Association between Obesity and Symptoms of Depression of Adults in Puerto Rico

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Objective: This study was aimed at determining the prevalence of overweight; of class 1 and class 2/3 obesity; and of the symptoms of depression in adults in Puerto Rico. The study also evaluated the relationship between the symptoms of depression and weight status.

Methods: The sample for this study consists of 6,025 adults (3,851 females and 2,174 males) who lived in Puerto Rico at the time of and who participated in either the 2006 or the 2010 BRFSS.

Results: In this sample 70.0% of the respondents were either overweight or obese. About 39.6% of them were considered overweight, while 18.1% were obese class 1 and 12.3% were obese class 2 or 3. When compared by gender, the prevalence rate of overweight was higher for males (46.9%) than it was for females (35.5%), but females (14.1%) had a higher rate of class 2/3 obesity than did males (9.2%). There were no significant gender-based differences in the class 1 (BMI between 30 and 35) obesity group. According to the study's findings, depression symptoms and class 1 obesity are not strongly associated. A positive relationship between depression and weight was found only in women with class 2/3 obesity (BMI>35).

Conclusion: In summary, the results of this study show that depressive symptoms are associated with obesity, and this correlation seems to be more significant in women, especially those with severe obesity, less education, and lower incomes. Findings point to the existence of a high risk of comorbid obesity and depression of adults in Puerto Rico. [*P R Health Sci J 2013;3:132-137*]

Key words: Obesity, Adult Depression, Socio-economic status

Obesity is a serious public health problem in the United States and in Puerto Rico. Prevalence rates in the US significantly increased during the second half of the 20th century (1). In 2000, approximately 30.5% of adults in the United States were considered to be obese (2), and by 2010 that prevalence rate had increased to 35.7% (3). Some literature suggests that 75.0% of US adults will be overweight or obese by the year 2015 (4). In the US, obesity rates are highest in African American and Hispanic populations (2).

In Puerto Rico, the Behavioral Risk Factor Surveillance System (BRFSS) reveals that 65.6% of the population is overweight or obese (5).

This is the highest rate in all of the US territories, and is higher than those found in 42 of the 50 states (5).

Obesity has been associated with several physical and mental health problems. Although the physical problems related to obesity have been extensively studied, the psychological correlates have not received the same attention (6). Studies have found that obesity is highly stigmatized, which leads to discrimination, and, as a consequence, to mental illnesses, such as anxiety disorders, somatoform disorders, eating disorders (7), and major depression (7-9). However, studies of depression and obesity have resulted in inconsistent findings. Some studies have not found there to be any significant associations between depression and obesity (10, 11), while others, more recently, have found that there is a significant positive relationship between obesity and depression (7, 12-16). Strine and collaborators (16) evaluated the association of depression and obesity in a number of samples of adults from 37 US states and territories, including Puerto Rico, using data from the CDC's 2006 BRFSS. Their results for the combined samples show that obesity was significantly related to current depressive symptoms and that obese people were more likely to have depressive symptoms than non-obese people were. This study did not report the association between depression and obesity by state.

Although obese individuals have varied psychosocial experiences, in many cases a high body mass index (BMI) has been related to an increase in depressive symptoms (17, 18). However, a higher risk for obesity and depression has been associated with specific demographic and socio-economic variables. Studies have found that severe obesity, being female, and low socio-economic status (SES) are risk

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factors for depression in obese individuals (6). Age and race are other demographic aspects related to the presence of depression and obesity in an individual. Heo and collaborators (13) found that young, obese Hispanic women are at higher risk for depressive symptoms than are their non-obese counterparts. Possible explanations for the gender disparity in the association between depression and obesity are disparities in stigmatization, perceived barriers to adequate treatment, reduced access to health services, and biological factors linked to psychopathological pathways (13).

The relationship between obesity and depression is bidirectional (19). Obesity may lead to depression onset, but depression might also cause obesity. Obesity may increase the risk of depression due to depressogenic effects when obesity 1) interferes with a person's day-to-day functioning, 2) increases an individual's self-perception of being in poor health, 3) generates discrimination and mistreatment, 4) leads to body-image dissatisfaction, and/or 5) motivates continuous dieting (7). On the other hand, depression may increase the risk of obesity because of both physiological and psychosocial factors. For example, depressed individuals are susceptible to weight gain due to changes in their cortisol levels. Among the psychosocial factors, depression may 1) interfere with adherence to a healthy diet and an exercise program, 2) precipitate episodes of binge eating, 3) increase a person's negative thoughts about his/her ability to lose weight, and 4) decrease the social support from family and friends that encourages adherence to healthy behaviors (7). Obese people who develop negative self-schemas manifest frequent negative automatic and dysfunctional thoughts about their self-efficacy and/or physical appearances, which puts them at risk for developing symptoms of depression.

Because of obesity's highly negative health consequences, it is imperative to know more about the epidemiology of obesity in Puerto Rico. This study estimates the prevalence of overweight; class 1 and class 2/3 obesity; and symptoms of depression in a representative national sample of adults living in Puerto Rico. In addition, the study evaluates the relationship between symptoms of depression and weight status.

Patients and Methods

Sample

The sample for this study consists of 6,025 adults who lived in Puerto Rico at the time of and participated in either the 2006 or the 2010 BRFSS (available at http://www.cdc.gov/brfss/). The BRFSS is a telephone survey created by the Centers for Disease Control (CDC) and that includes all 50 states, the District of Columbia, Puerto Rico, the US Virgin Islands, and Guam. It is a yearly survey, although not all of the questionnaire's modules are included each year. The 2006 and 2010 waves of the BRFSS were utilized for this study because these were the only 2 years in which the survey included the Anxiety and Depression module for Puerto Rico. The aggregate data set had a total of 8,229 participants from Puerto Rico, ages 18 to 98, but the final data set used had a total of 6,025 individuals who provided all of the relevant information solicited by the survey. The gender distribution of the sample was 3,851 females and 2,174 males. The data protocol was approved and declared exempt from further evaluation on March 28, 2012, by the University of Puerto Rico's Institutional Review Board (IRB). Table 1 presents the descriptive statistics of the data set utilized for this study.

Table 1. Socio-demographic characteristics of sample by gender [n (%)]

Variable	All	Female	Male
Gender		3,851 (63.9%)	2,174 (36.1%)
Age			
18-25 years	324 (5.4%)	183 (4.8%)	141 (6.5%)
26-35 years	627 (10.4%)	407 (10.6%)	220 (10.2%)
36-45 years	1,014 (16.8%)	674 (17.5%)	340 (15.6%)
46-55 years	1,071 (17.8%)	733 (19.0%)	338 (15.6%)
56-65 years	1,229 (20.4%)	769 (20.0%)	460 (21.2%)
Over 65 years	1,760 (29.2%)	1,085 (28.2%)	675 (31.1%)
Married	3,100 (51.5%)	1,683 (43.7%)	1,417 (65.2%)
Education			
No College	3,041 (50.5%)	1,867 (48.5)	1,174 (54.0%)
Some College or a Degree	2,984 (49.5%)	1,984 (51.5%)	1,000 (46.0%)
Income			
Less than $15,000	2,809 (46.6%)	1,898 (49.2%)	911 (41.9%)
$15,000 – $24,999	1,667 (27.7%)	1,042 (27.1%)	625 (28.8%)
$25,000 – $49,999	1,077 (17.9%)	657 (17.1%)	420 (19.3%)
$50,000 or more	472 (7.8%)	254 (6.6%)	218 (10.0%)

Measures

This study used data from the general questionnaire of the BRFSS, which data included weight, height, and BMI. It classified participants (according to their BMI) as normal, overweight, or obese (which classification is subdivided into three categories that are based on World Health Organization guidelines).

To obtain information about the symptoms of depression in the sample group, the Anxiety and Depression module of the BRFSS was used. Although the title of the module refers to anxiety and depression, the module includes only 8 questions that focus on the specific symptoms of depression – lack of pleasure in doing things, feeling down, changes in eating habits, sleeping problems, lack of energy, sense of failure, and the inability to think clearly and/or to move. A question about recurrent thoughts of death or suicidal ideation, which may be 1 of the symptoms of a person with depression, was excluded from the interviews, presumably, to avoid the potential risks associated with asking about suicidal thoughts by phone. Respondents who reported having any 1 of the aforementioned symptoms for the last 14 days were coded as having that particular depressive symptom. Individuals were grouped into 2 groups: the first one included people reporting the presence of at least 5 symptoms on every day of the 2 weeks

prior to the survey, and the other, consisting of those reporting 3 to 4 symptoms daily for the same period. To be included in either of the groups, an individual had to report experiencing daily either a depressed mood (feeling down) or the loss of interest or pleasure in nearly all activities (in addition to the other symptoms), as both are considered to be core symptoms for depression. To be included in either of the groups, an individual had to report experiencing daily either a depressed mood (feeling down) or the loss of interest or pleasure in nearly all activities (in addition to the other symptoms), as both are considered to be core symptoms for depression. These symptom classification follow the appropriate *Diagnostic Statistical Manual for Mental Health Disorders-IV-TR* (fourth edition, text revision) (20) criteria for evaluating the presence of major or minor depression. In addition to exploring the 8 symptoms of depression, the module includes 2 questions that inquire into the respondent's history of depression or anxiety diagnoses given by a health professional. Since this paper is concerned with concurrent obesity and depression symptoms, the diagnoses variables were included only in the descriptive analyses.

Analytical strategies

Descriptive analyses were performed to determine the prevalence of overweight and of class 1 and class 2/3 obesity by gender. The prevalence of depression-like symptoms was also calculated. The estimation of these analyses was performed separately for the two symptom groups that were discussed in the previous section.

Weight class was treated as the dependent variable in all analytical models. Given that causality is quite difficult to ascertain, especially when a repeated cross-sectional study such as the BRFSS is utilized, this paper limits its econometric analysis to evaluating the association between obesity status and the explanatory variables, not the direction of the effect. The explanatory variables were the presence of depression symptoms and socio-economic variables (age, marital status, education, and income), all in a dichotomous form. The main explanatory variable indicated the presence of 5 or more of the aforementioned depression symptoms, along with at least 1 core symptom. Non-married people of normal weight, not college educated, earning less than $15,000 a year, and less than 25 years of age were omitted.

Given that the literature consistently finds that the prevalence of obesity and that of depression are quite different by gender (2, 3, 21), the data set was split into female and male groups. Logistic regression was performed to estimate the presence, direction, and strength of the association between the explanatory variables and weight class. Separate regressions were performed for each weight class. In each regression the dichotomous dependent variable was fixed at 1 if the person belonged to that particular weight class and 0 if he or she belonged to any other weight group.

Results

Weight

In this sample, 70.0% of the respondents were overweight or obese; 39.6% of them were considered overweight, while 18.1% and 12.3% were obese class 1 or higher, respectively. When compared by gender, the prevalence rate of overweight was higher for males (46.9%) than it was for females (35.5%), but females (14.1%) had a higher class 2 or 3 obesity rate than did males (9.2%). There was no significant gender-based difference in the class 1 obese group.

Table 2. Body Mass Index Groups Distributed by Gender

BMI Range	Classification	All	Female	Male
18.5-24.9	normal weight	30.0%	32.4%	25.8%
25.0-29.9	overweight	39.6%	35.5%	46.9%
30.0-34.9	class 1 obesity	18.1%	18.1%	18.1%
35.0-39.9	class 2/3 obesity	12.3%	14.1%	9.2%

Symptoms of depression

The data also showed that a significant number of individuals had been, at some point in their lives, diagnosed with a depressive (20.1%) or an anxiety (16.5%) disorder. Such diagnoses were especially prevalent among women, 23.0% of whom reported having had a diagnosis of depression in their lifetimes. Results from the data show that 3.0% of the total sample reported having 5 or more symptoms of depression, while 3.6% reported having 3 to 4 symptoms for the last 14 days, including at least 1 of the 2 core symptoms described before. Symptoms of depression also varied by gender: women reported more symptoms of depression than men did. Figure 1 compares the prevalence rates of depressive symptoms among weight groups.

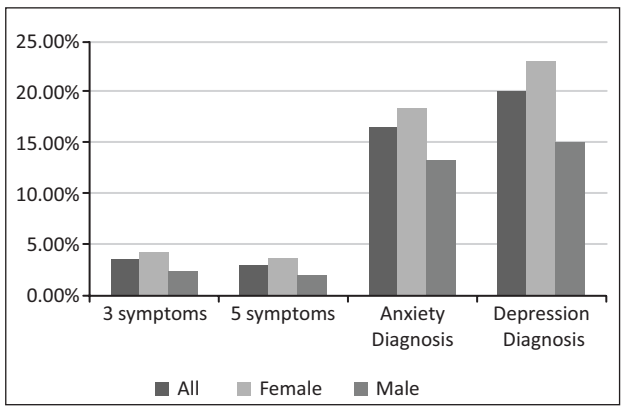

Figure 1. Symptom distribution for the total sample and by gender

Results from the logistic regression analyses for women are presented in Tables 3 and 4. Findings show that the presence of 5 symptoms in a given individual increased the likelihood of his or her suffering from obesity, especially the higher class of

obesity, but had no significant impact on the probability of that individual's being overweight. The socio-demographic variables were found to have several significant impacts. Having a college education decreased the likelihood of an individual's being obese (any class) but had no effect on his or her being overweight. Lower income was also significantly related to obesity. Age had no significance in terms of obesity class 2 or 3, but members of age groups including those over 46 years old had an increased likelihood of suffering from class 1 obesity or being overweight. Marital status was not significantly linked to obesity class 2 or 3; however, a given woman's being married increased her likelihood of being class 1 obese. Logistic regression analysis showed no significant association between the presence of 3 to 4 symptoms of depression and weight status.

Table 4 shows the results of the logistic regression analyses for men with 5 symptoms of depression. The presence of 5 symptoms of depression had no significant association with any weight group in men. As was the case with women, having a college education decreased the likelihood of an individual's being class 2 or 3 obese. Marital status had a significant impact on a given individual's likelihood of having class 2 or 3 obesity. Men with incomes over $15,000 ran a greater risk of being overweight than did their lower-income counterparts, but income level had no impact on obesity risk. Increasing age was significantly associated with men being overweight in all the age groups except that of 46 to 55 year olds, in which group no relationship between age and obesity was found. As was the case in females, the presence of 3 to 4 symptoms of depression was not associated with weight class.

Discussion

As was expected, the results show there to be an extremely high prevalence of adult obesity in Puerto Rico. About 30.4% of the sample was obese, while another 39.6% was overweight, which is slightly higher than what was found by Kaiser (5). Only 30.0% of the adult population of the island had a healthy weight. The prevalence of 5 or more symptoms of depression was estimated at 3.0%. This result is lower than that found by Strine and collaborators (16); this is because Strine utilized a different method for calculating depression. The higher

Table 3. Summary of Logistic Regression by BMI Group (Females)

	Obese 2/3				Obese 1				Overweight			
	OR	P-value	L.B. C.I.	U.B. C.I.	OR	P-value	L.B. C.I.	U.B. C.I.	OR	P-value	L.B. C.I.	U.B. C.I.
Five Symptoms	1.541	0.046	1.007	2.359	1.460	0.069	0.971	2.196	0.795	0.230	0.547	1.156
2006	1.413	0.001	1.163	1.717	0.820	0.022	0.692	0.971	0.974	0.703	0.849	1.117
College	0.586	0.000	0.469	0.734	0.819	0.048	0.672	0.999	1.060	0.472	0.904	1.243
Married	0.969	0.752	0.794	1.181	1.210	0.032	1.016	1.442	1.029	0.690	0.894	1.185
$15,000-$24,999	0.662	0.001	0.519	0.846	1.131	0.259	0.914	1.400	1.143	0.130	0.962	1.358
$25,000-$49,999	0.540	0.000	0.385	0.757	1.064	0.657	0.810	1.398	1.148	0.209	0.926	1.422
$50,000 or more	0.255	0.000	0.130	0.499	0.777	0.239	0.510	1.183	0.887	0.447	0.651	1.209
26-35 years	1.212	0.503	0.691	2.127	1.189	0.538	0.686	2.061	0.865	0.454	0.591	1.265
36-45 years	1.224	0.452	0.722	2.076	1.120	0.671	0.665	1.886	1.348	0.096	0.948	1.915
46-55 years	1.231	0.436	0.730	2.074	2.059	0.005	1.246	3.400	1.321	0.118	0.932	1.874
56-65 years	1.137	0.629	0.676	1.911	2.293	0.001	1.393	3.776	1.414	0.051	0.998	2.003
Over 65 years	1.274	0.347	0.769	2.109	1.626	0.056	0.988	2.674	1.090	0.624	0.773	1.537

Table 4. Summary of Logistic Regression by BMI Group (Males)

	Obese 2/3				Obese 1				Overweight			
	OR	P-value	L.B. C.I.	U.B. C.I.	OR	P-value	L.B. C.I.	U.B. C.I.	OR	P-value	L.B. C.I.	U.B. C.I.
Five Symptoms	1.725	0.182	0.775	3.837	0.961	0.921	0.439	2.103	0.743	0.345	0.401	1.377
2006	1.085	0.600	0.799	1.474	0.853	0.168	0.681	1.069	0.953	0.587	0.800	1.135
College	0.639	0.015	0.445	0.917	1.109	0.441	0.852	1.443	0.859	0.145	0.700	1.054
Married	1.406	0.052	0.998	1.981	1.225	0.114	0.952	1.576	1.084	0.408	0.896	1.311
$15,000-$24,999	0.829	0.321	0.572	1.201	1.048	0.740	0.793	1.387	1.212	0.081	0.977	1.504
$25,000-$49,999	0.838	0.457	0.526	1.334	0.904	0.571	0.638	1.281	1.544	0.002	1.181	2.019
$50,000 or more	0.676	0.222	0.361	1.267	0.905	0.651	0.586	1.397	1.475	0.026	1.048	2.075
26-35 years	0.834	0.653	0.378	1.840	1.104	0.743	0.610	1.998	1.668	0.025	1.067	2.605
36-45 years	1.127	0.744	0.548	2.317	1.588	0.099	0.916	2.754	1.533	0.049	1.002	2.343
46-55 years	1.470	0.280	0.731	2.956	1.387	0.247	0.797	2.414	1.407	0.115	0.920	2.153
56-65 years	0.740	0.410	0.362	1.514	1.144	0.631	0.661	1.981	1.744	0.008	1.153	2.639
Over 65 years	0.530	0.080	0.261	1.080	0.851	0.560	0.495	1.464	1.717	0.009	1.147	2.571

prevalence rates estimated in this paper are the product of a stricter interpretation of the disease/psychiatric condition than was used by Strine and his group (16).

Interestingly, findings did not show there to be a strong association between the symptoms of depression and class 1 obesity (those with a BMI between 30 and 34.9). A positive relationship between depression and weight was found only in women with one of the higher obesity class (BMI>35). This finding is congruent with the literature stating that, in women, severe obesity is a risk factor for depression. (6). As the literature suggests, this finding illustrates the gender-based differences that exist in the relationship between obesity and depression. It is relevant to point out that in the general population, depression is more prevalent in women than it is in men. Thus, it is not surprising to find the same pattern in the obese group. It is also possible that, as the literature suggests, the stigma associated with obesity may differ by gender (13). Thus the perceived emotional burden of obesity could be more distressing to women than it is to men. It could also be speculated that, because of the high rate of obesity in Puerto Rico, the impact of the stigma associated with being obese is not as severe as it is in other countries and so only the severely obese are at risk for depression.

Upon considering the socio-economic factors in the relationship between weight and symptoms of depression, it was found that education had an inverse relationship to class 2/3 obesity in women and men. As suggested by previous research (4, 22), high income was not associated with class 2 or class 3 obesity. Again, this finding is not surprising because highly educated people may be better informed of the healthy habits one can practice to avoid severe obesity. In the same way, individuals with high incomes have access to more resources for better care and to information that will help them to reduce severe obesity.

As mentioned earlier, the scientific literature linking obesity to depression is inconsistent. A thorough literature review did not identify any published study on depression and weight in Puerto Rico. As stated earlier, Strine et al (16) conducted a study examining the relationship between depression and obesity in a US sample that included Puerto Rico, but they did not report the results of that relationship by state. Therefore, the findings of this study represent an important first step in understanding the relationship between obesity and depression, two 2 health conditions that significantly affect the general functioning of a large number of adults in Puerto Rico. In summary, the results of this study show that depressive symptoms are associated with obesity, and this correlation seems to be more significant for women, especially those with severe obesity, less education, and/or lower income. It is important to note that the relationship between obesity and depression was also observed in those persons who reported the having only 3 symptoms of depression. Findings point to the existence of a high risk of co-morbid obesity and depression adults in Puerto Rico. The co-occurrence of these two health problems certainly limits the prognosis of any treatment for obesity. The inclusion of a mental health assessment, particularly one focusing on depression, when treating an obese person is extremely warranted. A psychological intervention should be part of both the prevention and treatment of obesity. In the same way, interventions to prevent obesity in those with depression are indicated. Clinicians treating depression might recommend physical activities and healthy diet to their patients to reduce the likelihood of the patients' developing obesity. Findings from this study have implications for public policy in Puerto Rico. The government needs to devote more resources to the prevention of obesity. Roberto and Brownell (23) propose that the main public policy should focus on the following areas: 1) school and work food environments, 2) food access and cost, 3) sugared-beverage consumption, 4) food marketing, and 5) restaurant food nutrition content and portions. Resources are also needed for evaluating the implementation and effectiveness of these efforts.

It is important to mention some methodological limitations of this study that could impact this paper's conclusions. This CDC dataset comes from a self-report measure that was obtained via telephone by individuals who are not mental health professionals. Thus, it seems prudent to conduct further research in order to collect data using diagnostic clinical interviews done by qualified mental health professionals to evaluate the full criteria for major depression and to evaluate as well whether those who are overweight or obese (BMI 25-35) show signs of being at risk for depression. It is also recommended that the current weight and height of each individual who participates in such a study be obtained. An assessment of the mediators and moderators of the relationship between obesity and depression are needed if future researchers are to have a better understanding of these co-morbid conditions. In addition, for further research, longitudinal data is crucial. Possible causality issues and time effects could be better controlled by conducting a measure over a certain length of time. Despite these limitations, it can be concluded that obesity and depression have a significant association, especially in women in Puerto Rico, and the implications of this association cannot be ignored when preventing and treating obesity in adults in Puerto Rico .

Resumen

Objetivo: Este estudio determina la prevalencia de sobrepeso, obesidad clase 1 y 2/3 y los síntomas de depresión de adultos en Puerto Rico. El estudio también evaluó la relación entre los síntomas de la depresión y el sobrepeso. Métodos: La muestra para este estudio consta de 6,025 adultos quienes viven en Puerto Rico y participaron en el BRFSS del 2006 o 2010. Resultados: El 70.0% de los encuestados estaban sobrepeso u obesos. El 39.6% de los participantes estaban sobrepeso, mientras que el

18.1% estaban obesos clase 1 y 12.3% clase 2 ó 3. La tasa de prevalencia de sobrepeso fue mayor en los hombres (46.9%) que en las mujeres (35.5%), pero las mujeres (14.1%) tenían un nivel superior de obesidad tipo 2 ó 3 que los hombres (9.2%). No hubo diferencia significativa en el grupo de obesos tipo 1 por género. Los resultados no mostraron una fuerte asociación entre los síntomas de la depresión y la obesidad tipo 1 (aquellos con un índice de masa corporal [IMC] entre 30 y 35). Una relación positiva entre la depresión y el peso se encontró sólo para tipos más elevados de obesidad en las mujeres (IMC>5). Conclusión: Los resultados de este estudio muestran que los síntomas depresivos se asocian con la obesidad, y esta correlación parece ser más importante para las mujeres, especialmente aquellas con obesidad severa, menor educación e ingresos bajos. Los resultados sugieren un alto riesgo para la obesidad y la depresión co-mórbida en adultos en Puerto Rico.

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