The Relation between Overweight and Subjective Health According to Age, Social Class, Slimming Behavior and Smoking Habits in Dutch Adults

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Abstract: Subjective health status was assessed in relation to overweight by administering a list of 51 health complaints to adult men and women who were either chronically overweight as defined by Body Mass Index (BMI) or not overweight, in a continuous morbidity registration in four general practices during the period 1967–83. Responses were received from 455 men (182 overweight) and 790 women (386 overweight), ages 26–66 years. Response rate (71 per cent) and age distribution (mean age 48) were similar in overweight and non-overweight groups of both sexes. BMI was correlated with the total number of complaints in women (r = 0.15) but not in men (r = 0.07). Multiple regression analysis revealed, however, that age was an effect modifier in this relation, there being a negative association between BMI and subjective health in younger men and a positive association in older men, whereas in women the association between BMI and subjective health was much more pronounced at younger ages than at older ages. In addition, current smoking habits and social class (in men and women) and reported slimming behavior (in women) had an independent relation to the total number of health complaints. BMI was also related to specific complaints and groups of complaints, particularly in women. (*Am J Public Health* 1986; 76:1410–1415.)

Introduction

Overweight is a risk factor for the development of various diseases[1,2] and is very common in affluent countries including The Netherlands. We have shown that overweight is accompanied by an excess of both objectively registered moribidity and subjective reported illness, increased use of medical care for particular reasons, and the use of certain drugs.[3] The subjective health status of overweight persons could be mediated through the association between overweight and morbidity. On the other hand, in the absence of illness, overweight per se may be related to a diminished feeling of well-being. Deviations from a cultural ideal of slimness may be involved in such a relation[4,5] as well as functional limitations due to excess weight.

The association of overweight with states of mental health has been the subject of many studies, but the association with subject health complaints has been a somewhat neglected subject. Research in the United States[6] indicated that overweight was related to functional limitations, pain, worry, and restricted activities. In Sweden, associations between overweight and indices of health were found to be less pronounced in middle-aged men than in women.[7,8]

In this study we investigated the association between the Body Mass Index (BMI = weight/height^2) and responses to a list of 51 subjective health complaints. The relations of BMI with the total number of complaints as well as with groups of complaints were studied, adjusting for the possible confounding effects of slimming behavior, smoking habits, age, and social class.

Methods

Sample Characteristics

The data presented in this paper were obtained from a questionnaire administered in the spring of 1984 to members of a study population that had been followed in a continuous morbidity registration.[9] For the overweight group, persons were selected on the basis of diagnosis of overweight at age 20–50 years by general practitioners from four general practices in a mixed rural/urban area. The control group, comprised of a random sample of adults who had never been diagnosed as overweight, was matched to the overweight group in age, sex, practice, and calendar-year at start of follow-up. Details of the follow-up study and sampling methods have been described elsewhere.[9]

The total population in the four general practices comprises about 12,000 individuals, and is representative for the Dutch population with respect to the distribution of age and sex. All persons sampled were Caucasian and of Dutch nationality.

Persons whose addresses were known (93 per cent) were sent a questionnaire, which was returned by 1,241 persons (71 per cent response). The response was not selective with regard to overweight status, sex, age, or social class. Table 1 shows some characteristics of the study group.

Description of Measures

Overweight was diagnosed in the period 1967–78 by general practitioners according to criteria that correspond to a Body Mass Index (BMI = weight/height^2) of at least 26.0 kg/m^2 (for women) or 27.0 kg/m^2 (for men). Height and weight were measured by the general practitioners at the time of the diagnosis of overweight. On average, this was 12 years prior to the administration of the questionnaire (range 6–17 years). As part of the follow-up questionnaire in 1984, subjects were asked to weigh themselves in the morning without shoes and clothes, and measure their actual height without shoes. Virtually all subjects indicated in the questionnaire that they had been able to follow these instructions for weighing themselves and measuring height. In addition, self-reported heights and weights were found to be accurate when compared to measured heights and weights in a sample of 305 of the overweight subjects. Unless otherwise specified, BMI when used in this paper refers to current BMI.

Social class was defined as lower (unskilled and skilled manual workers), middle (lower employees), or upper (higher employees), according to the profession of the head of the household.

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Smoking behavior was classified into four categories: never smoked, stopped smoking, smoking less than 10 cigarettes per day, and smoking 10 cigarettes or more per day. In multiple regression analyses, dummy variables for the categories "stopped smoking" and "smoking" were used, while "never smoked" was the reference category.

Slimming behavior was classified into five categories: "never", "seldom", "regularly", "often", or "(almost) always", trying to reduce weight. In the multiple regression analyses, "regularly" and "often" slimming were combined into one category. Dummy variables were used, with "never slimming" as the reference category.

Subjective health was measured by rated health on a 7-point scale and by the answers to a list of 53 health complaints.[10] This list is often used in The Netherlands to assess subjective health status.[11] Appendix I gives a short description of some single items, and items and clusters identified using factor analysis.[12] All items were dichotomous; two items ("do you feel too thin?" and "do you feel overweight?") were excluded from the analysis since these items could seriously confound the relation between overweight and the total number of complaints. The square root of the total number of complaints (from the remaining 51 items) had a close approximation to the normal distribution and showed the clearest linear relationship with BMI and other variables; it was therefore used in the analysis as an index for general subjective health. In logistic regression, scores on subscales were considered as well as some single items. These items were selected when—in analysis of contingency tables, after adjustments for sex, social class (in the period 1967–78), and age—the answers on these items differed between the overweight and the control group at a probability level of 0.05.

Statistical Methods

Multiple linear and logistic regression analyses were performed with the use of the statistical package programs BMDP2R and BMDPLR.[13] Presence of interactions was assessed by adding cross-product terms of variables to a model that contained all the main effects. When the F-to-enter of an interaction term had a probability value less than 0.10, the cross-product term was included in the straight regression analysis whose results are presented in the Tables. The dependent variable in multiple linear regression (Table 4) was the square root of the total number of complaints. Independent variables were BMI, age (and a cross-product term of BMI and age, reflecting statistical interaction of BMI and age in the analysis), social class, smoking habits, and slimming behavior. For categories of smoking habits and slimming behavior, dummy variables were used (using never-smoking and never-slimming as reference categories). In multiple logistic regression (Table 6) the same independent variables were used. The dependent variable was dichotomous: presence or absence of a complaint (single items) or presence or absence of at least one complaint (groups of items) (see Appendix I).

Results

Table 1 shows the distribution of subjects in BMI categories and categories of possible confounding variables. At the time of the study, about 27 per cent of the originally registered overweight women and 41 per cent of the originally registered overweight men could not be considered overweight any longer, while about 6 per cent of the women and

TABLE 1—Body Mass Index, Social Class, Age, Smoking Habits, and Slimming Behavior of Those Responding to the Questionnaire, Classified According to Overweight Status (1967–78) and Sex

	Women				Men			
	Overweight		Control		Overweight		Control	
Variables	n	%	n	%	n	%	n	%
Body Mass Index (kg/m²)								
< 25.0	55	14.8	313	80.5	27	14.8	181	67.3
25.0–26.9	96	25.9	53	13.6	48	26.4	56	20.8
27.0–29.9	117	31.6	17	4.4	64	35.2	30	11.2
≥ 30.0	102	27.6	6	1.5	43	23.6	2	0.7
Unknown	16	—	15	—	0	—	4	—
Social Class								
Lower	248	64.2	186	46.1	117	64.3	124	45.4
Middle	118	30.6	177	43.8	59	32.4	117	42.9
Upper	20	5.2	41	10.1	6	3.3	32	11.7
Age (years)								
26–39	82	21.2	87	21.5	35	19.2	62	22.7
40–49	98	25.4	131	32.4	64	35.2	78	28.6
50–66	205	53.1	184	45.5	74	40.7	130	47.6
Smoking Habits								
Never smoked	163	42.2	156	38.6	22	12.1	40	14.7
Stopped smoking	85	22.0	99	24.5	59	32.4	79	28.9
Smoking < 10 cigs/day	43	11.1	59	14.6	41	22.5	46	16.8
Smoking ≥ 10 cigs/day	95	24.6	90	22.3	60	32.0	108	39.6
Slimming Behavior								
Never	52	13.6	207	51.6	55	31.1	190	69.6
Seldom	83	21.8	108	26.9	59	33.3	55	20.1
Regular	119	31.2	56	14.0	34	19.2	16	5.9
Often	48	12.6	12	3.0	15	8.5	0	0.0
Almost always	79	20.7	18	4.5	14	7.9	12	4.4
Unknown	5	—	3	—	5	—	0	—
TOTAL	386	100	404	100	182	100	269	100

TABLE 2—Square Root of the Total Number of Complaints per Category of Current Body Mass Index by Overweight Status Based on the Diagnosis of Their General Practitioners 6–17 Years Earlier

Body Mass Index (kg/m²)	Women		Men	
	Overweight mean	Control mean	Overweight mean	Control mean
< 25.0	3.3	3.0	3.1	2.8
25.0–26.9	3.2	2.9	3.3	2.5
27.0–29.9	3.4	2.8	3.2	2.8
≥ 30.0	3.5	3.0	3.2	3.0

12 per cent of the men in the control group would be considered overweight, according to the same criteria used earlier by their general practitioners. In Table 1, current overweight is inversely related to social class; age and smoking habits did not differ between the overweight and control groups. Men generally smoked more than women; subjects in the overweight groups reported slimming more often than those in the control group, this being more pronounced in women than in men.

Subjective health, rated on a 7-point scale, was highly correlated with the square root of the number of complaints (men; r = 0.61, 95% CI = 0.55–0.66; women: r = 0.65, 95% CI = 0.61–0.69) [not shown in tables].

In women, BMI was correlated with the number of complaints (r = 0.15; 95% CI:0.08–0.21), but in men the correlation was very slight (r = 0.07; 95% CI: −0.03–0.17). In Table 2, the average of the square root of the total number of complaints in various categories of BMI is shown. It can be seen that in all categories of BMI more complaints were reported in the overweight group than in the control group. Overweight status in this Table was based on the classification by the general practitioners. In subsequent analysis we did not use the general practitioner classification as this would probably have led to an overestimation of the association between current overweight and current subjective health.

TABLE 3—Square Root of the Total Number of Complaints According to Current BMI, Social Class, Age, Smoking Habits, and Slimming Behavior for Men and Women

Variables	Women n = 790	Men n = 451
Body Mass Index (kg/m²)	mean	mean
< 25.0	3.0	2.8
25.0–26.9	3.1	2.9
27.0–29.9	3.3	3.1
≥ 30.0	3.5	3.1
Social Class		
Low	3.3	3.1
Middle	3.0	2.6
High	2.7	2.4
Age (years)		
26–39	3.0	2.7
40–49	3.2	2.9
50–66	3.3	3.0
Smoking Habits		
Never smoked	3.0	2.7
Stopped smoking	3.2	2.6
Smoking < 10 cigs/day	3.1	3.0
Smoking ≥ 10 cigs/day	3.4	3.1
Slimming Behavior		
Never	2.9	2.9
Seldom	3.0	2.8
Regular	3.3	2.8
Often	3.4	3.9
Almost always	3.5	2.9

TABLE 4—Relation of BMI, Age, Social Class, Smoking Habits, and Slimming Behavior to the Square Root of the Total Number of Complaints on 51 Questionnaire Items (Results of Multiple Linear Regression Analysis)

Sex	Variables	Regression Coefficient	Standard Error of Regression Coefficient
Women	BMI (kg/m²)	0.022	0.014
	Age (years)	0.078*	0.032
	BMI × (Age−48)†	−0.002*	0.001
	Social class	−0.272*	0.081
	Smoking††	0.326*	0.117
	Ex-smoking††	0.278*	0.131
	Slimming (seldom)§	0.233*	0.118
	Slimming (often/regular)§	0.352	0.220
	Slimming (almost always)§	0.438*	0.179
	Total $R^2 \times 100 = 7.6$		
Men	BMI (kg/m²)	0.020	0.021
	Age (years)	−0.092*	0.051
	BMI × (Age−48)†	0.004*	0.002
	Social class	−0.344*	0.099
	Smoking††	0.376*	0.189
	Ex-smoking††	−0.199	0.207
	Slimming (seldom)§	−0.003	0.145
	Slimming (often/regular)§	0.832*	0.422
	Slimming (almost always)§	0.228	0.284
	Total $R^2 \times 100 = 10.2$		

*p < 0.05.

†Cross-product term of BMI and age indicating statistical interaction between BMI and age in their association with subjective health (48 years is the average age in men and women).

††Dummy variables for categories of smoking habits ("never smoked" is the reference category).

§Dummy variables for categories of slimming habits ("never slimming" is the reference category).

The average number of complaints in categories of other variables that were used in this study are shown in Table 3. The number of complaints generally increased with age, with heavier smoking in both men and women, and with more frequent slimming in women. A clear inverse relation between social class and the number of complaints was found in men and women.

As the variables in Table 3 are known to be related to both overweight and to subjective health, we performed a multiple regression analysis in which all these variables were taken into account. In the evaluation of data, a clear interaction between age and BMI was observed in both men and women. Therefore this interaction was included in the multiple regression model (Table 4).

The results in Table 4 are in agreement with the simple analysis in that social class was found to be negatively related to subjective health, that smokers had more health complaints than those who reported they never smoked. Men who stopped smoking had fewer complaints and women who stopped smoking had more complaints than those who never smoked. In most categories of slimming frequency, the number of complaints was higher than in the category of "never slimming" also after adjustment for BMI and the other variables; this was more pronounced in women than in men. The presence of an interaction term in multiple regression in Table 4 complicates the interpretation of the regression coefficients of BMI and age.

For interpretation purposes we calculated the predicted average number of complaints according to the regression models in Table 4 for different values of BMI and age

TABLE 5—Average Number of Complaints, Predicted by Regression Coefficients of the Regression Model from Table 4, at Two Different Ages and for Two Different Levels of Body Mass Index

Sex	Age (years)	Body Mass Index 23 kg/m²	Body Mass Index 28 kg/m²
Women	35	9.6	11.1
	55	12.3	12.4
Men	35	9.2	8.3
	55	9.8	11.3

NOTE: Estimates corrected for transforming the predicted square root of complaints to the average number of complaints (by adding the residual variance of the number of complaints in the square root scale).

(corrected for the transformation of the predicted square root values to actual number of complaints).

The results are shown in Table 5. In men, a higher BMI was associated with more health complaints at the age of 55 but with fewer complaints at 35. In women, a higher BMI was associated with more complaints at the age of 35 but not at age 55. An increase in number of complaints with age was clearer in overweight men than in lean men, and clearer in lean women than in overweight women.

As the BMI might be related to specific complaints but not to others, we studied the relation of BMI to absence or presence of specific complaints and absence or presence of at least one complaint out of groups of complaints. The complaints that were found to be related to BMI—independent of age, social class, and smoking habits—are shown in Table 6.

Complaints of the digestive tract, the skeleto-muscular system, and shortness of breath were associated with BMI in men and women. In addition, in women an association was found between BMI and complaints of nervousness, tiredness, nose and throat, pain in the chest and heart region, often having mishaps, and often feeling tightness in the chest. Slimming behavior was independently related to complaints of tiredness and often having mishaps (not shown in the Tables).

Discussion

Our data show that increased Body Mass Index is associated with more subjective health complaints but that age is an effect modifier in this association. In men a positive association could be demonstrated in older ages and a negative association in younger ages. In women, on the other hand, the positive correlation between BMI and number of complaints diminished with age. Most studies that have reported an association between overweight and subjective health had failed to take a possible interaction between age and BMI into account.[6–8]

Although subjects received instructions for measuring heights and weights, the use of self-reported measurements has its limitations. For example, even when all subjects followed the instructions carefully, errors may have occurred because of the poor quality of some home weighing scales.

The effect modification of age in men cannot be easily explained. It may be that a long period of overweight is needed before an effect of overweight on subjective health becomes apparent in men. The reason why a much stronger relation between overweight and complaints was found in younger women than in older women may be that younger women worry more and are more concerned about being overweight, hence exhibit more health complaints. Some of the specific health complaints associated with BMI are psychosomatic (e.g., nervousness, tiredness, often having mishaps). In these relations, no significant interaction was observed but it must be noted that in logistic analysis, interaction is evaluated on a multiplicative scale whereas in multiple linear regression analysis interaction is assessed on an additive scale.[15]

In our study it was not possible to determine whether psychosomatic complaints were the cause or the result of overweight.[16,17] The effects of the stigma of obesity, especially in women, have been reviewed recently[4,5] and it has been suggested that society's discrimination against the obese and the pressures for thinness are enough to account for many psychological complaints in the overweight.[18] On the other hand, it has been shown that psychosocial problems may contribute to weight gain[19] and that weight changes are accompanied by changes in mood.[20,21] In women, a higher

TABLE 6—Groups of Complaints (clusters) and Single Complaints Related to the Body Mass Index, Adjusting for Age, Social Class, Slimming Behavior, and Smoking Habits (Results from Multiple Logistic Regression Analysis)

Sex	Description of Complaints	No. of Items in Cluster	% Reporting ≥ 1 Complaints from Cluster	Partial Logistic Regression Coefficient of BMI b	SE(b)
Women	Stomach/digestion	5	30.6	0.0422	0.0194
	Skeleto/muscular	5	67.2	0.0703	0.0244
	Nervousness	4	48.3	0.0570	0.0196
	Tiredness	5	50.0	0.0432	0.0194
	Nose/throat	3	22.6	0.0371	0.0208
	Shortness of breath	1	18.0	0.115	0.0228
	Pain chest/heart	1	13.8	0.0390	0.0230
	Often having mishaps	1	6.8	0.115	0.0309
	Tightness in chest	1	12.4	0.0584	0.0250
Men	Stomach/digestion	5	27.5	0.0760	0.0344
	Skeleto/muscular	5	59.3	0.0767	0.0359
	Shortness of breath	1	12.8	0.0898	0.0368

NOTE: All regression coefficients significantly different from zero ($p < 0.05$). The dependent variable in the analysis was dichotomous: presence or absence of a particular complaint (single items) or presence or absence of at least one complaint out of a group (cluster) of complaints.

frequency of slimming behavior was related to more health complaints, independently of the degree of overweight; only 15 per cent of the women, however, reported that health reasons were important as motives for slimming, whereas the reasons "problems with clothes" and "my figure" were each endorsed by 65 per cent of the women who had ever tried to lose weight. Therefore, it is not likely that the relation between slimming and subjective health complaints can be explained by the fact that most women try to lose weight because of health problems.

Perhaps slimming behavior in itself is associated with increased distress. When we stratified the overweight group (as classified by the general practitioners) into persons who shifted out of the overweight category (based current BMI) and those who remained in the overweight category it was surprising to find that these two groups had an equal average number of complaints and both groups had more complaints than the group that had remained non-overweight. Thus, successful slimming cannot account for improved subjective health status. Only 10 per cent or less of the variance in the number of complaints could be explained by all the variables in the regression analysis (Table 4). Thus there must be other unmeasured determinants that account for the unexplained part of the variance.

We conclude that the association of overweight and poorer subjective health status differs in men and women and is dependent on age. In younger women, this association seems to be related to an increased concern of these women about their weight or figure, and the "legitimization" of being overweight (as suggested by Stewart and her colleagues[6]) may have a positive effect on subjective health. In our opinion, public health measures, besides informing the public about the health hazards of overweight, should pay attention to the unwarranted social pressures for thinness especially in those women in whom overweight is predominantly a cosmetic problem.[22]

APPENDIX I

A. Description of clusters of complaints (identified using factor analysis[12])

Name of Cluster	Item	Women	Men
Stomach/digestion	1. Does your stomach often feel full and bloated?	+	+
	2. Do you often have pains in the stomach region?	+	+
	3. Do you often have an upset stomach?		+
	4. Do you often have stomach complaints?		
	5. Do you often have indigestion?	+	+
Skeleto-muscular	1. Do you often have unpleasantly cold fingers, hand, or feet?		
	2. Do your bones or muscles often ache?	+	+
	3. Are you bothered by weak or aching feet?	+	
	4. Are you often troubled by backache?	+	+
	5. Do your arms and legs often go dead or tingle?		+
Nervousness	1. Do you often get upset?		
	2. Do you often feel nervous?	+	
	3. Are you often irritable?	+	
	4. Do your hands often shake?		
Tiredness	1. Do you often feel tired?	+	
	2. Do you often feel sleepy or sluggish?	+	
	3. Do you often feel listless?	+	
	4. Do you generally get up feeling tired and not rested in the morning?		
	5. Do you feel tired sooner than you think is normal?	+	
Nose and throat	1. Are you regularly bothered by coughing?	+	
	2. Do you often have to clear your throat?	+	
	3. Is your nose often blocked?	+	

B. Other complaints, for which the answers were found to differ between the overweight and control groups ($p < 0.05$, after adjustment for social class). Only complaints that are not included in the clusters of complaints listed above are presented.

Complaint			
	1. Do you get short of breath easily?	+	+
	2. Do you fall asleep easily and do you sleep well?	+	
	3. Do you sometimes sweat heavily even when it is not hot?	+	
	4. Do you often have little mishaps?	+	
	5. Do you often feel tight in the chest?	+	

+ = Stratified analysis (with adjustment for social class) revealed a difference between overweight and control group ($p < 0.05$) (using the chi-squared test of Mantel Haenszel)[14].

NOTE: Clusters (factors) identified when, after rotation, the factor loading of the items on only one of the factors was at least 0.40. More information about the cluster analysis is available on request to the authors.

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NIH Consensus Development Conference: Diet and Exercise in Noninsulin-Dependent Diabetes Mellitus

The National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK) and the NIH Office of Medical Applications of Research, in collaboration with INSERM, Institut National de la Santé et de la Récherche Médicale, France, are sponsoring a Consensus Development Conference of Diet and Exercise in Noninsulin-Dependent Diabetes Mellitus, December 8–10, 1986, at NIH.

Noninsulin-dependent diabetes (also called adult-onset or type II diabetes) is the most common form of diabetes, affecting an estimated 10 million Americans. The cornerstone of treatment for this type of diabetes is not insulin or other drug therapy but, rather, the adoption of certain healthy living habits. Two of the most prominent lifestyle components are diet and excercise. This conference will address the significance and recommended use of dietary modification and exercise in the treatment and prevention of this disease.

The conference will bring together biomedical investigators, clinicians, other health professionals, and representatives of the public. Following two days of presentations by medical experts and discussion by the audience, a consensus panel will weigh the scientific evidence and formulate a draft statement in response to several key questions:

- What is the significance of excess body fat in the patient with noninsulin-dependent diabetes mellitus? How can weight reduction best be achieved and maintained?
- What are the appropriate components of the dietary prescription for patients with noninsulin-dependent diabetes mellitus?
- What are the benefits and risks of exercise in patient with noninsulin-dependent diabetes mellitus? How should exercise be prescribed?
- What is the evidence that weight control, diet, and/or exercise can prevent noninsulin-dependent diabetes mellitus?
- What are the directions for future research?

On the final day of the meeting, the consensus panel chairman will read the draft statement to the conference audience and invite comments and questions.

Conference sessions will be held in Masur Auditorium, Warren Grant Magnuson Clinical Center (Building 10), National Institutes of Health, 9000 Rockville Pike, Bethesda, Maryland.

Interested participants must register in advance. To obtain complete information, contact: Sharon Feldman, Prospect Associates, 1801 Rockville Pike, Suite 500, Rockville MD 20852, tel: 301/468-6555.