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Obesity, unexplained weight loss and suicide: The original Whitehall study

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Abstract

Background—Evidence on the association between obesity and suicide is mixed. However, the strength of obesity as a predictor of suicide may be reduced, because of the role of weight changes associated with mental disorders. We tested the hypothesis that both obesity and unexplained weight loss are related to elevated suicide risk.

Methods—A clinical examination with measurements of height, weight and self-reported unexplained weight loss was conducted at baseline for 18,784 men aged 40 to 69. Based on national mortality register, 61 suicides were identified during the 38-year follow-up.

Results—The age-adjusted hazard ratio for suicide among obese versus normal weight men was 2.22 (95% CI 0.94 to 5.28). Additional adjustment for unexplained weight loss raised this ratio to 2.48 (95% CI 1.04 to 5.92). Unexplained weight loss was associated with a substantial excess risk of suicide irrespective of obesity (age-adjusted hazard ratio 5.38, 95% CI 2.31 to 12.50; age- and obesity-adjusted hazard ratio 5.58, 95% CI 2.37 to 13.13).

Limitations—Inability to take into account the effect of depression as a potential mediating mechanism.

Conclusions—This study provides evidence that both obesity and unexplained weight loss may be important predictors of suicide. Lack of adjustment for weight loss may suppress the observed association between obesity and suicide.

Keywords

BMI; overweight; public sector; suicide; weight loss; work

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Introduction

While several studies have found elevated suicide risk among obese people (body mass index (BMI) ≥ 30 kg/m²) (Dong et al., 2006; Eaton et al., 2005; Pompili et al., 2006), there are notable exceptions reporting no or even inverse associations between obesity and suicide risk (Mangnusson et al., 2006; Mukamal et al., 2007). Reasons for mixed findings have remained unclear. We hypothesise that failure to take into account the role of weight changes has contributed to inconclusive findings. The rationale for our hypothesis comes from the central role of mental disorders in suicidal behavior. Both clinical and epidemiologic studies suggest a positive link between obesity and depression (Faith et al., 2002; McElroy et al., 2004; Simon et al., 2006). However, studies also show depressive episodes to be associated with weight loss reducing prevalence of obesity among people at elevated risk of suicide (Yorbik et al., 2004). Given this, the strength of current BMI as a predictor of suicide may be reduced in observational data, because of the frequency with which unexplained weight loss is associated with mental disorders. In this study, we examine associations of obesity and unexplained weight loss with risk of suicide mortality in a large occupational cohort, the Whitehall study. We hypothesise that lack of adjustment for weight loss suppresses the observed association between obesity and suicide.

Methods

Study population

Data were collected on 19 019 non-industrial London-based male government employees aged 40 to 69 years at screening between September 1967 and January 1970 (response rate 74%). Screening involved the completion of a study questionnaire and participation in a medical examination. Mortality records up to 2005 were successfully flagged for 18,863 men (99.2%). Three men with missing BMI measurements, 32 with unknown weight loss, and 44 with an unknown cause of death, were excluded from analyses. The remaining 18,784 men formed the study population.

Baseline measures

Height was measured with the subject wearing shoes and standing with his back to a measuring rod; readings were taken to the nearest ½ in. (approximately 12.7 mm) below. Weight was recorded with the participant wearing shoes but with jacket removed; readings were taken to the nearest ½ lb (227g). Following conversion to metric units, BMI was computed as weight [kg] divided by height squared [m²]. BMI was categorized into four groups, based on the WHO classification [<18.5 (under weight); 18.5–24.9 (normal weight); 25.0–29.9 (overweight) and ≥ 30 kg/m² (obese)]. Weight loss was a binary variable based on response to the question “Over the past year have you noticed unexplained weight loss?” (yes/no). In addition, history of hospitalisations, including those due to psychiatric illness, was obtained by self-report.

Ascertainment of all-cause and cause-specific mortality

Mortality data were obtained from the mortality register by National Health Services (NHS) for all participants who died between study entry and the 30th September 2005 using the NHS identification number assigned to each UK citizen. Among the 13,498 men who died, 83.8% of death certificates were coded according to the eighth revision of the International Classification of Diseases (ICD), 6.2% according to the ninth revision and 10.0% according to the tenth revision. Of those deaths, 61 were classified as intentional suicides (ICD 8/9: E950 –E959; ICD10: X60–X84).

Statistical analyses

Mortality rates were calculated using person years at risk and were standardized for age at entry to the total study population. Hazard ratios (HR) and accompanying 95% confidence intervals for the relation of BMI and weight loss with suicide mortality were computed using Cox's proportional hazards regression models with follow-up period as the time scale. All the analyses were performed using SAS software, version 9.1 (SAS Institute).

Results

As shown in Table 1, 4.3% were obese and 2.2% reported unexplained weight loss over the past year among the 18,784 men. Table 2 presents the age-adjusted hazard ratios for each BMI category and weight loss in relation to suicide mortality. The hazard ratio for suicide for obese versus normal weight men was 2.22 (95% CI 0.94 to 5.28) suggesting an excess but statistically non-significant risk. The age-adjusted hazard ratio of suicide mortality for men with unexplained weight loss versus men with no such weight loss was 5.38 (95% CI 2.31 to 12.50). When the effects of BMI and weight loss were analyzed simultaneously, obesity (HR 2.48, 95% CI 1.04 to 5.92) and weight loss (HR 5.58, 95% CI 2.37 to 13.13) were independently associated with excess suicide risk. There was a weak inverse correlation between BMI and unexplained weight loss ($r=-0.12$, $P<0.001$). The mean BMI was 22.40 (SE=0.14) among men who had unexplained weight loss and 24.80 (SE=0.02) in those without unexplained weight loss.

Of the 15,204 men with data on hospitalisations, 346 (2.3%) reported a history of hospital admission due to psychiatric illness. Their age-adjusted hazard for suicide was 6.53 (95% CI 2.95 to 14.43) times higher compared to men who did not report such a hospitalisation. Adjustment for hospitalisation due to psychiatric illness slightly attenuated the association between unexplained weight loss and suicide (56 suicides, age-adjusted hazard ratio 5.44, 95% CI 2.33 to 12.71, age- and hospitalisation-adjusted hazard ratio 4.68, 95% CI 1.99 to 11.01), but not the association between obesity and suicide (age-adjusted hazard ratio 2.31, 95% 0.97 to 5.52, age- and hospitalisation-adjusted hazard ratio 2.44, 95% 1.02 to 5.82).

Discussion

In this prospective cohort study of male civil servants, obesity and unexplained weight loss were both independently associated with an increased risk of suicide mortality. The association between obesity and suicide slightly strengthened when adjusted for unexplained weight loss. Our results should be considered as preliminary due to small number of suicides. However, they provide support for the possibility that weight change, and particularly unexplained weight loss, may suppress any associations between obesity and suicide (Mukamal et al., 2007).

While intentional weight loss has been shown to be associated with reduced depressive symptoms (Mamplakou et al., 2005) and other health problems, unexplained weight loss has consistently been shown to be associated with increased mortality (Wannamethee et al., 2005). In addition, the American Psychiatric Association's Diagnostic and Statistical Manual includes opposite pairs, such as weight gain/weight loss and hyperphagia/hypophagia, among criteria for a diagnosis of depression and weight loss has also suggested to be related to antidepressant use (Zimmermann et al., 2003). Furthermore, there are some diseases affecting one's weight that may also affect one's mood and lead to depression. Thus, unexplained weight loss may be a marker of depression associated with other diseases and suicide.

It has been hypothesised that depression may mediate the associations between BMI or weight loss and suicide. Unfortunately information on depression was not available in this study. However, we had data on the history of hospital admission due psychiatric illness and used this information as a proxy measure of serious psychiatric problems including depression. Only a modest part of the association between weight loss and suicide was explained by serious psychiatric problems. This does not necessarily refute the depression hypothesis as depression is only one of the causes for hospitalization due psychiatric illness. Further research is needed to determine the causal pathways and mechanisms linking adiposity, physical and psychiatric conditions, and suicide.

We found a weak inverse correlation between BMI and unexplained weight loss in agreement with previous studies (Locher et al., 2007). However, with cross-sectional assessment it remains unclear whether people who experienced weight loss were leaner than others already before the weight change. Finally, as many other studies in the field (Mangnusson et al., 2006; Mukamal et al., 2007), our study sample included only men. This potentially limits the generalisability of our findings.

If replicated, our findings suggest that future studies on obesity and suicide should take into account the confounding effect of unexplained weight loss in the analysis of obesity and suicide. Unexplained weight loss may be due physical illness or a change in eating habits or both. It has been suggested that changing eating habits is a possible warning sign for suicide and might be used to spot suicide risk.

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Table 1

Characteristics of participants and rates of suicide mortality.

	No. of men	Mean (SD) or %	Rate [~] (No. of suicides)
Age (years)	18 784	52.0 (6.7)	1.3 (61)
Body mass index (kg/m ²)			
Under weight <18.5	237	1.3	0.0 (0)
Normal weight 18.5–24.9	10 073	53.6	1.5 (37)
Overweight 25.0–29.9	7673	40.8	0.9 (18)
Obese ≥ 30	801	4.3	3.4 (6)
Unexplained weight loss			
No	18 368	97.8	1.2 (55)
Yes	416	2.2	7.2 (6)

[~] Age adjusted mortality per 10 000 person year

Table 2

Hazard ratios, and 95% confidence intervals, for suicide mortality by body mass index and unexplained weight loss in men (N=18 784, 61 deaths).

	Age-adjusted (A)		A + Mutually adjusted	
	Hazard Ratio (95% CI)	p-value	Hazard Ratio (95% CI)	p-value
Body mass index (kg/m ²) ⁺				
Normal weight 18.5–24.9	1.00		1.00	
Overweight 25.0–29.9	0.64 (0.37 – 1.13)	0.12	0.70 (0.39 – 1.23)	0.12
Obese ≥ 30	2.22 (0.94 – 5.28)	0.07	2.48 (1.04 – 5.92)	0.04
Unexplained weight loss				
No	1.00		1.00	
Yes	5.38 (2.13 – 12.50)	<0.001	5.58 (2.37 – 13.13)	<0.001

⁺ Underweight category has no suicide deaths and is not presented here