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The association between excess weight and comorbidity and self-rated health in the Italian population

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Abstract

Purpose—To evaluate the association of obesity with comorbidity and with subjective health perception in a large sample representative of the Italian population and how the association differs by age and gender.

Methods—Cross-sectional data were obtained from nine waves of the “Multipurpose Household Survey”, conducted by the Italian National Institute of Statistics. Self-reported height and weight, six weight-associated diseases and self-rated health (SRH) were evaluated on 352,020 subjects aged 20–89 years. Comorbidity was defined as the presence of 2 or more diseases.

Results—The prevalence of comorbidity was significantly different between obese and normal weight subject in all age categories. SRH was worse in obese subjects than in those of normal weight; this difference persisted, at least in females, into older ages.

Conclusions—Obesity is associated with comorbidity and self-rated health; this association varies across ages and genders. The results found for obese subjects of a given age category were similar to (or worse than) those found for older normal weight subjects of the next age class. For comorbidity this was true both in males and in females of all the considered age categories; for SRH, this was true in particular for females and younger males.

Keywords

Aging; Comorbidity; Obesity; Self Rated Health

INTRODUCTION

An epidemic of obesity has been observed in the last few years in the USA (1) as well as in Europe (2,3) and even extends into older ages. Although obesity, mainly visceral obesity, in

adult ages has been shown to be related to hypertension, type 2 diabetes, cardiovascular diseases morbidity and mortality (4,5), the prognostic importance of excess weight in elderly persons is questioned by some Authors (6–8).

Further, some evidence shows that excess body weight may determine a lower self-rated general health perception (9). Self-rated health (SRH) is a global summary measure of general health status that encompasses physical, mental, and social well-being (10); it is known that it is associated with many health conditions and it predicts mortality (11–13). Given the association between SRH and health outcomes, understanding the link between obesity and SRH could be valuable in developing strategies to improve overall health (10). Some evidence exists that links obesity with SRH (10,14), even if this link is not clear (10). Furthermore, in the National Health Interview Survey it has been shown that the degree of association varies across ages and gender (14) and in the Atherosclerosis Risk in Communities Study, age, lower education, smoking and obesity contributed to the decline in SRH over time (15). However, studies concerning the relation between overweight, obesity, comorbidity and SHR in subjects older than 80 years are not frequent in the literature.

The aim of the present study was to analyze the gender and age-specific association between excess weight and comorbidity and SRH in a very large sample representative of the Italian population, comprehensive of a large number of older subjects.

METHODS

The Multipurpose Household Survey (MHS) is a series of cross-sectional, nationally representative health and lifestyle habits examination surveys, conducted by the Italian National Institute of Statistics (ISTAT) employing a complex probabilistic multistage design (16,17). All the individuals were interviewed face-to-face. Nonresponse rate accounted for 17% of the total sample size (17). This study is based on data from the nine MHS waves conducted between 2001 and 2010.

From the MHS questionnaire, information on gender, age, self-reported height and weight was obtained. A section on health status included questions on selected diseases (“Are you currently affected by any of the following diseases: diabetes, hypertension, myocardial infarction, angina, gallbladder disease, osteoarthritis?”), as well as a question to determine SRH (“How would you rate your health in general?”) with five alternative answers: very good, good, fair, poor, very poor. These questions were always the same in the nine waves. Comorbidity was defined as the self-reported presence of 2 or more of the above mentioned diseases.

Body mass index (BMI) was calculated as weight in kilograms divided by the square of height in meters. Participants were classified as normal weight (BMI 18.5–24.9 kg/m²), overweight (BMI 25.0–29.9 kg/m²) or obese (BMI 30.0 kg/m² or higher).

When calculating prevalence figures, sampling weights were used. The Taylor series linearization method was adopted to obtain correct estimates of variance (18). Age-adjusted prevalences were calculated employing the general age structure of the overall data set as the standard population. Odds ratios (and 95% confidence intervals) were estimated

employing logistic regression adjusting for age and survey year. A *triangular coordinate system* plot (19) was employed to display the relationship between age and BMI with respect to the SRH perception. Ordinal logistic regression and log-linear models were used to evaluate the association between SRH and BMI. All the analyses were performed, separately for men and women, using R for Windows (20) and the “survey” tools of STATA 12.1 (21), to take into account sampling weights in regression models.

RESULTS

In the national sample (352,020 subjects; 172,420 males and 179,600 females), 54.3% of the subjects interviewed were normal weight (45.1% of males, 63.0% of females), 35.6% overweight (44.4% of males, 27.1% of females) and 10.1% were found to be obese (10.4% of males, 9.8% of females).

In table 1 the age-adjusted prevalences of the self-reported presence of selected diseases are shown according to BMI categories.

Table 1 shows also the ratio between the odds for the presence of a disease estimated among overweight and obese subjects and the corresponding odds estimated among normal weight subjects of the same gender (after having adjusted for age and survey year). In obese males all the considered diseases were significantly more common than in normal weight subjects, in particular hypertension and diabetes. Quite similar results were observed in females with odds ratios even higher than in males. This finding was also true when considering overweight females.

The age-specific prevalence of the selected diseases was always numerically higher in obese subjects than in those of normal weight; interestingly this was also true even in subjects aged 80–89 years (figure 1).

Figure 2 shows the prevalence of comorbidity according to gender, age and BMI categories as well as the pattern of age-specific odds ratios for comorbidity.

As expected, the prevalence of comorbidity was higher in older age groups. Furthermore, within each category of age and BMI, females showed a significantly higher presence of 2 or more diseases, with an odds ratio of 1.48 (95% C.I.: 1.45 – 1.51). The strength of association between obesity and comorbidity was generally higher in younger age groups (figure 2). A test for the interaction confirmed the non-homogeneity of the odds ratios across categories of age and gender (likelihood ratio test = 585; d.f. = 26; $p < 0.001$). The prevalence of comorbidity was significantly different between obese and normal weight also in the last age class both in males (OR: 1.62; 95% CI: 1.36 – 1.93) and in females (OR: 1.99; 95% CI: 1.75 – 2.26).

Table 2 shows the percentages of subjects within each category of SRH according to gender, age and BMI categories (because of the small proportion of respondents reporting very poor health, poor and very poor were collapsed into one category).

To highlight the pattern of SRH within age and BMI categories, which appears from numerical data presented in table 2, we propose two graphical displays.

In figure 3 we collapsed the categories good and very good together, as well as the categories poor and very poor. In this way SRH was considered a categorical variable with three levels: good/very good, fair, poor/very poor. Since the three percentages calculated within a given age/BMI category (the SRH “profile”) always sum up to 100, it is possible to represent each profile as a point in a Cartesian plane. This display is referred as a *triangular coordinate system* since there are three hypothetical extreme groups that are totally concentrated into one of the three categories. In our case these extreme groups correspond to three hypothetical sets of subjects all rating their SRH as good/very good (the vertex labeled “good” on the upper corner of the two triangles shown in figure 3) or fair (the vertex labeled “fair” on the lower left corner) or poor/very poor (the vertex labeled “poor” on the lower right corner).

These three vertices are displayed, separately for males and females, in figure 3 together with the points corresponding to the 7 groups of normal weight subjects and to the 7 groups of obese subjects (the 7 groups of overweight subjects were omitted to avoid overlapping). A “natural ordering” of these groups with respect to their SRH profile, which worsen going from top to down and from left to right of the triangles, is evident both in males and in females. The most striking feature is the ordered sequence of the age categories with younger ages located more near to the “good” vertex and older ages located more far. Within each category of age, obese subjects of both genders are always more distant from the “good” vertex than normal weight persons. It is interesting to note that the SRH profile of obese subjects of a given age is generally close to the SRH profile of normal weight subjects of the next (older) age category.

In figure 4 (top panel) are displayed the average scores of SRH, calculated after having rated the five original levels – very good, good, fair, poor, very poor – with 5,4,3,2,1 respectively.

As expected, the health status was perceived as better in younger age groups. A gender difference was also evident with a consistently lower percentage of females reporting a very good SRH (table 2) as well as a lower mean score (figure 4) across age and BMI categories. As far as BMI is concerned, females below 80 years showed a trend in the mean values of SRH (figure 4, top) as well as in the odds of rating their health status as poor or very poor (figure 4, bottom). Obese males below 80 years showed the worst SRH even if differences in the scores between weight categories were greater in younger age groups; in older males, the SRH profiles (table 2) as well as the mean scores (figure 4, top) were fairly similar among BMI categories.

Since SRH is an ordinal variable, to make inference on BMI, the ordered logistic regression was employed. Body mass index was significantly associated with SRH both in males (likelihood ratio test=468; d.f.=14; $p<0.001$) and in females (likelihood ratio test=1104; d.f.=14; $p<0.001$), even when the effects of age, survey year and selected diseases (diabetes, hypertension, angina and/or myocardial infarction, osteoarthritis) were accounted for. Furthermore, tests for the interaction were conducted fitting log-linear models on the data

shown in table 2. The strength of the association between SRH and BMI was significantly different across categories of age and gender (likelihood ratio test=74.5; d.f.=36; $p<0.001$). Figure 4 (bottom panel) shows the pattern of age-specific odds ratios for rating the health status as poor or very poor. A clear trend in the strength of the association between obesity and poor perceived health status is evident, with odds ratios generally higher in younger age groups.

In table 2 as well as in all the figures, age-specific data were shown. A characteristic feature of these data is that the results found for obese subjects of a given age category were generally similar to (or even worse than) those found for normal weight subjects of the next (older) age category. Fisher's exact test was employed to compare obese subjects of a given age category with normal weight subjects of the next (older) age category.

The prevalence of comorbidity of obese females of age categories from 20–29 to 70–79 was always significantly higher (i.e. worse) than that of normal weight women of the next age category (from 30–39 to 80–89). A similar result was found for obese males 70–79 year old with respect to normal weight men 80–89 year old; in the other cases the difference was not significant. More specifically, obese males 20–29 year old showed a prevalence of comorbidity similar to that of normal weight men 30–39 year old; the same was true for the other age categories (up to 60–69).

For obese females of age categories from 20–29 to 50–59, the odds of rating their health status as poor or very poor were always significantly higher than those of normal weight women of the next age class (from 30–39 to 60–69). A not significant result was found for obese females 60–69 or 70–79 year old with respect to normal weight women 70–79 and 80–89 year old. A similar, not significant, result was found for obese males of age categories from 20–29 to 40–49 with respect to normal weight males of age categories from 30–39 to 50–59.

DISCUSSION

Our study shows that, in addition to differences across ages, males and females revealed significant differences in the prevalence of both comorbidity and SRH and that the association of BMI with comorbidity and SRH varied across ages and genders. The prevalence of comorbidity was always higher in obese than in normal weight subjects of the same gender and age class. Similarly, SRH was worse in obese than in normal weight subjects and this difference persisted, at least in females, even into older ages. In general, the results found for obese subjects of a given age were similar to (or worse than) those found for normal weight subjects of the next class (i.e. 10-year older). For comorbidity this was true both in males and in females of all the considered age categories; for SRH, this was true in particular for females and younger males.

These results strengthen further the literature that excess weight is associated with chronic conditions and impaired health perception. The association between obesity and several chronic diseases such as diabetes, hypertension, coronary artery diseases, osteoarthritis and gallstone disease has been observed in cross-sectional and prospective studies, in young,

middle aged and older subjects (4,22–27). Since the prevalence of most of chronic diseases increases with aging, the effect of obesity and aging to increased morbidity and mortality could be relevant.

In our study we observed that the prevalence of diabetes, hypertension, coronary artery disease, gallbladder disease and osteoarthritis was significantly higher in obese men and women than in those with normal weight, even after adjustment for age. This was also true for age-specific prevalences and, interestingly, it was observed even in older subjects confirming a recent report of Dong et al. in a cross-sectional population study of people 85-years-old (28). These findings confirm that aging and obesity are both prognostic factors for chronic health conditions (26).

In our study, SRH was worse in older than in younger subjects. Other, longitudinal, studies have found that SRH is stable until the age of 50 years (29), and then declines (30). Obese subjects showed worse SRH than those with normal weight. These findings confirm and complement previous observations showing negative association between obesity and self-rated general health perception (9–11,31). Both in males and in females the strength of the association between obesity and SRH was generally higher in young and middle-aged adults. In line with a recent observation of Hlatky et al. (32) we observed that the association between obesity and worse subjective health status was still present even after adjusting for comorbidity.

All together, our data show that obesity itself is associated with lower SRH. As SRH is considered an overall measure of health and a predictor of mortality (33,34), the finding of a negative association between obesity and SRH (even in older ages, at least in females) may add a contribute to the debate of harm of obesity in the elderly.

Some limitations must be taken into account to interpret the results of our study. Both weight and height were self-reported. It is possible to hypothesize that height could be overestimated and weight, in particular in obese subjects, underestimated (35,36). However, when nationwide proportions of overweight and obesity are of interest, self-reported measurements of weight and height have been in general accepted (37,38).

Another limitation regards the self-reporting of selected diseases. There was a single question regarding the presence of any type of diabetes which did not distinguish between type 1 and type 2. The question regarding osteoarthritis was not site-specific so, for example, osteoarthritis of the hand was also included as well as that of other non-weight bearing sites; this could be a possible explanation for the small magnitude of the association found for osteoarthritis. A question on the presence of any type of cancer was present in the MHS questionnaires, but no cancer site-specific information was available. Therefore this pathology was not included among the considered diseases.

Data regarding body fat distribution, physical activity levels or personal health practices were not available. This information would be of interest since some studies have reported that excess abdominal fat is a potential risk factor for chronic diseases independent of total adiposity (39–41) and that the levels of physical activity are not constant through the aging

process. Furthermore, BMI becomes a poorer indicator of overall and abdominal fatness in older subjects (42,43).

Another limitation of this study is the cross-sectional nature of MHS which does not permit to draw conclusions regarding the causal association between obesity and health conditions. Furthermore a selection effect may have occurred: older obese individuals may be those who are resilient to some of the harmful effects of excess weight (25,44,45).

Self-rated health status on a five-point scale has been extensively used, since it is easy to collect and is consistently associated with subsequent morbidity and mortality (33,34,46). The question “How would you rate your health in general?” is supposed to summarize perception of one’s health far beyond the absence of illness, covering also social, physical and mental aspects of health (47).

Among the strengths of this study there are the large sample size (which permitted age-specific analyses), the sampling scheme (representative of the general Italian population), and the high response rate (thus biases due to survey nonresponse and missing values are unlikely to be present) as well as the large number of subjects aged 80–89 years selected (6,605 men and 11,206 women). An additional strength is the “dose-response” relationship between increasing BMI categories and increasing prevalence of selected diseases.

In conclusion, our study shows that the prevalence of comorbidity is higher in obese than in normal weight subjects even in older ages and that obesity is associated with a poor SRH. Our data show also that in both genders the prevalence of comorbidity in obese is similar to (or worse than) that of normal-weight subjects of the next (older) age class and that a similar finding was also true for SRH in females and in younger males. Given the cross-sectional nature of our data, the finding that in obese subjects comorbidity and impaired health conditions appear ten year earlier than in normal weight persons has to be verified in longitudinal studies.

Considering the current “obesity epidemic”, even among the elderly, as well as an increasing prevalence of older aged persons in industrialized populations, our findings on the whole show that obesity is a serious health concern also in the elderly and will require more attention by physicians and healthcare stakeholders.

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List of abbreviations and acronyms

BMI	Body Mass Index
HMS	Household Multipurpose Survey

NHANES National Health and Nutrition Examination Survey
SRH Self Rated Health

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Figure 1.

Age-specific prevalence of selected diseases in males (first row) and females (second row) in Italy (2001–2010) according to Body Mass Index category (normal weight: dotted line; overweight: dashed line; obese: solid line).

Figure 2.

Upper panel: Age-specific proportion of males and females in Italy (2001–2010) with 2 or more diseases (diabetes, hypertension, myocardial infarction, angina, gallbladder disease, osteoarthritis) stratified for Body Mass Index category. Lower panel: Age-specific odds ratios for comorbidity.

Figure 3.

Percentage of subjects who rated good/very good, fair or poor/very poor their health status according to age and BMI categories, represented in a triangular coordinate system. Each group is identified with two characters showing BMI and age category: N=normal weight, O=obese; 2=20–29 years, 3=30–39 years, 4=40–49 years, 5=50–59 years, 6=60–69 years, 7=70–79 years, 8=80–89 years.

Figure 4.

Upper panel: Average self-rated health in Italy (2001–2010) in males and females according to age and Body Mass Index category (higher scores on the vertical axis indicate a better perceived health status). Lower panel: Age-specific odds ratios for rating poor or very poor the health status.

Table 1

Age-adjusted prevalence (%) in Italy (2001–2010) of self-reported presence of selected diseases in males and females aged 20–89 years according to Body mass Index categories.

	MALES							
	Normal	Overweight	Obese	n	Overweight vs Normal		Obese vs Normal	
					OR	95% CI	OR	95% CI
Diabetes	4.02	5.26	8.97	9055	1.34	1.27 1.42	2.52	2.34 2.71
Hypertension	12.73	17.55	24.43	28317	1.57	1.51 1.63	2.58	2.45 2.72
Myocardial infarction	2.39	2.76	3.50	4553	1.17	1.08 1.26	1.50	1.35 1.66
Angina	3.16	3.50	4.38	6054	1.12	1.04 1.20	1.45	1.33 1.59
Gallbladder disease	1.55	1.81	2.74	3173	1.18	1.07 1.29	1.78	1.58 2.01
Osteoarthritis	15.56	17.92	21.06	30806	1.02	0.94 1.11	1.30	1.16 1.46
	FEMALES							
	Normal	Overweight	Obese	n	Overweight vs Normal		Obese vs Normal	
					OR	95% CI	OR	95% CI
Diabetes	4.26	6.93	11.67	10225	1.74	1.65 1.84	3.11	2.92 3.32
Hypertension	16.31	23.50	32.70	35044	1.77	1.71 1.83	3.08	2.94 3.23
Myocardial infarction	1.09	1.43	2.10	2198	1.34	1.20 1.49	1.90	1.66 2.17
Angina	3.13	3.71	5.50	6247	1.21	1.13 1.29	1.84	1.70 2.01
Gallbladder disease	3.00	3.97	6.00	6249	1.36	1.27 1.45	2.01	1.85 2.18
Osteoarthritis	27.23	33.16	38.41	52026	1.13	1.08 1.17	1.34	1.27 1.41

n: number of subjects who reported the disease observed in the whole sample.

OR: odds adjusted (logistic regression) for age and survey year.

Table 2

Percentages of subjects within each category of self-rated health in males and females according to age and body mass index categories.

MALES												
AGE	NORMAL				OVERWEIGHT				OBESE			
	Very good	good	fair	poor or very poor	very good	good	fair	poor or very poor	very good	good	fair	poor or very poor
20-29	41.3	49.7	8.1	0.9	38.4	50.5	10.0	1.1	31.0	50.6	16.0	2.5
30-39	30.4	54.4	13.8	1.4	27.8	55.0	15.6	1.5	22.2	51.6	22.8	3.3
40-49	20.3	56.5	20.8	2.4	18.0	55.1	24.6	2.3	13.5	47.6	34.1	4.8
50-59	13.0	48.7	33.2	5.0	10.9	48.9	36.1	4.1	9.5	41.5	41.7	7.3
60-69	7.7	39.4	42.8	10.1	6.6	37.3	48.0	8.1	5.4	30.9	51.3	12.4
70-79	4.6	23.8	52.5	19.1	3.8	23.6	55.9	16.7	3.2	19.5	56.7	20.5
80-89	2.5	15.9	52.1	29.5	2.6	15.1	53.2	29.1	2.8	12.2	54.7	30.3

FEMALES												
AGE	NORMAL				OVERWEIGHT				OBESE			
	very good	good	fair	poor or very poor	very good	good	fair	poor or very poor	very good	good	fair	poor or very poor
20-29	32.8	54.0	12.4	0.8	27.4	54.5	16.7	1.4	20.9	47.6	29.2	2.2
30-39	24.0	56.6	17.9	1.5	20.2	52.9	24.4	2.6	15.1	46.9	33.5	4.5
40-49	15.6	54.5	27.5	2.4	11.6	49.1	35.4	3.9	9.4	39.8	42.4	8.4
50-59	9.2	47.6	38.2	4.9	6.3	39.8	46.9	6.9	4.9	29.0	54.1	12.1
60-69	5.2	35.2	49.6	10.0	3.7	28.6	55.4	12.4	2.7	20.4	56.0	20.9
70-79	2.6	20.2	55.9	21.3	1.8	16.8	57.9	23.5	1.0	11.7	53.4	33.9
80-89	1.6	12.6	51.1	34.7	1.2	11.2	52.6	35.0	1.0	7.7	49.8	41.5