Eating Behaviors 14 (2013) 508–512

Contents lists available at ScienceDirect

Eating Behaviors

Preliminary validation of the Yale Food Addiction Scale for children ☆,☆☆

Ashley N. Gearhardt [a,*], Christina A. Roberto [b], Marissa J. Seamans [c], William R. Corbin [d], Kelly D. Brownell [e]

[a] Department of Psychology, University of Michigan, 530 Church St., Ann Arbor, MI 48109, USA
[b] Robert Wood Johnson Foundation Health & Society Scholar, Center for Population and Development Studies, Harvard School of Public Health, 9 BowStreet, Cambridge, MA 02138 USA
[c] Department of Epidemiology, University of North Carolina at Chapel Hill, Gillings School of Global Public Health, 2101 McGavran-Greenberg Hall, CB #7435, Chapel Hill, NC 27599, USA
[d] Department of Psychology, Arizona State University, 950 S. McAllister, Tempe, AZ 85287, USA
[e] Department of Psychology, Yale University, 2 Hillhouse Ave, New Haven, CT 06511, USA

ARTICLE INFO

Article history:
Received 1 February 2013
Received in revised form 31 May 2013
Accepted 15 July 2013
Available online 21 July 2013

Keywords:
Obesity
Addiction
Children
Eating
Food

ABSTRACT

Introduction: Evidence is growing that an addictive process may play a role in problematic eating behavior. The majority of research on this topic has examined the concept of "food addiction" solely in adult samples. If certain foods have addictive potential, children may be impacted as much as (or more) than adults due to psychological and neurobiological vulnerabilities at younger developmental stages. In the current study, we developed a measure of food addiction in children that reflects the diagnostic indicators of addiction.
Materials and methods: The content and reading level of the Yale Food Addiction Scale (YFAS) was altered to be appropriate for children (YFAS-C). The YFAS-C and other eating-related measures were administered to study participants to examine the validity and reliability of the YFAS-C.
Participants: 75 children were recruited from the community ranging from lean to obese.
Results: The validation of the YFAC-C provides preliminary support for its convergent validity with like constructs and incremental validity in predicting body mass index. Internal consistency was adequate given the small number of items on the scale.
Discussion: The YFAS-C appears to be a helpful tool for identifying addictive-like eating in children.

1. Introduction

A growing body of evidence suggests that highly processed foods, or ingredients in these foods, may be capable of triggering an addictive process (Avena, Rada, & Hoebel, 2008; Gearhardt, Davis, Kuschner, & Brownell, 2011). Animal models of addictive eating find that rats given access to sugar or highly processed foods exhibit classic behavioral and biological signs of addiction (e.g., withdrawal, tolerance, dopaminergic downgrading) (Avena et al., 2008; Johnson & Kenny, 2010). In adult humans, patterns of neural activation commonly implicated in addiction are also indicated in obesity (Volkow, Wang, Fowler, & Telang, 2008) and behavioral indicators of addiction such as loss of control over consumption and continued use despite negative consequences are also present in eating disorders (Gearhardt, Corbin, & Brownell, 2009a; Gold, Frost-Pineda, & Jacobs, 2003). Although evidence is growing to support the concept of addictive-like eating among adults, little is known about the role it may play in childhood obesity. In the substance dependence literature, an earlier age of exposure to addictive substances (e.g., alcohol, nicotine) is implicated in risk for the development of problematic substance use in the future (DeWit, Adlaf, Offord, & Ogborne, 2000). This risk is thought to result from adaptations in a vulnerable neural system (Tapert, Caldwell, & Burke, 2005), as well as an increased likelihood of relying on substances to cope psychologically (Clark, Thatcher, & Tapert, 2008). If highly processed foods also have addictive potential, children may be more susceptible to this effect than adults due to neural and psychological vulnerabilities.

There is some evidence to suggest that addictive processes may be at play in problematic eating behavior in children. Central components of addiction (i.e., emotionally triggered use and binge consumption) (Berking et al., 2011; Naimi et al., 2003) are also factors in problematic eating. Emotional eating and binge eating are documented phenomena in adults (Arnow, Kenardy, & Agras, 2006; Grilo, Masheb, & Wilson, 2001), but evidence is growing that children (especially obese children) are prone to these tendencies as well (Shapiro et al., 2007; van Strien & Oosterveld, 2008). In a qualitative study of overweight/obese 8-to-21 year olds, behaviors consistent with addiction (e.g., tolerance, cravings) were frequently described and 66% identified addiction as a contributor to their eating problems (Pretlow, 2011). Additionally, 15.2% of children receiving treatment at a pediatric lipid clinic reported that they often

☆ Funding: During this work, Christina Roberto was supported by the National Institute of Diabetes and Digestive and Kidney Diseases grant 1F31DK088523-01.
☆☆ Financial disclosure: The authors have no financial disclosures to report.
* Corresponding author at: 2268 East Hall, 530 Church St., Ann Arbor, MI 48109, USA. Tel.: +1 734 647 3920; fax: +1 734 764 2580.
E-mail address: agearhar@umich.edu (A.N. Gearhardt).

1471-0153/$ – see front matter © 2013 Elsevier Ltd. All rights reserved.
http://dx.doi.org/10.1016/j.eatbeh.2013.07.002

felt addicted to food (Merlo, Klingman, Malasanos, & Silverstein, 2009). Children who answered affirmatively to more addiction-related eating questions were also more likely to indicate other eating-related issues (Merlo et al., 2009).

This evidence is consistent with an addictive process contributing to childhood obesity, but further examination of this concept is needed. To facilitate future work on the topic, a valid measure is needed to operationalize food addiction in children based upon substance dependence diagnostic criteria. Although there is no validated measure of food addiction in children, the Yale Food Addiction Scale (Gearhardt, Corbin, & Brownell, 2009b) is a validated measure of addictive-like eating behavior in adults based on the Diagnostic and Statistical Manual of Mental Disorder IV-Text Revision (DSM-IV-TR) (American Psychiatric Association, 2000) diagnostic criteria for substance dependence (see Table 1). Higher scores on the YFAS are associated with a more severe presentation of binge eating disorder (BED) (Gearhardt, White, et al., 2011) and food addiction (as assessed by the YFAS) is associated with a pattern of neural response during exposure to food cues and food consumption that is consistent with the neural activation associated with other addictive behaviors (Gearhardt, Yokum, et al., 2011). The current study seeks to develop a new version of the YFAS to assess symptoms of food addiction in children. The YFAS for children (YFAS-C) is designed to measure the degree to which the substance dependence criteria outlined in the DSM-IV (American Psychiatric Association, 2000) are relevant to the consumption of calorie-dense foods in children. We conduct a preliminary validation of the YFAS-C by examining the internal consistency of the measure, the convergence with other measures of eating behavior, and the incremental utility of the measure in predicting body mass index (BMI) above and beyond other measures of eating.

2. Material and methods

2.1. Participants

This study was approved by the Yale Institutional Review Board. Parental guardians provided written informed consent and children provided verbal assent. A total of 117 children and their parents were recruited from the New Haven community for a larger study on family dining preferences and eating habits. The parents of the children participating in the study were 65.1% (n = 47) Caucasian, 25.7% (n = 18) African-American, 2.9% (n = 2) Hispanic and 4.3% (n = 3) of other race/ethnicity. A subset of 75 consecutively enrolled participants were administered the children's version of the Yale Food Addiction Scale (YFAS-C). These participants were 8.32 years old on average (SD = 2.78, Range 4–16) and 42.7% were female. Parents were given the opportunity to help their child complete the YFAS-C if they felt the measure was beyond their reading comprehension level.

Table 1
Diagnostic criteria for substance dependence as stated by the DSM-IV-TR (American Psychiatric Association, 2000).

1. Tolerance, as defined by either of the following:
a) The 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.
b) The same (or closely related) substance is taken to relieve or avoid withdrawal symptoms.
3. Taking the substance often in larger amounts or over a longer period than was intended.
4. There is a persistent desire or unsuccessful effort to cut down or control substance use.
5. Spending a great deal of time in activities necessary to obtain or use the substance or to recover from its effects.
6. Giving up social, occupational, or recreational activities because of substance use.
7. Continuing the substance use with the knowledge that it is causing or exacerbating a persistent or recurrent physical or psychological problem.

2.2. Measures

2.2.1. Body mass index (BMI) percentile

Height and weight were based on a parent's report and this information was used to compute the child's BMI percentile for his/her age based upon the Centers for Disease Control and Prevention (CDC) growth charts (Centers for Disease Control, Prevention, N. C. f. H. S., 2000). This common measure of size and growth indicates the child's BMI relative to other children of the same sex and age. The mean BMI percentile of the children administered the YFAS-C was 70.07% (SD = 32.45) and 38 children were in the healthy weight range (percentile between 5.00% and 84.99%). Based upon BMI percentiles, 3 children were in the underweight range (percentile less than 5.00%), 8 children were in the overweight range (percentile 85%–94.99%), and 17 were in the obese range (percentile equal to or greater than 95%).

2.2.2. Children's Eating Behaviour Questionnaire (CEBQ) (Wardle, Guthrie, Sanderson, & Rapoport, 2001)

The CEBQ is a measure of different behavioral phenotypes related to eating in children. The measure has been found to be internally consistent, has good test–retest reliability and is related to behavioral measures of eating (Carnell & Wardle, 2007; Wardle et al., 2001). The CEBQ has eight subscales, but only the Emotional Overeating (M = .89, SD = .73) and Satiety Responsiveness (M = 2.17, SD = .45) subscales were examined to investigate the convergent validity of the YFAS-C, as emotional eating is related to food addiction in adult samples (Gearhardt et al., 2009b) and diminished satiety responsiveness is related to hedonically motivated overeating (James, Gold, & Liu, 2004).

2.3. Measurement development

To develop the YFAS-C, the adult YFAS was altered to refer to age-appropriate activities (e.g., references related to employment were changed to school, parental interactions were included). The questions were also edited to lower the reading level (Flesch–Kincaid reading level = grade 2.7). Next, experts in the addiction and childhood obesity fields reviewed the questions for clarity and developmental appropriateness. The final scale included 25 questions that mapped onto the seven diagnostic criteria for substance dependence and clinically significant impairment/distress related to eating behavior (see Table 2 for sample questions). A symptom (e.g., loss of control, continued use despite negative consequences) was considered present if one or more questions for a particular diagnostic criteria met the threshold. For the symptom count scoring option, the number of symptoms endorsed was summed (range 0–7). For the dichotomous measure, participants reporting three or more symptoms and clinically significant impairment or distress (which is analogous to the substance dependence diagnostic requirements in the DSM-IV-TR) (American Psychiatric Association, 2000) were considered to have met the diagnostic criteria for food addiction.

2.4. Data analytic plan

All measures were examined for missing data and normality. The emotional eating measure was positively skewed and was log-transformed to meet normality assumptions. Initial diagnostic thresholds for continuous items of the YFAS-C were identified through the use of distribution graphs and scatter plots. Next, we conducted a confirmatory factor analysis to establish the factor structure and assessed internal reliability using M-Plus software for dichotomous variables (Muthén & Muthén, 1998–2011). Convergent validity was assessed by examining relations between the YFAS-C and related measures of eating behavior (i.e., emotional eating, satiety responsiveness, and BMI) using generalized estimating equations (GEE) in SPSS 17.0 (S.P.S.S. Inc., 2008) to control for the interdependence related to the inclusion of siblings in the sample. Incremental validity was assessed

Table 2
Sample YFAS-C Questions[a].
We want to know how kids feel about food and eating. There are no right answers. Every kid is different. We just want to know how *you* feel about "junk foods" like:

- Sweets (candy, ice cream, chocolate, cookies, cake, and doughnuts)
- Carbs (white bread, rolls, pasta, and rice)
- Salty snacks (chips, pretzels, and crackers)
- Fatty foods (french fries, hamburgers, pizza, bacon, and steak)
- Sugary drinks (soda pop, juice, milkshakes, smoothies, and energy drinks like Red Bull).

When we say "FOOD" we want you to think of ANY "junk food" like those above.

In the last year (past 12 months)	Never	Rarely	Sometimes	Very often	Always
1. When I start eating, I find it hard to stop.	0	1	2	3	4
2. If I cannot find a food I want, I will try hard to get it (ex. ask a friend to get it for me, find a vending machine, sneak food when people aren't looking).	0	1	2	3	4
3. I eat so much that I feel bad afterwards. I feel so bad that I do not do things I like (ex. play, hang out with friends).	0	1	2	3	4
4. When I do not eat certain foods, I feel upset or sick.	0	1	2	3	4
5. The way I eat makes me really unhappy	0	1	2	3	4
6. The way I eat causes me problems (ex. problems at school, with my parents, with my friends).	0	1	2	3	4
7. I want to cut down or stop eating certain foods.	0	1	2	3	4
In the last year (past 12 months)		**No**			**Yes**
8. I eat in the same way even though it is causing problems.		0			1
9. I need to eat more to get the good feelings I want (ex. feel happy, calm, relaxed).		0			1

[a] Please contact the corresponding author for the full YFAS-C and scoring instructions.

by examining the association between the YFAS-C and BMI in a GEE model that simultaneously included emotional overeating and satiety responsiveness as predictors.

3. Results

3.1. Establishment of scoring thresholds

Thresholds for the continuous questions in the adult YFAS were used as starting points to establish cut-offs for the YFAS-C. To evaluate whether the cut-offs accurately identified increased risk for eating pathology, scatter plots were created to explore the relation between YFAS-C questions and BMI. Of the 25 questions on the YFAS-C, three were altered from the scoring thresholds used in the adult YFAS. Additionally one question with a dichotomous scoring option from the adult version was changed to a continuously scored question to increase specificity. Seven dichotomous questions were retained on the YFAS-C. Like the adult YFAS, two scoring options were developed: a dichotomous "diagnosis" (yes/no) and a "symptom" count (ranging from 0 to 7). Participants who reported three or more "symptoms" and clinically significant impairment or distress in the last 12 months were classified as meeting the criteria for food addiction. The "symptom" count score is a summary of the seven "symptoms" assessed by the measure (see Table 3). The median number of YFAS-C criteria endorsed was 2 (SD = 1.81) and 7.2% of participants met the diagnostic threshold.

3.2. Factor structure and reliability

A confirmatory factor analysis for dichotomous data was conducted to confirm that the YFAS-C exhibited the same one-factor structure as the adult YFAS. The 22 questions related to the 7 diagnostic criteria (not including items related to impairment and distress) were entered into a confirmatory factor analysis (CFA). The single factor model provided good fit to the data, CFI = 0.71, RMSEA = .078, and the single factor demonstrated adequate internal consistency reliability, Kuder–Richardson $\alpha = .78$. Next, the seven dichotomous "symptoms" were entered into a separate CFA model. This model also provided adequate fit to the data, CFI = 0.94, RMSEA = .080. Internal consistency was marginal, Kuder–Richardson $\alpha = .67$, likely reflecting the relatively smaller number of items.

Table 3
Endorsement rates for YFAS-C "symptoms" and clinical thresholds.

	Met symptom/threshold	Did not meet symptom/threshold
Given up activities	29 (38.7%)	43 (59.7%)
Loss of control	22 (29.3%)	53 (70.7%)
Tolerance	18 (24.7%)	55 (75.3%)
Inability to cut down	47 (65.3%)	25 (34.7%)
Withdrawal	14 (18.9%)	60 (81.1%)
Large amount of time spent	19 (25.7%)	55 (74.3%)
3 ≥ symptoms	27 (38.6%)	43 (61.4%)
Clinically Significant impairment or distress	7 (9.6%)	66 (90.4%)

3.3. Convergent validity[1]

Convergent validity of the scale was established by examining the relationship between YFAS-C scores and other measures relevant to eating behaviors (i.e., BMI, emotional overeating and satiety responsiveness) using GEE models. Elevated scores on the YFAS-C were related to higher BMI, $\chi^2\ (1) = 3.89$, $\beta = .25$, $p = .049$, and higher levels of emotional overeating, $\chi^2\ (1) = 4.91$, $\beta = .30$, $p = .027$. An inverse relationship between satiety responsiveness and YFAS-C scores approached significance, $\chi^2\ (1) = 2.80$, $\beta = -.19$, $p = .094$.

3.4. Incremental validity

Incremental validity of the scale was established by examining the ability of the YFAS-C to predict BMI above and beyond emotional overeating and satiety responsiveness. In the first GEE model, neither emotional overeating, $\chi^2\ (1) = 1.88$, $\beta = .13$, $p = .170$, nor satiety responsiveness, $\chi^2\ (1) = .27$, $\beta = -.05$, $p = .605$, significantly predicted BMI. When the YFAS-C was added to the model, emotional overeating, $\chi 2\ (1) = .05$, $\beta = .02$, $p = .832$, and satiety responsiveness, $\chi^2\ (1) = .05$, $\beta = -.02$, $p = .824$, remained non-significant predictors, whereas the YFAS-C approached significance with higher scores associated with higher BMIs, $\chi^2\ (1) = 3.22$, $\beta = .24$, $p = .073$.

4. Discussion

The goal of the current study was to conduct a preliminary evaluation of a measure to operationalize addictive-like eating behavior in children and to examine the association of this scale with other measures of problematic eating. A CFA provided support for a single factor

[1] As only 7.2% of children met the "diagnostic" threshold on the YFAS-C in this community sample, only the symptom count version was used in validity analyses.

for the YFAS-C and demonstrated adequate internal consistency when the 22 items comprising the 7 diagnostic criteria were evaluated (Bentler, 1990; Browne & Cudek, 1993). The relatively lower internal consistency when the 7 higher order diagnostic criteria were used likely reflects the small number of items (Tiffany, Carter, & Singleton, 2000). Although the use of DSM-IV-TR criteria to assess food addiction increased the likelihood that the YFAS-C is assessing the same constructs used to diagnose other addictive behaviors, internal consistency was not a consideration for the development of DSM criteria. Other measures designed to reflect DSM diagnoses have not used factor structure for this reason (Stice, Telch, & Rizvi, 2000). The sample size was also relatively small which may have resulted in lower internal consistency for the YFAS-C relative to the original YFAS. Further validation of the YFAS-C in larger samples will likely assist in the evaluation of the internal consistency of this measure.

Addictive-like eating patterns in children (as measured by the YFAS-C) were related to elevated BMI and a greater tendency to overeat in response to emotional stimuli. Further, the negative association between the YFAS-C and satiety responsiveness approached significance, which suggests that children who exhibit more signs of food addiction may be less sensitive to homeostatic indicators related to food consumption. Higher scores on the YFAS-C were also a stronger predictor of elevated BMI relative to emotional eating and satiety responsiveness in the current sample. These findings are consistent with prior evidence suggesting that an addictive process may be at play in problematic eating behaviors in children (Merlo et al., 2009; Shapiro et al., 2007; van Strien & Oosterveld, 2008). Although the current study provides only preliminary evidence for the validity of the YFAS-C, it is an important step in advancing the literature on the role of an addictive process in childhood obesity. The YFAS-C could be used in future research to identify children who exhibit signs of food addiction, which might be related to cognitive (e.g., attentional biases), behavioral (e.g., greater motivation to seek out high-calorie foods) and biological (e.g., elevated neural activation to cues) indicators linked with other types of addiction. Further, the YFAS-C was developed to mirror the adult YFAS, allowing for the study of familial patterns of food addiction and underlying genetic factors.

Although the current study has important implications, there are limitations to consider. First, the study was conducted with a community sample of children. It will be important to continue the validation of the YFAS-C in clinical samples of children receiving treatment for obesity, binge eating, etc. The low prevalence of children meeting the full threshold of food addiction (7.2%) limited our ability to examine the psychometric properties of the dichotomous classification of food addiction. However, in the present sample, subclinical levels of food addiction were related to higher BMI and greater emotional eating. These findings underscore the importance of looking at the public health consequences of widespread subclinical food addiction symptoms, as well as clinically relevant problems. Future studies of the YFAS-C in clinical samples will also be important for determining the extent to which food addiction in children is distinct from BED. The current evidence in adult samples suggests that food addiction (as measured by the YFAS) does not completely overlap with BED, but is associated with a more severe subtype of BED (Gearhardt, White, et al., 2011). It will be important to examine whether the YFAS-C performs in a similar manner in children. Another limitation of the current study is that parental control over eating behavior was not assessed. Unlike adults who make their own dietary decisions, children's diets are often dictated, at least to some extent, by their parents. Parents' strategies to manage their children's food consumption may impact the likelihood that children develop addictive eating patterns or might alter the relationship between addictive-like eating and other eating-related measures (e.g. BMI). Further, assessment of parental reports of children's eating behaviors may assist in identifying food addiction in children who have limited awareness of the problematic nature of their responses to food. Thus, future research assessing parents' perspectives on their children's eating behavior will be essential. Finally, the current study was cross-sectional, which prevents inferences about food addiction as a cause of childhood obesity. It is also possible that reaching a higher BMI may trigger processes that contribute to the development of symptoms of food addiction. Future longitudinal studies will be helpful in illuminating the nature of the relations among food addiction, obesity and related disorders (e.g. BED).

Exposure to foods with addictive properties may be particularly harmful to young people for a variety of reasons. In addition to their heightened vulnerability during this developmental period (DeWit et al., 2000), children are often targeted for the marketing of potentially addictive foods (e.g., sugar-sweetened cereals and beverages) (Rudd Center for Food Policy, Obesity, 2011), which likely increases the risk for problematic eating behaviors. Addiction and obesity are both chronic conditions (Volkow & Wise, 2005), thus children who are showing signs of addiction in their eating may be at risk for a lifetime of eating-related negative consequences (e.g., diabetes). Evaluating and understanding the role an addictive process might play in problematic childhood obesity could lead to the development of more effective treatment, prevention, and public policy efforts. In addition to the potential obesity implications, animal model research also suggests that exposure to high levels of sugar (a potentially addictive ingredient) early in life, may increase the risk of developing substance use disorders in the future (Bocarsly et al., 2012). Thus, identifying and treating addictive-like eating patterns in childhood might also help prevent substance use disorders.

5. Conclusion

The current study provides preliminary evidence that the YFAS-C is a reliable and valid tool to operationalize food addiction in children. This measure provides a definition of addictive eating that is consistent with the diagnostic criteria for substance dependence, thus increasing the likelihood of identifying a similar process. Further, preliminary analyses suggest that the measure exhibits adequate internal consistency, as well as convergent and incremental validity. The YFAS-C provides an important tool to further evaluate the potential role of an addictive process in children's problematic eating behaviors.

Role of funding sources

During this work, Christina Roberto was supported by the National Institute of Diabetes and Digestive and Kidney Diseases grant 1F31DK088523-01. The funding source had no involvement in the interpretation of the data, writing of the report, and in the decision to submit the manuscript.

Contributors

Ashley N. Gearhardt: Dr. Gearhardt developed the YFAS-C, conducted analyses, drafted the initial manuscript and approved the final manuscript as submitted.

Christina A. Roberto: Dr. Roberto designed the study, supervised data collection, critically evaluated initial drafts, and approved the final manuscript as submitted.

Marissa J. Seamans: Ms. Seamans coordinated data collection, critically evaluated initial drafts and approved the final manuscript as submitted.

William R. Corbin: Dr. Corbin assisted in developing the YFAS-C, conducted analyses, critically evaluated initial drafts, and approved the final manuscript as submitted.

Kelly D. Brownell: Dr. Brownell assisted in developing the YFAS-C, critically evaluated initial drafts, and approved the final manuscript as submitted.

Conflict of interest

All authors declare that they have no conflicts of interest.

References

American Psychiatric Association (2000). *Diagnostic and statistical manual of mental disorders* (4th ed. text revision) (Washington DC).

Arnow, B., Kenardy, J., & Agras, W. S. (2006). The emotional eating scale: The development of a measure to assess coping with negative affect by eating. *International Journal of Eating Disorders, 18*(1), 79–90.

Avena, N. M., Rada, P., & Hoebel, B. G. (2008). Evidence for sugar addiction: Behavioral and neurochemical effects of intermittent, excessive sugar intake. *Neuroscience and Biobehavioral Reviews, 32*(1), 20–39.

Bentler, P.M. (1990). Comparative fit indexes in structural models. *Psychological Bulletin, 107*(2), 238.

Berking, M., Margraf, M., Ebert, D., Wupperman, P., Hofmann, S. G., & Junghanns, K. (2011). Deficits in emotion-regulation skills predict alcohol use during and after cognitive–behavioral therapy for alcohol dependence. *Journal of Consulting and Clinical Psychology*, *79*(3), 307.

Bocarsly, M. E., Barson, J. R., Hauca, J., Hoebel, B. G., Leibowitz, S. F., & Avena, N. M. (2012). Effects of perinatal exposure to palatable diets on body weight and sensitivity to drugs of abuse in rats. *Physiology & Behavior*, *107*(4), 568–575.

Browne, M., & Cudek, R. (Eds.). (1993). *Alternative ways of assessing model fit*. Newberry Park, CA: Sage Publications.

Carnell, S., & Wardle, J. (2007). Measuring behavioural susceptibility to obesity: Validation of the child eating behaviour questionnaire. *Appetite*, *48*(1), 104–113.

Centers for Disease Control, Prevention, N. C. f. H. S. (2000). CDC growth charts: United States. Retrieved from. http://www.cdc.gov/growthcharts/

Clark, D. B., Thatcher, D. L., & Tapert, S. F. (2008). Alcohol, psychological dysregulation, and adolescent brain development. *Alcoholism, Clinical and Experimental Research*, *32*(3), 375–385.

DeWit, D. J., Adlaf, E. M., Offord, D. R., & Ogborne, A.C. (2000). Age at first alcohol use: A risk factor for the development of alcohol disorders. *The American Journal of Psychiatry*, *157*(5), 745–750.

Gearhardt, A. N., Corbin, W. R., & Brownell, K. D. (2009a). Food addiction: An examination of the diagnostic criteria for dependence. *Journal of Addiction Medicine*, *3*(1), 1–7.

Gearhardt, A. N., Corbin, W. R., & Brownell, K. D. (2009b). Preliminary validation of the Yale Food Addiction Scale. *Appetite*, *52*(19121351), 430–436.

Gearhardt, A. N., Davis, C., Kuschner, R., & Brownell, K. (2011). The addiction potential of hyperpalatable foods. *Current Drug Abuse Reviews*, *4*(3), 140.

Gearhardt, A. N., White, M.A., Masheb, R. M., Morgan, P. T., Crosby, R. D., & Grilo, C. M. (2011). An examination of the food addiction construct in obese patients with binge eating disorder. *International Journal of Eating Disorders*, *45*(5), 657–663.

Gearhardt, A. N., Yokum, S., Orr, P. T., Stice, E., Corbin, W. R., & Brownell, K. D. (2011). Neural correlates of food addiction. *Archives of General Psychiatry*, *68*(8), 808.

Gold, M. S., Frost-Pineda, K., & Jacobs, W. S. (2003). Overeating, binge eating, and eating disorders as addictions. *Psychiatric Annals*, *33*(2), 2003, Feb,117–122

Grilo, C. M., Masheb, R. M., & Wilson, G. T. (2001). Subtyping binge eating disorder. *Journal of Consulting and Clinical Psychology*, *69*(11777111), 1066–1072.

James, G. A., Gold, M. S., & Liu, Y. (2004). Interaction of satiety and reward response to food stimulation. *Journal of Addictive Diseases*, *23*(3), 23–37.

Johnson, P.M., & Kenny, P. J. (2010). Dopamine D2 receptors in addiction-like reward dysfunction and compulsive eating in obese rats. *Nature Neuroscience*, *13*(20348917), 635–641.

Merlo, L. J., Klingman, C., Malasanos, T. H., & Silverstein, J. H. (2009). Exploration of food addiction in pediatric patients: A preliminary investigation. *Journal of addiction medicine*, *3*(1), 26.

Muthén, L. K., & Muthén, B. O. (1998-2011). *Mplus user's guide* (6th ed.) Los Angeles: Muthén & Muthén.

Naimi, T. S., Brewer, R. D., Mokdad, A., Denny, C., Serdula, M. K., & Marks, J. S. (2003). Binge drinking among US adults. *JAMA: The Journal of the American Medical Association*, *289*(1), 70–75.

Pretlow, R. A. (2011). Addiction to highly pleasurable food as a cause of the childhood obesity epidemic: A qualitative internet study. *Eating Disorders*, *19*(4), 295–307.

Rudd Center for Food Policy, Obesity (2011). Trends in television food advertising to young people: 2010 update. Retrieved from. http://www.yaleruddcenter.org/resources/upload/docs/what/reports/RuddReport_TVFoodAdvertising_6.11.pdf

Shapiro, J. R., Woolson, S. L., Hamer, R. M., Kalarchian, M.A., Marcus, M.D., & Bulik, C. M. (2007). Evaluating binge eating disorder in children: Development of the children's binge eating disorder scale (C-BEDS). *International Journal of Eating Disorders*, *40*(1), 82–89.

S.P.S.S. Inc. (2008). *SPSS Statistics for Windows, Version 17.0*. Chicago: IBM.

Stice, E., Telch, C. F., & Rizvi, S. L. (2000). Development and validation of the Eating Disorder Diagnostic Scale: A brief self-report measure of anorexia, bulimia, and binge-eating disorder. *Psychological Assessment*, *12*(2), 123.

Tapert, S. F., Caldwell, L., & Burke, C. (2005). Alcohol and the adolescent brain: Human studies. *Alcohol Research & Health*, *28*(4), 205–212.

Tiffany, S. T., Carter, B.L., & Singleton, E. G. (2000). Challenges in the manipulation, assessment and interpretation of craving relevant variables. *Addiction*, *95(8s2)*, 177–187.

van Strien, T., & Oosterveld, P. (2008). The children's DEBQ for assessment of restrained, emotional, and external eating in 7-to 12-year-old children. *International Journal of Eating Disorders*, *41*(1), 72–81.

Volkow, N. D., Wang, G. J., Fowler, J. S., & Telang, F. (2008). Overlapping neuronal circuits in addiction and obesity: Evidence of systems pathology. *Philosophical Transactions of the Royal Society B: Biological Sciences*, *363*(1507), 3191–3200.

Volkow, N. D., & Wise, R. A. (2005). How can drug addiction help us understand obesity? *Nature Neuroscience*, *8*(5), 555–560.

Wardle, J., Guthrie, C. A., Sanderson, S., & Rapoport, L. (2001). Development of the children's eating behaviour questionnaire. *Journal of Child Psychology and Psychiatry*, *42*(07), 963–970.