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Prevalence of Food Addiction Among Low-Income Reproductive-Aged Women

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Abstract

Background: Hyperpalatable foods (i.e., high in salt, sugar, or fat) have been shown to have addictive properties that may contribute to overeating. Prior studies conducted on food addiction behaviors are mostly based on white and middle-aged women. Data are not available, however, on reproductive-aged women from other races/ethnicities or low-income women. The purpose of this study was to examine the prevalence and correlates of food addiction among multiethnic women of low socioeconomic status.
Methods: We conducted a cross-sectional survey of health behaviors, including food addiction according to the Yale Food Addiction Scale (YFAS) between July 2010 and February 2011 among 18- to 40-year-old low-income women attending reproductive-health clinics ($N = 1,067$).
Results: Overall, 2.8% of women surveyed met the diagnosis of food addiction. The prevalence of food addiction did not differ by age group, race/ethnicity, education, income, or body mass index categories, tobacco and alcohol use, or physical activity. However, it did differ by level of depression ($p < 0.01$). The YFAS symptom count score significantly differed by race/ethnicity ($p < 0.01$) with black women having higher scores than Hispanic women. Racial differences were also observed among some of the YFAS symptoms.
Conclusion: These findings demonstrated a low prevalence of food addiction among low-income, reproductive-aged women. Racial differences were observed in the YFAS symptom count score, but not in the overall prevalence of food addition. Additionally, women with food addiction had higher levels of depression than women without food addiction.

Introduction

The prevalence of obesity has reached epidemic levels in the United States and currently affects approximately 63% of American females.[1] A number of biological, psychological, genetic, and environmental reasons have been implicated as contributors to this problem.[2] It has been speculated that addictive-like eating behavior, or ''food addiction,'' is a contributing factor. This theory is supported by recent studies which have demonstrated that hyperpalatable foods (i.e., high in salt, sugar, and/or fat) and addictive drugs both result in dopamine release in the mesolimbic regions, leading to subjectively rewarding properties.[3–5]

In 2009, the Yale Food Addiction Scale (YFAS) was developed to assess whether individuals exhibit patterns of consumption of highly palatable food consistent with substance dependence.[6] Based on this scale, the prevalence of food addiction has been reported in 11.4% of college students[6] and 6.7%–8.4% of middle-aged women.[2,7] However, these studies were conducted among predominately non-Hispanic whites and thus have limited generalizability. Moreover, the prevalence of food addiction among low-income reproductive-aged women is not known. Since higher rates of overweight and obesity are observed among low-income and minority groups,[1] and low-cost, hyperpalatable and potentially addictive foods make up a large proportion of their diet,[8] it is possible that the prevalence of food addiction is higher among low-income women, especially those from minority groups. The purpose of this study was to examine the prevalence and correlates of food addiction in a sample of multiethnic, low-income, reproductive-aged women.

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Materials and Methods

With Institutional Review Board approval, a cross-sectional survey on health behaviors, which was available in English and Spanish, was conducted between July 2010 and February 2011 among nonpregnant women 16–40 years of age attending reproductive health clinics in Southeast Texas. These clinics primarily serve low-income women, > 80% of whom have annual incomes <$30,000 per year. Women were seen for family planning services, pregnancy testing, treatment of sexually transmitted infections, and cervical cancer screening. All eligible women (2,059) seen in the clinics on a day the survey was being administered were approached and asked if they would agree to complete a health questionnaire. Of these, 1,726 agreed to participate and 333 declined for an overall response rate of 83.8%. After obtaining informed consent, participants completed a self-administered questionnaire. For this study, we conducted a secondary analysis based on all non-Hispanic white, non-Hispanic black, and Hispanic women ≥18 years old who completed the Yale Food Addiction Scale (YFAS) as part of this survey ($n = 1067$). All analyses reported in this study are based on these 1067 women.

Analyses focused on survey questions pertaining to sociodemographics, food addiction, use of tobacco and alcohol, frequency of physical activity and depressive symptoms. Age was calculated using years and months. Race and ethnicity were self-reported and then categorized as non-Hispanic white, non-Hispanic black, Hispanic, and others. No classification was available for mixed race. Information about education level and income were also obtained by self-report.

Table 1. Prevalence of Food Addiction Measured by the Yale Food Addiction Scale Among Reproductive-Aged Women (18–40 Years)

Characteristics	*Total*	*Prevalence of food addiction*	p
Age (years), *n* (%)	1067	30 (2.8)	0.11
<25	457	11 (2.4)	
≥25	610	19 (3.1)	
Race/ethnicity, *n* (%)	1067	30 (2.8)	0.15
Non-Hispanic white	288	8 (2.9)	
Non-Hispanic black	444	17 (3.8)	
Hispanic	335	5 (1.5)	
Education, *n* (%)	1056	30 (2.8)	0.86
Some high school classes	217	6 (2.8)	
Enrolled in/graduate of high school	431	11 (2.6)	
Some college course work or degree	408	13 (3.2)	
Household yearly income ($), *n* (%)	1067	30 (2.8)	0.20
<15,000	615	22 (3.6)	
≥15,000	365	7 (1.9)	
Do not know	87	1 (1.2)	
Marital status, *n* (%)	1053	30 (2.9)	0.48
Never married	494	17 (3.4)	
Living together/currently married	385	8 (2.1)	
Divorced/separated/widowed	174	5 (2.9)	
BMI (kg/m^2),[a] *n* (%)	1038	29 (2.8)	0.27
<25.0	351	6 (1.7)	
25.0–29.9	304	9 (3.0)	
≥30.0	383	14 (3.7)	
Current tobacco smoking, *n* (%)	1064	30 (2.8)	0.19
Yes	311	12 (3.9)	
No	753	18 (2.4)	
Current alcohol drinking, *n* (%)	1017	29 (2.8)	0.69
Yes	595	18 (3.0)	
No	422	11 (2.6)	
Past week exercise (≥30 minutes straight), *n* (%)	1060	30 (2.8)	0.40
None to <3 days/week	855	26 (3.0)	
≥3 days/week	205	4 (2.0)	
Depression,[b] *n* (%)	869	30 (3.4)	<0.01*
Minimal	666	13 (1.9)	
Mild	131	9 (6.9)	
Moderate	45	4 (8.9)	
Severe	27	4 (14.8)	

[a]Body mass index (BMI) <25.0 kg/m^2, underweight or normal weight; BMI 25.0–29.9 kg/m^2, overweight; BMI ≥30.0 kg/m^2, obese.
[b]Based on Beck Depression Inventory–Fast Screen (BDI-FS) score (range 0–21); scores interpreted as 0–3, minimal depression; 4–6, mild depression; 7–9, moderate depression; and 10–21, severe depression.
*$p < 0.05$ considered statistically significant (based on chi-squared test).

Height and weight values were obtained from each participant's medical record from the same day the survey was completed. Body mass index (BMI) was calculated as weight (in kg) divided by the square of the height (in meters).

Information on current tobacco use was obtained by asking, ''Do you now smoke cigarettes?'' Response options were ''every day,'' ''some days,'' and ''not at all.'' We considered current smokers as those who responded with ''every day'' or ''some days.'' Information on current alcohol use was obtained by asking, ''How often do you have a drink containing alcohol?'' Response options were ''do not ever drink alcohol,'' ''monthly or less,'' ''2–4 times a month,'' ''2–3 times a week,'' and ''≥4 times a week.'' We considered current alcohol users those who responded with any of the last four categories. Frequency of physical activity was obtained by asking, ''In the past 7 days, how many days did you exercise/play sports for at least 30 minutes straight?'' Response options were ''none,'' ''1–2 days,'' ''3–4 days'' and ''≥5 days.'' Responses were then dichotomized into '' <3 days/week'' versus ''≥3 days/week.''

Participants also self-completed the seven-item Beck Depression Inventory-Fast Screen (BDI-FS) questionnaire, which is a standardized measure to assess the severity of depression in adolescents and adults in a clinical setting.[9] Responses of each item are rated on a four-point scale ranging from 0 (not at all) to 3 (always). The total scores range from 0 to 21, with higher scores indicating greater levels of depression. We categorized BDI-FS scores into four categories: 0–3, minimal depression; 4–6, mild depression; 7–9, moderate depression; and 10–21, severe depression. The BDI-FS showed adequate internal consistency (coefficient α) for samples of clinical patients which ranged from 0.85 to 0.89.[9] The BDI-FS in our sampled population similarly exhibited adequate internal consistency ($\alpha = 0.96$).

In addition, all participants completed the 25-item YFAS questionnaire to assess whether they exhibited an eating pattern with a high consumption of high-fat and-sugar containing foods.[6] This questionnaire consists of both Likert scales and dichotomous items. These items fall under specific substance dependence symptoms (tolerance, withdrawal, loss of control over consumption, continued use despite problems, repeated unsuccessful attempts to quit, clinically significant impairment/distress, etc.) stated in the Diagnostic and Statistical Manual for Mental Disorders IV.[10] A total score of a symptom was calculated using a complex algorithm based on items under each symptom. A score of ''≥1'' indicated that the substance dependence criteria were met and ''0'' indicated that the criteria were not met. Total symptom count was measured by summing up the symptoms which met the criteria (range 0–7). A diagnosis of food addiction was made when more than three of the seven symptoms met the substance dependence criteria with the presence of clinically significant impairment or distress from overeating. The initial validation of the YFAS showed adequate internal consistency ($\alpha = 0.86$), good convergent validity and good discriminant validity based on a sample of young adults.[6] The population in our study also exhibited adequate internal consistency ($\alpha = 0.87$).

Bivariate comparisons were made between participants who met and did not meet the food addiction criteria with regard to age group, race/ethnicity, education level, annual income, marital status, BMI categories, tobacco and alcohol use, physical activity, and depression level using chi-square test or Fisher's exact tests as appropriate. The YFAS symptom count was compared among different race/ethnicities and BMI categories using Kruskal-Wallis and Wilcoxon rank sum tests. In addition, the association between BDI-FS scores and YFAS symptom scores was determined using linear regression analyses. Multivariable logistic regression analyses were also conducted to examine correlates of food addiction

Table 2. Odds Ratios (95% Confidence Interval) of Food Addiction Among Women (18–40 Years) Using the Yale Food Addiction Scale

Characteristics	*Odds ratios (95% CI)*	p[a]
Age (years)		
<25	ref	
≥25	1.39 (0.65–2.97)	0.39
Race/ethnicity		
Non-Hispanic White	ref	
Non-Hispanic Black	1.40 (0.60–3.28)	0.44
Hispanic	0.51 (0.17–1.59)	0.25
Education		
Some high school classes	ref	
Enrolled in/graduate of high school	0.71 (0.25–2.05)	0.53
Some college course work/degree	0.83 (0.29–2.35)	0.73
Household yearly income ($)		
<15,000	ref	
≥15,000	0.59 (0.24–1.41)	0.24
Do not know	0.39 (0.05–2.96)	0.36
Marital status		
Never married	ref	
Living together/currently married	0.80 (0.30–2.13)	0.66
Divorced/separated/widowed	0.82 (0.28–2.42)	0.72
BMI (kg/m^2)		
<25.0	ref	
25.0–29.9	1.75 (0.61–5.01)	0.29
≥30.0	2.00 (0.74–5.36)	0.17
Current tobacco smoking		
No	ref	
Yes	1.45 (0.66–3.18)	0.35
Current alcohol drinking		
No	ref	
Yes	1.02 (0.47–2.24)	0.95
Past week exercise (≥30 minutes straight)		
None to <3 days/week	ref	
≥3 days/week	0.65 (0.22–1.88)	0.43
Depression[b]		
Minimal	ref	
Mild	3.64 (1.51–8.80)	0.01*
Moderate	4.66 (1.45–15.0)	0.01*
Severe	9.11 (2.72–30.5)	<0.01*

CI, confidence interval.

[a]Based on multivariable logistic regression analysis; adjusted by age and race/ethnicity; outcome variable: food addiction (yes/no).

[b]Based on BDI-FS score (range 0–21); score interpreted as 0–3, minimal depression, 4–6, mild depression; 7–9, moderate depression; and 10–21, severe depression.

*$p < 0.05$ considered statistically significant.

Table 3. The Yale Food Addiction Scale Symptom Count by Race/Ethnicity and Body Mass Index Among Reproductive-Aged Women (18–40 Years)

	YFAS symptom count	
	Median (interquartile range)[a]	p[b]
Race/ethnicity		<0.01*
Non-Hispanic white	1.0 (1.0–2.0)	
Non-Hispanic black	1.0 (1.0–2.5)	
Hispanic	1.0 (1.0–2.0)	
BMI (kg/m^2)[c]		<0.01*
<25.0	1.0 (1.0–2.0)	
25.0–29.9	1.0 (1.0–2.0)	
≥30.0	1.0 (1.0–3.0)	

[a]Possible ranges for YFAS symptom count (0–7).
[b]Based on Kruskal-Wallis test.
[c]BMI <25.0 kg/m^2, underweight or normal weight; BMI 25.0–29.9 kg/m^2, overweight; BMI ≥30.0 kg/m^2, obese.
*$p < 0.05$ considered statistically significant.
YFAS, Yale Food Addiction Scale.

after adjusting for age and race/ethnicity. All analyses were performed using STATA 12 (Stata Corporation).

Results

A total of 1,067 women (18–40 years of age) were included in this study. Among them, 27.0% ($n = 288$) were non-Hispanic whites, 41.6% ($n = 444$) non-Hispanic blacks, and 31.4% ($n = 335$) Hispanics. The mean age of the sample was 26.9 years (standard deviation 5.8). The prevalence of food addiction was 2.8% (30/1067) according to the YFAS. Bivariate comparisons showed that the prevalence of food addiction did not differ by age group, race/ethnicity, education, income, BMI categories, tobacco and alcohol use, and physical activity (Table 1). However, the level of depression differed significantly ($p < 0.01$). Multivariable logistic regression analyses, after adjusting for age and race/ethnicity, showed that women addicted to food were more likely to have higher levels of depression compared with women not addicted to food (Table 2). No other characteristics were significantly associated with food addiction.

The median (interquartile range) of the YFAS symptom count score overall was 1.0 (1.0–2.0). It was 5.0 (4.0–6.0) among women who met the diagnostic criteria for food addiction and 1.0 (1.0–2.0) among those who did not. The YFAS symptom count score differed significantly by race/ethnicity. Black and white women had a higher symptom count than Hispanic women ($p < 0.01$ and $p = 0.049$, respectively) (Table 3). It also differed significantly by BMI categories with obese and overweight women having a higher symptom count than normal weight and underweight women ($p < 0.01$). Linear regression analysis, after adjusting for age and race/ethnicity, also showed a significant association between BDI-FS and YFAS symptom count scores (β coefficient 0.13; $p < 0.01$). Analysis of individual food addiction symptoms showed that ''unsuccessful attempts to cut down food'' was the most common symptom (92.7%) followed by ''tolerance'' (18.3%), ''continuous use despite problems'' (17.7%) and ''spending much time obtaining or eating food'' (16.0%) (Table 4). Racial differences were also observed with regard to individual symptoms. Hispanic women were less likely to report ''tolerance,'' ''withdrawal,'' ''spending much time obtaining or eating food,'' and ''giving up important activities for food'' than their counterparts. Frequency of almost all individual symptoms significantly increased with higher levels of BMI categories.

Discussion

We found a low prevalence of food addiction among reproductive-aged women of white, black, and Hispanic race/ethnicity. The prevalence we detected in this study is somewhat lower than that observed predominately among non-Hispanic whites.[2,6,7] However, the median YFAS symptom count in our study is similar to a prior study conducted among young adults.[11] Consistent with the latter study,[6] we did not observe any racial differences with regard to the prevalence of food

Table 4. The Yale Food Addiction Scale Symptoms Met the Substance Dependence Criteria (DSM-IV) Among Reproductive-Aged Women (18–40 Years) of Different Race/Ethnicity and Body Mass Index Categories

	DSM-IV criteria met (%)								
		Race/ethnicity				*Body mass index (kg/m^2)*[a]			
YFAS symptoms	*Overall*	*White*	*Black*	*Hispanic*	p[b]	*<25.0*	*25.0–29.9*	*≥30.0*	p[b]
Tolerance	18.3	17.7	21.6	14.3	0.03*	12.7	19.2	22.0	<0.01*
Withdrawal	5.4	8.0	5.9	2.7	0.01*	2.8	6.8	6.5	0.03*
Continuous use despite problems	17.7	18.1	17.6	17.6	0.98	13.0	16.0	23.5	<0.01*
Loss of control	10.8	11.1	12.8	7.8	0.08	6.3	10.4	15.5	<0.01*
Spending much time	16.0	18.1	19.1	10.2	<0.01*	11.6	15.9	19.6	0.01*
Giving up important activities	8.4	6.9	11.0	6.3	0.03*	5.5	6.8	13.2	<0.01*
Unsuccessful attempts to cut down	92.7	91.7	94.6	91.0	0.13	89.5	92.5	95.3	0.01*
Clinically significant impairment/distress	3.2	3.1	4.4	1.8	0.15	2.2	3.3	3.9	0.42

[a]BMI <25.0 kg/m^2, underweight or normal weight; BMI 25.0–29.9 kg/m^2, overweight; BMI ≥30.0 kg/m^2, obese.
[b]Based on chi-squared test.
*$p < 0.05$ considered statistically significant.
DSM-IV, *Diagnostic and Statistical Manual for Mental Disorders*, fourth edition.

addiction. However, we observed that the YFAS symptom count scores and frequency of many of the YFAS symptoms (which met the substance dependence criteria) were lower among Hispanic women compared with their counterparts.

Our finding that the prevalence of food addiction did not differ by BMI categories is also consistent with a prior study conducted by Gearhardt, et al.[11] However, several other studies[7,12,13] observed a substantially higher prevalence of food addiction among obese individuals. This could be due to an addictive-type response to highly palatable foods resulting in obesity. Thus, obesity status may not be a correlate of food addiction, but instead might be a consequence of food addiction. Future longitudinal studies are needed to shed more light on the mechanism of obesity among food-addicted individuals. We also observed higher YFAS symptom count scores and a higher frequency of individual symptoms among obese/overweight women compared with underweight and normal weight women. Due to the cross sectional design of our study, however, it is not possible to determine whether these symptoms would lead to a higher prevalence of food addiction among overweight/obese women in the future.

Consistent with published studies,[2,14] we observed that depression levels correlated with food addiction. This suggests that anxiety and depression are linked to addictive-like eating behaviors, similar to other types of substance dependence. However, we could not determine whether a cause and effect relationship exists between these two events. Overall, the prevalence of food addiction we observed (2.8%) was comparable with other eating disorders. For example, the 12-month prevalence of binge eating disorder and bulimia nervosa among young U.S. women is 1.8% and 1.5%, respectively.[15] However, there may be an overlap between food addiction and other eating disorders.

This study has both strengths and limitations. The main strength is that it was conducted among a large number of ethnically diverse young women of low socioeconomic status. In addition, food addiction was assessed using a standardized, valid, and reliable scale. There are also several limitations. First, the number of YFAS food addicts we detected was relatively small, which prevented us from conducting more complex analyses. Second, as this study was based on women only, the results are not generalizable to both genders. Third, as the majority of this sample was drawn from women of low socioeconomic status residing in one geographic region, the results may not be applicable to all women in the United States. Finally, self-reported measures are subject to potential social desirability bias.

Conclusion

These findings demonstrate a low prevalence of food addiction among low-income reproductive-aged women even though obesity rates are high in this population. Thus interventions implemented in this population may need to focus on other mechanisms to combat the obesity epidemic in the US.

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Author Disclosure Statement

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References

1. Flegal KM, Carroll MD, Kit BK, Ogden CL. Prevalence of obesity and trends in the distribution of body mass index among US adults, 1999–2010. JAMA 2012;307:491–497.
2. Flint AJ, Gearhardt AN, Corbin WR, Brownell KD, Field AE, Rimm EB. Food addiction scale measurement in 2 cohorts of middle-aged and older women. Am J Clin Nutr 2014;99:578–586.
3. Gearhardt AN, Yokum S, Orr PT, Stice E, Corbin WR, Brownell KD. The neural correlates of food addiction. Arch Gen Psychiat 2011;68:808–816.
4. Volkow N D, Wise RA. How can drug addiction help us understand obesity? Nat Neurosci 2005;8:555–560.
5. Volkow ND, Wang GJ, Tomasi D, Baler RD. Obesity and addiction: Neurobiological overlaps. Obes Rev 2013;14: 2–18.
6. Gearhardt AN, Corbin WR, Brownell KD. Preliminary validation of the Yale Food Addiction Scale. Appetite 2009;52:430–436.
7. Pedram P, Wadden D, Amini P, et al. Food Addiction: Its prevalence and significant association with obesity in the general population. PLoS ONE 2013;8:e74832.
8. Drewnowski A, Specter SE. Poverty and obesity: The role of energy density and energy costs. Am J Clin Nutr 2004; 79:6–16.
9. Beck AT, Steer RA, Brown GK. BDI: Fast screen for medical patients manual. San Antonio (TX): The Psychological Corporation, 2000.
10. American Psychiatric Association. Diagnostic and statistical manual of mental disorders, 4th edition. Washington, DC: American Psychiatric Association, 2000.
11. Gearhardt A N, Boswell RG, White MA. The association of ''food addiction'' with disordered eating and body mass index. Eat Behav 2014;15:427–433.
12. Davis C, Curtis C, Levitan RD, Carter JC, Kaplan AS, Kennedy JL. Evidence that 'food addiction' is a valid phenotype of obesity. Appetite 2011;57: 711–717.
13. Murphy CM, Stojek MK, MacKillop J. Interrelationships among impulsive personality traits, food addiction, and body mass index. Appetite 2014;73:45–50.
14. Parylak SL, Koob GF, Zorrilla EP. The dark side of food addiction. Physiol Behav 2011;104: 19–156.
15. American Psychiatric Association. Diagnostic and statistical manual of mental disorders, 5th ed. Washington, DC: American Psychiatric Association, 2013.

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