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Preliminary validation of the Yale Food Addiction Scale for Children 2.0: A dimensional approach to scoring.

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Abstract

Objective. Assessment approaches for food addiction in younger samples have not been updated to reflect recently revised diagnostic approaches for addictive disorders. The aim of the current study is to develop a new dimensional approach to assess food addiction in adolescents that is psychometrically sound, developmentally appropriate, and reflective of the updated diagnostic criteria.

Methods. The dimensional Yale Food Addiction Scale for Children 2.0 (dYFAS-C 2.0) and related-measures were administered to 127 adolescents from the community in the United States. Endorsement rates for each question were reviewed and the psychometric properties were evaluated.

Results. Problem-focused symptoms had low endorsement rates and were excluded from the final version of the scale. The dYFAS-C 2.0 demonstrated partial evidence for a one-factor structure, had good internal consistency reliability, and was positively associated with emotional eating, external eating, and body mass index (BMI). The dYFAS-C 2.0 also accounted for unique variance in BMI. Unexpectedly, the dYFAS-C 2.0 was positively associated with restrained eating.

Conclusions. The dYFAS-C 2.0 appears to have adequate psychometric properties for assessing food addiction in community samples of adolescents. Future research should evaluate the measure in clinical samples and investigate the association between food addiction and restrained eating over the lifespan.

Highlights

- The assessment of food addiction in younger cohorts has not been updated for the DSM 5.
- A developmentally modified version of the YFAS 2.0 appears to be psychometrically sound in a community sample of adolescents.
- Future research in clinical samples of adolescents is needed.

Key words: Food addiction, adolescents, eating, dimensional

Introduction

In recent years, a growing body of evidence suggests that the overconsumption of highly palatable foods (e.g., high sugar and high fat foods) can trigger an addictive-like response in animals and humans (Ferrario, 2017; Schulte, Grilo, & Gearhardt, 2016). However, the concept of food addiction is controversial and questions regarding the validity and utility of the concept remain (Hebebrand et al., 2014; Ziauddeen & Fletcher, 2013). Thus, further research into the construct of food addition is warranted. To operationalize food addiction, the Yale Food Addiction Scale (YFAS) was developed (Gearhardt, Corbin, & Brownell, 2009). The YFAS applies the Diagnostic and Statistical Manual 4th ed. (DSM-IV) criteria for substance dependence (e.g., loss of control, tolerance, withdrawal) to the problematic consumption of highly palatable foods. In adult samples, the YFAS has been associated with factors implicated in addiction, such as increased consumption in response to emotions and environmental cues (Clark & Saules, 2013; Gearhardt et al., 2009; Joyner, Schulte, Wilt, & Gearhardt, 2015; Loxton & Tipman, 2017; Manzoni et al., 2018). The YFAS is also associated with negative consequences related to overeating, such as obesity (Gearhardt et al., 2009; Innamorati et al., 2015; Pursey, Stanwell, Gearhardt, Collins, & Burrows, 2014; Torres et al., 2017). Thus, in adults, the YFAS appears to be a psychometrically sound assessment tool to investigate food addiction.

Adolescence is a high-risk period for addictive behaviors (Crews, He, & Hodge, 2007), but little is known about addictive-like eating in this developmental period. Adolescence is marked by a strong reward drive, but relatively weak inhibitory control (Steinberg, 2010).

Adolescence is also associated with the experience of intense emotions, but with limited emotion regulation capabilities (Cracco, Goossens, & Braet, 2017; Larson, Moneta, Richards, & Wilson, 2002; Miller & Shields, 1980). These factors may contribute to the higher rates of problematic substance use (e.g., binge drinking, drinking and driving, smoking cigarettes) and increased risk for obesity that emerges during adolescence (Dietz, 1994; Eaton et al., 2010). Thus, adolescence may be a key developmental period to investigate the emergence of food addiction.

To operationalize food addiction in both children and adolescents, the YFAS was modified into the Yale Food Addiction Scale for Children (YFAS-C) (Gearhardt, Roberto, Seamans, Corbin, & Brownell, 2013). The YFAS-C uses the same DSM-IV substance dependence criteria as the YFAS, however items on the YFAS-C are adapted to reflect age-appropriate behaviors (e.g., problems at school rather than work) and reading level (i.e., second grade reading level, 8 years of age on average). In a community sample including both children and adolescents, higher scores on the YFAS-C were associated with greater emotional eating, greater *ad libitum* food intake, and higher body mass index (BMI) percentile (Gearhardt et al., 2013, Richmond, Roberto, & Gearhardt, 2017). In a non-clinical sample of Chinese adolescents, YFAS-C scores were associated with increased binge eating (i.e., consuming an objectively large amount of food plus loss of control) (Chen, Tang, Guo, Liu, & Xiao, 2015). In adolescents with overweight and obesity, YFAS-C scores have also been associated with binge eating, as well as overeating (i.e., consuming an objectively large amount of food without a loss of control), elevated cravings, greater attentional and motor impulsivity, and higher BMI (Meule, Müller,

Gearhardt, & Blechert, 2017; Schulte, Jacques-Tiura, Gearhardt, & Naar, 2017). Finally, in a group of Dutch adolescents in an inpatient psychiatry unit, scores on the YFAS-C have been associated with increased hunger and disinhibition (Albayrak et al., 2017). Thus, the YFAS-C is associated with factors related to addiction (e.g., emotionally triggered use, craving, impulsivity) and also negative consquences of overeating (e.g., higher BMI) in adolescents.

In 2013, the DSM-5 was released, posing significant alterations to the conceptualization of substance use disorders (SUD). Whereas the DSM-IV included two separate diagnoses, substance dependence and substance abuse, the DSM-5 combined the symptoms into a single diagnosis, SUD. Further, the substance abuse criterion of legal problems was eliminated and experiencing cravings was added (see Table 1). A severity scale ranging from mild (2 to 3 symptoms), to moderate (4 to 5 symptoms), to severe (6 or more symptoms) was also added (American Psychiatric Association, 2013). To reflect the updated criteria, the Yale Food Addiction Scale 2.0 (YFAS 2.0) was developed by altering the SUD criteria to reflect an addictive-like response to highly palatable foods (Gearhardt, Corbin, & Brownell, 2016). Preliminary evidence in community samples of adults suggests that higher scores on the YFAS 2.0 demonstrate similar if not improved convergent and incremental validity in comparison to the original YFAS (Gearhardt et al., 2016). Additionally, scores on the YFAS 2.0 demonstrate discriminant validity with other established eating disorders (i.e., anorexia nervosa, bulimia nervosa, and binge eating disorder) (Gearhardt et al., 2016) and demonstrated a null relationship with dietary and cognitive restraint (Meule et al., 2017). Therefore, food-addiction as measured

by the YFAS 2.0 appears to represent a unique pattern of problematic eating over and above other known forms of eating pathology.

Currently there is no operationalized measure of food addiction for adolescents based on the updated DSM-5 criteria. However, criticisms concerning the updated DSM-5 criteria have arisen. Critics suggest that the new criteria are too problem-focused, relying too heavily on the consequences associated with substance use rather than the mechanisms driving addictive behavior (Lane & Sher, 2015). Diagnosing an individual based on the consequences of their use may be problematic as these consequences are highly influenced by demographic and contextual variables (Lane & Sher, 2015). The overreliance on problem-focused criteria may be particularly consequential for diagnosing SUDs in younger cohorts. Adolescents may just be developing patterns of maladaptive substance use and have fewer responsibilities than adults (Liu, 2017; Peiper, Ridenour, Hochwalt, & Coyne-Beasley, 2016). As such, adolescents may have fewer opportunities to experience the problematic consequences associated with substance use. Consistent with this idea, adolescents do appear to exhibit symptoms related to reward dysfunction like craving and binge drinking, but these symptoms often do not interfere with day-to-day functioning (Piontek, Kraus, Legleye, & Bühringer, 2011; Schuckit et al., 2008). Thus, the problem-focused symptoms may be less likely to be endorsed by adolescents even when other indicators of addictive behaviors are present (e.g., craving, loss of control) and modifications may be needed to effectively assess addictive behaviors in younger samples.

Additionally, the DSM-5 utilizes a categorical approach to assessment, requiring an individual to meet an established threshold of symptoms in order to receive a diagnosis (American Psychiatric Association, 2013). However, research suggests that pathological substance use in adolescence may be better represented dimensionally, as a continuous syndrome rather than a discrete entity (Liu, 2017). Further, dimensional approaches may be more sensitive than categorical approaches in detecting meaningful symptom variability in emerging psychopathology (Hudziak, Achenbach, Althoff, & Pine, 2007), which may be particularly important in adolescent samples. Thus, the use of dimensional assessment approaches for food addiction may be particularly useful in younger cohorts where addictive-like eating behaviors may just be emerging but may not have reached clinical levels as reflected by categorical cut-offs.

The aim of the current study was to develop a dimensional version of the YFAS 2.0 adapted to be developmentally appropriate for younger cohorts (dimensional YFAS 2.0 for Children; dYFAS-C 2.0) and to investigate the psychometric properties of the adapted scale in a community sample of adolescents. We hypothesize that 1) adolescents will endorse the problem-focused symptoms present in the DSM-5 criteria for SUDs at a low rate; 2) as with previous iterations of the YFAS (Gearhardt et al., 2009, 2016; Gearhardt et al., 2013), the dYFAS-C 2.0 will demonstrate an adequate one-factor model and good internal consistency reliability, representing one underlying latent factor; 3) the dYFAS-C 2.0 will demonstrate expected convergent validity with constructs associated with traditional substance use disorders (i.e.,

emotionally and environmentally triggered use) and with higher BMI; 4) scores on the dYFAS-C 2.0 will demonstrate discriminant validity with restrained eating behaviors, and 5) scores on the dYFAS-C 2.0 will demonstrate incremental validity, accounting for unique variance in BMI over and above established measures of eating pathology.

Methods and Materials

Participants

Data for the current study was obtained from a larger study conducted from 2015 to 2018 examining adolescent eating behavior and responsivity to food advertisements. This study was approved by the University of Michigan Institutional Review Board and research complied with the ethical standards of the American Psychological Association (American Psychiatric Association, 2013). Participants were recruited from Southeast Michigan in the United States using print and online advertisements. Due to the aims of the larger study which investigated reward response to food marketing in adolescents, participants 1) with a history of or a current eating disorder diagnosis, 2) with current mood, anxiety, trauma, or psychotic disorders, 3) with a current prescription for a psychotropic medication, and 4) who were underweight were excluded as these factors are known to influence reward functioning. Prior to participation, a parent or guardian provided written informed consent and adolescents provided written informed assent. Adolescents, (N = 193) ranging from 13 to 16 years of age (M = 14.28, SD = 1.03), were recruited for the full study. The dYFAS-C 2.0 was added to the questionnaire battery later in data collection and 127 participants completed the measure. Slightly more females (n = 66) than males (n = 61) completed the dYFAS-C 2.0, and the average age of participants who completed the measure was 14.38 (SD = 1.02). Adolescents completing the dYFAS-C 2.0 were 71.7% Caucasian, 15.0% African American, 6.3% Mixed Race, 2.4% American Indian/Alaska Native, and 4.7% Other. No participant had missing data on the other measures of interest.

Measures

Body Mass Index (BMI) z-Score. Height was measured in centimeters using a stadiometer. Height was measured repeatedly until two consecutive measurements were within two millimeters of each other. The two scores were then averaged to ensure accuracy. Weight was measured in kilograms using a standardized electronic scale. Two measurements were obtained and averaged to ensure accuracy. Height and weight information was used to calculate BMI z-score, a measure of BMI that takes into account normative growth patterns that are adjusted for child age and sex (Inokuchi, Matsuo, Takayama, & Hasegawa, 2011). The average BMI z-score of the current sample was .95 (*SD* = .89) (BMI in the 81st percentile for age and gender). Based on BMI adjusted for age and sex, 51.2% of participants qualified as healthy weight, (*n* = 65; BMI in the 5th to 84th percentile for age and gender), 23.6% qualified as overweight (*n* = 30; BMI in the 85th to 94th percentile for age and gender) and 25.2% qualified as obese (*n* = 32; BMI in the 95th percentile or above for age and gender).

Dutch Eating Behaviors Questionnaire (DEBQ). The DEBQ is a 30-item, self-report measure composed of three subscales: External Eating, Emotional Eating, and Restrained Eating. The External Eating subscale measures eating in response to environmental cues such as television advertisements. The Emotional Eating scale measures eating in response to both diffuse negative affect and clearly labeled negative emotions. The Restrained Eating scale measures both intentions and attempts to eat less than desired or to avoid certain foods. The External Eating and Emotional Eating subscales on the DEBQ do not reliably discriminate from

one another, and as a result we combined scores on both scales into a single External/Emotional Eating score (Van Strien, Schippers, & Cox, 1995). Each item is scored on a 5-point Likert scale ranging from 1 (Never) to 5 (Always). Scores on the DEBQ have been shown to have good internal consistency reliability and predictive validity (Van Strien, Frijters, Van Staveren, Defares, & Deurenberg, 1986; Van Strien, Peter Herman, & Anschutz, 2012). In the current sample, scores on the DEBQ Emotional/External Scale demonstrated good internal consistency reliability (α = .88), and scores on the DEBQ Restrained Eating Scale demonstrated excellent internal consistency reliability (α = .93).

Palatable Eating Motives Scale (PEMS). The PEMS is a widely used 19-item, self-report scale that measures an individual's motivation to eat highly palatable foods (Boggiano et al., 2015). The PEMS contains four subscales: 1) Coping with Negative Affect, 2) Enhancement of Pleasure, 3) Social Situations, and 4) Conformity to Peer Expectations. As the PEMS Coping subscale is most associated with addictive-like eating in relation to the other PEMS subscales (Joyner et al., 2015), it was used in the subsequent analyses. Individuals are given general examples of highly palatable foods (e.g., fried foods, sweets) to keep in mind while responding to the survey. Each item is scored on a 5-point Likert scale ranging from 1 (Never/Almost Never) to 5 (Always/Almost Always). Scores on the PEMS have been shown to demonstrate good internal consistency reliability and strong test-retest reliability (Burgess, Turan, Lokken, Morse, & Boggiano, 2014). In the current sample, scores on the PEMS Coping subscale demonstrated acceptable internal consistency reliability (α = .76).

Development of the dYFAS-C 2.0

The dYFAS-C 2.0 was developed by adapting items on the adult YFAS 2.0 to reflect age-appropriate activities (e.g., items referring to employment were changed to school) and adapting the language to be appropriate for children at a third-grade reading level (9 years of age on average, Flesch-Kincaid Grade Level test). The initial scale included 35 items reflecting the eleven DSM-5 SUD criteria (see Table 2). Like the adult version, the dYFAS-C 2.0 instructs participants to think of foods high in refined carbohydrates and/or fat when responding to the items as these foods are most implicated in addictive-like eating behaviors (Schulte, Avena, & Gearhardt, 2015). All items on the dYFAS-C 2.0 are measured using a 5-point Likert scale (0 = Never, 1 = Rarely, 2 = Sometimes, 3 = Very Often, 4 = Always). A dimensional approach was used in which no categorical thresholds were applied and the scores for all items were summed. Scores on the dYFAS-C 2.0 could range from 0 to 64, with higher scores reflecting more severe addictive-like eating behavior.

Data Analytic Plan

Hypothesis 1: Item Endorsement and Demographic Associations. All analyses were conducted in SPSS 24 (IBM Statistics, 2016) with the exception of the Confirmatory Factor Analysis, which was conducted in MPlus Version 7 (Muthén & Muthén, 2012). Endorsement rates for each dYFAS-C 2.0 item were examined by reviewing descriptive statistics. Based on the response distributions on prior iterations of the YFAS, distribution plots on the current scale, and clinically relevant thresholds (Gearhardt et al., 2009, 2016; Gearhardt et al., 2013), any item

endorsed as occurring “Sometimes”, “Very Often”, or “Always” by fewer than 10% of the sample was excluded. Associations of dYFAS-C 2.0 scores with demographic variables were also evaluated. Gender (male/female) and ethnicity (Hispanic/non-Hispanic) were investigated using t-tests and age (13, 14, 15, 16) and race (White, African American, American Indian/Alaska Native, Mixed Race, Other) were investigated using Analysis of Variance (ANOVA).

Hypothesis 2: Factor Structure and Internal Consistency Reliability. To examine the underlying factor structure of the dYFAS-C 2.0, we conducted a Confirmatory Factor Analysis (CFA) in MPlus Version 7 (Muthén & Muthén, 2012) on the retained items. Univariate and multivariate normality was assessed for items included in the scale using Q-Q plots and the Shapiro-Wilk test of normality. Due to non-normality, Robust Maximum Likelihood (MLR) estimation was used to conduct the CFA to account for this violation (Li, 2016). As all previous iterations of the YFAS demonstrated a one-factor latent structure (Gearhardt et al., 2009, 2016; Gearhardt et al., 2013), we examined whether scores on the dYFAS-C 2.0 similarly reflected a one-factor latent structure using factor loadings and fit indices (i.e., Comparative Fit Index (CFI), Tucker Lewis Index (TLI), Root Mean Square Residual (RMSEA), and Standardized Root Mean Square Residual (SRMR)) to determine goodness of fit. Factor loadings were considered weak if they were lower than .3 (Briggs & MacCallum, 2003). Current standards in the field suggest the following for a scale to demonstrate good fit indices: 1.) CFI > .09, 2.) TLI > .095, 3.) RMSEA > .06-.08, and 4.) SRMR < .08 (Hu & Bentler, 1999). Internal consistency reliability was assessed

by examining Cronbach's α for all retained items. Cronbach's α is said to be acceptable when falls between .7 and .8, good when it falls between .8 and .9, and excellent when it exceeds .9 (Nunnally & Bernstein, 1994; Streiner, 2003).

To determine if an alternative model demonstrated stronger fit, we also conducted an Exploratory Factor Analysis (EFA) using MPlus Version 7 (Muthén & Muthén, 2012). Maximum Likelihood was used as the factor extraction method (Costello & Osborne, 2005). Additionally, oblique rotation was used to account for inter-item correlations (Costello & Osborne, 2005). For analyses of goodness of fit, we retained all factors with eigenvalues greater than 1 (Costello & Osborne, 2005) (see Supplementary Material). To assess goodness of fit, we examined the same fit indices as above and the amount of variance explained by the retained factors.

Hypothesis 3: Convergent Validity. Convergent validity was investigated by conducting correlational analyses between the dYFAS-C 2.0 and measures of emotionally and externally triggered eating (DEBQ Emotional/External Eating scores, PEMS Coping Scale) and BMI z-score. The association of the dYFAS-C 2.0 and weight status (i.e., healthy, overweight, obese) was examined with ANOVA with Bonferroni-corrected post-hoc comparisons.

Hypothesis 4: Discriminant Validity. Discriminant validity was assessed by examining correlations between scores on dYFAS-C 2.0 and scores on the Restrained Eating Scale of the DEBQ.

Hypothesis 5: Incremental Validity. Incremental validity was assessed using hierarchical linear regression to determine if scores on the dYFAS-C 2.0 significantly predicted BMI z-score over and above DEBQ Emotional/External eating scores.

Results

Hypothesis 1: Item Endorsement and Demographic Associations

After excluding items with low endorsement, 16 items remained reflecting seven individual substance use disorder criteria (i.e., loss of control, craving, the inability to cut down, withdrawal, tolerance, continued use despite problems resulting from eating, and spending large amounts of time eating) (see Table 1). All items related to the newly added DSM-5 problem-focused symptoms were ultimately dropped due to low endorsement (see Table 2 for the retained items). Further, giving up important activities in order to eat, a criterion carried over from the DSM-IV, was endorsed at low rates and was not included in the final version.

Females (M = 30.00, SD = 1.12) demonstrated higher scores on the dYFAS-C 2.0 than males (M = 24.95, SD = .84), (t (125) = -3.45, p < .001, η^2 = .08, 95%, SE = 1.49). Additionally, individuals identifying as Hispanic/Latino (M = 27.82, SD = 10.42) did not demonstrate higher scores on the dYFAS-C 2.0 in comparison to individuals who did not identify as Hispanic/Latino (M = 27.55, SD = 8.59; t (125) = .10, p = .92, 95%, SE = 2.76). Scores on the dYFAS-C 2.0 did not differ between 13, 14, 15 or 16-year-old participants (F (3,123) = 1.59, p < .20) or on race (F (3,123) = .85, p <.52).

Hypothesis 2: Factor Structure and Internal Consistency Reliability

In the CFA, the CFI (.84), TLI (.82), and RMSEA (.09) suggested a less than optimal fit with the one-factor model. However, the SRMR (.07) suggested a good fit with the one-factor

model. Additionally, the factor loadings were all above .3 suggesting that each item included on the dYFAS-C 2.0 was moderately to strongly associated with the single factor (see Table 3). A Cronbach's α of .90 indicated good internal consistency reliability for the 16-item scale.

Given the less than optimal fit suggested by some indices, we conducted an EFA to investigate alternative factor structure. The EFA suggested a three-factor model with three factors demonstrating eigenvalues over 1 (see Supplementary material). However, the CFI (.88), TLI (.81), and RMSEA (.11) also indicated a less than optimal fit for the three-factor model, while the SRMR (.05) indicated a good fit with the three-factor model. Given the lack of improved fit, a one-factor model was retained (For additional information about the EFA, please see Supplementary materials).

Hypothesis 3: Convergent Validity

Scores on the dYFAS-C 2.0 were significantly positively correlated with higher DEBQ Emotional/External eating scores (r = .54, p < .001), PEMS Coping scores (r = .45, p < .001), and BMI z-score (r = .33, p < .001). Scores on the dYFAS-C 2.0 differed by weight status (F (2, 124) = 8.12, p < .001, η^2 = .16). Post-hoc comparisons identified that individuals with obesity (M = 32.06, SD = 10.18) demonstrated higher scores on the dYFAS-C 2.0 in comparison to individuals of healthy weight status (M = 24.97, SD = 7.13) (p < .001, SE = 1.78). There was no significant difference between individuals with overweight (M = 28.43, SD = 8.27) and individuals with healthy weight (p = .18, SE = 1.82) or between individuals with overweight and those with obesity (p = .26, SE = 2.10).

Hypothesis 4: Discriminant Validity

Scores on the dYFAS-C 2.0 were positively correlated with restrained eating (r = .32, p < .001).

Hypothesis 5: Incremental Validity

DEBQ Emotional/External eating did not significantly predict BMI z-score in step one of the hierarchical linear regression model (t (125) = .95, β = .09, p = .34). When the dYFAS-C 2.0 was added in the second step of the model, DEBQ Emotional/External eating remained a non-significant predictor (t (125) = -1.32, β = -.13, p = .19), while dYFAS-C 2.0 score was significant (t (125) = 4.00, β = .40, p < .001), accounting for 3.4% of the unique variance in BMI z-score (See Table 4).

Discussion

In the current study, we examined the utility of using the updated DSM-5 criteria for SUD to examine food addiction with a dimensional approach in a community sample of 13- to 16- year old adolescents that ranged from healthy weight to obese. Hypothesis 1 (adolescents will endorse the problem-focused symptoms at a low rate) was supported, as endorsement rates were low for problem-focused symptoms and items related to giving up important activities due to eating problems. These questions were thus excluded from the final version of the dYFAS-C 2.0. Hypothesis 2 (the dYFAS-C 2.0 will demonstrate an adequate one-factor model and good internal consistency reliability) was partially supported, with some, but not all, fit indices supporting a one-factor latent structure. The measure did exhibit good internal consistency reliability. Hypothesis 3 (the dYFAS-C 2.0 will demonstrate expected convergent validity with constructs associated with traditional substance use disorders) was fully supported, as scores on the dYFAS-C 2.0 were associated with established measures of eating pathology (e.g., DEBQ External/Emotional Eating, PEMS Coping, BMI z-score, obesity). Hypothesis 4 (scores on the dYFAS-C 2.0 will demonstrate discriminant validity with restrained eating behaviors) was not supported. Unlike the adult version of the scale (Gearhardt et al., 2016), scores on the dYFAS-C 2.0 unexpectedly positively correlated with restrained eating and discriminant validity from this construct was not demonstrated. Hypothesis 5 (scores on the dYFAS-C 2.0 will account for unique variance in BMI over and above established measures of eating pathology) was supported

as scores on the dYFAS-C 2.0 exhibited incremental validity by predicting small but significant variability in BMI z-score above and beyond existing measures.

Implications

Adolescence is a high-risk period for the emergence of addictive behaviors due to increases in reward drive and emotional intensity, paired with relatively weaker inhibitory control and emotional regulation skills (Steinberg, 2010). As such, it is important to create developmentally appropriate assessment tools to understand addictive behaviors more effectively during this period. Due to developmental differences, dimensional approaches for assessing addiction may more accurately reflect pathological substance use in younger cohorts (Liu, 2017). Thus, the current study examined the psychometric properties of a developmentally appropriate, dimensional scale to assess food addiction in adolescents (dYFAS-C 2.0).

In the development of the dYFAS-C 2.0, endorsement rates of each of the 11 symptoms of SUDs were reviewed (see Table 1). Adolescents in the current study had low endorsement rates of problem-focused symptoms associated with the consequences of food addiction (i.e., eating in spite of interpersonal problems, eating in hazardous situations, and eating interfering with important role obligations). Additionally, items associated with giving up important activities in order to eat, a symptom originally from the DSM-IV substance dependence criteria, were endorsed at low levels (see Table 2). Given the low endorsement rates, items reflecting these symptoms were not retained in the final version of the dYFAS-C 2.0. This is consistent with the low endorsement of problem-focused symptoms in the assessment of pathological

substance use in adolescents (Piontek et al., 2011; Schuckit et al., 2008). As adolescents may just be developing addictive behaviors and have fewer responsibilities than adults, there may be fewer opportunities to experience the consequences of substance use and addictive eating (Liu, 2017; Peiper et al., 2016). Of note, adolescents did endorse eating in spite of physical or emotional problems, a symptom retained from the DSM IV. It is possible that continuing to eat excessively even when faced with emotional or physical problems is the first consequence to emerge. As obligations and expectations increase over time, the problem-focused symptoms may become increasingly relevant. This seems particularly likely given that adult samples endorse these symptoms at notably higher levels on the YFAS 2.0 (Gearhardt et al., 2016).

However, similar to indicators of problematic substance use in adolescence (Piontek et al., 2011; Schuckit et al., 2008), participants did endorse symptoms most associated with the mechanisms implicated in addiction (e.g., craving, the inability to cut down/stop eating certain foods, loss of control, tolerance, withdrawal). This pattern of endorsement highlights that certain indicators may be more relevant for assessing food addiction in non-clinical samples of adolescents. The assessment of food addiction with developmentally appropriate indicators in younger, community samples will assist in early detection of these mechanistic symptoms and may be useful in the preventing the emergence of more severe food addiction and impairment in daily functioning. Yet, the exclusion of several SUD symptoms from the dYFAS-C 2.0 due to these developmental considerations does raise concerns about the degree to which this measure fully assesses an addictive phenotype. Although the omitted symptoms (e.g., problem-focused

symptoms) appear to have limited utility in assessing food addiction in non-clinical samples, it is likely that these criteria may be more relevant in clinical samples of adolescents (e.g., adolescents with obesity, adolescents with eating disorders).

Overall, the dYFAS-C 2.0 exhibited expected psychometric properties with some exceptions. Although scores on the measure had good internal consistency reliability, there was mixed support for a one-factor latent structure. The investigation of alternative factor structures did not result in an improved model fit. The relatively healthy nature of the current sample likely limited the variability in the endorsement of symptoms and the latent structure of the measure may be more likely to emerge in clinical samples with greater variability in endorsement. Consistent with this possibility, a one-factor latent structure was only partially supported for the YFAS 2.0 for adults in a community sample (Gearhardt et al., 2016), but evidence for a one-factor latent structure was more clearly supported in a clinical sample (Granero et al., 2018). Thus, future research should examine whether evidence for a one-factor latent structure for the dYFAS-C 2.0 is also more consistent in a clinical sample of adolescents.

The dYFAS-C 2.0 demonstrated expected convergent validity. Specifically, scores on the dYFAS-C 2.0 were positively associated with emotionally and externally triggered consumption, constructs also implicated in SUDs (Joyner et al., 2015; Loxton & Tipman, 2017; Manzoni et al., 2018). Prior food addiction research in adults and children with other versions of the YFAS have found similar associations with emotional and externally-triggered eating (Brunault et al., 2017; Clark & Saules, 2013; Gearhardt et al., 2009, 2016; Loxton & Tipman, 2017; Manzoni et al.,

2018). These findings suggest that interventions to increase emotion regulation (e.g., mindfulness) and the ability to cope with environmental triggers (e.g., craving management) may be beneficial for adolescents endorsing indicators of food addiction, although future research is needed.

Consistent with previous iterations of the YFAS (Gearhardt et al., 2009, 2016; Innamorati et al., 2015; Pursey et al., 2014; Richmond, Roberto, & Gearhardt, 2017; Torres et al., 2017), scores on the dYFAS-C 2.0 were also associated with higher BMI z-scores and with obesity. Although the dYFAS-C 2.0 only accounted for 10.9% of variance in BMI z-scores, this likely reflects the multifactorial nature of contributors to body mass (e.g., genetics, physical activity, dietary patterns, medication, mental health conditions, environmental exposures) (Wyatt, Winters, & Dubbert, 2006). Incremental validity of the dYFAS-C 2.0 was also supported by accounting for variance in BMI z-scores over and above other measures of eating pathology. Although the amount of unique variance accounted for was relatively small (3.4%), it is similar in magnitude to the unique variance accounted for in BMI by the original YFAS 2.0 in an adult community sample (3.5%) (Gearhardt et al., 2016). The association of the YFAS 2.0 with BMI z-scores and obesity highlights the potential utility of assessing food addiction to evaluate contributors to excess body weight in adolescents.

Unexpectedly, high scores on the dYFAS-C 2.0 were positively correlated with restrained eating behaviors, failing to demonstrate discriminant validity with this construct. In adults, high levels of weight cycling are associated with food addiction (Gearhardt, Boswell, & White, 2014;

Gearhardt et al., 2016). Thus, repeated failures to restrain food intake may lessen the motivation to continue restricting over time. However, in adolescence, food addiction does appear to be associated with intention and attempts to restrain eating behavior. Due to the social pressures associated with body image in adolescence (Carlson, 2004), younger individuals with food addiction symptoms may still be actively attempting to suppress their desires in order to achieve a thin body ideal. As they have had fewer failed experiences in weight loss or restraining eating due to their younger age, they may still be motivated to restrict. However, if food addiction symptoms persist or become more severe over time, restriction attempts may be more likely to fail and motivation to restrict food intake may be reduced during adulthood. The association between restraint and addictive-like eating behaviors across the lifespan should be explored further to determine how these problematic eating behaviors vary across different age cohorts.

Limitations and Future Directions

Although the current study has important implications for using the DSM-5 criteria for SUDs to assess addictive-like eating in younger populations, there are several limitations to consider. First, the study was conducted on a non-clinical, community sample and any participant endorsing clinical eating disorders or other significant psychopathology was excluded. As a result, despite a relatively high proportion of participants having overweight and obesity, the sample was largely healthy. This likely contributed to the low endorsement rate of certain items on the dYFAS-C 2.0. Although this provided important insights for the assessment of food addiction in non-clinical samples of adolescents, future research should examine the

utility of the original 35-item dYFAS-C 2.0 in more clinical populations (e.g., children and adolescents in treatment for BED). In more clinically severe samples, problem-focused food addiction symptoms may be endorsed at a higher rate and have psychometric utility.

Additionally, traditional, categorical approaches to scoring may be more appropriate in clinical samples if specificity is needed over sensitivity in detecting food addiction pathology. However, even with low levels of eating pathology in the current community sample, significant, positive associations between dYFAS-C 2.0 food addiction scores were found with emotional eating, cue triggered eating, eating to cope, BMI z-scores, and obesity. This suggests that dimensional approaches are useful for examining food addiction in non-clinical, community samples and may be appropriate for identifying individuals at-risk for developing clinically significant food addiction. In the future, it will be especially important to investigate the predictive utility of the dYFAS-C 2.0 to determine if higher scores do predict more pathological eating behaviors later in life.

Another important next step will be to investigate the psychometric properties of the dYFAS-C 2.0 in younger children to determine if addictive-like eating emerges earlier in development. Further, the dYFAS-C 2.0 is self-report in nature and it will be important to compare scores on the dYFAS-C 2.0 to objective measures of the mechanisms implicated in addictive disorders (e.g., neurobiological reward dysfunction, attentional biases to food cues) to further establish the utility of the measure.

Despite these limitations, the current study demonstrates the utility of using a dimensional approach for examining food addiction symptoms in a community sample of adolescents. Further, it suggests that problem-focused criteria may be less relevant in non-clinical samples of adolescents, which is consistent with recent concerns about the problem-focused nature of the DSM-5 substance use criteria. While future research is needed to determine the utility of the dYFAS-C 2.0 in more clinical samples, this study provides critical evidence that a dimensional approach to assessing food addiction has utility in a community sample of adolescents.

References

Albayrak, Ö., Föcker, M., Kliewer, J., Esber, S., Peters, T., Zwaan, M., & Hebebrand, J. (2017). Eating -related Psychopatholog Inpatients. *European Eating Disorders Review, 25*(3), 214-220. doi:https://doi.org/10.1002/erv.2509

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders (DSM-5®)*: American Psychiatric Pub.

Boggiano, M. M., Wenger, L. E., Turan, B., Tatum, M. M., Sylvester, M. D., Morgan, P. R., . . . Burgess, E. E. (2015). Real-time sampling of reasons for hedonic food consumption: further validation of the Palatable Eating Motives Scale. *Frontiers in Psychology, 6*, 744. doi:https://doi.org/10.3389/fpsyg.2015.00744

Briggs, N. E., & MacCallum, R. C. (2003). Recovery of weak common factors by maximum likelihood and ordinary least squares estimation. *Multivariate Behavioral Research, 38*(1), 25-56. doi:10.1207/S15327906MBR3801_2

Brunault, P., Courtois, R., Gearhardt, A. N., Gaillard, P., Journiac, K., Cathelain, S., . . . Ballon, N. (2017). Validation of the French version of the DSM-5 Yale Food Addiction Scale in a nonclinical sample. *The Canadian Journal of Psychiatry, 62*(3), 199-210. doi:10.1177/0706743716673320

Burgess, E., Turan, B., Lokken, K. L., Morse, A., & Boggiano, M. M. (2014). Profiling motives behind hedonic eating. Preliminary validation of the Palatable Eating Motives Scale. *Appetite, 72*, 66-72. doi:https://doi.org/10.1016/j.appet.2013.09.016

Carlson, D. J. (2004). Body image among adolescent girls and boys: a longitudinal study. *Developmental Psychology, 40*(5), 823. doi:http://dx.doi.org.proxy.lib.umich.edu/10.1037/0012-1649.40.5.823

Chen, G., Tang, Z., Guo, G., Liu, X., & Xiao, S. (2015). The Chinese version of the Yale Food Addiction Scale: An examination of its validation in a sample of female adolescents. *Eating Behaviors, 18*, 97-102. doi:https://doi.org/10.1016/j.eatbeh.2015.05.002

Clark, S. M., & Saules, K. K. (2013). Validation of the Yale Food Addiction Scale among a weight-loss surgery population. *Eating Behaviors, 14*(2), 216-219. doi:http://dx.doi.org.proxy.lib.umich.edu/10.1016/j.eatbeh.2013.01.002

Costello, A. B., & Osborne, J. W. (2005). Best practices in exploratory factor analysis: Four recommendations for getting the most from your analysis. *Practical Assessment, Research & Evaluation, 10*(7), 1-9. doi:http://pareonline.net/getvn.asp?v=10&n=7

Cracco, E., Goossens, L., & Braet, C. (2017). Emotion regulation across childhood and adolescence: evidence for a maladaptive shift in adolescence. *European Child & Adolescent Psychiatry, 26*(8), 909-921. doi:https://doi.org/10.1007/s00787-017-0952-8

Crews, F., He, J., & Hodge, C. (2007). Adolescent cortical development: a critical period of vulnerability for addiction. *Pharmacology Biochemistry and Behavior, 86*(2), 189-199. doi:doi:10.1016/j.pbb.2006.12.001

Dietz, W. H. (1994). Critical periods in childhood for the development of obesity. *The American Journal of Clinical Nutrition, 59*(5), 955-959. doi:https://doi.org/10.1093/ajcn/59.5.955

Eaton, D. K., Kann, L., Kinchen, S., Shanklin, S., Ross, J., Hawkins, J., . . . Chyen, D. (2010). Youth risk behavior surveillance-United States, 2009. *MMWR Surveillance Summary, 59*(5), 1-142.

Ferrario, C. R. (2017). Food addiction and obesity. *Neuropsychopharmacology, 42*(1), 361. doi:http://dx.doi.org/10.1038/npp.2016.221

Gearhardt, A. N., Boswell, R. G., & White, M. A. (2014). The association of "food addiction" with disordered eating and body mass index. *Eating Behaviors, 15*(3), 427-433. doi:https://doi.org/10.1016/j.eatbeh.2014.05.001

Gearhardt, A. N., Corbin, W. R., & Brownell, K. D. (2009). Preliminary validation of the Yale food addiction scale. *Appetite, 52*(2), 430-436. doi:https://doi.org/10.1016/j.appet.2008.12.003

Gearhardt, A. N., Corbin, W. R., & Brownell, K. D. (2016). Development of the Yale Food Addiction Scale Version 2.0. *Psychology of Addictive Behaviors, 30*(1), 113. doi:http://dx.doi.org/10.1037/adb0000136

Gearhardt, A. N., Roberto, C. A., Seamans, M. J., Corbin, W. R., & Brownell, K. D. (2013). Preliminary validation of the Yale Food Addiction Scale for children. *Eating Behaviors, 14*(4), 508-512. doi:https://doi.org/10.1016/j.eatbeh.2013.07.002

Granero, R., Jiménez-Murcia, S., Gerhardt, A. N., Agüera, Z., Aymamí, N., Gómez-Peña, M., . . . Neto-Antao, M. I. (2018). Validation of the Spanish Version of the Yale Food Addiction Scale 2.0 (YFAS 2.0) and Clinical Correlates in a Sample of Eating Disorder, Gambling Disorder, and Healthy Control Participants. *Frontiers in Psychiatry, 9*. doi:doi: 10.3389/fpsyt.2018.00208

Hebebrand, J., Albayrak, O., Adan, R., Antel, J., Dieguez, C., de Jong, J., . . . Dickson, S. L. (2014). "Eating addiction", rather than "food addiction", better captures addictive-like eating behavior. *Neuroscience & Biobehavioral Reviews, 47*, 295-306. doi:10.1016/j.neubiorev.2014.08.016

Hu, L. t., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling: A Multidisciplinary Journal, 6*(1), 1-55. doi:https://doi.org/10.1080/10705519909540118

Hudziak, J. J., Achenbach, T. M., Althoff, R. R., & Pine, D. S. (2007). A dimensional approach to developmental psychopathology. *International Journal of Methods in Psychiatric Research, 16*(S1), S16-S23. doi:https://doi.org/10.1002/mpr.217

IBM Statistics, S. (2016). SPSS Version 24.0. *Chicago, IL, USA*.

Innamorati, M., Imperatori, C., Manzoni, G. M., Lamis, D. A., Castelnuovo, G., Tamburello, A., . . . Fabbricatore, M. (2015). Psychometric properties of the Italian Yale Food Addiction Scale in overweight and obese patients. *Eating and Weight Disorders-Studies on Anorexia, Bulimia and Obesity, 20*(1), 119-127. doi:https://doi-org.proxy.lib.umich.edu/10.1007/s40519-014-0142-3

Inokuchi, M., Matsuo, N., Takayama, J. I., & Hasegawa, T. (2011). BMI z-score is the optimal measure of annual adiposity change in elementary school children. *Annals of Human Biology, 38*(6), 747-751. doi:https://doi.org/10.3109/03014460.2011.620625

Joyner, M. A., Schulte, E. M., Wilt, A. R., & Gearhardt, A. N. (2015). Addictive-like eating mediates the association between eating motivations and elevated body mass index. *Translational Issues in Psychological Science, 1*(3), 217. doi:http://dx.doi.org/10.1037/tps0000034

Lane, S. P., & Sher, K. J. (2015). Limits of current approaches to diagnosis severity based on criterion counts: An example with DSM-5 alcohol use disorder. *Clinical Psychological Science, 3*(6), 819-835. doi:https://doi.org/10.1177/2167702614553026

Larson, R. W., Moneta, G., Richards, M. H., & Wilson, S. (2002). Continuity, stability, and change in daily emotional experience across adolescence. *Child Development, 73*(4), 1151-1165. doi:https://doi.org/10.1111/1467-8624.00464

Li, C.-H. (2016). Confirmatory factor analysis with ordinal data: Comparing robust maximum likelihood and diagonally weighted least squares. *Behavior Research Methods, 48*(3), 936-949. doi:https://doi.org/10.3758/s13428-015-0619-7

Liu, R. T. (2017). Substance use disorders in adolescence exist along continua: taxometric evidence in an epidemiological sample. *Journal of Abnormal Child Psychology, 45*(8), 1577-1586. doi:https://doi.org/10.1007/s10802-017-0269-6

Loxton, N. J., & Tipman, R. J. (2017). Reward sensitivity and food addiction in women. *Appetite, 115*, 28-35. doi:https://doi-org.proxy.lib.umich.edu/10.1016/j.appet.2016.10.022

Manzoni, G. M., Rossi, A., Pietrabissa, G., Varallo, G., Molinari, E., Poggiogalle, E., . . . Piccione, C. (2018). Validation of the Italian Yale Food Addiction Scale in postgraduate university students. *Eating and Weight Disorders-Studies on Anorexia, Bulimia and Obesity, 23*(2), 167-176. doi:https://doi.org/10.1007/s40519-018-0495-0

Meule, A., Müller, A., Gearhardt, A. N., & Blechert, J. (2017). German version of the Yale Food Addiction Scale 2.0: prevalence and correlates of 'food addiction'in students and obese individuals. *Appetite, 115*, 54-61. doi:https://doi.org/10.1016/j.appet.2016.10.003

Miller, E. M., & Shields, S. A. (1980). Skin conductance response as a measure of adolescents' emotional reactivity. *Psychological Reports, 46*(2), 587-590. doi:https://doi.org/10.2466/pr0.1980.46.2.587

Muthén, B., & Muthén, L. (2012). Software Mplus Version 7. *Google Scholar*.

Nunnally, J. C., & Bernstein, I. (1994). *Psychometric Theory (McGraw-Hill Series in Psychology)* (Vol. 3): McGraw-Hill New York.

Peiper, N. C., Ridenour, T. A., Hochwalt, B., & Coyne-Beasley, T. (2016). Overview on prevalence and recent trends in adolescent substance use and abuse. *Child and Adolescent Psychiatric Clinics, 25*(3), 349-365. doi:https://doi.org/10.1016/j.chc.2016.03.005

Piontek, D., Kraus, L., Legleye, S., & Bühringer, G. (2011). The validity of DSM -IV cannabis abuse and dependence criteria in adolescents and the value of additional cannabis use

indicators. *Addiction, 106*(6), 1137-1145. doi:https://doi.org/10.1111/j.1360-0443.2010.03359.x

Pursey, K. M., Stanwell, P., Gearhardt, A. N., Collins, C. E., & Burrows, T. L. (2014). The prevalence of food addiction as assessed by the Yale Food Addiction Scale: a systematic review. *Nutrients, 6*(10), 4552-4590. doi:10.3390/nu6104552

Richmond, R. L., Roberto, C. A., & Gearhardt, A. N. (2017). The association of addictive-like eating with food intake in children. *Appetite, 117*, 82-90. doi:https://doi.org/10.1016/j.appet.2017.06.002

Schuckit, M. A., Danko, G. P., Smith, T. L., Bierut, L. J., Bucholz, K. K., Edenberg, H. J., . . . Trim, R. (2008). The prognostic implications of DSM-IV abuse criteria in drinking adolescents. *Drug and Alcohol Dependence, 97*(1-2), 94-104. doi:https://doi.org/10.1016/j.drugalcdep.2008.03.020

Schulte, E. M., Avena, N. M., & Gearhardt, A. N. (2015). Which foods may be addictive? The roles of processing, fat content, and glycemic load. *PloS One, 10*(2), e0117959. doi:https://doi.org/10.1371/journal.pone.0117959

Schulte, E. M., Grilo, C. M., & Gearhardt, A. N. (2016). Shared and unique mechanisms underlying binge eating disorder and addictive disorders. *Clinical Psychology Review, 44*, 125-139. doi:https://doi.org/10.1016/j.cpr.2016.02.001

Schulte, E. M., Jacques-Tiura, A. J., Gearhardt, A. N., & Naar, S. (2017). Food Addiction Prevalence and Concurrent Validity in African American Adolescents With Obesity. *Psychology of Addictive Behaviors: Journal of the Society of Psychologists in Addictive Behaviors*. doi:http://dx.doi.org/10.1037/adb0000325

Steinberg, L. (2010). A dual systems model of adolescent risk taking. *Developmental Psychobiology, 52*(3), 216-224. doi:https://doi.org/10.1002/dev.20445

Streiner, D. L. (2003). Starting at the beginning: an introduction to coefficient alpha and internal consistency. *Journal of Personality Assessment, 80*(1), 99-103. doi:https://doi.org/10.1207/S15327752JPA8001_18

Torres, S., Camacho, M., Costa, P., Ribeiro, G., Santos, O., Vieira, F. M., . . . Oliveira-Maia, A. J. (2017). Psychometric properties of the Portuguese version of the Yale Food Addiction Scale. *Eating and Weight Disorders-Studies on Anorexia, Bulimia and Obesity, 22*(2), 259-267. doi:https://doi-org.proxy.lib.umich.edu/10.1007/s40519-016-0349-6

Van Strien, T., Frijters, J. E., Van Staveren, W. A., Defares, P. B., & Deurenberg, P. (1986). The predictive validity of the Dutch restrained eating scale. *International Journal of Eating Disorders, 5*(4), 747-755. doi:https://doi.org/10.1002/1098-108X(198605)5:4<747::AID-EAT2260050413>3.0.CO;2-6

Van Strien, T., Peter Herman, C., & Anschutz, D. (2012). The predictive validity of the DEBQ - external eating scale for eating in response to food commercials while watching television. *International Journal of Eating Disorders, 45*(2), 257-262. doi:https://doi.org/10.1002/eat.20940

Van Strien, T., Schippers, G. M., & Cox, W. M. (1995). On the relationship between emotional and external eating behavior. *Addictive Behaviors, 20*(5), 585-594. doi:https://doi.org/10.1016/0306-4603(95)00018-8

Wyatt, S. B., Winters, K. P., & Dubbert, P. M. (2006). Overweight and obesity: prevalence, consequences, and causes of a growing public health problem. *The American Journal of the Medical Sciences, 331*(4), 166-174. doi:https://doi.org/10.1097/00000441-200604000-00002

Ziauddeen, H., & Fletcher, P. C. (2013). Is food addiction a valid and useful concept? *Obesity Reviews, 14*(1), 19-28. doi:https://doi.org/10.1111/j.1467-789X.2012.01046.x

Table 1

Diagnostic and Statistical Manual Version 5 Substance Use Disorder Criteria and Item Endorsement Rate

	Number of Items Associated with the Symptom	Number of Items Retained
Loss of Control	3	3
Unsuccessful Attempts to Cut Down	4	4
Large Amount of Time Spent	3	3
Craving†	2	1
Failure to Fulfil Obligations†	2	0
Social or Interpersonal Problems†	3	0
Important Activities Given Up	4	0
Use in Hazardous Situations†	3	0
Use Despite Emotional/Physical Problems	2	2
Tolerance	2	1
Withdrawal	5	2

Notes. † indicates symptoms that are new to the Yale Food Addiction Scale for Children 2.0; Bolded items reflect problem-focused symptoms

Table 2

Dimensional Yale Food Addiction Scale for Children 2.0 Questions

1. When I started to eat certain foods, I found it hard to stop.	**(*M* = 2.13, *SD* = .80)**
2. I keep eating certain foods even though I was not hungry.	**(*M* = 2.19, *SD* = .96)**
3. I ate until my stomach hurt or I felt sick.	**(*M* = 1.57, *SD* = .72)**
4. I worried about cutting down on certain foods, but ate them anyway.	**(*M* = 2.09, *SD* = 1.01)**
5. I spent a lot of time feeling tired from eating too much.	**(*M* = 1.47, *SD* = .72)**
6. I ate certain foods all day long.	**(*M* = 1.56, *SD* = .81)**
7. If I could not find a food I wanted, I tried hard to get it (e.g., asked a friend to get it for me, found a vending machine, snuck food when people weren't looking).	**(*M* = 1.50, *SD* = .72)**
8. I ate certain foods rather than do other things I like. (e.g., play, hang out with friends)	(*M* = 1.15, *SD* = .42)
9. I had fights with my family for friends because I ate too much.	(*M* = 1.11, *SD* = .36)
10. I avoided places that had certain foods, because I might eat too much. (e.g., parties, friends' houses)	(*M* = 1.20, *SD* = .54)
11. When I cut down or stopped eating certain foods, I felt angry, upset, or sad.	**(*M* = 1.28, *SD* = .59)**
12. If I felt sick because I hadn't eaten certain foods, I would eat those foods to feel better.	(*M* = 1.19, *SD* = .45)
13. If I was upset because I hadn't eaten certain foods, I would eat those foods to feel better.	(*M* = 1.35, *SD* = .65)
14. When I cut down on or stopped eating certain goods, I felt sick. (e.g., my head hurt or I was really tired)	(*M* = 1.21, *SD* = .53)
15. When I cut down or stopped eating certain foods, I craved them a lot more.	**(*M* = 1.90, *SD* = 1.05)**
16. The way I ate made me really unhappy.	(*M* = 1.74, *SD* = 1.03)
17. The way I ate caused me problems. (e.g., problems at school, with parents, with friends)	(*M* = 1.21, *SD* = .51)
18. I ate so much that I felt bad afterwards. I felt so bad that I did not do things I like. (e.g., play, hang out with friends)	(*M* = 1.28 *SD* = .63)
19. I ate so much that I did not do other important things. (e.g., homework, chores)	(*M* = 1.14, *SD* = .39)
20. I avoided places where I could not get the foods I wanted.	(*M* = 1.24, *SD* = .53)
21. I avoided hanging out with other kids because they thought I ate too much.	(*M* = 1.08, *SD* = .35)
22. I kept eating too much even though it made me feel sad,	**(*M* = 1.29, *SD* = .66)**

nervous, or guilty.	
23. I kept eating too much even though it made me unhealthy.	**(*M* = 1.59, *SD* = .82)**
24. When I ate the same amount of food, it didn't make me feel as good as it used to (e.g., feel happy, calm, relaxed).	**(*M* = 1.28, *SD* = .59)**
25. I really wanted to cut down on or stop eating certain kinds of foods, but I just couldn't.	**(*M* = 1.80, *SD* = .95)**
26. I needed to eat more to get the good feelings I wanted from eating. (e.g., feeling happy, calm or relaxed)	(*M* = 1.22, *SD* = .49)
27. I didn't do well at school because I was eating too much.	(*M* = 1.04, *SD* = .20)
28. I kept eating certain foods even though I knew it was dangerous. (e.g., eating sweets even though I have diabetes)	(*M* = 1.10, *SD* = .35)
29. I had such strong urges to eat certain foods that I couldn't think of anything else.	(*M* = 1.28, *SD* = .55)
30. I was craving certain foods so much that I felt like I had to eat them right away.	**(*M* = 1.46, *SD* = .70)**
31. I tried to cut down on certain foods, but it didn't work.	**(*M* = 1.62, *SD* = .88)**
32. I tried and failed to stop eating certain foods.	**(*M* = 1.61, *SD* = .91)**
33. I was so distracted by eating that I could have been hurt. (e.g., crossing the street)	(*M* = 1.04, *SD* = .23)
34. I was so distracted by thinking about food that I could have been hurt. (e.g., crossing the street)	(*M* = 1.04, *SD* = .23)
35. My friends or family worried that I ate too much.	(*M* = 1.19, *SD* = .55)

Notes. Sixteen bolded items represent the remaining items after questions with a low endorsement rate were dropped. The response options for each item range from 0 to 4 (0 = Never, 1 = Rarely, 2 = Sometimes, 3 = Very Often, and 4 = Always). All responses were summed together to reflect a dimensional food addiction score.

Table 3

Standardized Factor Loadings from Confirmatory Factor Analysis

Item	Estimate
1. When I started to eat certain foods, I found it hard to stop.	.62
2. I keep eating certain foods even though I was not hungry.	.70
3. I ate until my stomach hurt or I felt sick.	.52
4. I worried about cutting down on certain foods, but ate them anyway.	.83
5. I spent a lot of time feeling tired from eating too much.	.39
6. I ate certain foods all day long.	.45
7. If I could not find a food I wanted, I tried hard to get it (e.g., asked a friend to get it for me, found a vending machine, snuck food when people weren't looking).	.49
8. When I cut down or stopped eating certain foods, I felt angry, upset, or sad.	.46
9. When I cut down or stopped eating certain foods, I craved them a lot more.	.61
10. I kept eating too much even though it made me feel sad, nervous, or guilty.	.62
11. I kept eating too much even though it made me unhealthy.	.70
12. When I ate the same amount of food, it didn't make me feel as good as it used to (e.g., feel happy, calm, relaxed).	.55
13. I really wanted to cut down on or stop eating certain kinds of foods, but I just couldn't.	.75
14. I was craving certain foods so much that I felt like I had to eat them right away.	.53
15. I tried to cut down on certain foods, but it didn't work.	.75
16. I tried and failed to stop eating certain foods.	.78

Notes. All items demonstrated a factor loading above .3, indicating a moderate to strong association with the underlying factor of food addiction.

Table 4

Hierarchical linear regression analysis to assess incremental validity.

	β	**Standard Error**	**Standardized Beta**	***t***	***p***
Step 1					
DEBQ Emotional/External Eating	.07	.07	.09	.95	.34
Step 2					
DEBQ Emotional/External Eating	-.11	.08	-.13	-1.32	.19
dYFAS-C 2.0	.04	.01	.40	4.00	<.001*

Notes. Scores demonstrate that scores on the dimensional Yale Food Addiction Scale for Children 2.0 significantly predicted Body Mass Index Z-score over and above scores on the Dutch Eating Behaviors Questionnaire Emotional/External Eating Scale.