The Fast Food and Obesity Link: An Investigation of Consumption Patterns and Severity of Obesity in Pre-Bariatric Surgery Patients

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Abstract

Objectives. The rates of extreme forms of obesity are rapidly rising as is the use of bariatric surgery for its treatment. The aim of the present study was to examine selected behavioral factors associated with severity of obesity among pre-operative bariatric surgery patients in the San Antonio area; focusing specifically on the effects of fast food consumption. *Methods*. Data are based on the pre-surgical responses of 270 men and women and are intended to assess various behavioral and psychosocial factors associated with extreme forms of obesity. We used ordered logistic regression to model the effects of behavioral and attitudinal variables on obesity outcomes. These outcomes were based on severity of obesity and were measured on the basis of body mass index (BMI). *Results*. Our results indicated that among the behavioral factors, fast food consumption exerted the largest influence on higher levels of obesity. After controlling for several social and demographic characteristics, the effects of fast food consumption remained significant in the model. This suggests that fast food plays a pivotal role in predicting severe obese outcomes. *Conclusions*. The role of fast food consumption as it relates to the obesity epidemic has been documented, and these findings suggest that higher rates of fast food

consumption are connected to the increasing rates of severe obesity. Given that morbid and super-morbid obesity rates are growing at a more advanced pace, it is necessary to explore the behavioral characteristics associated with these trends.

Keywords: Severe/Extreme Obesity; Bariatric Surgery; Fast Food Consumption

Introduction

Obesity has become one of the foremost public health concerns in the United States in recent decades. According to the Centers for Disease Control, more than one third of U.S. adults were classified as obese, with a body mass index (BMI) of 30.0 or more, in 2009[1]. Rates of obesity have increased among all socio-demographic groups[2, 3], and the most marked increases have been in the more severe designations of obesity, i.e. morbid obesity (BMI 40.0-49.9) and super-morbid obesity (BMI 50.0+)(4, 5). Combined, this group (BMI≥40.0) accounts for approximately 5.7% of the population[2]. These individuals are at least 100 pounds overweight and experience serious health problems at much higher rates than normal weight individuals. Their numbers are on the rise and are growing at a much faster pace than those in the moderate obese classification. In fact, between 2000 and 2005, the rates of morbid obesity and super-morbid obesity increased by 50% and 75%, respectively[4]. In comparison, the rate of obesity increased by 24% during the same period[4].

Recent studies have shown that these increases in extreme obesity rates are not specific to a certain population, but are rather an integral part of the weight distribution in the United States and the more extreme the obesity the higher the rate of growth[4]. Thus, the public health concerns associated with this growth are of extreme importance given that those who are obese in any form are much more likely to suffer from obesity comorbidities including type 2 diabetes, cardiovascular disease, hypertension, hyperlipidemia, asthma, sleep apnea, and stroke[1, 6].

Furthermore, the costs associated with obesity are on the rise and accounted for 27% of the increases in medical costs between 1987 and 2001[1, 7]. The affected population has the greatest need for weight loss therapy, and currently, the only effective treatment for extreme obesity is bariatric surgical intervention[6, 8-11]. The utilization of bariatric surgery as a treatment for the morbidly obese has increased dramatically since 1998. In a report published by AHRQ, the authors found that bariatric surgeries increased by 400% between 1998 and 2002 (13,386 surgeries were performed in 1998 and 121,055 were performed in 2002)[12]. More recently, it is estimated that 220,000 people in the U.S. had bariatric surgery in 2008.

While there is a vast amount of literature on the rates, associated risks, and costs related to severe obesity, there is relatively little work on the behavioral factors associated with morbid and super-morbid obesity. Additionally, there is a great deal of work that focuses on trends in bariatric surgery as well as post-surgical weight-loss outcomes. Our research seeks to examine the characteristics of the extremely obese who have sought out surgical intervention as a treatment for their obesity. We assess the behavioral and attitudinal characteristics of our sample while controlling for socio-demographic characteristics in an effort to link certain behaviors with an increased prevalence of more severe forms of obesity. We expand the current literature by focusing specifically on pre-surgical patients' behaviors as they relate to the incidence of extreme obesity.

Methods

Study Population

Our results are based on the responses of 270 patients collected prior to bariatric surgical intervention in the San Antonio, Texas area. The surveys were administered to patients by medical staff from June 2009 to Sep 2010 and were provided to the researchers in de-identified

format. The research has been approved by the Institutional Review Board at the University of Texas at San Antonio.

Statistical Analysis

We used ordered logistic regression to determine the risk of three obesity outcomes, i.e. obese, morbidly obese, and super-morbidly obese. This model is best suited to address our outcome variable given that the spacing between outcomes, though ordered, is not uniform. Ordinal logistic regression assumes that the coefficients linking variable values are to different outcomes will be the same across all the outcomes[13]. For example, eating fast food will affect the likelihood of being obese (the lowest category) the same as it would affect the likelihood of being super-morbidly obese. This is referred to as the proportional odds assumption or parallel lines assumption. Our model has been tested to ensure this assumption has not been violated, and thus we are confident that the ordered logistic regression is most appropriate to determine the effects of our independent variables on the outcome. We assessed the influence of fast food consumption, dining behaviors, exercise, reasons for eating, and age at which respondent first reported overweight/obesity while controlling for gender, race/ethnicity, level of education, and self-reported social class. All analyses were performed using STATA version 10 STATA Corp., LP, College Station, TX).

Results

Each of the respondents had a minimum BMI of 30.00; hence our dependent variable is based on severity of obesity. Table 1 presents the descriptive characteristics for the sample. We created three categories of obesity, namely obese (BMI 30-39.99), morbidly obese (40.00-49.99) and super morbidly obese (50.00+). Approximately 54 patients were in the obese category, 149 in the morbidly obese category, and 67 in the super morbidly obese category. The largest

racial/ethnic category is Hispanic, which accounts for approximately 49% of the sample. The average age for the entire group is 43.5 years, and males account for 23.7% of the sample. Some college/associate's degree is the most common response for education and represents about 50% of the sample. Working class was the modal response for social class and accounts for 34% of the group (among Whites the modal response was lower middle at about 39%). Among the behavioral characteristics, it was observed that the average amount of exercise reported per week was 1.33 times (48.15% of the sample reported exercising at least once per week); 7.41% of the sample reported that they first considered themselves overweight/obese at or prior to the age of 10 years. The average rate of fast food consumption was 2.68 times per week (the modal response was once per week at a value of 23.70%). Finally, about 37% of the sample reported boredom as their primary reason for eating in general.

Table 1 – Sample Characteristics: Bariatric Outcomes Study Sample, San Antonio, TX, 2009-2010

	Full Sample (n = 270)	Non-Hispanic Whites (n = 115)	Hispanics (n = 132)	Non-Hispanic Blacks (n = 23)
Mean BMI	46.20	45.47	46.90	45.85
Obesity Status, %				
Overweight/Obese (30-34.99 BMI)	20.00	19.13	21.97	13.04
Morbid (40-49.99)	55.19	58.26	52.27	56.52
Super Morbid (50.00+)	24.81	22.61	25.76	30.43
Mean Age (SD)	43.51 (11.89)	47.01 (12.19)	40.84 (11.32)	41.39 (9.26)
Gender (male), %	23.70	26.09	24.24	8.70
Education, %				
< High School	3.33	0.87	5.30	4.35
HS Grad	19.26	15.65	23.48	13.04
Some college	50.00	50.43	52.27	34.78
Bachelor's +	27.41	33.04	18.94	47.83
Social Class (self-rated), %				
Upper (200K +)	2.29	4.59	0.77	0.00
Upper Middle ($100-199K)	16.03	22.02	10.00	21.74

Lower Middle ($50-99K)	30.15	38.53	26.15	13.04
Working ($30- 49K)	33.97	25.69	36.15	60.87
Lower (<$29K)	17.56	9.17	26.92	4.35
Mean Exercise/Wk (SD)	1.33 (1.64)	1.56 (1.80)	1.16 (1.55)	1.17 (1.19)
Early Onset Obesity, %	7.41	7.83	7.58	4.35
Mean Fast Food Consumption/Wk (SD)	2.68 (1.89)	2.10 (1.58)	2.98 (1.91)	3.91 (2.23)
Mean Rate of Eating Out/Wk (SD)	2.70 (.79)	2.73 (.72)	2.65 (.82)	2.78 (1.00)
Reason for Eating (Boredom), %	36.67	37.39	38.64	21.74
Knowledge of Proper Nutrition (1=mod.-very)	22.96	32.17	17.42	8.70
Took Immediate Action	37.04	40.87	32.58	43.48

Ordered logistic regression was used to compare the outcomes across estimates in all categories, thus allowing for an analysis of how individual-specific variables affect the likelihood of observing given outcome. The results are separated into three models on the basis of varying factors and confirm that several of the variables of interest have statistically significant effects on the severity of obesity. Table 2 presents the adjusted odds ratios (ORs) and the 95% confidence intervals (CIs) from the ordered logistic regressions. In Model 1, the effects of background characteristics including age, sex, Hispanic ethnicity, level of education, social class, and early onset obesity (patients reported onset of overweight/obesity at age 10 or prior) are assessed. In Model 2, social and behavioral factors including fast food consumption, frequency of eating out, reason for eating in general[1] (boredom is presented), knowledge of healthy behaviors/eating habits, frequency of exercise (1= those who reported exercising at least once per week), and

[1] The original survey asked respondents their reasons for eating in general and included hunger, loneliness, anxiety, happiness, boredom, anger, and frustration. The most common responses included hunger, loneliness, and boredom. Each of these responses was coded as a separate binary variable that was assessed in various models. Boredom was selected for the final model as it exerted some influence in the behavioral models.

speed of reaction to obese status (1= took immediate action to address overweight/obesity) are assessed; and Model 3 contains the results for all factors combined. Overall, it was found that several variables had a significant effect on obesity status.

TABLE 2- Background and Behavioral Effects (Odds Ratios and Confidence Intervals) on Severity of Obesity, Estimated by Ordered Logistic Regression

	Model 1[a], OR (95%CI)	Model 2[b], OR (95%CI)	Model 3[c], OR (95%CI)
Background Variables			
Age	1.00 (-0.02, 0.02)		1.00 (-0.02, 0.02)
Gender (1=male)	0.77 (-0.82, 0.31)		0.85 (-0.76, 0.43)
Hispanic	0.86 (-0.64, 0.33)		0.67 (-0.91, 0.10)*
Level of Education	1.13 (-0.21, 0.45)		0.90 (-.70, 0.48)
Social Class (upper/mid=1)	0.39 (-1.63, 0.26)***		0.45 (-1.49,-0.11)***
Early Onset Obesity	1.82 (-.29, 1.49)		1.99 (-0.24, 1.62)*
Behavioral Variables			
Fast Food Consumption		1.27 (0.09, 0.39)***	1.29 (0.10, 0.40)***
Frequency of Eating Out		1.40 (-0.004, 0.68)**	1.30 (-0.08, 0.61)*
Reason for Eating (boredom=1)		0.65 (-0.92, 0.07)*	0.62 (-0.97, 0.04)*
Knowledge of Proper Nutrition		0.77 (-0.83, 0.31)	0.82 (-0.79, 0.40)
Exercise at Least Once per Week		0.50 (-1.18, -0.21)***	0.50 (-1.20, 0.19)***
Immediately Took Action for Weight		0.75 (-0.79, 0.20)	0.73 (-0.82, 0.20)
LR Chi-squared	9.89	27.52	37.65
P	0.129	0.000	0.000

Note. OR= odds ratio; CI= confidence interval. Obesity was defined as having a BMI of 30 or greater.
[a]Model 1 adjusted for background variables only
[b]Model 2 adjusted for behavioral variables only
[c]Model 3 adjusted for both background and behavioral variables
*P<0.1; **P<0.05; ***P<0.01

In Model 1, social class was the only variable that was statistically significant. For this variable (upper versus lower class status), the odds of super-morbid obesity versus the combined morbid and obese categories are decreased by 61.1 percent for upper class respondents, all else constant. In Model 2, the effects of behavioral characteristics were evaluated and fast food consumption, frequency of eating out, as well as frequency of exercise were found to be statistically

significant. We focus specifically on the effects of fast food consumption, and the models confirm that, relatively speaking, this variable exerts the most influence on the severity of obesity (this is assessed by examining the semi-standardized coefficients). Here, it is observed that with each one unit increase in fast food consumption per week, odds of super-morbid obesity versus the combined morbid and obese categories are 26% greater, given that the other variables are held constant. In addition, frequency of eating out and exercise were statistically significant. For exercise, the odds of being super-morbidly obese versus morbidly obese and obese combined are decreased by 50.3% for those who reported exercising at least once per week, all else equal. For each one unit increase in eating out per week, the odds of super-morbid obesity versus morbid and obese combined are 40.1% greater, other variables held constant. Finally it was observed that the variable for eating in general due to boredom was approaching significance ($z=-1.69$, $p=.09$). Thus, the odds of being in the highest category of obesity versus the lower two categories combined are decreased by 35% for those who reported eating due to boredom, all else equal.

Model 3 adjusted for the effects of background characteristics in addition to behavioral ones. Here, we find that the effects of our behavioral variables are not diminished with the inclusion of additional controls. The variables for social class, fast food consumption, and exercise were all significant at the .01 level. Additionally, the variables for Hispanic ethnicity, early onset obesity, eating out, and eating due to boredom were all approaching significance ($p\leq0.1$). As mentioned above, it is important to note the effects of fast food consumption as this variable exerts the most influence on the outcome. Once the additional controls were added, fast food consumption remained significant and with each one unit increase in fast food consumption, the odds of being in the highest category of obesity versus the lower two combined were increased by about 29%,

all else equal. Table 3 reports the predicted probabilities for fast food consumption at 0-7 or more times per week.

Table 3 – Predicted Probabilities of Obesity Status by Fast Food Consumption

Fast Food Consumption per Week	Obese (y=1)	Morbidly Obese (y=2)	Super-Morbidly Obese (y=3)
0	.296	.577	.127
1	.246	.596	.158
2	.203	.603	.195
3	.165	.598	.237
4	.133	.581	.286
5	.106	.554	.340
6	.085	.516	.399
7+	.067	.472	.461

For each value of fast food, the highest category of respondents is in the morbidly obese category, which makes sense based on the fact that the largest number of respondents falls into this category. However, it is important to note that with each increase in value of fast food, the predicted probability for super-morbidly obese (y=3) increases significantly. This indicates that the effect of fast food consumption on super-morbidly obese status is strongly correlated. Alternately, as fast food consumption increases, the predicted probability of being in the lowest category (y=1) of obesity decreases. The overall sample mean for fast food consumption is 2.68, thus the predicted probabilities at a value of 3 should give an estimate close to the observed percentages in obesity categories.

Discussion

The foregoing results illustrate the importance of behavioral factors including fast food consumption and rates of exercise in the determination of greater severity of obesity. Even after controlling for the effects of background characteristics, the strength of these influences is not diminished. Fast food consumption emerged as a key determinant of higher levels of obesity and

exerted the greatest influence relative to the other independent variables in the model for behavioral factors and the full model. Additionally, Table 3 displays the effects of this variable in the form of predicted probabilities, and it is observed that higher rates of fast food consumption directly correlate with increasing values in the highest obesity category, i.e. super morbid obesity (rates are decreased in the lower two categories). This is a particularly important finding as it underscores the relationship between fast food consumption and the most severe form of obesity.

Overall, some disagreement exists as to the formal definition of fast food. However, it is generally accepted to characterize fast food as that which is designed for ready availability, use or consumption, and is easily reached and/or in nearby locations[14]. This type of food is often offered in establishments that have drive-through windows, a limited menu, no formal wait staff, the food preparation process is highly mechanized, and offerings are prepared prior to ordering[15]. Additionally, some consideration should be given to the type and nutritional makeup of fast food. Given that fast food itself is correlated with obesity, it is important to note the characteristics of many of the offerings at fast food establishments which include: oversized portions, high energy density, highly processed, high fat content, and large amounts of refined starch and added sugars [16]. The largest sales categories of fast food are hamburgers, pizza, and fried chicken[17]. According to the USDA, fast food consumption has steadily increased since the 1980's and accounted for 37.9 percent of away from home food expenditures in 2002[18]. It is expected that spending on fast food will increase by 6 percent between 2000 and 2020[18]. Given these trends, it is necessary to address ways in which the negative effects of consuming unhealthy options at fast food restaurants may be counteracted. Our recommendations include

greater transparency and availability of nutrition content, efforts to control portion sizes and/or increase consumer awareness of portion sizes, and full reporting of ingredients.

Given that the largest gains in rates of obesity have been observed for those in the higher levels (morbid and super morbid), and it is expected that these rates will continue to increase; it is of the utmost importance that studies focus on the correlates to these severe forms of obesity. Studies such as this call to light the significance of fast food consumption in particular and demonstrate the need for continuing work focused on this relationship.

Conclusions

Recent studies have illustrated that extreme forms of obesity have become increasingly common, and the rates of both morbid and super morbid obesity are growing at a much faster pace than standard obesity[4]. In fact, the rate of growth for those in the super morbid obese category increased from roughly 1 in 2000 to 1 in 400 (500% growth) between 1986 and 2000, while the rate of obesity increased from 1 in10 to 1 in 5 (200% growth) during the same period[4]. The potential ramifications for such growth are tremendous as these populations are much more likely to suffer from obesity-related illnesses and require a great deal more in the way of accommodations than the general population. Accordingly, the health care costs associated with these more extreme forms can be expected to rise as a result of increases in the more extreme categories of obesity. As such, it is of the utmost importance that studies related to obesity focus on the correlates associated with such patterns. Furthermore, it is particularly important to focus on bariatric patients as this is the only viable treatment option for those in the more severe categories of obesity.

Our findings demonstrate the importance of behavioral factors in the determination of extreme forms of obesity and place an emphasis on the importance of fast food consumption. We have effectively shown that fast food exerts a significant influence on the likelihood of more extreme forms of obesity. This indicates several things. First, in combating the obesity epidemic, it is important to recognize the effects of such behaviors and develop strategies that address the role of fast food consumption. Health care practitioners and members of the research community should understand this connection and focus their efforts on increasing awareness of behavioral factors as well as stress the associated outcomes. The availability and popularity of fast food must be diminished if there is to be any change in the growth of obesity rates. Additionally, as bariatric surgery becomes increasingly utilized as a form of treatment, it is necessary that the research community focuses on studies that investigate those who seek treatment. Future studies should continue to explore the relationship between such behaviors and extreme forms of obesity as well as assess post-surgical success rates (as measured by sustained weight loss) with respect to pre-surgical characteristics.

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