



Are the Obese at Greater Risk for Depression?

Robert E. Roberts,¹ George A. Kaplan,² Sarah J. Shema,³ and William J. Strawbridge³

Two waves of data from a community-based study (Alameda County Study, 1994–1995) were used to investigate the association between obesity and depression. Depression was measured with 12 items covering *Diagnostic and Statistical Manual of Mental Disorders: DSM-IV* diagnostic criteria for major depressive episode. Following US Public Health Service criteria, obese subjects were defined as those with body mass index scores at the 85th percentile or higher. Covariates were age, sex, education, marital status, social isolation and social support, chronic medical conditions, functional impairment, life events, and financial strain. Results were mixed. In cross-sectional analyses, greater odds for depression in 1994 were observed for the obese, with and without adjustment for covariates. When obesity and depression were examined prospectively, controlling for other variables, obesity in 1994 predicted depression in 1995 (odds ratio (OR) = 1.73, 95% confidence interval (CI): 1.04, 2.87). When the data were analyzed with obesity defined as a body mass index of ≥ 30 , cross-sectional results were the same. However, the prospective multivariate analyses were not significant (OR = 1.43, 95% CI: 0.85, 2.43). Although these data do not resolve the role of obesity as a risk factor for depression, overall the results suggest an association between obesity and depression. The authors found no support for the “jolly fat” hypothesis (obesity reduces risk of depression). However, there has been sufficient disparity of results thus far to justify continued research. *Am J Epidemiol* 2000;152:163–70.

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Are the obese at greater risk for depression? The answer to this question would seem to turn on a single question of fact: Do the obese have higher rates of depression, or do they not?

Given the known deleterious health effects of obesity, in particular severe obesity (1–7), one might assume that the question of its effects on psychiatric disorder would be well-established. This is not the case, however. Perusing the literature bearing on this question of fact, we found some studies that showed increased risk for depression among the obese, others showed decreased risk for depression among the obese, and still others have shown no effect of obesity on risk for depression (7).

In one of the early studies, Crisp and McGuiness (8) found that obesity was related to low levels of anxiety in both middle-aged women and men and to low levels of

depression in men. This “jolly fat” hypothesis was subsequently reexamined in a more rural sample, and the same result was found for middle-aged men. However, the association was much weaker for women overall, obesity being related to low anxiety in older, working class women and to low depression in younger, middle class women. There was no association between obesity and depression in younger men (9).

Reed (10), using data from the First National Health and Nutrition Examination Survey (NHANES I), found that obesity was related to worse mental health in both White women and Black women. Regression analyses identified young, more educated, obese females as a subgroup with worse mental health (mostly symptoms of anxiety and depression). Hällström and Noppa (11) studied women aged 38–54 years and found no association between obesity and present or past mental illness (including anxiety, phobias, depression, contact with psychiatrists, or use of psychotropic drugs). Six years later, this sample of women was followed up (12) to examine the association between weight gain and other factors. There was a positive association between weight gain and depression but not anxiety, phobias, or use of psychotropic drugs. Istavan et al. (13) used baseline data from the NHANES I study and found that relative body weight was weakly related to elevated depression scores in women but not men.

Ross (14), using data from a representative sample of 2,020 adults 18 years and older, found no direct effect of being overweight in most groups. Overweight persons were more likely to diet and to experience worse physical health,

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Abbreviations: CI, confidence interval; DSM-IV, *Diagnostic and Statistical Manual of Mental Disorders: DSM-IV*; NHANES I, First National Health and Nutrition Examination Survey; OR, odds ratio; USPHS, US Public Health Service.

¹Department of Behavioral Sciences, School of Public Health, The University of Texas at Houston Health Science Center, Houston, TX.

²Department of Epidemiology, School of Public Health, University of Michigan, Ann Arbor, MI.

³Human Population Laboratory, Public Health Institute, Berkeley, CA.

both of which were associated with depression. However, being overweight increased depression among the more educated (but not among the less educated). Palinkas et al. (15) found that obesity was not related to risk for depression in women aged 50–89 years, but among men depression was inversely related to obesity, thus partially confirming the “jolly fat” hypothesis.

More recently, Han et al. (16) found no overall association between obesity and mental health functioning using the mental health measure from the SF-36 in a sample aged 20–59 years in the Netherlands. However, men in the highest tertile for obesity were more likely to report not being happy, and women in the highest tertile for obesity were more likely to report depressed mood.

At this point, the preponderance of evidence suggests that obesity may be implicated in the etiology of depression. We say “may be implicated” for several reasons. First, as noted, there have been a limited number of studies that have focused on obesity and depression. Second, five of nine studies have reported at least some evidence of an association between obesity and depression such that the obese have higher rates of depression. Third, none of the studies cited above reporting evidence to support a link between obesity and increased risk for depression have been based on prospective data. This is a key issue, because while prevalence studies can provide evidence for covariation of obesity and depression, they do not allow us to address the question of whether obesity is related to the onset of depression. To answer this question, we need prospective studies that examine the occurrence of future depression in those with and without obesity at baseline. This is critical, since it is generally assumed that the causal structure producing morbidity is different before and after depression has occurred. In other words, factors that cause the disorder may be different from those that sustain or prolong it (17, 18). The only prospective study to date had as its focus the association between depression at baseline and subsequent risk of weight gain. Noppa and Hällström (12) found that middle-aged women who were more severely depressed at baseline and who had a greater degree of disability were at greater subsequent risk for weight gain. They did not address the issue of whether obesity increased risk for depression.

The consequences of obesity for physical health, as noted above, are reasonably well-established. By examining the mental health consequences, we hope to not only provide additional data on the negative impact of obesity on well-being but also increase our understanding of risk factors for depression. Since there have been no prospective studies specifically examining the future risk for developing depression among the obese and nonobese, our purpose here is to investigate this association using prospective data. That is, we examine the risk for depression at follow-up occurring among the obese and nonobese at baseline who did not meet diagnostic criteria for major depression at baseline. To our knowledge, the research reported here is the first attempt to use epidemiologic methods and data from a community-based, prospective study to further clarify the role of obesity in risk for depression.

MATERIALS AND METHODS

The mental and physical health of a community sample in Alameda County, California, has been studied for over 29 years (19). In 1994, a fourth wave of data was collected on subjects 46–102 years of age. As part of this follow-up study, data on major depression were obtained using criteria from the *Diagnostic and Statistical Manual of Mental Disorders*. In addition, extensive data on putative risk factors were collected, including data on social and physical functioning. In 1995, another follow-up survey was conducted. This permitted examination of the effects of obesity on depression with prospective data.

Using data from the 1994 and 1995 surveys, we estimated the prevalence of symptoms of *Diagnostic and Statistical Manual of Mental Disorders: DSM-IV* (DSM-IV) major depressive episodes in the Alameda County Study cohort and examined associated risk factors (in particular the effects of obesity) in a cohort aged 50 years and older. We examined the prevalence of obesity; its association with major depressive episodes; and the contribution of other putative risk factors for major depressive episodes, specifically, sex, marital status, socioeconomic status, physical health and disability, life stress, and social support.

Sample

The sample was drawn from the Alameda County Study, a longitudinal study of physical and mental health and mortality that has followed a cohort of 6,928 persons selected in 1965 to represent the adult noninstitutionalized population of Alameda County, California. Subjects are followed regardless of subsequent location or disability status. Survivors were interviewed previously in 1974 and 1983 (50 percent sample), with response rates of 85 percent and 87 percent, respectively. Detailed design and sampling procedures for this study have been reported elsewhere (19, 20).

Our analyses are based on data from the 1994 follow-up sample that included 2,730 subjects aged 46–102 years who responded to the survey (93 percent of those eligible). In 1995, all those who completed a questionnaire in 1994 were contacted again. Of these 1994 respondents, 2,661 able to participate were relocated and 2,570 completed a brief version of the 1994 questionnaire that focused primarily on health and functional status. The analyses reported here are based on a subsample ($n = 2,298$) in which respondents were 50 years or older in 1994, had complete data on the measure of depression in 1994 and 1995, and had complete data on the 1994 risk factor measures including body mass index. The mean age was 64.7 (range, 50–95) years.

Measures

The measure of depression comprised 12 items that operationalized the diagnostic symptom criteria for a major depressive episode outlined in DSM-IV (21). Designated the DSM-12D (for the 12-item scale for depression in the *Diagnostic and Statistical Manual of Mental Disorders*), the items or symptom queries were adapted from the PRIME-

MD mood disorders section (22). The items are presented in table 1. The probe statement inquires whether the respondent felt that way *nearly every day for the past 2 weeks* (yes/no). The measure can be used to estimate the prevalence of major depressive episodes. "Cases" of major depressive episode were identified as subjects in 1994 or 1995 who experienced depressed mood and/or anhedonia *almost every day for the past 2 weeks* and who also experienced four other symptoms of depression, as specified in the DSM-IV (21, pp. 339-45). Operating characteristics of this measure in the Alameda County Study cohort have been reported previously (23, 24).

Every wave of the Alameda County Study except 1995 has included items inquiring about height (without shoes) in feet and inches and weight (without heavy clothes) in pounds. These are converted to kilograms of weight and meters of height to calculate the body mass index (weight (kg)/height (m)²). In these analyses, separate body mass index cutpoints were used for men and women, with those in the 0-15th percentile as low (underweight), 16-84th percentile as normal, and 85th percentile and above as high (obese). We used age- and sex-specific body mass index values, by decade of age, beginning with those aged 45-54 years, developed by the US Public Health Service (USPHS) (25). Subjects who were older than the upper age category (65-74 years) used by the USPHS were categorized using the same percentile as this age group.

Other risk factors (correlates) examined were age, sex, education, marital status, social isolation, social support, life events, financial strain, problems with normal daily activities, and chronic medical conditions. These factors can be categorized as status attributes, psychosocial resources, and stressors and are widely considered to be important determinants of risk for depression (18, 26, 27).

Age was categorized as 50-59, 60-69, 70-79, and 80 years or older. Educational attainment was dichotomized: 12 years or less and more than 12 years. Marital status also was dichotomized: married versus other (divorced, sepa-

rated, widowed, never married). Our measure of isolation consisted of six items: "1) How many friends can you confide in, 2) how many relatives do you feel close to, 3) how many friends and relatives do you see at least once a month, 4) how many friends and relatives can you turn to for help, 5) how many friends and relatives can you talk to about personal matters, and 6) how many friends and relatives do you have you can ask for advice or information." A score of less than three on each question was considered an isolated response. The number of isolated responses was summed and coded into low (i.e., 0), medium (i.e., 1-2), and high (i.e., 3+) social isolation. Our measure of social support asked, "How often is the following available to you: 1) someone to take you to the doctor, 2) someone to prepare meals for you, 3) someone to help you with your daily chores if you are sick, and 4) someone to loan you money if you need it." Each question was scored from zero (*none of the time*) to four (*all of the time*) and then summed into a total scale ($\alpha = 0.90$). The scale was divided into low (i.e., 0-9), medium (i.e., 10-15), and high (i.e., 16+) support.

We also asked subjects about whether any of 17 life events had occurred in the current or previous year, that is, 1993. The total number of recent events was then summed. Financial strain consisted of five items that inquired, "How many times there was not enough money: 1) to buy clothes, 2) to fill a prescription, 3) to see a doctor, 4) to pay rent or mortgage, and 5) to buy food." Not having enough money on any one item was coded as financial strain.

We asked about the occurrence of 12 chronic medical conditions (heart trouble, high blood pressure, asthma, chronic bronchitis, arthritis, emphysema, diabetes, stroke, cancer, cataracts, osteoporosis, and circulatory problems) in the last 12 months and whether a physician had been consulted. We also asked respondents if they had "difficulty with usual daily activities such as: 1) walking across a small room, 2) bathing, 3) brushing hair or washing face, 4) eating, 5) dressing, 6) moving from bed to a chair, and 7) using the toilet." Any difficulty on any item was classified as having a problem with usual daily activities.

In terms of age, 37.2 percent of the sample were 50-59, 29.5 percent were 60-69, 24.1 percent were 70-79, and 9.3 percent were 80 years or older. The age range was 50-95 years. Females comprised 55.8 percent of the sample. Most of the sample were married, with 28.8 percent reporting that they were divorced, separated, widowed, or never married.

Statistical analysis

The prevalence of obesity in 1994 by age and depression was calculated, and differences in proportions were tested with a chi-square statistic. Separate logistic regression models were used to estimate the odds of depression by all risk factors measured in 1994. Sequential logistic regression models, adding covariates in groups, were used to assess the association between risk factors measured in 1994 and subsequent depression in 1995, after excluding people who were depressed in 1994.

TABLE 1. Symptom queries in the DSM-12D,* Alameda County, California, 1994-1995

Feeling sad, blue, or depressed
Loss of interest or pleasure in most things
Feeling tired out or low on energy most of the time
Loss of appetite or weight loss
Overeating or weight gain
Trouble falling asleep or staying asleep
Sleeping too much
More trouble than usual concentrating on things
Feeling down on yourself, no good, or worthless
Being so fidgety or restless that you moved around a lot more than usual
Moved or spoke so slowly that other people could have noticed
Thought about death more than usual, either your own, someone else's, or death in general

* DSM-12D, 12-item scale for a major depressive episode outlined in the *Diagnostic and Statistical Manual of Mental Disorders: DSM-IV*, 4th ed.

RESULTS

The sample was categorized as 71.9 percent normal relative weight, 14.3 percent underweight, and 13.8 percent obese. Table 2 presents data on body mass index categories by age in 1994. There was a significant association, with relatively more of those 80 years or older being underweight and fewer being overweight ($p < 0.001$).

Table 3 presents data on the association between body mass index category and depression in 1994. Those categorized as obese were significantly more likely to be depressed than were those who were either normal or underweight ($p < 0.001$). Those who were obese were twice as likely to report symptoms of depression as were those with normal weight. The prevalence of major depressive episode among the obese was 15.5 percent.

The associations between each of the putative risk factors, including obesity measured in 1994 and depression in both 1994 and 1995, are presented in table 4. Greater odds for 1994 depression were observed for the obese, women, the unmarried, the less educated, those with one or more chronic medical conditions, those with functional impairments (usual daily activities), those with financial problems, those with three or more recent life events, the more isolated, and those with less social support. The strongest association was for usual daily activities (odds ratio (OR) = 6.27), followed by two or more chronic medical conditions (OR = 3.68). To estimate the relative risk for depression in 1995 among the obese and nonobese in 1994, we eliminated all subjects who met diagnostic criteria for major depressive episode in 1994. Again, greater relative risk for future depression was observed for the obese, as well as for those 80 years and older, females, those with two or more chronic conditions, those with usual daily activities, those with financial problems, those with three or more life events, and those who were more isolated.

We next examined the risk for depression in 1995 by body mass index categories at baseline, also excluding those who were depressed in 1994. That is, we eliminated all subjects who met DSM-IV criteria for a major depressive episode at baseline. We then used sequential logistic regression analysis to assess risk for depression in 1995. As can be seen in table 5, the obese in 1994 were more likely to report depression in 1995 (OR = 1.91). When we introduced controls for age, sex, marital status, and education, the odds ratio

TABLE 2. Prevalence of obesity by age in 1994, Alameda County, California, 1994-1995*

Age in 1994 (years)	Underweight (%) (n = 329)	Normal weight (%) (n = 1,652)	Obese (%) (n = 317)
50-59	11.7	70.9	17.4
60-69	14.6	70.9	14.5
70-79	14.7	75.2	10.1
≥80	23.0	70.4	6.6
Total	14.3	71.9	13.8

* $p = 0.001$.

TABLE 3. Prevalence of symptoms of DSM-12D* major depression by level of obesity in 1994, Alameda County, California, 1994-1995†

1994 Weight‡	1994 Depression	
	Depressed (%) (n = 200)	Not depressed (%) (n = 2,098)
Underweight	8.8	91.2
Normal	7.4	92.6
Obese	15.5	84.5

* DSM-12D, 12-item scale for a major depressive episode outlined in the *Diagnostic and Statistical Manual of Mental Disorders: DSM-IV*, 4th ed.

† $p = 0.001$ (chi square).

‡ Based on body mass index.

changed little and remained significant (see model 2). When we introduced controls for usual daily activities and chronic conditions (model 3), financial strain and life events (model 4), and social isolation and social support (model 5), the odds ratios for obesity and depression were reduced slightly but remained statistically significant in each model. Thus, obesity at baseline was significantly associated with depression a year later, even when controlling for an array of psychosocial risk factors, all of which were associated with depression at baseline. In the best case scenario, there was a 70 percent increase in odds for depression prospectively for those obese at baseline, net of the effects of the covariates examined.

What about the other factors? Prospectively, women (OR = 1.80), those with two or more chronic conditions (OR = 2.00), those with usual daily activities (OR = 2.04), and those with moderate or high isolation (OR = 1.99 and 3.01) had greater odds of depression, controlling for each of the other putative risk factors (data not shown).

DISCUSSION

We began this paper by asking whether the obese are at increased risk for depression. Using prospective data from the Alameda County Study, we found the answer is yes and no. Overall, 15.5 percent of our sample who were classified as obese in 1994 met symptom criteria for DSM-IV major depression during the previous 2 weeks. This was about double the rate for those with normal relative weight and those underweight ($p < 0.001$). The prevalence of depression among the obese using international criteria (body mass index ≥ 30) was 14.0 percent, compared with 7.5 percent among those with normal weight. Excluding those who met DSM-IV symptom criteria for a major depressive episode at baseline, those who were obese at baseline using USPHS obesity criteria had increased odds of major depressive episode 1 year later. This was true in both univariate analyses and in a series of multivariate analyses controlling for a number of covariates that affect risk for depression. There was no depression effect for those who were underweight at baseline.

In bivariate analyses using 1994 baseline data, the association between depression and obesity was comparable in

TABLE 4. Univariate odds ratios of DSM-12D* major depression in 1994 and 1995 by 1994 risk factors, Alameda County, California, 1994-1995

Risk factor, 1994	Odds ratios for depression, 1994	95% CI*	Odds ratios for depression, 1995†	95% CI
Body weight				
Normal	1.00		1.00	
Underweight	1.21	0.79, 1.85	1.02	0.58, 1.80
Obese	2.29	1.61, 3.27	1.91	1.18, 3.08
Age (years)				
50-59	1.00		1.00	
60-69	0.82	0.56, 1.20	0.97	0.59, 1.60
70-79	1.31	0.91, 1.89	1.35	0.83, 2.21
≥80	1.56	0.97, 2.51	2.02	1.11, 3.68
Sex				
Male	1.00		1.00	
Female	1.56	1.15, 2.11	1.62	1.09, 2.41
Marital status				
Married	1.00		1.00	
Divorced, separated, widowed, never married	1.62	1.20, 2.19	1.11	0.73, 1.68
Education				
≥12 years	1.00		1.00	
<12 years	1.89	1.33, 2.67	1.55	0.97, 2.49
Chronic conditions				
None	1.00		1.00	
1	1.73	1.15, 2.58	1.48	0.90, 2.43
≥2	3.68	2.56, 5.28	2.75	1.75, 4.34
Activities of daily living				
No problems	1.00		1.00	
Problems	6.27	4.48, 8.77	3.09	1.87, 5.12
Financial problems				
No problems	1.00		1.00	
Any problems	3.41	2.50, 4.66	1.88	1.20, 2.95
Recent life events				
None	1.00		1.00	
1	1.18	0.80, 1.74	1.16	0.72, 1.87
2	1.45	0.96, 2.19	0.91	0.51, 1.62
≥3	1.91	1.27, 2.86	1.70	1.01, 2.85
Social isolation				
Not isolated	1.00		1.00	
Moderate isolation	1.48	1.00, 2.20	1.91	1.17, 3.12
High isolation	3.30	2.31, 4.73	2.86	1.77, 4.61
Social support				
High	1.00		1.00	
Moderate	1.87	1.30, 2.70	1.19	0.77, 1.84
Low	3.15	2.16, 4.59	1.45	0.89, 2.36

* DSM-12D, 12-item scale for a major depressive episode outlined in the *Diagnostic and Statistical Manual of Mental Disorders: DSM-IV*, 4th ed; CI, confidence interval.

† Excludes those depressed in 1994 ($n = 2,098$).

magnitude with other risk factors such as sex, marital status, education, and stressful life events. The strongest correlates

of depression were chronic health problems and functional disability, particularly the latter (OR = 6.27).

TABLE 5. Sequential logistic regression models showing relation between obesity in 1994 and depression in 1995, with adjustment for other 1994 risk factors, Alameda County, California, 1994–1995

Risk factor, 1994	Body weight	Odds ratios for depression, 1995*	95% CI†
Model 1 (crude body weight alone)	Normal	1.00	
	Underweight	1.02	0.58, 1.80
	Obese	1.91	1.18, 3.08
Model 2 (model 1 + age, sex, marital status, education)	Normal	1.00	
	Underweight	0.90	0.50, 1.60
	Obese	2.08	1.28, 3.39
Model 3 (model 2 + chronic conditions, activities of daily living)	Normal	1.00	
	Underweight	0.96	0.53, 1.71
	Obese	1.78	1.08, 2.92
Model 4 (model 3 + financial strain, life events)	Normal	1.00	
	Underweight	0.95	0.53, 1.70
	Obese	1.69	1.02, 2.80
Model 5 (model 4 + social isolation and support)	Normal	1.00	
	Underweight	0.89	0.49, 1.60
	Obese	1.73	1.04, 2.87

* Excludes people depressed in 1994 ($n = 2,098$).

† CI, confidence interval.

How do our results compare with those from other studies? This comparison is easy: No other study published to date has shown such an adverse effect of obesity on risk for depression. The results are all the more noteworthy, generated as they are from a relatively large, prospective community survey using multivariate analyses to examine and control for an array of putative risk factors for depression in addition to relative body weight.

As noted earlier, only one other study has investigated the mental health effects of obesity using data from a prospective study (12). Those more severely depressed at baseline and who had a greater degree of disability were at greater subsequent risk for weight gain. Noppa and Hällström concluded that psychosocial factors might be of causal importance for the development of obesity.

There also is evidence from clinical studies. In this case, studies have examined differences between obese individuals presenting for weight loss and general population controls on measures of depression. Using a meta-analysis of such studies, Friedman and Brownell (7) found a moderate effect, and this result was consistent across studies; the obese presenting for weight loss were more depressed.

Thus, the data we present are the first epidemiologic data from a prospective study and the data appear unambiguous. Among those obese and not depressed at baseline, there was almost a twofold risk of meeting DSM-IV symptom criteria for major depression 1 year later. The cross-sectional results using 1994 data are essentially the same, demonstrating about a twofold increased risk for depression among the obese.

Five cross-sectional studies also have found an association between depression and body weight. One study (10)

studied only women using data from NHANES I, while the other (13) found the same association among women using a different measure of depression from NHANES I. This latter study, however, found no association between obesity and depression among men. Ross (14) found an association between being overweight and depression, but this effect was limited to those with higher education. There was no effect among the less educated. Although not measuring depression specifically, one study of a general population sample has reported that the obese are more likely to report symptoms of depression such as unhappiness and depressed mood (16).

In the only other study that focused on subjects 50 years and older, Palinkas et al. (15) found no association between obesity and depression among women. However, both overweight and obese men were at much lower risk for depression than were men of normal weight. They argue these results for men are consistent with the "jolly fat" hypothesis. Thus, at this point, the only two studies of older samples have found very different results. The most likely explanation for these disparate results relates to differences in the populations studied and the procedures used, particularly the measures of depression and the classification of obesity.

Palinkas et al. (15) used the Beck Depression Inventory (28) as a categorical measure. While our measure is different, incorporating DSM-IV diagnostic criteria, we doubt whether this accounts for the observed differences. We used the USPHS guidelines for scoring the body mass index. Palinkas et al. used the international convention of <25, 25–29.9 (overweight), and >30 (obese) kg/m². We reanalyzed our data using this criterion for obesity. The odds ratio for depression in 1995, excluding those who were depressed in 1994, was still significant for those with a body mass index of ≥ 30 (OR = 1.67, 95 percent confidence interval (CI): 1.02, 2.74). However, when we adjusted for the covariates as we did in table 5, the association between 1994 obesity and 1995 became nonsignificant (OR = 1.43, 95 percent CI: 0.85, 2.43). The results suggest that differences in the definition of obesity affect the estimate of the risk for depression.

One possible explanation is that the USPHS criteria for obesity are based on the upper 15th percentile for specific age and sex groups. The criteria used by Palinkas et al. (15), which are the international guidelines, use the same categories for everyone. A cross-tabulation of the two sets of categories revealed that the USPHS definition of obese is more restrictive, including only 317 individuals compared with 385 using the international definition. This suggests that the more severely obese are at greater risk for depression. However, even though the multivariate results were different, there was still no protective effect observed for obesity. Those who were fat were not more jolly. Still, our two different results add to the body of disparate data.

On the basis of our results presented here and of the results from the other studies we presented, we conclude that the obese may be at increased risk for depression. However, there has been sufficient diversity in results from epidemiologic studies to justify further examination of this issue. In particular, we need more data from long-term,

prospective studies using contemporary diagnostic criteria for depression. To date, ours is the only study to use DSM-IV diagnostic criteria to assess depression. Ours is the only prospective study to date looking at future risk for depression among the obese.

One obvious limitation of our study is that, although we had a prospective study design, we had measures of height and weight only in 1994. Lack of data on body mass index in 1995 precluded an examination of the alternate hypothesis that depression increases the risk for obesity. At least one study (12) has reported that depression at baseline is related to subsequent weight gain, at least among women. There also is considerable evidence from clinical studies to suggest possibly reciprocal effects between depression and obesity (7). Measures of obesity and mental health over two, preferably three or more, waves are needed to address the question of reciprocal effects. Major depression can be a chronic, intermittent disorder, and to understand more fully its association with another condition, such as obesity, ideally requires data on lifetime episodes. We did not have data on the lifetime prevalence of major depressive episode, nor did we have information on treatment for depression. As noted earlier (17, 18), in the absence of prospective data, it is not possible to identify what the etiologic role of obesity in depression might be, if any.

Several studies also have examined obesity and anxiety (8, 9, 11, 12). These results have been mixed as well, with some supporting the jolly fat hypothesis and others providing no support. The Alameda County Study did not include a measure of anxiety per se, so we could not examine the effect of obesity on that outcome. Given the inconclusive results thus far, more research certainly is warranted on the association between obesity and anxiety.

A number of explanations for a relation between obesity and mental health, particularly depression, have been offered, including the possible role of psychologic, sociologic, and biologic factors (7, 14, 15). Ross (14), for example, has outlined two possible explanations for an association between obesity and depression. One, the reflected self-appraisal perspective, argues that the stigma toward and devaluation of the obese may cause overweight individuals to suffer lower self-esteem, have more negative self-images, think others dislike them, and have higher levels of depression. The less common, normal, and acceptable it is to be overweight in a group, the greater should be the psychologic impact. The second, the fitting norms of appearance perspective, argues that, for those who are obese, fitting the norm for weight is stressful because dieting is stressful rather than obesity per se. This may be particularly true when weight control is not successful, which is commonly the case (2). Ross (14) presents data supporting the fitting norms of appearance hypothesis but found little support for the reflected appraisal hypothesis. These competing perspectives offer plausible explanations for sociocultural processes linking obesity with psychologic dysfunction. However, to date there have been no attempts to replicate or extend the research by Ross.

Palinkas et al. (15) note that obesity also might be associated with depression through differential consumption of

nutrients affecting depression, in particular, carbohydrates. Consumption of carbohydrates appears to affect the vegetative symptoms of depression via central serotonergic activity while also affecting weight per se (29-32). Obese people also are less likely to exercise, and physical activity reduces the risk of depression by increasing levels of endorphins, improved regulation of norepinephrine, improved fitness, and enhanced self-esteem (33, 34).

There is also evidence, albeit limited, that first-degree relatives of probands with morbid obesity are more likely to have mental disorders, particularly depression, bipolar disorder, and antisocial personality disorders (35), than are relatives of controls. From these data, however, it is not possible to partition variance attributable to genetics versus environment. But the results provide additional evidence for a link between obesity and psychopathology.

Obesity is a complex phenomenon. There is now good evidence for important genetic and physiologic components in the etiology of obesity and for obesity being quite heterogeneous with regard to etiology, effects of obesity on health, and response to treatment (2, 3, 8).

Further conjecture as to possible contributory factors would seem premature, however, until an etiologic link between obesity and psychologic dysfunction has been more clearly established. We agree with Friedman and Brownell (7) that little information exists on the presence or nature of causal relations between obesity and psychopathology, and that the next generation of studies should focus on which subgroups of the obese have more psychologic dysfunction, the nature of the dysfunction, and associated risk and protective factors. Studies also are needed that focus on whether there are mental health effects of obesity and whether these effects are specific to particular mental health outcomes or are more generic in nature. Data also are needed on the natural history of obesity and mental health to ascertain the nature and magnitude of reciprocal effects and the implications of such effects for prevention and treatment.

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