and Reliability Results

In this study, the HFAQ demonstrated high internal consistency with a Cronbach's coefficient alpha of .95, suggesting a strong inter-relatedness between the 33 items. A high coefficient alpha indicates that the items of a test are related to each other. This was confirmed as the item total scale correlations of the 33 HFAQ items were between .35 and .75. Because demonstration of internal consistency is recommended prior to use in a study (Tavakol & Dennick, 2011), the HFAQ was initially piloted in 2011. With a sample of 57 HSU students (59% female), results showed a Cronbach's coefficient alpha of .94 (Worledge & Reynolds, 2011). After revising the HFAQ items to meet a 5th grade reading level, a second study included 82 HSU students (68% female) and also found a Cronbach's coefficient alpha of .94 (Taylor & Reynolds, 2012). The internal consistency results of the current study parallel what was found in the pilot and second studies, corroborating initial findings that the HFAQ is a reliable measure. To further support evidence of reliability, a test-retest between time one and time two, over a one-week period, resulted in a high correlation of .89. The high test-retest correlation demonstrated stability of responses despite administration of the HFAQ at different time points. Overall, internal consistency and reliability of the HFAQ was established.

Validity Results

Criterion validity results. The criterion measures in this study, Yale Food Addiction Scale (YFAS) and Eating Behaviors Questionnaire (EBQ), were chosen

because they have been established in the literature as both reliable and valid tools for measuring food addiction (Gearhardt et al., 2009b; Merlo et al., 2009). In-line with the literature, this study confirmed internal consistency showing Cronbach's coefficient alphas of .91 and .92 for the YFAS and EBQ, respectively. Similar items are included in the YFAS and EBQ. For example, 1 item on YFAS items states, "My behavior with respect to food and eating causes significant distress" and another in the EBQ states, "Do you feel upset or sad about your eating habits?" Because the criterion measures have been established as valid and reliable tools for measuring the same construct of food addiction, it was expected that the HFAQ would be highly related to them. Evidence for a strong relationship between the HFAQ and criterion measure YFAS was provided, $r = .78$, $p < .001$. A strong relationship between the HFAQ and EBQ, $r = .76$, $p < .001$, was also shown. Likewise, the YFAS and EBQ shared a similarly strong relationship of .79. As hypothesized, the HFAQ and criterion measures, YFAS and EBQ were all highly correlated with each other, confirming criterion validity of the HFAQ.

Convergent validity results. Two convergent measures were used in this study, the Eating Attitudes Test (EAT-26) and the Delaying Gratification Inventory (DGI short form with food subscale). Both measures have established reliability and validity (Garner et al., 1982; Hoerger et al, 2011). This study confirms adequate internal consistency of the EAT-26 and DGI with Cronbach's coefficient alphas of .89 and .79, respectively. The EAT-26 contains eating disorder items describing food restriction and binging and purging. It also asks questions related to food addiction such as, "Find myself preoccupied with food" Items on the DGI relate to impulse control and converge

with the HFAQ where there is a focus on controlling food consumption such as, “I can resist junk food when I want to.” Because the convergent measures share some items related to the same food addiction construct, it was expected that the HFAQ would have a medium relationship with them. As hypothesized, there was a moderate correlation between the HFAQ and convergent measures, EAT-26 (r = .40, p < .001) and DGI (r = .66, p < .001). A stronger relationship between the DGI and HFAQ compared to the EAT-26 and HAFQ can be explained by the higher number of items related to food addiction included in the DGI. Thus, convergent validity of the HFAQ was demonstrated by its moderate relationship with the EAT-26 and stronger-moderate relationship with the DGI.

Discriminant validity results. A measure of college substance use (College Substance Use Scale; CSUS) was used as the discriminant measure. Questions on the CSUS ask the participant how frequently they have consumed beer, wine, and/or used drugs over the past year. Since there are no questions about food on the CSUS, it is theoretically different from the HFAQ. Whereas convergent and criterion measures should show respectively increasing levels of relationship, discriminant measures should show none (Campbell & Fiske, 1959). Discriminant validity was demonstrated as there was a very low nonsignificant correlation of .06 (p = .13) between the HFAQ and the discriminant measure of substance use, CSUS.

Factor Analysis Results

To answer whether the DSM-IV-TR dependence criteria that the HFAQ items are based upon, would emerge as factors comprising the HFAQ, a factor analysis was conducted. Results revealed that DSM substance criteria were present within the five factors. Together, the first two factors captured the seven DSM substance criteria with multiple items included in them. Remaining factors three, four, and five each accounted for single and unique DSM substance criteria.

The first factor includes items that show the most agreement with the four following DSM substance dependence criteria: 3) "the substance is often taken in larger amounts or over a longer period than was intended", 4) "there is a persistent desire or unsuccessful efforts to cut down or control substance use", 5) "a great deal of time is spent in activities necessary to obtain the substance (e.g., visiting multiple doctors or driving long distances), use the substance (e.g., chain-smoking), or recover from its effects", and 7) the substance use is continued despite knowledge of having a persistent or recurrent physical or psychological problem that is likely to have been caused or exacerbated by the substance.

Items on factor two most align with the following 3 DSM substance dependence criteria: 1) "tolerance, as defined by either a need for markedly increased amounts of the substance to achieve intoxication or desired effect and markedly diminished effect with continued use of the same amount of the substance", 2) "withdrawal, as manifested by either the characteristic withdrawal syndrome for the substance and the same (or a closely

related) substance is taken to relieve or avoid withdrawal symptoms", and 6) "important social, occupational, or recreational activities are given up or reduced because of substance use" Together, factors one and two account for the items pertaining to all 7 DSM substance dependence criteria.

Factor three contains items related to a preoccupation with food including, "I spend a lot of time thinking about my next meal." Items on factor three are best described by the DSM substance criteria (5), "a great deal of time is spent in activities necessary to obtain the substance (e.g., visiting multiple doctors or driving long distances), use the substance (e.g., chain-smoking), or recover from its effects" Continued use despite negative consequences is captured on factor four with items such as, "I am afraid of what people will think of my over-eating but I still continue to do it." DSM criteria (7) best describes factor four, "the substance use is continued despite knowledge of having a persistent or recurrent physical or psychological problem that is likely to have been caused or exacerbated by the substance (e.g., current cocaine use despite recognition of cocaine-induced depression, or continued drinking despite recognition that an ulcer was made worse by alcohol consumption)." An ability to control the amount of food consumed is described by the items in factor five including, "Once I start eating these foods, it is easy for me to stop." Most related to factor five is the DSM substance criteria (3), "The substance is often taken in larger amounts or over a longer period than was intended."

Because the first two factors contained multiple DSM substance abuse criteria within them, a clear distinction was not established. Still, given that the DSM substance

criteria are so closely related, this result was not particularly surprising. In addition, the last three factors showed distinct relationships with three of the DSM substance criteria. Overall, the factor analysis demonstrated relationships between the DSM substance criteria and the items in the HFAQ.

Secondary Analyses Results

Food addiction scores. There was a low correlation (r = .26) between scores on the HFAQ and BMI. Likewise, a low correlation (r = .26) existed between scores on the YFAS and BMI. Research supports these findings as positive relationships between food addiction and BMI have been found (Gearhardt, Boswell, & White, 2014; Murphy, Stojek, & MacKillop, 2014; Pursey, Stanwell, Gearhardt, Collins, & Burrows, 2014). Those who reported to be currently dieting had a small increase in HFAQ scores than those who said they were not currently dieting (d = 0.22). Similarly, there was a difference in higher YFAS mean scores for current dieters versus those who were not currently dieting (d = 0.37).

Binge eating. In comparing those who binge ate versus those who did not, secondary analyses revealed higher scores on both the HFAQ and YFAS for those who reported binge eating. The effect size of this analysis was d = 0.95, demonstrating a large difference in food addiction scores between those who reported binging and those who did not. This result supported findings in the literature showing a significant positive relationship between those who binge eat and those who score higher on measures of food addiction (Cassin & von Ranson, 2007; Gearhardt, et al., 2012; Pursey et al., 2014).

Those who reported binge eating also had higher BMIs than those who did not (d = 0.24). Research supports these findings as it has found that the prevalence of binge eating increases as the degree of obesity increases (Telch, Agras, & Rossiter, 1988; ZelitchYanovski, 1993). These results demonstrate a positive relationship between binge eating, food addiction, and BMI.

Sex differences. Women had higher HFAQ scores than men, d = 0.42. YFAS scores were also higher for women than men, d = 0.32. These findings are supported by the literature showing higher prevalence of food addiction in women than in men (Pursey et al., 2014). Past research has also shown that women are more likely to experience food cravings than men (Pelchat, 1997).

Limitations

Several limitations were present in this study. First, the majority of participants were HSU students residing in a rural Northern California community and thus not entirely representative geographically or educationally. Second, participants recruited online from health and weight-related forums/social media may have inherent differences based on the nature of their willingness to participate in the anonymous study as well as the types of websites from which they were recruited. Fourth, given that most of the participants were female, males may have been underrepresented. Finally, self-reported items, including height and weight, were not able to be independently verified.

Recommendations for Future Research

The preliminary results of this study demonstrated the utility of the HFAQ for measuring food addiction in adults. Further research with the HFAQ administered to a more representative sample is justified. Although the HFAQ does not have a clinical cutoff score to diagnose food addiction, higher scores indicate greater endorsement of food addiction criteria. Given the strong psychometric properties of the HFAQ, this measure can be used in studies to examine the nature of food addiction. Though the study of food addiction has become more prevalent in recent years, additional research is needed to examine the relationship between food addiction, health outcomes, and psychosocial correlates. Because food addiction and binge eating share a moderate amount of variance, additional examination into the differences and similarities in their development and symptomology is warranted. Additional fine-tuning of the HFAQ is also a possibility for future research.

Future development of the HFAQ could include a short-from version of the measure where there is a reduction in the current number of items (33). Results from the HFAQ factor analysis indicated that the first two factors encompassed all 7 DSM diagnostic criteria for substance dependence. It is plausible that a short form version of the HFAQ can be developed using the items identified in the first two factors while still retaining high reliability and validity. In addition to developing a short-from version of the HFAQ, translated versions can also be created. Given that food is universal, it might

be worthwhile to translate the HFAQ into additional languages where it's psychometric properties can be evaluated for use with varying populations.

Conclusions

This study set out to establish reliability and validity of the HFAQ as a psychometrically sound tool to measure food addiction in adults. A relatively large sample consisting of 626 participants provided demographic information and completed several measures, providing a rich dataset for numerous analyses. Two groups were recruited for participation in this study; HSU students and online participants. HSU students were given a paper and pencil version of the study while the online participants completed the study using an online survey tool. Because there were two groups in the study, recruited via different methods, comparisons between them yielded valuable insight into their unique characteristics and demonstrated a level of diversity among the total sample. With a robust dataset, hypotheses were tested.

Reliability of the HFAQ was excellent and the results agreed with two previous pilot studies that examined its psychometric properties. The coefficient alpha of the HFAQ was in the same range as the other validated criterion measures of food addiction. Test-retest data showed that even after a one week break between taking the measure, scores among participants remained stable. In addition to being highly reliable, the HFAQ also demonstrated criterion, convergent, and discriminant validity.

Strong correlations between the HFAQ and the two criterion measures, YFAS and EBQ, validated that the HFAQ was measuring the same construct of food addiction.

Convergent validity was evidenced by the moderate relationship between the HFAQ and the EAT-26 and DGI and between the HFAQ and DGI. Establishing discriminant validity, there was a low non-significant relationship between the HFAQ and a measure of college substance use, the CSUS. To further support validity, a factor analysis was conducted to determine whether items in the HFAQ would pertain to the DSM substance abuse criteria. Five factors emerged with the first two containing items that related to all 7 DSM criteria, illustrating a strong relationship between items on the HFAQ and the DSM substance abuse criteria.

The results of this study showed that the HFAQ is a psychometrically sound measure of food addiction for use with adults. High internal consistency, good re-test reliability, and criterion, convergent, and discriminate validity of the HFAQ were found. A large sample size was useful in conducting a factor analysis that provided insight into the items comprising the HFAQ and the DSM substance abuse criteria from which the HFAQ items were derived. Though certain limitations existed, the research methods in this study were carefully planned and implemented, resulting in valuable data that was used to inform the outcome of this study's hypotheses.

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Appendices

Appendix A

DSM Criteria: Binge Eating Disorder and Substance Dependence

DSM-5 criteria for Binge Eating Disorder
A. Recurrent episodes of binge eating. An episode of binge eating is characterized by both of the following:
1. eating, in a discrete period of time (for example, within any 2-hour period), an amount of food that is definitely larger than most people would eat in a similar period of time under similar circumstances
2. a sense of lack of control over eating during the episode (for example, a feeling that one cannot stop eating or control what or how much one is eating)
B. The binge-eating episodes are associated with three (or more) of the following:
1. eating much more rapidly than normal
2. eating until feeling uncomfortably full
3. eating large amounts of food when not feeling physically hungry
4. eating alone because of feeling embarrassed by how much one is eating
5. feeling disgusted with oneself, depressed, or very guilty afterwards
C. Marked distress regarding binge eating is present.
D. The binge eating occurs, on average, at least once a week for three months.
E. The binge eating is not associated with the recurrent use of inappropriate compensatory behavior (for example, purging) and does not occur exclusively during the course Anorexia Nervosa, Bulimia Nervosa, or Avoidant/Restrictive Food Intake Disorder.

DSM-5 criteria for Substance Dependence
A maladaptive pattern of substance use, leading to clinically significant impairment or distress, as manifested by three (or more) of the following, occurring at any time in the same 12-month period:

1. tolerance, as defined by either of the following:
    a. a need for markedly increased amounts of the substance to achieve intoxication or desired effect
    b. markedly diminished effect with continued use of the same amount of the substance
2. withdrawal, as manifested by either of the following:
    a. the characteristic withdrawal syndrome for the substance (refer to Criteria A and B of the criteria sets for Withdrawal from the specific substances)
    b. the same (or a closely related) substance is taken to relieve or avoid withdrawal symptoms

3. the substance is often taken in larger amounts or over a longer period than was intended
4. there is a persistent desire or unsuccessful efforts to cut down or control substance use
5. a great deal of time is spent in activities necessary to obtain the substance (e.g., visiting multiple doctors or driving long distances), use the substance (e.g., chain-smoking), or recover from its effects
6. important social, occupational, or recreational activities are given up or reduced because of substance use
7. the substance use is continued despite knowledge of having a persistent or recurrent physical or psychological problem that is likely to have been caused or exacerbated by the substance (e.g., current cocaine use despite recognition of cocaine-induced depression, or continued drinking despite recognition that an ulcer was made worse by alcohol consumption)

Similar Criteria	Food Addiction	Binge Eating
Overeating	3. Larger Amounts or longer than intended	1. an amount of food that is definitely larger than most people would eat in a similar period of time under similar circumstances
3. Eating large amounts of food when not feeling physically hungry		
Loss of Control	4. there is a persistent desire or unsuccessful efforts to cut down or control substance use	A2. a sense of lack of control over eating during the episode (for example, a feeling that one cannot stop eating or control what or how much one is eating)
Continued Use Despite Negative Consequences	7. the substance use is continued despite knowledge of having a persistent or recurrent physical or psychological problem that is likely to have been caused or exacerbated by the substance	B2. eating until feeling uncomfortably full

Appendix B

Humboldt Food Addiction Questionnaire

The statements below relate to your **experience with food** and especially **foods that are high in sugar, salt, and/or fat** over the past **12 months**. These foods include **ice cream, candy, chocolate, soda, pastries, pizza, pasta, chips, fried foods, cookies, and fast food**. Circle the number that best describes your level of agreement or disagreement with each statement.

#	Items	Strongly Agree	Agree	Disagree	Strongly Disagree
1	I often can't help eating more of these foods than I originally wanted to.	1	2	3	4
2	The food taste so good that even if I start to feel full I often continue to eat until my stomach hurts.	1	2	3	4
3	Most of the time I can eat a single serving of these foods and feel satisfied.	1	2	3	4
4	I find that I often eat these foods even when I am not very hungry.	1	2	3	4
5	Most of the time, if I have an urge to eat something I can't get it out of my mind until I have it.	1	2	3	4
6	I often have the urge to eat these foods.	1	2	3	4
7	I've often tried to stop eating these foods, but I like them so much I can't stop.	1	2	3	4
8	I have tried to control the amount that I eat, but I almost always fail.	1	2	3	4
9	I spend a lot of time thinking about my next meal.	1	2	3	4
10	I will go out of my way to get the foods that I want to eat.	1	2	3	4
11	I feel that I think too much about food.	1	2	3	4
12	My social or personal life has suffered because of my need to eat these foods.	1	2	3	4
13	There have been times I've missed activities, work, or doing things with others because of my need to eat.	1	2	3	4
14	If I go to an event (movie, ball game, etc.) I am more interested in the food there than the event	1	2	3	4

#	Items	Strongly Agree	Agree	Disagree	Strongly Disagree
15	I eat these foods even though it may be bad for me (i.e., weight gain).	1	2	3	4
16	I feel guilty after I overeat.	1	2	3	4
17	If the food I eat makes me feel bad physically or mentally, I will not eat it.	1	2	3	4
18	I am afraid of what people will think of my over-eating but I still continue to do it.	1	2	3	4
19	My eating habits do not cause problems for me.	1	2	3	4
20	It is important for me to be healthy, but my diet does not look like it.	1	2	3	4
21	The more I eat these foods the more often I feel the need for them.	1	2	3	4
22	If I stop eating these foods I feel rotten (headache, irritability, shakiness, or anxious).	1	2	3	4
23	I feel good when eating these foods but crash or feel down afterward.	1	2	3	4
24	I want to change my eating habits but am not strong enough to do so.	1	2	3	4
25	Nearly every day I struggle with the effects of eating foods that are bad for me.	1	2	3	4
26	It is easy for me to avoid desserts, fast food, or junk food.	1	2	3	4
27	I feel my cravings for food keeps me from being the person who I want to be.	1	2	3	4
28	Once I start eating these foods, it is easy for me to stop.	1	2	3	4
29	It seems I have to eat more of these foods to feel good.	1	2	3	4
30	I feel the need to eat some of these foods every day.	1	2	3	4
31	I feel anxious or jittery when I do not regularly eat these foods.	1	2	3	4
32	I usually eat these foods when no one I know is around.	1	2	3	4
33	I feel that I am addicted to fast food or junk food.	1	2	3	4

Appendix C

Yale Food Addiction Scale

This survey asks about your eating habits in the past year. People sometimes have difficulty controlling their intake of certain foods such as:

- Sweets like ice cream, chocolate, doughnuts, cookies, cake, candy, ice cream
- Starches like white bread, rolls, pasta, and rice
- Salty snacks like chips, pretzels, and crackers
- Fatty foods like steak, bacon, hamburgers, cheeseburgers, pizza, and French fries
- Sugary drinks like soda pop

When the following questions ask about "CERTAIN FOODS" please think of ANY food similar to those listed in the food group or ANY OTHER foods you have had a problem with in the past year.

#	IN THE PAST 12 MONTHS:	Never	Once a month	2-4 times a month	2-3 times a week	4+ times daily
1.	I find that when I start eating certain foods, I end up eating much more than planned	0	1	2	3	4
2.	I find myself continuing to consume certain foods even though I am no longer hungry	0	1	2	3	4
3.	I eat to the point where I feel physically ill	0	1	2	3	4
4.	Not eating certain types of food or cutting down on certain types of food is something I worry about	0	1	2	3	4
5.	I spend a lot of time feeling sluggish or fatigued from overeating	0	1	2	3	4
6.	I find myself constantly eating certain foods throughout the day	0	1	2	3	4
7.	I find that when certain foods are not available, I will go out of my way to obtain them. For example, I will drive to the store to purchase certain foods even though I have other options available to me at home.	0	1	2	3	4

#	IN THE PAST 12 MONTHS:	Never	Once a month	2-4 times a month	2-3 times a week	4+ times daily
8.	There have been times when I consumed certain foods so often or in such large quantities that I started to eat food instead of working, spending time with my family or friends, or engaging in other important activities or recreational activities I enjoy.	0	1	2	3	4
9.	There have been times when I consumed certain foods so often or in such large quantities that I spent time dealing with negative feelings from overeating instead of working, spending time with my family or friends, or engaging in other important activities or recreational activities I enjoy.	0	1	2	3	4
10.	There have been times when I avoided professional or social situations where certain foods were available, because I was afraid I would overeat.	0	1	2	3	4
11.	There have been times when I avoided professional or social situations because I was not able to consume certain foods there.	0	1	2	3	4
12.	I have had withdrawal symptoms such as agitation, anxiety, or other physical symptoms when I cut down or stopped eating certain foods. (Please do NOT include withdrawal symptoms caused by cutting down on caffeinated beverages such as soda pop, coffee, tea, energy drinks, etc.)	0	1	2	3	4
13.	I have consumed certain foods to prevent feelings of anxiety, agitation, or other physical symptoms that were developing. (Please do NOT include	0	1	2	3	4

#	IN THE PAST 12 MONTHS:	Never	Once a month	2-4 times a month	2-3 times a week	4+ times daily
	consumption of caffeinated beverages such as soda pop, coffee, tea, energy drinks, etc.)					
14.	I have found that I have elevated desire for or urges to consume certain foods when I cut down or stop eating them.	0	1	2	3	4
15.	My behavior with respect to food and eating causes significant distress.	0	1	2	3	4
16.	I experience significant problems in my ability to function effectively (daily routine, job/school, social activities, family activities, health difficulties) because of food and eating.	0	1	2	3	4

#	IN THE PAST 12 MONTHS:	No	Yes
17.	My food consumption has caused significant psychological problems such as depression, anxiety, self-loathing, or guilt.	0	1
18.	My food consumption has caused significant physical problems or made a physical problem worse.	0	1
19.	I kept consuming the same types of food or the same amount of food even though I was having emotional and/or physical problems.	0	1
20.	Over time, I have found that I need to eat more and more to get the feeling I want, such as reduced negative emotions or increased pleasure.	0	1
21.	I have found that eating the same amount of food does not reduce my negative emotions or increase pleasurable feelings the way it used to.	0	1
22.	I want to cut down or stop eating certain kinds of food.	0	1
23.	I have tried to cut down or stop eating certain kinds of food.	0	1
24.	I have been successful at cutting down or not eating these kinds of food	0	1

25.	How many times in the past year did you try to cut down or stop eating certain foods altogether?	1 time	2 times	3 times	4 times	5 + times

26. Please circle ALL of the following foods you have problems with:

Ice cream	Chocolate	Apples	Doughnuts	Broccoli	Cookies	Cake
White Bread	Rolls	Lettuce	Pasta	Strawberries	Rice	Crackers
Pretzels	French Fries	Carrots	Steak	Bananas	Bacon	Hamburgers
Candy	Chips	Cheese burgers	Pizza	Soda Pop	None of the above	

27. Please list any other foods that you have problems with that were not previously

Appendix D

Eating Behaviors Questionnaire

Please Indicate the degree to which the statements below apply to you.	Never	Very Rarely	Rarely	Occasionally	Very Frequently	Always
1 Do you eat more food now than you used to?	1	2	3	4	5	6
2 Do you think eating is less fun than it used to be?	1	2	3	4	5	6
3 Do you wish you could eat if you have not eaten in a while?	1	2	3	4	5	6
4 Do you eat more food than you mean to?	1	2	3	4	5	6
5 Do you spend more time eating than you mean to?	1	2	3	4	5	6
6 Do you want to cut down on your eating?	1	2	3	4	5	6
7 Do you try to cut down on your eating?	1	2	3	4	5	6
8 Do you spend a lot of time getting food (asking for food, making snacks)?	1	2	3	4	5	6
9 Do you spend a lot of time eating during the day?	1	2	3	4	5	6
10 Do you spend a lot of time “recovering” after you eat (resting, feeling too full to do anything)?	1	2	3	4	5	6
11 Do you miss out on activities because of your eating?	1	2	3	4	5	6

Please Indicate the degree to which the statements below apply to you.	Never	Very Rarely	Rarely	Occasionally	Very Frequently	Always
12 Do you eat foods that you know are bad for you and you aren't supposed to eat?	1	2	3	4	5	6
13 Do you eat too much food even when you know you aren't supposed to?	1	2	3	4	5	6
14 Do you feel upset or sad about your eating habits?	1	2	3	4	5	6
15 Do you eat even when you know you could get into trouble?	1	2	3	4	5	6
16 Do you try to eat in places where eating is not allowed?	1	2	3	4	5	6
17 Have you gotten in trouble because of your eating?	1	2	3	4	5	6
18 Do you ever fight with your family, friends, or others about your eating?	1	2	3	4	5	6
19 Do you save up or hide food?	1	2	3	4	5	6
20 Do you think you are addicted to food?	1	2	3	4	5	6

Appendix E

Eating Attitudes Test

Direction: Please respond to the following items as they pertain to ***you, personal experience.***

#	Item	Never	Rarely	Sometimes	Often	Usually	Always
1	Am terrified about being overweight	1	2	3	4	5	6
2	Avoid eating when I am hungry	1	2	3	4	5	6
3	Find myself preoccupied with food	1	2	3	4	5	6
4	Have gone on eating binges where I feel that I may not be able to stop	1	2	3	4	5	6
5	Cut my food into small pieces	1	2	3	4	5	6
6	Am aware of calorie content of foods that I eat	1	2	3	4	5	6
7	Particularly avoid foods with high carbohydrate content (i.e., bread, rice, potatoes, etc.)	1	2	3	4	5	6
8	Feel that others would prefer if I ate more	1	2	3	4	5	6
9	Vomit after I have eaten	1	2	3	4	5	6
10	Am preoccupied with a desire to be thinner	1	2	3	4	5	6
11	Think about burning up calories when I exercise	1	2	3	4	5	6
12	Other people think that I am too thin	1	2	3	4	5	6
13	Am preoccupied with the thought of having fat on my body	1	2	3	4	5	6
14	Take longer than others to eat my meals	1	2	3	4	5	6
15	Avoid foods with sugar in them	1	2	3	4	5	6

#	Item	Never	Rarely	Sometimes	Often	Usually	Always
16	Eat diet foods	1	2	3	4	5	6
17	Feel that food controls my life	1	2	3	4	5	6
18	Display self-controls around food	1	2	3	4	5	6
19	Feel that others pressure me to eat	1	2	3	4	5	6
20	Give too much time and thought to food	1	2	3	4	5	6
21	Feel uncomfortable after eating sweets	1	2	3	4	5	6
22	Engage in dieting behavior	1	2	3	4	5	6
23	Like my stomach to be empty	1	2	3	4	5	6
24	Enjoy trying new rich foods	1	2	3	4	5	6
25	Have the impulse to vomit after meals	1	2	3	4	5	6
26	I feel extremely guilty after eating	1	2	3	4	5	6

Appendix F

Delaying Gratification Inventory Short Form with Food Subscale

Please Indicate the degree to which the statements below apply to you.	Strongly Disagree	Disagree	Neither Disagree or Agree	Agree	Strongly Agree
1. I can resist junk food when I want to.	1	2	3	4	5
2. I try to spend my money wisely.	1	2	3	4	5
3. I would have a hard time sticking with a special, health diet.	1	2	3	4	5
4. If my favorite food were in front of me, I would have a difficult time waiting to eat it.	1	2	3	4	5
5. It is easy for me to resist candy and bowls of snack foods.	1	2	3	4	5
6. I have given up physical pleasure or comfort to reach my goals.	1	2	3	4	5
7. I try to consider how my actions will affect other people in the long-term.	1	2	3	4	5
8. I cannot be trusted with money.	1	2	3	4	5
9. Sometimes I eat until I make myself sick.	1	2	3	4	5
10. I do not consider how my behavior affects other people.	1	2	3	4	5
11. I cannot motivate myself to accomplish long-term goals.	1	2	3	4	5
12. I have always tried to eat healthy because it pays off in the long run.	1	2	3	4	5
13. When faced with a physically demanding chore, I always tried to put off doing it.	1	2	3	4	5
14. I have always felt like my hard work would pay off in the end.	1	2	3	4	5
15. Even if I am hungry, I can wait until it is meal time before eating something.	1	2	3	4	5

Appendix G

College Substance Use Scale

Please indicate how often you may have used the following substances over the past 12 months.

#	In the past year I have used:	Never or almost Never	Couple of times a month	Once a week	Couple of times a week	Nearly every day	Several times a day
1	Marijuana	□	□	□	□	□	□
2	Beer / Wine	□	□	□	□	□	□
3	Hard liquor (rum, vodka, etc.)	□	□	□	□	□	□
4	Downers, sleeping pills, Quaaludes	□	□	□	□	□	□
5	Cocaine	□	□	□	□	□	□
6	Meth/ amphetamines, Adderall, Dexedrine, Ritalin,etc.	□	□	□	□	□	□
7	Pain killers (Oxycontin, Percocet, Vicodin. etc.)	□	□	□	□	□	□
8	Other drugs (for nonmedical reasons)	□	□	□	□	□	□

Appendix H

Demographic Form

Age____ Sex____ Height_____ Weight in lbs_____ Ethnicity _____
*Do you live in an urban or suburban area? _____
*How many times per week do you eat out? _____
*How many times per week do you eat junk food? _____
*How many hours per week do you exercise? _____
*Are you currently seeking or involved in psychological treatment? _____ If yes, for what reason(s)? _____
*Do you binge eat? _____ If yes, do you also purge (purposefully vomit afterward)?_____
*Please circle the highest level of education you have completed:
High school Some college Bachelor's degree Graduate degree
*Please circle the highest level of education your parents completed:
High school Some college Bachelor's degree Graduate degree
*HSU Participants only:
Please circle your grade level: Fresh Soph Junior Senior Grad

Appendix I

Consent Form

Dear Participant,

This study is being conducted to understand the relationship between eating behavior and attitudes and well-being in adults. We would appreciate your participation by completing the following questionnaires. The survey will take about 50 minutes to complete. Participation is voluntary. To participate, please read the information below and then sign your name at the bottom of the page. After you have finished with this page, please tear it off of the packet and it will be collected by a researcher. Your name will not be associated with your responses to the questionnaires. Please note that some of the questions ask about mental health problems and you may experience some mild emotional discomfort.

Please do not write your name anywhere on the survey. If you are under the age of 18, please do not participate in this survey. If at any point you feel like stopping and no longer wish to participate please do so.

I understand that my participation is entirely voluntary and that I may decline to enter this study or may withdraw from participation at any time without consequence. I understand that identifying information will NOT be obtained or requested of me. My responses, therefore, will be completely anonymous. I understand that I will be asked for non-identifiable demographic information and that this information along with my survey responses will be stored electronically in a password-protected filing system.

If I have any questions regarding the survey and/or my participation I can contact Sarah Taylor, HSU Graduate Student, at Sarah.Taylor@humboldt.edu or Dr. William M. Reynolds, PhD HSU Psychology Professor at William.Reynolds@humboldt.edu or (707) 826-3162. If I have any concerns about this research project, or any dissatisfaction with any part of this study, I can contact the IRB Chair, Dr. Ethan Gahtan, at eg51@humboldt.edu or (707) 826-4545. If I have any concerns regarding my rights as a participant, I can report them to the IRB Institutional Official at Humboldt State University, Dr. Rhea Williamson, at Rhea.Williamson@humboldt.edu or (707) 826-5169.

I hereby acknowledge that I have read and understand the implications of this research. By indicating my consent below and continuing on to the following questionnaires, I give my consent to participate, and therefore also declare that I am 18 years of age or older and thus eligible for participation in this study.

Please indicate (check) if you consent to participate in this study: ○ I agree ○ I do not agree

Your signature:

_____

Please remove this page from the survey packet. It will be collected by a researcher.

Thank you.

Appendix J

Debriefing

We wish to thank you for completing this survey. Your participation has been of significant value in helping us understand eating behavior and well-being in adults. Some of the questions ask about aspects of eating behavior and well-being that may be potential areas of concern for you. People sometimes, while completing the survey, become aware of behaviors and thoughts that may suggest the need to talk to a professional or seek out further information.
This recognition and self-awareness can be a very useful outcome of completing the survey.
If, after completing the survey, you recognize that there may be some things or feelings that are a potential issue for you, we strongly urge you to contact a professional to talk about your concerns or to answer questions that you may have.
In addition to local mental health care providers and agencies in your community, the following agencies and resources are available for you to contact:

American Psychological Association on eating disorders- overview, help, and news.
www.apa.org/topics/eating/
Overeaters Anonymous- offers a program of recovery from compulsive eating using the Twelve Steps and Twelve Traditions of OA. Information, groups, and services.
www.oa.org/
National Eating Disorders Association- non-profit organization advocating and supporting individuals and families affected by eating disorders. Helpline, blog, support.
www.nationaleatingdisorders.org/
toll free, confidential Helpline at 1-800-931-2237
CrisisChat.org
Online Emotional Support
Hours Vary - Approx 12hrs daily / 7 days

New Hope 24 Hour Telephone Counseling Center (714) NEW-HOPE (714) 639-4673

Online Counseling Live crisis intervention and support from a New Hope Counselor - free!
24-Hour National Hopeline Network… 1-800-784-2433

For college students: http://www.ulifeline.org/

HSU Community Counseling Clinic- offers low-cost counseling/psychotherapy services for HSU and for the broader Humboldt County community.
826-3921 Clinic Location:

BSS 208
Clinic Hours: M - W from 10am - 7 pm, Closed Th & Fri.

Once again, we thank you for your participation in this research project.

Appendix K

HFAQ Scree Plot