

Are the Fat More Jolly?

Robert E. Roberts, Ph.D.

The University of Texas Health Science Center at Houston
School of Public Health

William J. Strawbridge, Ph.D. and Stephane Deleger, M.S.

Human Population Laboratory
Berkeley, California

George A. Kaplan, Ph.D.

University of Michigan
School of Public Health

ABSTRACT

Does obesity affect mental health? Two waves of data from a panel study of community residents 50 years and older were used to investigate the association between obesity and eight indicators of mental health: happiness, perceived mental health, life satisfaction, positive affect, negative affect, optimism, feeling loved and cared for, and depression. For none of the eight mental health outcomes examined did we observe a protective effect for obesity. Either no association was observed between obesity and psychological functioning, or the obese were worse off. Using 1994–1999 prospective data, the obese were at increased risk for poorer mental health on five of the outcomes examined using bivariate analyses. However, controlling for mental health problems at baseline and using statistical controls for covariates, the increased relative risk was limited to depression. There has been sufficient disparity of results thus far to justify further research on this question.

(Ann Behav Med 2002, 24(3):169–180)

INTRODUCTION

Given the known deleterious health effects of obesity, in particular severe obesity (1–7), one might assume that the question of its effects on mental health would be well established. This is not the case, however. Perusing the literature bearing on this question of fact, two things are readily apparent. First, there has been surprisingly little research on this subject (4,8). Second, the results from the studies that have been done provide little clarification.

This article is the revision of a paper presented at the Annual Meeting of the Society for Behavioral Medicine, April 2000, Nashville, Tennessee. This research was supported in part by Grant No. 1R37AG11375 from the National Institute on Aging to Dr. George A. Kaplan and by the Prevention Health Services Block Grant from the Centers for Disease Control and Prevention.

Reprint Address: R. E. Roberts, Ph.D., The University of Texas Health Science Center at Houston, P.O. Box 20186, Houston, TX 77225.
E-mail: rerober@sph.uth.tmc.edu

© 2002 by The Society of Behavioral Medicine.

In one of the early studies, Crisp and McGuiness (9) 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, leading them to surmise that the fat are more “jolly.” This “jolly fat” hypothesis was reexamined in a subsequent study, and the same result was found for middle-aged men but not for younger men, and the association was much weaker for women (10).

Kittel, Rustin, Dramaix, De Backer, and Kornitzer (11), in a sample of men ages 40 to 59, found that the obese were less neurotic and more extroverted than the nonobese. Segers and Mertens (12) found that their obese participants did not have increased risk of anxiety and depression compared with those who were normal weight. Stewart and Brook (13), in a sample aged 14 to 61, found that heavier people were less anxious and less depressed. No association was observed between obesity and positive well-being. Reed (14), using data from the first National Health and Nutrition Examination Survey (NHANES I), found that obesity was related to worse mental health among women. However, Faubel (15) found no association between obesity and depression in a small sample of women. Hällström and Noppa (16) studied women 38 to 54 years of age and found no association between obesity and present or past mental illness. A 6-year follow-up found a positive association between weight gain and depression but not anxiety, phobias, or use of psychotropic drugs (17). Istvan, Zavela, and Weidner (18) used baseline data from NHANES I and found that relative body weight was weakly related to elevated depression scores in women but not in men. Homer and Utermohlen (19), using data from a female college sample, found that obesity was significantly correlated with depression scores but not anxiety scores.

Ross (20), using data from a representative sample of 2,020 adults 18 years and older, found no direct effect of being overweight on depression in most groups. Being overweight did increase depression among the more educated but not among the less educated. Palinkas, Wingard, and Barrett-Connor (21) found that obesity was not related to risk for depression in women aged 50 to 89, but among men depression was inversely related to obesity, thus partially confirming the “jolly fat” hypothesis. Han, Tijhuis, Lean, and Seidell (22) found no association between obesity and mental health functioning overall using the mental health measure from the Short Form-36 in a

sample aged 20 to 59 in the Netherlands. Carpenter, Hasin, Allison, and Faith (23), using data from a large national sample from the United States, found that obesity was associated with increased risk of depression and suicidal ideation among women but not men. Roberts, Kaplan, Shema, and Strawbridge (24) found a strong relationship (odds ratio [OR] = 2.0) between obesity and prevalence of depression. Obesity at baseline also predicted depression at follow-up 1 year later using U.S. Public Health Service obesity criteria (body mass index [BMI] \geq 85th percentile) but not using international criteria for obesity (BMI \geq 30).

Based on the evidence thus far, the effects of obesity on mental health functioning are unclear. Do the obese have worse mental health? Or, as Crisp and McGuinness (9) suggested a quarter century ago, are the fat more jolly? As our brief review indicates, the evidence on this question is mixed. Of the previous studies, six have found a protective effect for obesity (9–11,13,21,22), seven have found at least some evidence that obesity has a negative effect on mental health (14,17–20,23,24), and three have found no association between obesity and mental health (12,15,16). Given these disparate results thus far, our purpose was to further investigate the role of body weight in mental health functioning. Specifically, we reexamined the “jolly fat” hypotheses using data from a sample of persons 50 years old and older followed prospectively for 5 years. To our knowledge, only one other study (24) has examined obesity as a risk or protective factor for mental health outcomes using prospective data. The remaining studies were based on prevalence data. This is a critical constraint on existing evidence because although prevalence studies can provide evidence for covariation of obesity and mental health, they do not allow us to address the question of whether obesity is related to the onset of mental health problems. To answer this question, we need prospective studies that examine the occurrence of future psychological dysfunction in those with and without obesity at baseline. This is critical because it is generally assumed that the causal structure producing morbidity is different before and after mental health problems have occurred. In other words, factors that cause the disorder may be different from those that sustain or prolong it (25,26).

METHOD

The mental and physical health of a community sample in Alameda County, California, has been studied for more than 29 years. In 1994, a fourth wave of data was collected. As part of this follow-up study, data on a diverse set of mental health indicators were collected, including the *Diagnostic and Statistical Manual of Mental Disorders* (27) major depressive disorders. In addition, extensive data on putative risk factors were collected, including data on social and physical functioning. In 1999, a follow-up survey was conducted that permitted examination of the effects of obesity on mental health with prospective data.

Using data from the 1994 and 1999 surveys, we examined obesity, its association with mental health, and the contribution of other putative risk factors for mental health, such as gender, marital status, socioeconomic status, physical health and disability, life stress, social support, and physical activity.

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. Participants are followed regardless of subsequent location or disability status. Survivors were interviewed with the full questionnaire in 1974, 1983 (50% sample), 1994 and 1999 with response rates of 85%, 87%, 93%, and 96% respectively. Detailed design and sampling procedures for this study have been reported elsewhere (28–29).

The 1994 follow-up sample included 2,730 participants aged 46 to 102 who responded to the survey. The analyses reported here are based on 1,739 participants who were 50 years or older in 1994 and who had complete data on the eight measures of mental health in 1994 and 1999 and the 1994 risk factor measures, including BMI.

In terms of age, 43.2% of the sample were 50 to 59, 30.8% were 60 to 69, 26.0% were 70 or older. The age ranged from 50 to 91 with a mean age of 63. The mean age for men was 63.4; for women it was 62.5. Women made up 55.8% of the sample. Most members of the sample were married, with 25.4% reporting that they were divorced, separated, widowed, or never married. Only 12.1% of the sample had less than a high school education.

Measures

Every wave of the Alameda County Study has included items inquiring about height (without shoes) in feet and inches and weight (without heavy clothes) in pounds. These items are converted to kilograms in weight and meters in height to calculate BMI (kg/m^2). We classified obesity using the 1998 guidelines from the National Institutes of Health (NIH) (4). Based on the NIH criteria, obesity is defined as a BMI \geq 30. There are actually three levels of obesity: I, BMI = 30–34.9; II, BMI = 35–39.9; and III, BMI \geq 40. (Extreme Obesity). Our sample size was not sufficient to examine levels of obesity and mental health. In a previous paper, we used U.S. Public Health Services guidelines (30), but this clarification has been superseded by the new NIH guidelines.

Happiness has been assessed in every wave by one item (“All in all, how happy are you these days?”) categorized as *very/pretty vs. not too happy*. One item inquired “All in all, how would you say that your emotional or mental health is generally?”: *fair/poor vs. good/excellent* were the categories used.

Life satisfaction consisted of one item: “I am pleased at how things in my life turned out” (categorized as *strongly agree/agree vs. disagree/strongly disagree*). Positive affect used four items inquiring how often (*never/sometimes/often*) the respondent had felt “on top of the world; particularly excited or interested in something; pleased about having accomplished something; and proud because of a compliment on something he/she had done.” The negative affect items, scored the same way, were as follows: “So restless you couldn’t sit long in a chair; depressed or very unhappy; bored; and vaguely uneasy about something without knowing why.” The positive and nega-

tive affect items were each summed in two scales ranging from 0 to 8 and then categorized as low (0–3) and high (4–8).

Optimism was measured by six items (31): “(a) If something can go wrong for me it will; (b) I am always optimistic about the future; (c) in uncertain times, I expect the best; (d) overall, I expect more good things to happen to me than bad; (e) I hardly ever expect things to go my way; (f) I rarely count on good things happening to me.” The responses were *strongly agree/agree somewhat/disagree somewhat/strongly disagree*. The scores for items were summed into a scale with a score range of 0 to 18 and then categorized (0–10 vs. 11–18). Items 2, 3, and 4 were reversed.

The measure of depression was a set of 12 items that operationalized the diagnostic criteria for major depression. Queries were adapted from the PRIME-MD mood disorders section (32). “Cases” of major depressive episode included participants who experienced five symptoms of depression “almost every day for the past 2 weeks,” including disturbed mood or anhedonia. Use of this measure in the Alameda County Study cohort has been reported previously (33,34).

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

Age was categorized as 50 to 59, 60 to 69, and 70 or older at baseline. Educational attainment was dichotomized: 12 years or less and more than 12 years. Marital status also was dichotomized: married versus other (divorced, separated, widowed, never married). Our measure of isolation consisted of six items: “(a) How many friends can you confide in?, (b) How many relatives do you feel close to?, (c) How many friends and relatives do you see at least once a month?, (d) How many friends and relatives can you turn to for help?, (e) How many friends and relatives can you talk to about personal measures?, (f) How many friends and relatives do you have you can ask for advice or information?” A score of fewer than three on each question was considered an isolated response. The number of isolated responses were summed and coded into low (0), medium (1–2) and high social isolation (3+).

Our measure of social support asked “How often is the following available: (a) Someone to take you to the doctor, (b) Someone to prepare meals for you, (c) Someone to help you with your daily chores if you are sick, (d) Someone to loan you money if you need it.” Each question was scored from 0 (*none of the time*) to 4 (*all of the time*) and then summed into a total scale ($\alpha = 0.90$). The scale was divided into low (0–9), medium (10–15) and high (16) support.

We asked participants about whether 17 life events had occurred in the current (1994) or previous year (1993). The total number of recent events was summed. Financial strain consisted of five items that inquired “How many times there was not enough money: (a) to buy clothes, (b) to fill a prescription, (c) to see a doctor, (d) to pay rent or mortgage, (e) 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 in the last 12 months and whether a physician had been consulted. These conditions included heart trouble, high blood pressure, asthma, chronic bronchitis, arthritis, emphysema, diabetes, stroke, cancer, cataracts, osteoporosis, and circulatory problems. The number of conditions were summed and then categorized as *none*, *1*, or *2 or more*. We also asked respondents if they had difficulty with usual activities of daily living (ADL): (a) walking across a small room, (b) bathing, (c) brushing hair or washing face, (d) eating, (e) dressing, (f) moving from bed to a chair, and (g) using the toilet. Any difficulty on any item was classified as having a problem with ADLs. Physical activity was measured with four questions. Participants were asked how often they did physical exercise, took part in active sports, took long walks, or swam. These items have been shown in a previous analysis to predict both all-cause and cardiovascular mortality (35). Responses to these questions were 1 (*never*), 2 (*sometimes*), or 3 (*often*). The resulting physical activity scale ranged from 4 to 12.

Statistical Analyses

Crude and age- and gender-adjusted logistic regression models were used to assess the association between obesity and 1994 mental health indicators: happiness, perceived mental health, negative affect, leisure satisfaction, feeling loved, depression, optimism, positive affect, satisfaction with relationships, and life satisfaction.

To examine the effect of obesity on subsequent mental health, two sets of models were fitted. In the first, we computed odds ratios between 1994 obesity and 1999 mental health status, regardless of mental health status in 1994. In the second, we estimated the same odds ratio after eliminating all participants with impaired mental health in 1994. All models were age and gender adjusted. Because of a possible interaction between gender and obesity vis-à-vis depression (see for example 21,22), a term for this interaction was added to all models.

For models in which there remained a statistically significant association between obesity and mental health, sequential logistic regression models were run. Groups of variables were added to the models to examine the influence of the different stressors on the obesity/mental health association. Separate logistic regression models were used for each mental health indicator.

RESULTS

We calculated the odds ratios for obesity and indicators of mental health in 1994 with and without adjustments for age and gender (Table 1). These results provide no support for the jolly fat hypothesis. Crude odds ratios were significant for poor perceived mental health, high negative affect, low optimism, life dissatisfaction, and depression. Adjusted for age and gender, the ratios indicated increased relative risk for poor perceived mental health, pessimism (low optimism), life dissatisfaction, and depression.

TABLE 1
Odds Ratio of 1994 Mental Health by 1994 Obesity Status (BMI \geq 30)

Mental Health Indicators	OR	95% CI	Age and Gender Adjustments	
			OR	95% CI
Not too happy	1.39	0.93–2.08	1.35	0.90–2.03
Fair/Poor mental health	1.54*	1.05–2.26	1.54*	1.05–2.26
High negative affect	1.33	1.00–1.76	1.31	0.99–1.74
Feel somewhat or little loved or cared about	1.15	0.87–1.50	1.13	0.86–1.49
Low optimism	1.62***	1.22–2.16	1.68**	1.26–2.24
Low positive affect	1.28	0.88–1.88	1.36	0.93–2.00
Not pleased with how life turned out	1.42*	1.04–1.93	1.38*	1.01–1.88
Depressed	2.13***	1.43–3.18	2.12***	1.41–3.17

Note. $N = 1,739$. BMI = body mass index; OR = odds ratio; CI = confidence interval.

* $p < .05$. ** $p < .01$. *** $p < .001$.

We then examined whether obesity affected the risk of future impaired mental health functioning (Table 2). The obese in 1994 were at increased relative risk for five indicators of mental health in 1999: unhappiness, pessimism, low positive affect, life dissatisfaction, and depression. Excluding those with mental health problems at baseline, obesity still predicted risk of depression (OR = 2.11) and pessimism (OR = 1.63) in 1999, as well as unhappiness (OR = 1.80).

We then examined the significant associations between obesity and the mental health outcomes observed in Table 2, conditional upon the effects of the covariates. These results are presented in Tables 3 through 8. As noted earlier, because of concerns regarding a possible gender difference in the association between obesity and subsequent mental health outcomes (21,22), an obesity-by-gender interaction term was added to the incident models presented in Table 2. The interaction term between gender and obesity never reached statistical significance. The p values ranged from 0.38 to 0.98 (data not shown) so the models presented in Tables 3 through 8 do not integrate an interaction term.

Tables 3 and 4 present the results of multivariate analyses for unhappiness. Adjustment for covariates eliminated the asso-

ciation between obesity and unhappiness. Gender did not predict unhappiness using either 1999 prevalence (Table 3) or 1999 incidence data (Table 4). The only significant predictors of incident unhappiness in 1999 were age 60 to 69, lack of physical activity, problems with ADL, and financial strain in 1994.

Likewise, as can be seen in Tables 5 and 6, adjustment for covariates also resulted in a nonsignificant odds ratio between obesity at baseline and low optimism or pessimism. Table 5 presents results for prevalent low optimism, and Table 6 presents results for incident low optimism in 1999. The 1994 factors predicting incident pessimism in 1999 were lower education, high social isolation, lack of physical activity, and low social support. Gender did not predict pessimism or low optimism in either Table 5 or Table 6.

Using prevalence data, adjustment for age, gender, education, and marital status, obesity in 1994 predicted depression in 1999 (Table 7). However, adjustment for the other covariates eliminated this association in Models 3 and 4, but the association was close to significant ($p = .075$). Using incidence data, the results were different. Obesity in 1994 predicted depression in 1999 in Models 1, 2, 3, and 4. Unlike the

TABLE 2
1994 Obesity Status (BMI \geq 30) Predicting 1999 Mental Health Indicators

Mental Health Indicators	n^c	Prevalence ^a		Incidence ^b	
		OR	95% CI	OR ^b	95% CI
Not too happy	1,585	1.70*	1.11–2.60	1.80*	1.04–3.11
Fair/Poor mental health	1,574	1.39	0.95–2.03	1.24	0.74–2.07
High negative affect	1,342	1.32	0.99–1.76	1.08	0.70–1.66
Feel somewhat or little loved or cared about	1,250	1.13	0.86–1.49	1.00	0.65–1.56
Low optimism	1,393	1.59**	1.17–2.15	1.63*	1.05–2.53
Low positive affect	1,556	1.46*	1.02–2.09	1.43	0.90–2.26
Not pleased with how life turned out	1,446	1.39*	1.01–1.93	0.83	0.50–1.36
Depressed	1,610	2.16***	1.47–3.19	2.11**	1.29–3.47

Note. All models are age and gender adjusted. BMI = body mass index; OR = odds ratio; CI = confidence interval.

^aParticipants included in the prevalence models. ^bExcludes people with the mental health condition in 1994. ^cParticipants included in the incident for each outcome.

* $p < .05$. ** $p < .01$. *** $p < .0001$.

TABLE 3
Full Sequential Logistic Regression Models Showing a Relation Between Obesity in 1994 (BMI \geq 30) and Unhappiness in 1999

1994 Characteristics	Model 1		Model 2		Model 3		Model 4	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
BMI								
Obese	1.70*	1.11–2.60	1.31	0.83–2.05	1.14	0.71–1.81	1.18	0.73–1.90
Normal	1.00		1.00		1.00		1.00	
Age (years)								
70 or older	1.13	0.74–1.73	0.86	0.54–1.36	1.28	0.78–2.09	1.28	0.77–2.12
60–69	0.55*	0.34–0.89	0.49**	0.30–0.81	0.59*	0.35–0.98	0.64	0.38–1.07
50–59	1.00		1.00		1.00		1.00	
Gender								
Female	1.02	0.70–1.48	0.94	0.64–1.38	0.92	0.62–1.36	1.00	0.67–1.49
Male	1.00		1.00		1.00		1.00	
Education								
Less than high school	1.67*	1.02–2.72	1.30	0.78–2.17	1.12	0.67–1.88	1.13	0.67–1.91
High school or higher	1.00		1.00		1.00		1.00	
Marital status								
Div/Sep/Wid/NM	1.22	0.81–1.85	1.09	0.71–1.66	0.91	0.59–1.41	0.85	0.55–1.33
Married	1.00		1.00		1.00		1.00	
Two or more	—	—	1.11	0.66–1.88	1.04	0.61–1.76	1.06	0.62–1.81
One	—	—	1.38	0.88–2.16	1.36	0.87–2.14	1.39	0.88–2.20
None	—	—	1.00		1.00		1.00	
ADL								
Problem	—	—	2.92****	1.75–4.87	2.57***	1.52–4.35	2.64***	1.54–4.51
No problem	—	—	1.00		1.00		1.00	
Physical activity (4–12)								
1-point scale increase	—	—	0.78****	0.69–0.88	0.79****	0.70–0.89	0.82**	0.72–0.92
Financial strain								
Yes	—	—	—	—	2.80****	1.82–4.32	2.38****	1.53–3.72
No	—	—	—	—	1.00		1.00	
Recent life events								
Three or more	—	—	—	—	1.87*	1.09–3.23	1.97*	1.13–3.43
Two	—	—	—	—	1.57	0.90–2.72	1.57	0.90–2.75
One	—	—	—	—	1.39	0.83–2.31	1.45	0.86–2.44
Social isolation (0–6)								
High (3 or more)	—	—	—	—	—	—	2.92****	1.77–4.81
Medium (1–2)	—	—	—	—	—	—	1.70*	1.01–2.87
Low (0)	—	—	—	—	—	—	1.00	
Social support (0–16)								
Low (0–9)	—	—	—	—	—	—	2.00**	1.21–3.31
Medium (10–15)	—	—	—	—	—	—	1.29	0.80–2.08
High (16)	—	—	—	—	—	—	1.00	

Note. Dash indicates that the variable was excluded from the model. BMI = body mass index; OR = odds ratio; CI = confidence interval; Div/Sep/Wid/NM = divorced/separated/widowed/never married; ADL = activities of daily living.

* $p < .05$. ** $p < .01$. *** $p < .001$. **** $p < .0001$.

results presented in Tables 3 through 6, in Tables 7 and 8, gender predicted depression. That is, females were at increased risk of depression using both prevalence and incidence data. Other predictors of incident depression, in addition to obesity and gender, were lack of physical activity, poor health (ADL), and life stress (financial strain).

DISCUSSION

We began by asking whether, as some researchers have suggested, the fat are more jolly. Based on both cross-sectional and

prospective data from the Alameda County Study, the answer is a most emphatic "No." For not one of the eight mental health outcomes examined did we observe a protective effect for obesity. There was either no observed association between obesity and psychological dysfunction or the obese were worse off.

When we examined the jolly fat hypothesis using 1994 to 1999 prospective data, the obese were at increased relative risk of poorer mental health on a number of the outcomes examined. Controlling for mental health problems at baseline and using statistical controls for covariates, however, the increased relative

TABLE 4
Full Sequential Logistic Regression Models Showing Relation Between Obesity in 1994 (BMI \geq 30)
and Incident Unhappiness in 1999

1994 Characteristics	Model 1		Model 2		Model 3		Model 4	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
BMI								
Obese	1.82*	1.05–3.16	1.54	0.87–2.75	1.29	0.71–2.35	1.32	0.72–2.41
Normal	1.00		1.00		1.00		1.00	
Age (years)								
70 or older	1.10	0.64–1.88	0.91	0.51–1.63	1.25	0.67–2.34	1.19	0.63–2.25
60 to 69	0.35**	0.17–0.72	0.33**	0.16–0.68	0.40*	0.19–0.84	0.41*	0.20–0.86
50 to 59	1.00		1.00		1.00		1.00	
Gender								
Female	1.19	0.73–1.97	1.10	0.66–1.83	1.08	0.65–1.81	1.11	0.66–1.86
Male	1.00		1.00		1.00		1.00	
Education								
Less than high school	1.28	0.63–2.59	1.11	0.54–2.27	0.92	0.44–1.91	0.91	0.44–1.88
High school or higher	1.00		1.00		1.00		1.00	
Marital status								
Div/Sep/Wid/NM	1.18	0.68–2.04	1.10	0.63–1.92	0.91	0.51–1.61	0.88	0.50–1.57
Married	1.00		1.00		1.00		1.00	
Chronic medical conditions								
Two or more	—	—	0.78	0.38–1.62	0.76	0.36–1.59	0.80	0.38–1.66
One	—	—	1.59	0.91–2.79	1.56	0.89–2.75	1.59	0.90–2.81
None	—	—	1.00		1.00		1.00	
ADL								
Problem	—	—	2.77**	1.37–5.59	2.45*	1.19–5.03	2.49*	1.21–5.11
No problem	—	—	1.00		1.00		1.00	
Physical activity (4–12)								
1-point scale increase	—	—	0.81**	0.69–0.94	0.81**	0.70–0.95	0.83*	0.71–0.97
Financial strain								
Yes	—	—	—	—	3.17****	1.82–5.15	2.96***	1.69–5.19
No	—	—	—	—	1.00		1.00	
Recent life events								
Three or more	—	—	—	—	1.54	0.79–2.98	1.53	0.79–2.98
Two	—	—	—	—	0.94	0.44–1.97	0.92	0.43–1.95
One	—	—	—	—	0.83	0.43–1.60	0.82	0.42–1.60
None	—	—	—	—	1.00		1.00	
Social isolation (0–6)								
High (3 or more)	—	—	—	—	—	1.50	0.79–2.83	
Medium (1–2)	—	—	—	—	—		1.40	0.77–2.54
Low (0)	—	—	—	—	—		1.00	
Social support (0–16)								
Low (0–9)	—	—	—	—	—		1.62	0.85–3.07
Medium (10–15)	—	—	—	—	—		1.12	0.62–2.02
High (16)	—	—	—	—	—		1.00	

Note. Incident unhappiness excludes unhappy participants in 1994. Dash indicates that the variable was excluded from the model. BMI = body mass index; OR = odds ratio; CI = confidence interval; Div/Sep/Wid/NM = divorced/separated/widowed/never married; ADL = activities of daily living.

* $p < .05$. ** $p < .01$. *** $p < .001$. **** $p < .0001$.

risk was observed only for depression. In Tables 3 through 6, adjustment for chronic conditions, ADL, and physical activity eliminated the association between obesity and two indicators—unhappiness and low optimism—suggesting that health differentials were driving the associations observed initially. In Tables 7 and 8, using prevalence data, there was no association between 1994 obesity and 1999 depression, controlling for life

stress and isolation or lack of social support. This suggests that chronic depression may be more of a function of these factors than obesity per se. For incident depression (Table 8), obesity remained a significant risk factor. Gender, impaired physical function, and life stress also predicted incident depression, consistent with earlier findings from the Alameda County Study (33,34) as well as those reported from other studies (36–39). In

TABLE 5
Full Sequential Logistic Regression Models Showing Relation Between Obesity in 1994 (BMI ≥ 30) and Low Optimism in 1999

1994 Characteristics	Model 1		Model 2		Model 3		Model 4	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
BMI								
Obese	1.57**	1.16–2.14	1.21	0.88–1.67	1.13	0.82–1.57	1.15	0.82–1.61
Normal	1.00		1.00		1.00		1.00	
Age (years)								
70 or older	1.31	0.97–1.78	0.97	0.70–1.34	1.17	0.83–1.65	1.12	0.79–1.60
60 to 69	0.87	0.64–1.18	0.77	0.56–1.06	0.84	0.61–1.17	0.88	0.63–1.22
50 to 59	1.00		1.00		1.00		1.00	
Gender								
Female	0.86	0.67–1.11	0.79	0.61–1.03	0.77	0.59–1.01	0.80	0.60–1.05
Male	1.00		1.00		1.00		1.00	
Education								
Less than high school	2.87****	2.08–3.96	2.43****	1.74–3.39	2.23****	1.59–3.12	2.34****	1.66–3.32
High school or higher	1.00		1.00		1.00		1.00	
Marital status								
Div/Sep/Wid/NM	1.25	0.93–1.66	1.14	0.85–1.53	1.03	0.76–1.39	0.93	0.68–1.26
Married	1.00		1.00		1.00		1.00	
Chronic medical conditions								
Two or more	—	—	1.61**	1.14–2.28	1.57*	1.11–2.23	1.64**	1.15–2.34
One	—	—	1.60**	1.18–2.18	1.59**	1.16–2.17	1.61**	1.17–2.21
None	—	—	1.00		1.00		1.00	
ADL								
Problem	—	—	1.93**	1.28–2.92	1.78**	1.17–2.71	1.74*	1.13–2.67
No problem	—	—	1.00		1.00		1.00	
Physical activity (4–12)								
1-point scale increase	—	—	0.83****	0.77–0.90	0.84****	0.78–0.91	0.86***	0.79–0.93
Financial strain								
Yes	—	—	—	—	2.08****	1.51–2.87	1.81***	1.30–2.52
No	—	—	—	—	1.00		1.00	
Recent life events								
Three or more	—	—	—	—	1.16	0.79–1.69	1.19	0.80–1.76
Two	—	—	—	—	1.08	0.75–1.56	1.08	0.74–1.56
One	—	—	—	—	0.99	0.71–1.38	1.00	0.71–1.41
None	—	—	—	—	1.00		1.00	
Social isolation (0–6)								
High (3 or more)	—	—	—	—	—	—	2.15****	1.54–3.00
Medium (1–2)	—	—	—	—	—	—	1.64**	1.18–2.29
Low (0)	—	—	—	—	—	—	1.00	
Social support (0–16)								
Low (0–9)	—	—	—	—	—	—	2.44****	1.73–3.44
Medium (10–15)	—	—	—	—	—	—	1.30	0.94–1.78
High (16)	—	—	—	—	—	—	1.00	

Note. Dash indicates that the variable was excluded from the model. BMI = body mass index; OR = odds ratio; CI = confidence interval; Div/Sep/Wid/NM = divorced/separated/widowed/never married; ADL = activities of daily living.

p* < .05. *p* < .01. ****p* < .001. *****p* < .0001.

no case did we observe better mental health among the obese. In sum, the obese were not more jolly.

To our knowledge, this is only the second instance of a test of the jolly fat hypothesis using data from a prospective study. In prior analyses of data on obesity and depression from the Alameda County Study (24), we found no support for the jolly fat hypothesis. Our results here extend the line of negative evidence for the jolly fat hypothesis. Our finding of no support for this

proposition in these analyses is all the more noteworthy, given that the data are from a large, community-based, 5-year prospective study and that we studied multiple indicators of psychological well-being using multivariate analyses to examine and control for the effects of an array of putative risk factors for psychological dysfunction.

How do our results compare with those from other studies? Such a comparison is problematic because most of the

TABLE 6
Full Sequential Logistic Regression Models Showing Relation Between Obesity in 1994 (BMI \geq 30)
and Incident Low Optimism in 1999

1994 Characteristics	Model 1		Model 2		Model 3		Model 4	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
BMI								
Obese	1.63*	1.05–2.54	1.35	0.85–2.13	1.27	0.80–2.02	1.25	0.78–1.99
Normal	1.00		1.00		1.00		1.00	
Age (years)								
70 or older	1.52	0.99–2.34	1.19	0.75–1.88	1.31	0.81–2.12	1.31	0.80–2.14
60 to 69	0.87	0.55–1.36	0.80	0.50–1.26	0.85	0.53–1.35	0.89	0.56–1.43
50 to 59	1.00		1.00		1.00		1.00	
Gender								
Female	0.81	0.56–1.17	0.77	0.53–1.11	0.75	0.52–1.09	0.78	0.53–1.14
Male	1.00		1.00		1.00		1.00	
Education								
Less than high school	2.93****	1.82–4.69	2.59****	1.60–4.20	2.53***	1.55–4.10	2.58***	1.58–4.22
High school or higher	1.00		1.00		1.00		1.00	
Marital status								
Div/Sep/Wid/NM	1.14	0.75–1.73	1.05	0.69–1.61	0.98	0.64–1.51	0.89	0.57–1.38
Married	1.00		1.00		1.00		1.00	
Chronic medical conditions								
Two or more	—	—	1.32	0.81–2.17	1.30	0.79–2.13	1.37	0.83–2.25
One	—	—	1.42	0.91–2.20	1.41	0.91–2.19	1.40	0.90–2.19
None	—	—	1.00		1.00		1.00	
ADL								
Problem	—	—	1.81	0.99–3.30	1.67	0.90–3.07	1.62	0.88–3.01
No problem	—	—	1.00		1.00		1.00	
Physical activity (4–12)								
1-point scale increase	—	—	0.84**	0.75–0.94	0.84**	0.75–0.94	0.85**	0.76–0.95
Financial strain								
Yes	—	—	—	—	1.77*	1.08–2.90	1.63	0.99–2.68
No	—	—	—	—	1.00		1.00	
Recent life events								
Three or more	—	—	—	—	1.08	0.63–1.86	1.11	0.64–1.93
Two	—	—	—	—	0.92	0.55–1.55	0.93	0.55–1.58
One	—	—	—	—	0.82	0.51–1.31	0.83	0.52–1.33
None	—	—	—	—	1.00		1.00	
Social isolation (0–6)								
High (3 or more)	—	—	—	—	—	—	1.83*	1.15–2.92
Medium (1–2)	—	—	—	—	—	—	1.55	0.99–2.43
Low (0)	—	—	—	—	—	—	1.00	
Social support (0–16)								
Low (0–9)	—	—	—	—	—	—	2.08**	1.28–3.37
Medium (10–15)	—	—	—	—	—	—	1.28	0.83–1.98
High (16)	—	—	—	—	—	—	1.00	

Note. Incident low optimism excludes low optimistic participants in 1994. Dash indicates that the variable was excluded from the model. BMI = body mass index; OR = odds ratio; CI = confidence interval; Div/Sep/Wid/NM = divorced/separated/widowed/never married; ADL = activities of daily living.

* $p < .05$. ** $p < .01$. *** $p < .001$. **** $p < .0001$.

mental health outcomes we examined have not been included in previous studies. As Friedman and Brownell (8) pointed out, only one mental health outcome has been consistently the focus of research on the effects of obesity. That is depression. What is the evidence from other studies on depression and obesity?

As noted earlier, in a previous article we found mixed results using prospective data on obesity and depression (24), depending on the definition of obesity. However, regardless of the definition of obesity used, no protective effect was observed for obesity. In the only other study to investigate the association between mental health and obesity using data from a

TABLE 7
Full Sequential Logistic Regression Models Showing Relation Between Obesity in 1994 (BMI \geq 30) and Depression in 1999

1994 Characteristics	Model 1		Model 2		Model 3		Model 4	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
BMI								
Obese	2.19****	1.48–3.24	1.58*	1.04–2.39	1.46	0.95–2.23	1.48	0.96–2.28
Normal	1.00		1.00		1.00		1.00	
Age (years)								
70 or older	1.47	0.96–2.23	1.03	0.65–1.62	1.43	0.88–2.33	1.45	0.89–2.37
60 to 69	0.91	0.59–1.42	0.80	0.51–1.26	0.93	0.58–1.49	0.98	0.61–1.57
50 to 59	1.00		1.00		1.00		1.00	
Gender								
Female	1.90**	1.29–2.80	1.76**	1.18–2.61	1.74**	1.16–2.59	1.85**	1.23–2.77
Male	1.00		1.00		1.00		1.00	
Education								
Less than high school	2.31***	1.50–3.56	1.80*	1.15–2.83	1.61*	1.02–2.55	1.63*	1.03–2.59
High school or higher	1.00		1.00		1.00		1.00	
Marital status								
Div/Sep/Wid/NM	1.50*	1.03–2.19	1.33	0.90–1.96	1.17	0.79–1.74	1.14	0.76–1.70
Married	1.00		1.00		1.00		1.00	
Chronic medical conditions								
Two or more	—	—	1.72*	1.05–2.82	1.63	0.99–2.68	1.68*	1.02–2.76
One	—	—	1.69*	1.08–2.67	1.69*	1.07–2.67	1.73*	1.09–2.75
None	—	—	1.00		1.00		1.00	
ADL								
Problem	—	—	2.34***	1.42–3.85	2.10**	1.25–3.51	2.11**	1.26–3.54
No problem	—	—	1.00		1.00		1.00	
Physical activity (4–12)								
1-point scale increase	—	—	0.78****	0.70–0.88	0.79****	0.70–0.89	0.80****	0.71–0.90
Financial strain								
Yes	—	—	—	—	2.37****	1.56–3.60	2.20****	1.43–3.37
No	—	—	—	—	1.00		1.00	
Recent life events								
Three or more	—	—	—	—	1.53	0.90–2.61	1.57	0.92–2.69
Two	—	—	—	—	1.45	0.86–2.44	1.47	0.87–2.49
One	—	—	—	—	1.40	0.87–2.26	1.45	0.90–2.35
None	—	—	—	—	1.00		1.00	
Social isolation (0–6)								
High (3 or more)	—	—	—	—	—	—	1.95**	1.22–3.11
Medium (1–2)	—	—	—	—	—	—	1.51	0.95–2.40
Low (0)	—	—	—	—	—	—	1.00	
Social support (0–16)								
Low (0–9)	—	—	—	—	—	—	1.51	0.95–2.39
Medium (10–15)	—	—	—	—	—	—	0.80	0.51–1.25
High (16)	—	—	—	—	—	—	1.00	

Note. Dash indicates that the variable was excluded from the model. BMI = body mass index; OR = odds ratio; CI = confidence interval; Div/Sep/Wid/NM = divorced/separated/widowed/never married; ADL = activities of daily living.

* $p < .05$. ** $p < .01$. *** $p < .001$. **** $p < .0001$.

prospective study, Noppa and Hällström (17) found that those more severely depressed at baseline and those who had a greater degree of disability were at greater subsequent risk of weight gain. Evidence from prevalence surveys has been mixed (9–11,13,14,16,18–23). Prevalence data from our earlier study (24) provided no support.

There is also 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. Based on a meta-analysis of such studies, Friedman and Brownell (8) found a moderate effect for obesity and depression; the obese presenting for weight loss were more depressed.

Several studies also have examined obesity and anxiety (9, 10,13,16,17). The results have been mixed; some results support the jolly fat hypothesis, and others provide no support. The

TABLE 8

Full Sequential Logistic Regression Models Showing Relation Between Obesity in 1994 (BMI \geq 30) and Incident Depression in 1999

1994 Characteristics	Model 1		Model 2		Model 3		Model 4	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
BMI								
Obese	2.25**	1.36–3.71	1.87*	1.10–3.17	1.72*	1.00–2.95	1.77*	1.03–3.05
Normal	1.00		1.00		1.00		1.00	
Age (years)								
70 or older	1.26	0.74–2.14	1.04	0.58–1.84	1.41	0.77–2.59	1.42	0.77–2.63
60 to 69	0.81	0.47–1.41	0.76	0.43–1.34	0.88	0.49–1.57	0.90	0.50–1.62
50 to 59	1.00		1.00		1.00		1.00	
Gender								
Female	1.94**	1.18–3.19	1.86*	1.12–3.07	1.84*	1.11–3.06	1.94*	1.16–3.25
Male	1.00		1.00		1.00		1.00	
Education								
Less than high school	2.08*	1.16–3.70	1.84*	1.02–3.32	1.69	0.92–3.08	1.73	0.94–3.16
High school or higher	1.00		1.00		1.00		1.00	
Marital status								
Div/Sep/Wid/NM	1.74*	1.08–2.79	1.63*	1.01–2.64	1.47	0.90–2.40	1.55	0.94–2.55
Married	1.00		1.00		1.00		1.00	
Chronic medical conditions								
Two or more	—	—	0.88	0.46–1.70	0.83	0.43–1.62	0.86	0.44–1.67
One	—	—	1.64	0.96–2.78	1.63	0.96–2.78	1.68	0.98–2.87
None	—	—	1.00		1.00		1.00	
ADL								
Problem	—	—	2.34*	1.20–4.58	2.16*	1.09–4.28	2.24*	1.13–4.46
No problem	—	—	1.00		1.00		1.00	
Physical activity (4–12)								
1-point scale increase	—	—	0.78***	0.67–0.90	0.78***	0.67–0.90	0.78**	0.68–0.91
Financial strain								
Yes	—	—	—	—	2.15**	1.27–3.65	2.17**	1.27–3.69
No	—	—	—	—	1.00		1.00	
Recent life events								
Three or more	—	—	—	—	1.73	0.88–3.38	1.77	0.90–3.48
Two	—	—	—	—	1.72	0.90–3.28	1.74	0.90–3.35
One	—	—	—	—	1.43	0.78–2.63	1.46	0.79–2.70
None	—	—	—	—	1.00		1.00	
Social isolation (0–6)								
High (3 or more)	—	—	—	—	—	—	1.48	0.81–2.71
Medium (1–2)	—	—	—	—	—	—	1.51	0.88–2.60
Low (0)	—	—	—	—	—	—	1.00	
Social support (0–16)								
Low (0–9)	—	—	—	—	—	—	0.94	0.52–1.69
Medium (10–15)	—	—	—	—	—	—	0.54*	0.31–0.94
High (16)	—	—	—	—	—	—	1.00	

Note. Incident depression excludes depressed participants in 1994. Dash indicates that the variable was excluded from the model. BMI = body mass index; OR = odds ratio; CI = confidence interval; Div/Sep/Wid/NM = divorced/separated/widowed/never married; ADL = activities of daily living.

* $p < .05$. ** $p < .01$. *** $p < .001$.

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 is warranted on the association between obesity and anxiety.

None of the indicators of psychological well-being other than depression that we examined have been the specific focus of previous epidemiologic studies of the mental health effects of obesity. One study has reported that obese men were more likely

to report “not being a happy person” and obese women were more likely to report being “down in the dumps” (22). Given the paucity of data on body weight and psychological functioning broadly considered, more research on this topic is needed. This need for research is further underscored by our results. For example, the obese were at greater risk of being less happy, having low optimism, and being more depressed in both cross-sectional and prospective bivariate analyses. Although multivariate analyses es-

entially eliminated these associations, except for depression, the results need to be replicated with data from other samples.

We examined the effect of gender on the association between obesity and mental health by introducing an Obesity \times Gender interaction term to the incident models in Table 2. None were significant. These findings, too, reflect the untidy state of empirical affairs on this research topic. Other researchers have reported differential effects by gender (9,10,18,21–23). All of these studies were based on cross-sectional data and used varied measures of both obesity and mental health outcomes. In addition, the age range of the samples also varied considerably. Whether and how gender operates to mediate or moderate the effects of obesity on mental health functioning, in particular depression, is another unresolved question in this literature.

A number of explanations for a relationship between obesity and mental health, particularly depression, have been offered, including the possible role of psychological, sociological, and biological factors (8,20,21). Ross (20), for example, outlined two possible explanations for an association between obesity and depression. One explanation, 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 that it is to be overweight in a group, the greater the psychological impact should be. The second explanation, the fitting norms of appearance perspective, argues that for those who are obese, fitting the norm for weight is stressful because dieting is more stressful than obesity per se. This may be particularly true when weight control is not successful, which is commonly the case (1). Ross (20) presented data supporting the fitting appearance norms hypothesis but found little support for the reflected appraisal hypothesis. These competing perspectives offer plausible explanations for socio-cultural processes linking obesity with psychological dysfunction. However, to date no attempts have been made to replicate or extend the research by Ross.

Palinkas, Wingard, and Barrett-Connor (21) noted 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 (40–43). Obese people also are less likely to exercise, and physical activity reduces the risk of depression by increasing levels of endorphins, improving regulation of norepinephrine, improving fitness, and enhancing self-esteem (44–45). However, at this point the relationship between obesity, carbohydrate consumption, exercise, and depression is not well specified. To date, no community-based, prospective study has been published that has examined these factors simultaneously. Until we have such data, the etiologic role of carbohydrate consumption, exercise, and obesity in depression remain unclear.

There is also evidence, albeit limited, that first-degree relatives of probands with morbid obesity are more likely to have mental disorders than relatives of controls, particularly depres-

sion, bipolar disorder, and antisocial personality disorders (46). 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 that genetic and physiological components are important in the etiology of obesity and that obesity is quite heterogeneous with regard to etiology, effects of obesity on health, and response to treatment (1,4,8).

Further conjecture as to possible contributory factors would seem premature, however, until an etiologic link between obesity and psychological dysfunction has been more clearly established. We agree with Friedman and Brownell (8) that little information exists on the presence or nature of causal relationships between obesity and psychopathology and that the next generation of studies should focus on which subgroups of the obese have more psychological dysfunction, the nature of the dysfunction, and any 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.

REFERENCES

- (1) Brownell KD, Wadden TA: Etiology and treatment of obesity: Understanding a serious, prevalent, and refractory disorder. *Journal of Consulting and Clinical Psychology*. 1992, 60:605–617.
- (2) Bender R, Trautner C, Spraul M, Berger M: Assessment of excess mortality in obesity. *American Journal of Epidemiology*. 1998, 147:42–48.
- (3) McGinnis JM, Foege WH: Actual causes of death in the United States. *Journal of the American Medical Association*. 1993, 270:2207–2212.
- (4) National Institutes of Health: *Clinical guidelines on the identification, evaluation, and treatment of overweight and obesity in adults: The Evidence Report*. Obesity Education Initiative, DHHS Publication No. 98–403. Bethesda, MD: National Institutes of Health, 1998.
- (5) Pi-Sunyer FX: Medical hazards of obesity. *Annals of Internal Medicine*. 1993, 119:655–660.
- (6) Stevens J, Cai J, Pamuk ER, et al.: The effect of age on the association between body mass index and mortality. *New England Journal of Medicine*. 1998, 338:1–7.
- (7) Wolf AM, Colditz GA: Current estimates of the economic costs of obesity in the United States. *Obesity Research*. 1998, 6:97–106.
- (8) Friedman MA, Brownell KD: Psychological correlates of obesity: Moving to the next research generation. *Psychological Bulletin*. 1995, 117:3–20.
- (9) Crisp AH, McGuinness B: Jolly fat: Relation between obesity and psychoneurosis in the general population. *British Medical Journal*. 1975, 1:7–9.
- (10) Crisp AH, Queenan M, Sittampaln Y, Harris G: "Jolly fat" revisited. *Journal of Psychosomatic Research*. 1980, 24:233–241.

- (11) Kittel F, Rustin RM, Dramaix M, De Backer G, Kornitzer M: Psycho-socio-biological correlates of moderate overweight in an industrial population. *Journal of Psychosomatic Research*. 1978, 22:145-158.
- (12) Segers M-J, Mertens C: Psychological and bioclinical CHD risk factors: Quantitative differences between obese, normal, and thin subjects. *Journal of Psychosomatic Research*. 1974, 18:403-411.
- (13) Stewart AL, Brook RH: Effects of being overweight. *American Journal of Public Health*. 1983, 73:171-178.
- (14) Reed DB: The relationship between obesity and psychological general well-being in United States women. *Dissertation Abstracts International*. 1985, 46:3791.
- (15) Faubel M: Body image and depression in women with early and late onset obesity. *Journal of Psychology*. 1989, 12:385-395.
- (16) Hällström T, Noppa H: Obesity in women in relation to mental illness, social factors, and personality traits. *Journal of Psychosomatic Research*. 1981, 25:75-82.
- (17) Noppa H, Hällström T: Weight gain in adulthood in relation to socioeconomic factors, mental illness, and personality traits: A prospective study of middle-aged women. *Journal of Psychosomatic Research*. 1981, 25:83-89.
- (18) Istvan J, Zavela K, Weidner G: Body weight and psychological distress in NHANES I. *International Journal of Obesity*. 1992, 16:999-1003.
- (19) Homer TN, Utermohlen V: A multivariate analysis of psychological factors related to body mass index and eating preoccupation in female college students. *Journal of the American College of Nutrition*. 1993, 12:459-465.
- (20) Ross C: Overweight and depression. *Journal of Health and Social Behavior*. 1994, 35:63-79.
- (21) Palinkas LA, Wingard DL, Barrett-Connor E: Depressive symptoms in overweight and obese older adults: A test of the "jolly fat" hypothesis. *Journal of Psychosomatic Research*. 1996, 40:59-66.
- (22) Han TS, Tjshuis MA, Lean ME, Seidell JC: Quality of life in relation to overweight and body fat distribution. *American Journal of Public Health*. 1998, 88:1814-1820.
- (23) Carpenter KM, Hasin DS, Allison DB, Faith MS: Relationships between obesity and DSM-IV Major Depressive Disorder, Suicide Ideation, and Suicide Attempts: Results from a general population study. *American Journal of Public Health*. 2000, 90:251-257.
- (24) Roberts RE, Kaplan GA, Shema SJ, Strawbridge WJ: Are the obese at greater risk of depression? *American Journal of Epidemiology*. 2000, 152:163-170.
- (25) Eaton WW: Studying the natural history of psychopathology. In Tsuang MT, Tohen M, Zahner GEP (eds), *Textbook in psychiatric epidemiology*. New York: Wiley-Liss, Inc., 1995, 157-177.
- (26) Roberts RE: Epidemiological issues in measuring preventive effects. In Munoz RF (ed), *Depression Prevention: Research Directions*. Washington, DC: Hemisphere, 1987, 45-75.
- (27) American Psychiatric Association: *Diagnostic and statistical manual of mental disorders* (4th ed.). Washington, DC: American Psychiatric Association, 1994.
- (28) Hochstim JR: Health and ways of living: The Alameda County, California, population laboratory. In Kessler II, Levin ML (eds), *The Community as an Epidemiologic Laboratory*. Baltimore: Johns Hopkins University Press, 1970, 149-176.
- (29) Berkman LF, Breslow L: *Health and Ways of Living: The Alameda County study*. New York: Oxford University Press, 1983.
- (30) National Center for Health Statistics. Anthropometric Reference Data and Prevalence of Overweight, United States, 1976-1980. In Najjar MF, Rowland M (eds), *Vital Health Statistics* (Series 11, No. 238 DHHS Publication No. (PHS) 87-1688). Washington, DC: U.S. Government Printing Office, 1987, 3-5.
- (31) Scheier MF, Carver CS: Optimism, coping, and health: Assessment and implications of generalized outcome expectancies. *Health Psychology*. 1985, 4:219-247.
- (32) Spitzer RL, Williams JBW, Kroenke K, Linzer, M: Utility of a new procedure for diagnosing mental disorders in primary care: The PRIME-MD 1000 study. *Journal of the American Medical Association*. 1994, 272:1479-1756.
- (33) Roberts RE, Kaplan GA, Shema SJ, Strawbridge WJ: Does growing old increase risk for depression? *American Journal of Psychiatry*. 1997, 154:1384-1390.
- (34) Roberts RE, Kaplan GA, Shema SJ, Strawbridge WJ: Prevalence and correlates of depression in an aging cohort. *Journal of Gerontology* (Series B Psychological Sciences and Social Sciences). 1997, 52B:5252-5258.
- (35) Kaplan GA, Strawbridge WJ, Cohen RD, Hungerford LH: Natural history of leisure-time physical activity and its correlates: Associations with mortality from all-causes and cardiovascular disease over 28 years. *American Journal of Epidemiology*. 1996, 144:793-797.
- (36) Blazer D, Burchett B, Service C, George LK: The association of age and depression among the elderly: An epidemiologic exploration. *Journal of Gerontology*. 1991, 46:210-215.
- (37) Lewinsohn PM, Rohde P, Seeley JR, Fischer SA: Age and depression: Unique and shared effects. *Psychology and Aging*. 1991, 6:247-260.
- (38) Kennedy GJ, Kelman HR, Thomas C: Persistence and remission of depressive symptoms in late life. *American Journal of Psychiatry*. 1991, 148:174-178.
- (39) Jorm AF: The epidemiology of depressive states in the elderly: Implications for recognition, intervention, and prevention. *Social Psychiatry and Psychiatric Epidemiology*. 1995, 30:53-59.
- (40) Rosenthal NE, Genhart M, Jacobson RG, Skwerer RG, Wehr TA: Disturbances of appetite and weight regulation in seasonal affective disorder. *Annals of the New York Academy Sciences*. 1987, 499:216-230.
- (41) Wurtman JJ, Brzezinski A, Wurtman RJ, Laferrere B: Effect of nutrient intake on premenstrual depression. *American Journal of Obstetrics and Gynecology*. 1989, 161:1228-1234.
- (42) Wurtman RJ, Wurtman JJ: Carbohydrates and depression. *Scientific American*. 1989, 260:68-75.
- (43) Lieberman HR, Wurtman JJ, Chew B: Changes in mood after carbohydrate consumption among obese individuals. *American Journal Clinical Nutrition*. 1986, 44:772-778.
- (44) Ross CE, Hayes D: Exercise and psychologic well-being in the community. *American Journal of Epidemiology*. 1988, 127:762-771.
- (45) Lobstein DD, Mosbacher BJ, Ismail AH: Depression as a powerful discriminator between physically active and sedentary middle-aged men. *Journal of Psychosomatic Research*. 1983, 27:69-76.
- (46) Black DA, Goldstein RB, Mason EE: Prevalence of mental disorder in 88 morbidly obese bariatric clinic patients. *American Journal of Psychiatry*. 1992, 149:227-234.