

Predictors of Obesity in Adults: The Roles of Demographic Factors, Body
Dissatisfaction, Depression, and Life Stress

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ABSTRACT

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This study explored the link between sociodemographic and psychological factors when predicting obesity. Analyses were conducted on an Internet sample of 1664 male and female participants from the Teachers College Columbia University Eating and Self Image Survey. Independent variables included sociodemographic factors such as race, sex, geographic location, and socioeconomic status (SES) and psychological variables such as body image dissatisfaction (BID), depression, and life stress. The dependent variable for all analyses was obesity. An initial two-step hierarchical logistic regression was fitted to the data with sex, geographic location, race, and education (a proxy for income) in the first step and BID, depression, and life stress in the second step. All sociodemographic variables were found to be significant in the first step with obesity being predicted by having a high school education or less, being Black, residing in a southern state, and being female. However, after entering the psychological variables in the second step, being Black was the only sociodemographic variable to retain significance with high BID, being depressed, and higher amounts of life predicting obesity. A second series of hierarchical logistic regressions were performed separately to assess to what extent race, gender, and education combined with the effects of BID, depression, and life stress moderate obesity. There was no evidence that the product of race and any of the psychological factors moderated obesity. However, it was revealed

that the combination of gender by BID was a significant moderator of obesity (but not the effects of depression and life stress) with females with elevated levels of BID being more likely to report being obese. The product of education by BID moderated obesity with the combination of a college education or beyond and elevated amounts of BID predicting obesity. The product of education by life stress also moderated the effects of obesity, with individuals with a high school education or less and who reported higher amounts of life stress showing increased likelihood of being obese. The product of depression and SES did not prove to be a significant moderator of obesity. On the whole, this study provides insight into the interactions of sociodemographic and psychological variables as predictors of obesity in adults.

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DEDICATION

I dedicate this dissertation to my mother. Your support, love, warmth, and guidance were integral for my development not only as an academic but also as a man. Without you I would not be.

Predictors of Obesity in Adults: The Roles of Demographic Factors, Body Dissatisfaction, Depression, and Life Stress

Obesity is being presented to the American public as something of an epidemic as issues related to obesity and the related conditions have increasingly become a focus of public discussion. Indeed, morning talk shows and national newspapers have devoted a significant amount of time to obesity. However, it is of note that though obesity has become a topic of national dialogue, it is generally being presented in the frame of tertiary interventions, with much less emphasis on empirical research that has attempted to establish any reliable predictors of obesity. Furthermore, even when researchers have attempted to establish predictors, the focus has tended to be mainly on either sociodemographic variables *or* psychological factors and how they separately predict the outcome of obesity. Consequently, there is a scarcity of research that has attempted to ask whether and how sociodemographic and psychological factors interact in their ability to predict obesity. These discrepancies served as a rationale for this study.

Obesity continues to be a leading public health concern both in the United States and in other parts of the world (Ben-Sefer, Ben-Natan, & Ehrenfeld, 2009; Ogden et al., 2006; Lobstein & Frelut, 2003). It is associated with physiological ailments such as hypertension, Type 2 diabetes, heart disease, stroke, various forms of cancer, and is a key factor in metabolic syndrome (Field et al., 2001; Must et al., 1999). Despite attempts to combat obesity, the frequency of associated medical conditions increased dramatically between 1999 and 2004 (Ogden et al., 2006).

Several studies have focused on the associations of demographic factors with obesity. Data have been collected on the relationships to obesity of neonate birth weight,

parents' weight, dietary factors, activity, and several psychological and behavioral attributes (Novak, Ahlgren, and Hammarstrom 2006; Parsons, Power, Logan, and Summerbell, 1999; Hardy, Wadsworth, Kuh, 2000). There has also been interest separately in the relationship of obesity to both demographic variables and psychological factors such as body distress, depression, and life stress. These relationships served as the foci for this study.

Environment and Race

Low socioeconomic status (SES) has been found to be associated with obesity (Ogden et al., 2006) especially among women (Hedley et al., 2004), due to the fact that SES influences individuals' energy intake and energy expenditure and thus affects body fat storage (Sandquist & Johansen, 1998). Similarly, childhood SES tends to be associated with weight gain and amount of body weight in adult women (Danielzik et al., 2004; Lobstein and Frelut, 2003). Indeed, in a systematic review of cross-sectional studies that attempted to establish a link between family SES and obesity from 1990 to 2005, a strong inverse correlation between SES and adiposity in children was found (Shrewsbury & Wardle, 2008). Living in a resource poor environment is also associated with weight gain both in children of both sexes and in adult women (Danielzik et al., 2004; Lobstein and Frelut, 2003). In regards to the mechanisms responsible for these relationships, there has been some inconsistency associated with the definition of SES (e.g. income, parents' education, participants' terminal education). For example, when parental education is used as the indicator of SES, then SES accounts for more of the variance in obesity in both children and adults compared to other more traditional indicators, including income (Lopez, 2007; Shrewsbury & Wardle, 2008). Furthermore,

studies have found that individual SES and race are linked to one another, and specifically, Blacks and Latinos exhibit higher rates of overweight and obesity compared to their White counterparts (Flynn & Fitzgibbon, 1998; Kumanyika, 1993).

Education plays a dramatic role in ultimate socioeconomic position with a positive correlation existing between education and income and median income increasing with each level of education (U.S. Census, 2005). Moreover, higher levels of education (e.g. college, doctorate, and/or professional degrees) are associated with positive physical, psychological, and economic outcome (APA, 2007). Similarly those with less education (e.g. high school diploma or less) have been shown to have disproportionately higher rates of physiological and psychological distress along with having decreased economic mobility in terms of housing, employment and other core factors linked to SES (APA, 2007).

There also is a substantial amount of evidence that regional differences in rates of obesity exist in the U. S. with the majority of obese individuals residing in Southern states, albeit with a few exceptions, e.g. Michigan and Indiana (Houle, Holt, Gillespie, Freedman, & Reyes, 2009). Another study uncovered substantial regional differences in the prevalence of obesity in adolescents with South-central states carrying the majority of the burden of obesity with residents in some Southern states being twice as likely of being obese compared to others (Singh, Kogan, van Dyck, 2008). Thus, it is important to factor in regional differences when considering obesity.

Body Image, Depression, Life Stress, and Obesity

Body Image Dissatisfaction. Recently, body image dissatisfaction (BID) has received a substantial amount of attention when considering the link between obesity and

psychological distress, and it has been suggested that BID places people at risk for psychological distress (Markowitz, Friedman, Arent, 2008). Though perceptions of one's body vary considerably among obese individuals (Hill & Williams, 1998), higher BMI is positively associated with greater levels of BID, (Docteur, Urdapillete, Defrance, & Raison, 2010; Kostanski, Gullone, 1998), and obese groups tend to have higher levels of dissatisfaction with their bodies compared to non-obese individuals (Sarwer, Wadden, & Foster, 1998). BID is linked to low self-esteem, which is in turn strongly associated with depression, and as obese individuals are more likely to be dissatisfied with their body type, this dissatisfaction may play a role in increasing the chances of depression in these dissatisfied individuals (Markowitz, Friedman, & Arent, 2008).

Previous research has uncovered a positive relationship between BID and BMI, and other studies have found positive relationships between elevated BID and adverse psychological outcomes including depressive symptoms (Schwartz & Brownell, 2004; Sarwer, Wadden, & Foster, 1998) and suicidal behavior among adolescents (Crow, Eisenberg, Story, Neumark-Sztainer, 2008). Recent evidence indicates that after accounting for BID, obese women of low SES backgrounds are particularly at risk for depression (Gavin, Simon, & Ludman, 2010). There is also evidence that BID is associated with elevated life stress and other forms of psychological distress (Johnson & Wardle, 2005). Hence, as BID has such a profound role in the outcome of psychological distress, it seems prudent to investigate what other roles it may have in its relationship to obesity.

Depression and Obesity. The link between depression and obesity continues to be poorly understood. It is commonly believed that obese individuals are more likely to

be depressed relative to the general population (Dong, Sanchez, & Price, 2004) and as it is predicted that by the year 2020 that depression will be one of the two leading causes of disability, much of the empirical research has focused on establishing a link between obesity and depression (Murray, & Lopez, 1997). Indeed, several studies have found that obese people are at an elevated risk for depression across gender and racial groups, even after controlling for chronic physical disease, familial depression and other demographic risk factors (Blanchard, 2009; Petry, Barry, Pietrzak, & Wagner, 2008; Dong, Sanchez, & Price, 2004; Roberts, Strawbridge, Deleger, Kaplan, 2002; Roberts, Strawbridge, Kaplan, Shenma, 2000).

In a prospective study, young Finnish children and adolescents were followed through adulthood and it was revealed that women having metabolic syndrome in childhood had higher rates of depressive symptomatology and of metabolic syndrome in adulthood as well (Pulkki-Raback et al., 2009). Studies have also found that abdominal fat was a significant mediating variable between obesity and depression and that depressive symptoms are related to higher rates of abdominal obesity independent of overall obesity (Rivenes, Harvey, & Arnstein, 2009; Vogelzangs et al., 2008). In addition, depression in early adolescence is a significant predictor of obesity in later adolescence (Richardson, et al., 2003). Most of the studies attempting to establish a link between depression and obesity have concluded that obesity tends to cause depression (Heo, Pietrobelli, Fontaine, Sirey, Faith, 2006; Onyike, Crum, Lee, Lyketsos, & Eaton, 2003; Stunkard, Faith, & Allison, 2003). Conversely, others have found that overweight people were less depressed, conforming to the “jolly fat hypothesis” (Crisp, Queenan, Sittampaln, & Harris 1980; Palinkas, Wingard, & Barrett-Connor, 1996). Additionally,

several studies found no relationship between obesity and depression, and still others have found gender differences, wherein obese women were more likely to be depressed than obese men (Carpenter, Hasin, Allison, & Faith, 2000; Erickson, Robinson, Haydel, & Killen 2000; Friedman & Brownell, 1995; Hallstrom & Noppa, 1981; Ulrich, Meyer, Rumpf, & Hapke, 2005). These inconsistencies may be the result of differences between clinical and epidemiological samples, sample sizes, definitions and degrees of obesity, and variations in age, gender, race, and SES. In contrast to this study, prior research typically did not examine relationships to obesity while controlling for both demographic and psychological variables.

Life Stress and Obesity. Although there has been a considerable amount of interest in the possible link between psychological stress and eating behavior, our understanding of how these two variables influence each other is still limited (Appelhans, Pagoto, Peters, & Spring, 2010; Torres & Nowson, 2007). Because of the complex physiological and psychological nature of the stress response, linking it to obesity can be very complex. Elevated cortisol, a glucocorticoid hormone secreted by hypothalamic-pituitary-adrenal (HPA) axis associated with the physiological stress response, is linked to increased energy intake in rats (Freedman, 1986). However, in research designed to replicate these findings in humans yielded only mixed results (for a full review see Torres and Nowson, 2007). Nonetheless, there is a substantial amount of empirical evidence that increased stress is associated with a higher amount of daily fatty food intake and obesity in humans. One study focusing on English government workers found that there was a significant relationship between daily stress and an increase in consumption of between-meal snacks that were high in fat and sugar, along with a reduction in consumption of

healthy foods during meals (O'Connor, Jones, Connor, & McMillian, 2008). Other large cross-sectional studies have also found links between perceived stress and higher fat diets (Ng & Jeffery 2003) and between occupational stress and BMI (Kouvonen, Kivimaki, Cox, Cox, & Vahtera, 2005). Finally, low SES and specifically low education level has been linked to heightened cardiovascular response to stress (Lynch, Everson, Kaplan, Salonen, & Salonen, 1999).

Moderating Variables

In this section, I begin by presenting brief summaries of research on proposed integrative predictors of obesity. Following this summary, the hypotheses and research questions are presented.

BID, Demographic Variables, and Obesity. While there is a substantial amount of evidence that links body image dissatisfaction (BID) to other psychological variables and to obesity, research on the relationship of BID to obesity in different subgroups of the population is surprisingly sparse. In one study, educational attainment was associated with greater disturbances in body image. Additionally, higher social class was associated with elevated BID in women having higher BMIs (Abrams & Cook Stormer, 2002). It has also been found that young adult Black women and Latinas tend to favor larger body sizes and perceive less of a discrepancy between their current and ideal weight highlighting possible cultural differences in views of body image. The finding that Blacks and Latinas favor larger body sizes indicate they may be protected against BID in the presence of higher BMI (Fitzgibbon, Blackman, & Avellone, 2000). When, however, as SES increases amongst Blacks and Latinas, they too become more susceptible to BID at higher levels of BMI (Abrams & Cook Stormer, 2002). It has also been cited that the

prevalence of BID is higher in females compared to males (Pingitore, Spring, & Garfield, 1997; Tiggmann & Pennington, 1990).

Depression, Demographic Variables, and Obesity. Though there have been many studies that have attempted to uncover links between demographic factors, psychological distress variables and obesity, many do not attempt to control one for the other and relatively few studies exist that have attempted to ascertain whether demographic variables moderate the effects of psychological factors in regard to obesity. Much of the current literature focuses on depression. Some large epidemiological studies have found significant positive relationships among demographic factors, psychological distress, and the outcome of obesity. Results from a national study indicated that lower household income and lower parental education were each associated with approximately one third of depression and obesity cases within the sample (Goodman, Slap, & Huang, 2003). Furthermore, individuals residing within the context of significant poverty (200% below the poverty line) were 2.5 times more likely to suffer from clinical depression along with being significantly more likely to suffer from obesity and obesity-related disorders (Everson, Siobhan Lynch, & Kaplan, 2002). Additionally, structural factors including impoverished learning environments and low educational attainment have also been implicated with depressive symptomatology (APA, 2007). Others have found that race and gender moderated depressive mood such that depressed minority women were more likely than any other group to report being obese (Heo, Pietrobelli, Sirey, & Faith, 2006).

Life Stress, Demographic Variables, and Obesity. As described above, a substantial body of literature exists on the relationship between stress and obesity.

However, research based on conceptual models that include both the main effects and interactions of stress, demographic variables, and obesity is decidedly sparse. Indeed, it has been posited by Wardle et al. (2011), that demographic factors such as living in a resource poor environment could be potentially moderate the relationship between stress and depression. Although one study found that there was no interactive effect of gender and stress on obesity among adolescents (Cartwright et al, 2003), minority group membership may be a moderating factor on obesity. Specifically, the inherent stress associated with minority group status combined with the relative paucity of resources for coping with stress may predict that minority group members will have problems with obesity (Kumanyika, 2007).

Hypotheses

In sum, this dissertation describes a study using cross-sectional survey data wherein predictors of obesity among adults are examined. On the basis of prior literature, I present a study on the relationships to obesity of demographic variables: race, sex, geographic location along with evaluating the relationship of obesity to BID, depression, and life stress. My three hypotheses and one research question are as follows:

1. Education moderates the relationship between psychological factors and obesity such that higher rates of obesity are associated with the combination of
 - 1a. Having a college education or above and higher BID
 - 1b. Having a high school education or less and self reports of higher levels of depressive symptoms

- 1c. Having a high school education or less and below and higher self-reported life stress
2. Second sex moderates the relationship between psychological factors and obesity such that obesity is more likely to be incurred by
 - 2a. Females who report higher BID
 - 2b. Females who report higher levels of depression, and
 - 2c. Females who report higher amounts of stress
3. Thirdly, I propose race moderates the relationship between psychological factors and obesity such that obesity is most likely to occur among
 - 3a. Blacks who report higher BID
 - 3b. Blacks who report higher levels of depression
 - 3c. Blacks who report higher amounts of stress

The following research question is as follows:

Will demographic predictors of obesity remain significant after controlling for psychological factors in our sample?

Determining the psychological predictors of obesity is important in any attempt to understand and ultimately, to prevent and treat obesity. Additionally, understanding the magnitude of the effect each of these predictors will allow us to focus our efforts more accurately and effectively when developing programs designed to prevent and treat diverse populations.

Method

Participants

The data for this study came from The Eating and Self Image Survey, an Internet survey conducted at Teachers College, Columbia University. Data for the current study consisted of responses by 764 participants whose BMIs were in the obese range and 1200 people whose BMIs were within the normal range, i.e., who were not anorexic, underweight or overweight.

Demographics

Participants reported their age, zip code, marital status, education, and race. The age range of the sample was from 18 to 60, with a mean age of 32.23 years ($SD = 11.606$ years). Of the sample, 16.4% identified as Black or African American. 15.7% were male. 25.6% of respondents had completed graduate study, 48.7% had completed undergraduate study, and 25.6% had not attended college. Table 1 presents the descriptive data for study demographics.

Procedure

The Eating and Self Image Survey is a 198-item survey designed to ascertain the prevalence of eating disorders, distorted body image, and obesity in the general population. The included instruments featured both Likert-like and open answer response formats. After approval by the Institutional Review Board, the survey research instrument was placed on the Columbia University website. Informed consent was obtained from all participants. Initial data collection began February of 2005 and is ongoing. The goal of the study was described as an "exploration of the relationship between eating behavior and factors such as body image in adults at various ages." It was also noted that the survey was intended for people 18 years and older, and only data from participants 18 years of age and older were retained in the researchers' database. There

were no other inclusion or exclusion criteria used in this study. A variety of techniques were used in order to obtain the greatest number of respondents for the survey. These included radio, television, and print media throughout the Western hemisphere in all countries with sizable English speaking populations. In addition, the researchers recruited participants by placing posters in a range of public venues such as gymnasiums, hair salons, subway and bus stations, supermarkets, health clubs, medical centers, of primary care. Field investigators also distributed business cards that included a description of the study and provided the Internet address for the survey.

Measures

Body dissatisfaction. Body dissatisfaction was assessed using the 2-item Contour Drawing Rating Scale (Thompson & Gray, 1995). Using numbered drawings of either male or female figures from 1 (figure with the lowest weight) to 9 (figure with the highest weight), participants chose the number corresponding to figures that most accurately depicted their actual and ideal body sizes. The discrepancy between participants' current and ideal body size was calculated and used as a measure of body dissatisfaction. As the key measure was a scale number representing the discrepancy between perceived versus ideal body size, it was not possible to calculate an alpha for this scale.

BMI and Measure of Obesity. Body Mass Index (BMI) was calculated from the participants' self-reported weight in pounds, which was multiplied by 703, and then divided by their height in inches squared. Weight categories of normal and obese were classified according to the Department of Health & Human Services' National Heart Lung and Blood Institute (NHLBI) with a BMI of 18.5 – 24.9 being normal weight, a

BMI of 25.0 – 29.9 being overweight and a BMI \geq 30.0 being considered obese (National Institutes of Health, 1998).

CES-D. The Center for Epidemiological Studies Depression scale (CES-D) is a twenty question, Likert-type self-report scale that was developed to measure several functional domains that are commonly linked to depressive symptomatology such as sadness, crying, self-esteem, and feelings of loneliness. Each item is rated on a scale from 0 to 4 and the scores can range from zero to sixty with higher scores indicative of greater amounts psychological stress (Pandya, Metz, Patten, 2005). Scores of 16 or greater on the CES-D are traditionally interpreted as clinically significant for depression (McDowell & Newell, 1996). This scale was developed in an attempt to identify cases of depression within the general population (Hertzog, van Alstine, Usala, Hultsch, Dixon, 1990; Makambi, Williams, Taylor, Rosenberg, Adams-Campbell, 2009). It is often utilized in assessing depressive symptoms in large-scale epidemiological studies because of its validity and reliability in capturing depressed mood in diverse populations (Hann, Winter, & Jacobsen, 1999; Makambi et al., 2009; Vera et al., 1991). Cronbach's alpha for the current sample was $\alpha = .76$.

Geographic Location. Participants' zip codes were used to identify their regional location. This information was used categorize participants into North and South by the definition of the United States Census Bureau (U. S. Census Bureau, 2010).

Life Stress. A five-item Likert-type scale was developed by the investigators to attempt to gain an accurate assessment of participants' life stress. Questions were designed to tap into participants' perception of the extent to which they had experienced life stress (e.g. To what extent have you experienced life stress in the past year/month?)

perceived relationship of eating behavior and their eating behavior related to stressful times (e.g. to what extent do you eat more during life stress?). Answers to these questions ranged from “1 – Not at all” to “7 – a great deal. Higher scores were indicative of more life stress.

SES. In past studies, various indicators have been used to assess socioeconomic status. Indicators such education, income, and occupational position have been used to denote socioeconomic position. Though each of these indicator has its own inherent strengths and limitations, educational attainment has been established to be the most stable and robust predictor of an individual’s SES (Liberatos, Link, & Kelsey, 1988; Williams & Collins, 1995). Education was chosen as an indicator variable for SES because a person’s education is less likely to be affected by their own body weight, and education tends to be more stable across time as compared to income or occupation (Zhang & Wang, 2004). Because of the inherent nature of an Internet-based survey, the overwhelming majority of our subjects were college and graduate school educated (75.6%) whereas only 24.4% were not. As a consequence of this, college and graduate school-educated subjects were combined into one group, which was compared to the no college group.

Data Analysis

All analyses were conducted using the PASW Statistics software package (Version 18.0). Descriptive statistics of the sample of participants were generated. Analysis using logistic regression is often used to identify presence versus absence of a disease or syndrome and its usefulness lies in its ability to test interaction effects and control for multivariate models (Hosmer & Lemeshow, 1989) and it has been used

consistently to ascertain and predict the risk factors associated with overweight and obesity in various populations (Boardman, Saint Onge, Rodgers, Denney, 2005). Moreover, logistic regression has the benefit of having an odds ratio in its output measure, thus giving us an easily interpretable statistic on which to base inferences.

Contrast coding was used to compare White and Black participants in the analysis (e.g., -1 = White and 1 = Black). Contrast coding was also used to compare obese participants with normal weight participants in our sample. Specifically, obese participants were contrast coded against normal participants according to their BMI (e.g. if $BMI \leq 24.99$, obese = -1; if $BMI > 29.99$, obese = 1). Dummy coding was used to examine depression. Scores of 16 or higher on the CES-D are indicative of clinical depression and this cutoff was used to dummy code individuals in the sample who indicated clinical depression against those who did not indicate clinical depression (0 = < 16; non-depressed, ≥ 16 ; 1 = depressed). Education was also a dichotomous variable with individuals reporting education of high school or less coded as (-1) being compared to individuals with a college education or above (1). Life stress and body image dissatisfaction were continuous variables and thus were centered before they were entered into the logistic regression model.

Analysis of Research Question. To assess whether demographic predictors of obesity would remain significant after controlling for psychological factors in our sample, we ran a two-step hierarchical logistic regression with the sociodemographic variables of race, sex, geographic location, and SES (education) included in the first step. Then, the psychological factors of BID, depression, and life stress were entered into the second step.

Moderation. To assess moderation by demographic factors when predicting obesity from psychological variables (BID, depression, life stress), a separate series of hierarchical logistic regression analyses were conducted. An analysis using the psychological predictors along with the moderating variables were run in the first step. Then, as recommended by Baron and Kenny (1986) the interaction effects of the potential moderators were tested by first multiplying each psychological variable by education, sex, and race. These interactions along with the main effects were subsequently included in the second step of the logistic regression model. As there were three moderators (education, sex, and race), three separate hierarchical logistic regression analyses were run to ascertain the extent to which education, sex, and race moderated the relationships of psychological variables to obesity.

Results

Descriptive Data

Descriptive data is given in Table 1. The mean age of the normal and obese participants was 29.41 ($SD = 10.33$) and 37.64 ($SD = 10.33$) respectively. The mean BMIs for the normal weight and obese samples were 21.85 ($SD = 1.70$) and 37.92 ($SD = 9.78$); respective CES-D scores for the normal and obese samples were 21.64 ($SD = 7.14$) and 21.89 ($SD = 7.33$), indicating that both groups appeared to be depressed. Mean responses to the 2-item Contour Drawing Rating Scale for normal weight and obese participants were 1.67 ($SD = 1.34$) and 3.53 ($SD = 1.44$) respectively. Life stress scores for the normal weight and obese participants were 23.55 ($SD = 4.51$) and 26.14 ($SD = 4.87$). Descriptive data for the categorical variables used in this study are given in Table 2. Correlation coefficients were also calculated to assess relationships

among the study variables. Pearson Product Moment correlations were used to assess significance of relationships among the continuous variables (see Table 4) and Kendall's Tau coefficients were used to assess the significance of relationships among categorical variables (see Table 5).

Assessing the Significance of Demographic and Psychological Variables

To test the research question, I ran a two-step logistic regression equation to assess the main effects of the demographic variables, and then to examine their significances after controlling for the psychological variables. Results of the analysis are given in Table 5. In the step 1, all four of the variables (race, geographic location, sex, SES) were significant with participants from the south being one-third more likely to be overweight compared to their northern counterparts, $OR = 1.37, p < .05, CI [1.06 - 1.75]$; and participants without a college education one-sixth more likely to be obese compared to their normal weight counterparts, $OR = .88, p < .05, CI [.78 - 1.00]$. Additionally, Black participants were over two-and-a-half times more likely to be obese compared to their White counterparts, $OR = 2.73, p < .001, CI [1.69 - 4.56]$. Sex was not a significant predictor in the first step. However, after controlling for the psychological variables, sex, and race were the only sociodemographic variable to remain significant with women being three-fourths more likely to be obese compared to men and Blacks being four times as likely to be obese compared to their White counterparts, $OR = 3.93, p < .001, [2.16-7.15]$ and women being over two and a half times more likely to report being obese $OR = 2.68, p < .001, [1.83-3.92]$. All of the psychological variables significantly predicted obesity; people with significant amounts of BID were over two times more likely to be obese $OR = 1.31, p < .001, [1.11-1.52]$; people who reported elevated amounts of life

stress were three-fourths more likely to be obese $OR = 1.10, p < .001, [1.06-1.13]$; and participants who were clinically depressed were one and one and a half times more likely to be obese $OR = 1.72, p < .01, [1.24-2.38]$.

Suppression Analysis. Results from the prior analysis indicated sex only became significant in the second step of hierarchical logistic regression analysis indicating possible suppression by one or more of the psychological variables. In the most useful and widely employed definition, suppression is evident when a variable that is non-significant becomes significant when additional variables are added in a subsequent step of the analysis (Conger, 1974). In this study, the possibility of a suppression effect was assessed by means of a second hierarchical logistic regression analysis. The results of this analysis indicated that a suppression effect was evident in the relationship between sex, BID, and obesity. That is, sex ($OR = .44, p < .01, [.31-.62]$) only attained significance after BID was included in the second step. Suppression was also found in the relationship between sex, life stress, and obesity, where sex attained significance only after life stress was introduced into the hierarchical logistic regression model ($OR = .63, p < .01, [.47-.88]$). Finally, an independent samples Student's t was performed to establish to what degree sex was associated with life stress. Results indicated that females were significantly more likely to report higher amounts of life stress than males $t(1964) = 8.46, p < .001$ (see Table 5). The results of these analyses indicate that although the relationship between sex and obesity is not significant, it becomes significant when BID and life stress are taken into account. Depression was not included in the analysis because it was not significantly related to obesity ($\tau = .04, ns$).

Evaluation of Moderating Variables

Education as a Moderator. To assess the degree to which education moderates the effects of psychological variables on obesity, a two-step hierarchical logistic regression analysis was introduced. Specifically, the interaction effects of education and the psychological variables on obesity were assessed. I separately multiplied BID, depression, and life stress with education, and assessed the relationship of the resulting product on obesity. As predicted in Hypothesis 1a, and as shown in Table 7, the product of education and BID had a moderating effect on obesity such that college educated people who reported more body image dissatisfaction were also more likely to be obese, $OR = 1.03, p < .01, [1.01-1.05]$, than those without a college education (see Figure 1). However, the product of education and depression was not found to be a significant moderator of obesity, giving no evidence for Hypothesis 1b. On the other hand, in accordance with Hypothesis 1c, it was revealed that the combined effects of education and life stress moderated obesity such that individuals who reported elevated life stress and lacked a college education were significantly more likely to report being obese; $OR = .97, p < .05, [.94-1.00]$ (see Figure 2). Additionally, although all psychological variables remained significant after controlling for the interactions, education became non-significant in the second step, suggesting that a significant amount of the variance in the model was explained by the interaction between education and psychological distress. In sum, these results suggest inconsistent support for Hypothesis 1.

Sex as a Moderator. To evaluate the degree to which sex and psychological factors had moderating effects on obesity, another series of hierarchical logistic regression equations was introduced for this analysis as shown in Model 5 (see Table 7). As illustrated in Figure 3, there was evidence that the product of sex and BID had

moderating effects on obesity in the sample, with women who indicated high levels of BID being significantly more likely to report being obese compared to men and normal weight women providing support for part a of Hypothesis 2a; $OR = .69, p < .001, [.59-.81]$. However, neither part b nor part c of hypothesis 2 was supported. That is neither sex x depression nor sex x life stress had moderating effects on obesity. In sum, the results suggest that there is partial support for Hypothesis 2.

Race as a Moderator. Hierarchical logistic regression models were then used to evaluate the significance of any moderating effects of race and psychological factors on obesity as indicated in Model 6. Overall there was no evidence that the products of race and the psychological variables had significant interactive effects on obesity. Thus, results of this study provide no support for Hypothesis 3.

Discussion

This Internet study attempted to establish relationships of sociodemographic and psychological variables to obesity. Specifically, an attempt was made to ascertain the degree to which sociodemographic variables moderated the relationships of obesity to psychological variables. I also was interested in the amount of variance in obesity that was explained by demographic variables while controlling for psychological variables. Results revealed a number of important findings, some which are consistent with earlier investigations and some, which were found for the first time in this investigation.

For the research question, will sociodemographic variables remain significant after controlling for psychological factors, I found that both sex and race remained significant after all three psychological variables were entered into the analysis. This finding suggests that although sociodemographic factors were significantly related to

obesity in our sample, psychological variables also account for a significant amount of the variance, demonstrating that it is necessary to consider psychological factors when examining obesity. These findings add to the literature that depression, BID, and life stress are all associated with obesity (Cargill, Clark, Pera, Niaura, & Abrams, 1999; Kontaski & Gullone, 1998). However, they are unique in that when stress, depression, and BID are controlled for, neither educational attainment nor regional location remained significant. This finding is inconsistent with other studies reporting that certain demographic variables remain significant even after controlling for psychological factors (Goodman, Slap, & Huang, 2003) and that SES and geographic location remain the strongest predictors of obesity (e.g. Gavin et al., 2010; Ogden et al, 2006). This finding argues for the importance of considering psychological factors when investigating the correlates of obesity. Specifically, though sociodemographic factors are important when considering obesity, to only look at these and similar variables is insufficient and a broader focus on both sociodemographic and psychological factors is needed for an optimal understanding of obesity.

Also of interest is the finding that sex was not a significant factor in the first step of the model but that it attained significance when included along with other psychological variables in the second step. Results of further analyses suggested that one or more of the psychological variables included in the second step produced a suppressor effect, so that although sex accounts for little of the variance in the model, when either BID or life stress is taken into account, sex becomes significant. Indeed, as evidenced above, there was a strong moderating effect associated with the combination of sex and BID (but not sex and life stress) on obesity. It is possible that body image dissatisfaction

is associated both with being female and with obesity (see Figure 3). This combination may also account for a significant amount of the covariation between the sex and obesity. However, the suppressor effect of life stress is of less importance, as there was no evidence that the product of sex and life stress had a moderating effect on obesity (see Table 7). It may be that because life stress is correlated with BMI ($r = .20, p < .01$) and there is also a relationship between gender and life stress $t(1964) = 8.46, p < .001$, then life stress may link these two non-related variables in terms of the covariance.

For Hypothesis 1, I attempted to establish the degree to which the products of education x BID, education x depression, and education x life stress moderate obesity. My analyses indicate that education x BID significantly moderate the effects of obesity such that those individuals who are college educated and who reported higher levels of BID are more likely to be obese than are individuals who do not report elevated levels of BID and do not have a college education, which accords with Hypothesis 1a (see Table 7). This finding is consistent with other research indicating that educational attainment and higher SES are associated with greater dissatisfaction with body image, among both obese and normal weight individuals (Abrams & Cook Stormer, 2002). Ostensibly, individuals of higher educational attainment may be more exposed to the societal “thin ideal” to a greater extent than those with less education; hence, obese people with more education may experience more BID compared to those with less education due to social interactions incurred in academic and/or occupational settings (cf. Matz, Foster, Faith, and Wadden, 2002).

There was no evidence that the interaction of education and depression played a moderating role on obesity, which disconfirms Hypothesis 1b. Past studies have found

that lower SES is associated with psychological distress along with being associated with physical disorders and ailments, including obesity (Everson et al., 2002). Several other factors could have led to this finding, which limitations associated with Internet samples such as factors associated with self-selection and lack of randomization. Nevertheless, further investigation into the role of variables associated with SES, as moderating variables in the relationship between depression and obesity should be the focus of future study.

Concerning Hypothesis 1c, it was found that education also moderated the relationship between life stress and obesity, such that individuals reporting elevated life stress and who lacked a college education were nearly twice as likely to report being obese. This finding is consistent with findings from several other studies that have uncovered relationships between, SES related variables, life stress, and, albeit none have attempted to establish the degree to which education x life stress is a moderator in regard to obesity (Everson et al, 2002; Wamala, Wolk, Orth-Gomer, 2002; Wardle, Waller, &, Jarvis, 2002). It also substantiates Wardle et al.'s (2011) proposition that factors associated with SES (with education as a proxy in this case) may play a moderating role in the relationship between stress and obesity. Indeed, researchers have indicated in the past that these factors may share a relationship. It has been proposed that the factors associated with having reduced upward mobility due to lack of education and to that end are locked into low SES are also associated with a variety of life stressors, which stem from issues such as living in resource poor conditions, fear of crime, and other variables that increase cognitive demand (APA. 2007; Lopez, 2007; Wardle et al, 2002).

In regard to Hypothesis 2a, a relationship was found for the product of sex and psychological factors with obesity. Specifically, the relationship of BID by sex was associated with obesity; women who reported elevated body dissatisfaction were overwhelmingly more likely to report being obese than their male counterparts. This finding accords with the results of studies that suggest that women are more likely than men to react adversely to negative body image (Cash & Roy, 1999) and women who are overweight are more likely than men to classify themselves as overweight, and to be more dissatisfied with their bodies compared to men (Cash & Hicks, 1990). Cash and Hicks hypothesize that self-classification may also be associated with sex differences in body dissatisfaction as overweight men are more likely to view themselves as big and strong rather than fat. This view, may in turn serve as a cognitive protector against BID. It is not known however, whether this strategy is employed by obese men.

In regard to Hypothesis 2b, no evidence was found that sex moderates the effects of depression on obese individuals. Prior research has yielded inconsistent results concerning this issue. Specifically, according to Heo et al. (2006), a relationship to obesity was found for the product of sex x depression, with obese females more likely to be depressed than males. Conversely Onyike, Crum, Lee, Lyketsos & Eaton (2003) found that both severely depressed males and females were equally likely to be obese. However, more recently Wardle, Wiliamson, Johnson, and Edwards (2006) found no link between sex x depression, and obesity suggesting that the link between these three variables may be weak at best. Assuming that our finding of a non-significant relationship are correct, it is possible that even in groups wherein slimness is most valued (e.g., among females), depression may not be inextricably linked to obesity (Warde,

Williamson, Johnson, & Edwards, 2006). Thus, it is plausible that obese women, similar to other groups who are stigmatized in society, may have developed cognitive mechanisms for protecting against any emotional distress incurred as a result of being obese.

In regard to Hypothesis 2c, no evidence was found in support of the prediction that sex moderates the relationship between less stress and obesity. This finding differs from research that suggests that women undergoing stress tend to use food as a means for stress reduction, while men are more likely to use other oral methods of stress reduction such as smoking or alcohol consumption (Conway, Vickers, Ward, & Rahe, 1981). Others have also noted that women prefer food high in sugar content by a two to one ratio compared to men when stress is induced in an experimental setting (Grunberg & Straub, 1992). However, women's preference for food that is high in sugar content during stressful situations may not necessarily lead to the outcome of obesity outside the psychology lab, even if they even if the women report chronic life stress. As Oliver, Wardle, and Gibson (2000) have indicated, a woman's preference for sweet snacks in a stress-inducing experimental paradigm does not necessarily indicate that she will engage in stress-related overeating during meals.

In investigating hypotheses 3a, 3b, and 3c, no evidence was found that race moderates the relationships to obesity of BID, depression, or life stress. These results run contrary to the findings of Heo et al. (2006) wherein minority status (e.g., Black and Hispanic) and depression were reported to be robust moderators for obesity. However, in some prior research, no significant relationships have been found between race, depression, and obesity (Carpenter, Hasin, Allison, & Faith, 2000). There have been a

few studies in which Blacks who reported significant amounts of life stress were also more likely than Whites to be at elevated risk of subclinical carotid disease, which is highly associated with obesity (Troxel, Matthews, Bromberger, & Sutton-Tyrrell, 2003). Needless to say, further investigation into whether or not race is a moderator is needed.

Limitations

There are several limitations in this study that require mention. First, this was a cross-sectional survey and thus, no causal relationships can be assessed. Future research should employ longitudinal or experimental methods to investigate the relationships among the variables examined, in order to establish causality. Second, our data were entirely based on self-reports, and therefore subject to all of the internal validity issues associated with this methodology. Third, the sample was self-selected, so findings cannot be generalized to the US population, as one may do with a representative random sample. A particularly striking finding was that the sample overall was skewed in terms of mood, with depressed individuals outnumbering non-depressed individuals, which may have affected the ability to detect relationships between depression and other variables. Future studies can address this by ensuring that the samples used hold equal variance across as many variables as possible. Finally, our sample was relatively homogeneous in regard to race, with Whites making up the majority of our sample and thus, our results should be interpreted with caution. Future studies might use a nationally representative sample when investigating the associations between socio-demographic and psychological variables and weight when attempting to replicate and extend our findings.

Conclusion

In sum, I attempted to ascertain whether psychological variables were associated with obesity in an Internet sample. Specifically, social and psychological factors differentially predict obesity. It was also found that the product of education and BID moderates obesity such that those who are educated at the college level or above and who report a significant amount of BID are more likely to also report being obese compared to those who do not. It was also found that the product of education and life stress moderate obesity such that those with a high school education or less who also report a significant amount of life stress are more likely to also report being obese than those who do not report elevated amounts of life stress. Finally, it was found that product of BID and sex also moderate obesity where women who report elevated amounts of BID are more likely to report being obese than those who are not. Though the replication of our findings is in order, our results are nonetheless important when considering variables that are associated with obesity in the context of race, especially when attempting to initiate primary and secondary interventions for obese adults.

These findings also support a more integrative approach studying obesity. By having an understanding of how education and other factors related to SES combine with psychological factors in their relationship to obesity, we might be able to develop a clearer understanding of the interplay between SES and the psychological elements related to obesity. This might facilitate the development of preventative intervention strategies at the primary and secondary levels, which would likely be more beneficial for afflicted individuals along with being more cost effective. Furthermore, by understanding how sociodemographic factors related to SES and psychological factors interact in predicting obesity, rather than attempting to develop one-size-fits-all

paradigms to treat obesity, we may be able to deliver a more nuanced approach to treatment, whereby improving treatment quality. These findings add to the growing amount of literature that suggest that a greater understanding of differing sociodemographic and psychological factors should be a focus in future studies of obesity.

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Table 1.

Descriptive Statistics for Continuous Variables

	<i>Normal Weight (n = 1200)</i>		<i>Obese (n = 764)</i>	
	Mean (<i>SD</i>)	Range	Mean (<i>SD</i>)	Range
Age	29.41 (10.33)	18 – 60	37.64 (11.81)	18 – 60
BMI	21.85 (1.70)	18.52 – 24.99	37.92 (9.78)	30.01 – 78.92
CESD Total	21.64 (7.14)	8 – 50	21.89 (7.33)	6.00 – 50.00
BID	1.668 (1.34)	-4.00 – 8.00	3.533 (1.44)	-4.00 – 8.00
Stress*	23.55 (4.51)	10.00 – 35.00	26.14 (4.87)	12.00 – 35.00

*Cronbach's alpha for the sample: $\alpha = .78$

Table 2.

Descriptive Statistics for Categorical Variables

	<i>Normal Weight (n = 1200)</i>	<i>Obese (n = 764)</i>	<i>X²</i>
	Frequency (Percent)	Frequency (Percent)	
CES-D < 16	241 (12.27)	195 (9.93)	2.78
CES-D > 16	959 (48.82)	569 (28.97)	
> High school	306 (15.58)	409 (20.82)	158.46***
< High School	894 (46.02)	355 (17.57)	
Female	984 (53.97)	638 (30.35)	0.74
Male	216 (8.76)	126 (6.92)	
Northern	962 (49.61)	452 (23.00)	8.40**
Southern	328 (16.75)	209 (10.64)	
Black	162 (9.47)	170 (7.43)	25.45***
White	1038 (55.24)	594 (28.31)	

Note: $p < .05^*$, $p < .01^{**}$, $p < .001^{***}$

Table 3. Correlation Coefficients for Continuous Variables (Person's r)

	1	2	3	4
1. Life Stress	-	.28**	.36**	.20**
2. BID	.28**	-	.25**	.35**
3. CES-D Score	.36**	.25**	-	-.00
4. BMI	.20**	.35**	-.00	-

Note: $p < .05^*$, $p < .01^{**}$, $p < .001^{***}$

Table 4. Correlations Coefficients for Categorical Variables (Kendall's τ)

	1	2	3	4	5
1. Depressed (Y/N)	-	-.12**	.01	.04	-.12**
2. North vs. South	.07**	-	.07**	.02	-.05
3. Obese (Y/N)	.04	.07**	-	.127**	.02
4. Race	.04	.04	.127**	-	-.02
5. Sex	-.12**	-.05*	.02	-.02	-

Note: $p < .05^*$, $p < .01^{**}$, $p < .001^{***}$