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PAPER

Weight cycling in treatment-seeking obese persons: data from the QUOVADIS study

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OBJECTIVE: To determine parameters of weight history useful for the assessment of weight cycling and their association with psychological distress and binge eating.
DESIGN: Cross-sectional.
SUBJECTS: A total of 1889 treatment-seeking obese subjects, enrolled by 25 Italian centers (78% female subject), aged 20–65 y (median 45); 1691 reported previous efforts to lose weight (median age of first dieting, 30 y).
MEASUREMENTS: The number of yearly attempts to lose weight, weight gain since age 20 y, cumulative weight loss and gain were checked by a predefined structured interview. Psychological distress was tested by means of Symptom Check-List 90 (SCL-90), Binge Eating Scale (BES) and Three Factor Eating Questionnaire (TFEQ).
RESULTS: Differences in anthropometric, clinical and psychological parameters were observed in relation to previous attempts to lose weight. Patients in the upper quartile of parameters of weight history were considered weight cyclers. In multivariate logistic regression analysis, after correction for age, sex and BMI, a high BES score was the only factor systematically associated with a high frequency of dieting (OR, 1.70; 95% confidence interval, 1.22–2.36; $P = 0.022$), with higher cumulative weight loss (1.42; 1.12–1.80; $P = 0.003$) and cumulative weight gain (1.38; 1.06–1.79; $P = 0.017$). However, the sensitivity, specificity and positive predictive value of a high BES score were very low to detect cyclers. Weight cycling did not carry a higher risk of complicating diseases.
CONCLUSIONS: Weight cycling is associated with psychological distress, and binge eating independently increases the risk, but cannot be used to predict cycling. Also, obese patients who do not experience overeating as a loss of control discontinue treatment or regain weight following therapy.
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Keywords: weight history; binge eating; psychopathology; weight cycling

Weight cycling is a major problem in obese people.[1] In several cases, voluntary restrained eating is followed by a return to the previous eating pattern, and weight regain is observed up to a final weight, which may be even greater than the predieting weight. Dieting might also induce disinhibition, making permanent lifestyle changes more difficult to achieve,[2,3] although a few studies did not confirm that weight cycling reduces the chance of subsequent weight loss and makes weight regain more rapid.[4,5]

There is no commonly accepted definition of weight cycling. The percentage weight loss and regain, percent weight variability, and number of cycles have been previously used as parametric estimates of the phenomenon. Consequently, the prevalence of reported weight cycling is extremely variable.

Several studies reported a detrimental effect of weight cycling on significant health outcomes, mainly cardiovascular mortality,[6–8] although recent data questioned the

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[8]A complete list of participant in the QUOVADIS study has been published elsewhere (Diabet Nutr Metab 2003; 16: 115–124).
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independent role of weight variability on hypertension.[9,10] Repeated weight gain and loss may also be associated with a greater risk of diabetes,[11] further contributing to morbidity and mortality.

Disorders of eating behaviors are common in obesity,[12] where repeated or chronic dieting may precipitate binge eating or exacerbate it in those already affected.[13–15] The Binge Eating Disorder (BED), characterized by self-perception of loss of control on eating pattern,[16] has been recently included as a psychiatric disturbance in the fourth edition of the Diagnostic and Statistical Manual (DSM-IV) of the American Psychiatric Association as a category requiring further evaluation.[17] A few studies have associated a higher disinhibition score at the Three-Factor Eating questionnaire (TFEQ)[18] and a higher score at the Binge Eating Scale (BES)[19] to difficulties in dieting, and high risk of weight regain after weight loss.[1,20,21] Other psychiatric symptoms, different from binge eating, have been associated with weight cycling, namely anxiety and depression,[22,23] which may reduce compliance to food restriction. Psychiatric distress is associated with binge eating; therefore, it is difficult to dissect the relative role of general psychopathology and binge eating *per se* in fluctuations of body weight. The present report was aimed at: (1) studying the parameters of weight history suggestive of weight cycling in a large population of obese patients, in an attempt to define cutoff data; (2) verifying the relationship between weight cycling and psychopathological data, as assessed by self-administered questionnaires.

Materials and methods

Patients

We report data on 1889 obese patients (Table 1), enrolled by 25 Italian centers in the observational QUOVADIS study, specifically aimed at measuring the burden of obesity and its complications on health-related quality of life and psychological distress. The protocol of the study and the main features of patients have been previously reported.[24] All obese subjects seeking treatment were eligible for the study, provided they were not on active treatment for obesity at the time of enrolment, were in the age range between 20 and 65 y, agreed to fill a package of self-administered questionnaires, and signed an informed consent to participate.

Socioeconomic and clinical data were recorded on a specifically constructed on-line Case Report Form. No patients had previously undergone bariatric surgery. The weight history was checked according to a predefined structured interview including questions about body weight at the age of 20 y, age at first dieting and the number of times patients had lost weight as an effect of dietary programs. For this purpose, patients were asked how many times they had lost more than 30, 20–30, 10–20, 5–10 or less than 5 kg because of programmed dietary restriction. Values reported by systematic interviews were used to compute the total number of dieting programs and total weight loss because of dieting programs. The sum of total weight loss and the difference between actual body weight and body weight at the age of 20 y was calculated as an estimate of total weight gain, independent of growth. The number of dieting attempts was normalized for age difference since first dieting; all other parameters of diet history were normalized for age difference since the age of 20 y.

The checklist analysis was compared with a systematic analysis of weight history carried out by a qualified dietitian in the coordinating center, and values in over 200 patients agreed with a coefficient of variation $<10\%$.

Body weight was measured in light clothing and without shoes to the nearest half kilogram. Height was measured to the nearest half centimeter.

Before entering into the study, all patients signed an informed consent. The protocol was approved by the ethical committees of the individual centers, after approval of the ethical committee of the coordinating center (Azienda Ospedaliera di Bologna, Policlinico S Orsola—Malpighi).

Table 1 Characteristics of treatment-seeking obese patients, according to previous efforts to lose weight

	No. of previous dieting (n = *198*)	*Previous dieting* (n = *1691*)	P-*value*[a]
Female sex (%)	69 (20–5)	79 (20–65)	0.0014
Age (y)	47.4 ± 11.3	44.4 ± 10.9	0.0003
Body mass index (kg/m^2)	35.3 ± 5.1	38.5 ± 6.5	<0.0001
Obesity class (%)			<0.0001
Class I (30–34.9 kg/m^2)	60 (53–66)	36 (34–38)	
Class II (35–39.9 kg/m^2)	16 (11–21)	35 (33–38)	
Class III (>40 kg/m^2)	24 (19–30)	29 (27–31)	
Weight gain singe the age of 20 y (kg)	29.5 ± 14.8	32.7 ± 17.2	0.014
Associated diseases[b]			
Hypertension	34 (28–41)	37 (34–39)	0.554
Diabetes	6 (3–10)	10 (8–11)	0.129
Dyslipidemia	25 (19–31)	22 (20–24)	0.517
Cardiovascular disease	2 (1–5)	3 (2–4)	0.539

Data are presented as mean ± s.d. or prevalence and 95% confidence interval. [a]Student's *t*-test, or χ^2 test. [b]The prevalence is calculated on cases reporting previous or current treatment for somatic complications at the time of enrolment.

Questionnaires

Binge eating was evaluated by means of two specific questionnaires, the Binge Eating Scale (BES)[19] and the Three-Factor Eating Questionnaire (TFEQ).[18] BES includes 16 items measuring the severity of the BED. It examines both behavioral manifestations (eating large amounts of foods) and feeling/cognition during a binge episode (loss of control, guilt, fear of being unable to stop eating). A BES value above 16 was considered indicative of binge eating, whereas a BES >26 is nearly diagnostic for BED.

TFEQ includes 36 items with an agree/disagree format and 15 items on 4–5 response scales. All item responses are aggregated into three main factors: restrained eating, disinhibition and hunger. Restrained eating measures the amount of intentional restraining on food intake; disinhibition measures the loss of control on eating pattern and social/emotional eating; hunger measures subjective feeling of hunger. Values exceeding 11, 8 and 7 in the three scales were considered indicative of restraint, disinhibition and hunger, respectively. Both TFEQ and BES have been translated into Italian and validated by the NetWorking team Group of the Italian Society for Eating Behavior Disorders.

The Symptom CheckList-90 was used to identify psychopathological distress.[25] For each item, patients scored how much that problem has distressed them during the last week, with responses ranging from 0 (not at all) to 4 (extremely). The 90 items of the test were used to compute the general symptom index (GSI), an indicator of the overall psychological distress.[26] A value ≥ 1 in GSI or in a specific subscale is suggestive of psychopathology (1.00–1.49, mild; 1.50–1.99, moderate; ≥ 2.00, severe).

Statistical analysis

All data were implemented on a personal computer and analyzed using StatView 5.0™ program (ABACUS Concepts, Inc., Berkeley, CA, USA). Differences in individual parameters between groups were analyzed by parametric (Student's *t*-test) or nonparametric methods (Mann–Whitney *U*-test and Kruskal–Wallis test), whenever appropriate. The χ^2 and Fisher's exact tests were used to compare prevalence between groups. Logistic regression analysis was used to identify the factors significantly associated with weight gain and weight cycling. For this purpose, parametric data were dichotomized and values belonging to the forth quartile were indicated as positive. Independent factors included age, sex, BMI and the response to self-administered questionnaires. The odds ratio (OR), the 95% confidence limits and *P*-values were calculated. Factors significant at univariate analysis were tested in multivariate logistic regression analysis.

The significance limit was set at $P = 0.05$.

Results

There was a large prevalence of female subjects in our population (over 75%), but cases were uniformly distributed in the three obesity classes. Only approximately one patient in 10 was at his/her first attempt to lose weight (198 cases); the remaining 1691 patients had started their dieting history at a median age of 30 y, but sometimes in childhood (range, 5–63 y; interquartile range, 19–35 y). On average, 26% of subjects reported an age at first dieting lower than 20 y (19% in male subjects, 27% in female subjects; $P = 0.003$, Fisher's exact test).

Treatment-seeking patients reporting previous efforts to lose weight in the past were more frequently female subjects, were younger and more obese than patients at their first attempt (Table 1). Also, their weight gain since the age of 20 y was higher. The prevalence of reported associated diseases was not different.

Table 2 Binge Eating Scale and Three-Factor Eating Questionnaire and Symptom CheckList-90 in patients, according to previous efforts to lose weight

	No previous dieting (n = *198*)	*Previous dieting* (n = *1691*)	P-*value*[a]
Binge Eating Scale	13.2 ± 9.3	15.0 ± 9.4	0.013
Score >16 (%)	33 (26–39)	40 (38–42)	0.048
Score >26 (%)	12 (8–17)	14 (12–16)	0.508
Three-Factor Eating Questionnaire			
Restraint	8.3 ± 3.6	8.7 ± 4.1	0.214
Score >11 (%)	23 (17–29)	25 (23–27)	0.539
Disinhibition	7.7 ± 3.6	8.6 ± 3.4	0.0002
Score >8 (%)	42 (35–49)	53 (51–56)	0.0039
Hunger	5.9 ± 3.9	6.5 ± 3.6	0.025
Score >7 (%)	33 (26–40)	40 (37–42)	0.074
Symptom CheckList-90			
Global severity index	0.70 ± 0.56	0.80 ± 0.58	0.018
Normal (%)	76 (69–81)	70 (68–72)	0.240
Mild distress (%)	15 (10–20)	17 (15–19)	
Moderate distress (%)	5 (3–9)	8 (7–9)	
Severe distress (%)	4 (2–7)	5 (4–6)	

Data are presented as mean ± s.d. or prevalence and 95% confidence interval. [a]Mann–Whitney *U*-test, or Fisher's exact test.

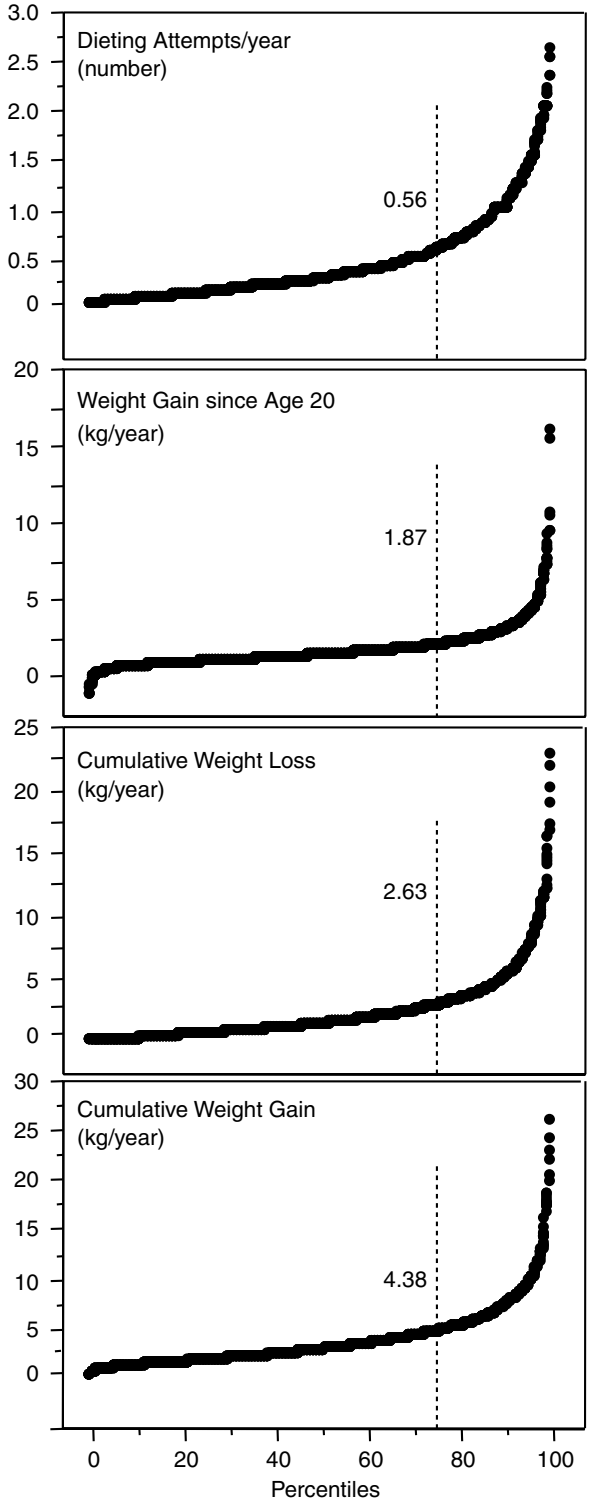

Figure 1 Percentile plots of parameters of weight history in our obese population. The figures indicate the cutoff value of the 75° percentile (dotted line).

In subjects with previous efforts to reduce body weight, the number of weight losing programs was highly variable, ranging from 1 to over 20 (median, three for male and four for female subjects). Also, the age at first dieting was different in relation to gender (male subjects, median 30 y; female subjects, 25; $P=0.0007$, Mann–Whitney test). The median maximum weight loss in the course of previous programs was as large as 20 kg (range, 2–65) in male subjects and 17 (2–70) in female subjects ($P=0.015$).

Cumulative weight loss was estimated to range up to over 400 kg in both genders (median, 1.0 (0.2–22.5) kg/y since first dieting in male *vs* 1.1 (0.2–21.5) in female subjects ($P=0.658$)). When this was added to the difference in weight since the age of 20 y (median, 31 kg in male and 30 in female subjects), only very few patients (two male and two female subjects) had a negative balance, and no differences were observed in relation to gender (male subjects, 2.5 kg/y (−0.1–25.6); female subjects, 2.4 (−0.2–24.8); $P=0.546$).

The percentile plots of parameters of weight history showed an exponential increase in the last 20–25 centiles, and the cutoff corresponding to the 75° percentile was selected to identify patients with a weight history more indicative of weight cycling (Figure 1).

In the whole population, the BES score was significantly higher in female subjects (median, 15 *vs* 10 in male subjects; $P<0.0001$), and 14% of female subjects *vs* 9% of male subjects ($P<0.0001$) had BES values >26, commonly seen in patients with BED. Also, restraint and disinhibition at TFEQ were higher in female subjects. Finally, psychiatric distress, measured by a GSI of the SCL-90 questionnaire >1, was present in 33% of female *vs* 15% of male subjects ($P<0.0001$). In particular, over one in 20 female subjects had a severe psychiatric distress, a prevalence increasing to nearly one in 10 in female subjects with morbid (Class III) obesity.

The group of patients reporting previous attempts to lose weight was characterized by higher BES scores, higher disinhibition and hunger values at TFEQ and higher values of GSI at SCL-90 questionnaire (Table 2). Also, the total prevalence of values exceeding cutoff criteria was increased.

Logistic regression analysis identified a significant association between high scores of self-administered questionnaires and weight history parameters in the upper quartile, but also age, sex and high BMI were significantly associated (Table 3). In multivariate analysis, after correction for age, sex and BMI, a high BES score was the only factor associated with the number of previous efforts to lose weight (OR, 1.70; 95% confidence interval, 1.22–2.36; $P=0.022$), with cumulative weight loss (1.42; 1.12–1.80; $P=0.003$) and cumulative weight gain (1.38; 1.06–1.79; $P=0.017$). However, the sensitivity, specificity and positive predictive value of a BES score >16 were 45, 59 and 27%, respectively, for identifying subjects in the upper quartile of number of weight cycling per year, and 45, 63 and 28% for the upper quartile of cumulative weight gain. The prevalence of BES-positive cases increased linearly with deciles of weight history, and no cut-point could be identified (Figure 2). Similar data were obtained when ROC curves were built to analyze the sensitivity and specificity of BES score in identifying subjects

Table 3 Factors associates with weight history data (univariate analysis)

	No. of dieting attempts per year (cutoff: 0.56)		*Cumulative weight loss (cutoff: 2.63 kg/y)*		*Cumulative weight gain (cutoff: 4.38 kg/y)*	
	OR (95% CI)	P-*value*	*OR (95% CI)*	P-*value*	*OR (95% CI)*	P-*value*
Female gender	1.18 (0.87–1.58)	0.282	1.05 (0.81–1.37)	0.696	0.89 (0.69–1.15)	0.386
Age (y/5)	0.78 (0.73–0.82)	<0.0001	0.69 (0.65–0.73)	<0.0001	0.61 (0.58–0.65)	<0.0001
BMI (kg/m^2 /5)	1.03 (0.94–1.13)	0.480	1.26 (1.17–1.37)	<0.0001	1.65 (1.51–1.80)	<0.0001
BES score >16	1.21 (0.95–1.55)	0.121	1.55 (1.24–1.94)	<0.0001	1.42 (1.13–1.77)	0.002
BES score >26	1.57 (1.15–2.16)	0.005	1.43 (1.06–1.92)	0.018	1.32 (0.98–1.79)	0.069
TFEQ Restraint score >11	1.01 (0.76–1.33)	0.950	1.10 (0.86–1.42)	0.442	1.00 (0.77–1.29)	0.986
TFEQ Disinhibition score >8	1.11 (0.87–1.42)	0.398	1.28 (1.03–1.60)	0.026	1.05 (0.84–1.31)	0.663
TFEQ Hunger score >7	0.96 (0.75–1.23)	0.766	1.13 (0.91–1.41)	0.281	1.00 (0.80–1.25)	0.999
SCL-90 Global severity index >1	1.09 (0.84–1.41)	0.517	1.22 (0.97–1.55)	0.093	1.25 (0.99–1.58)	0.066

Outcome was set at the upper quartile of clinical data.

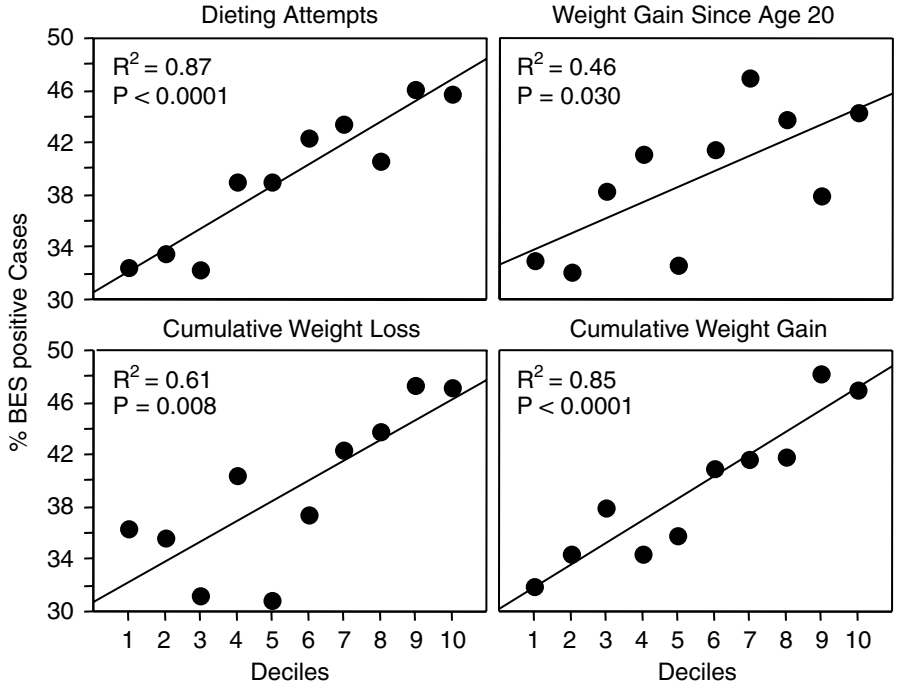

Figure 2 Prevalence of patients with a BES score >16 according to deciles of weight history parameters. The prevalence increases linearly in a rather narrow range (from 30 to 50%), without any cutoff useful for diagnostic purposes.

with weight history parameters in the upper quartile. The area under the ROC curve at best cutoff did not exceed 55% for the four tested parameters of weight history (not reported in details).

Discussion

The present study confirms previous findings that have convincingly associated weight cycling with eating disorders, namely binge eating.[13,15,27] A high BES score was the only marker of psychiatric distress predicting a high yearly number of cycles, as well as a massive weight loss and regain, after adjustment for age, sex and BMI. Subjects entering a weight-losing program after previous efforts to lose weight constitute a specific group of patients, with different clinical, anthropometric and psychological features compared to subjects seeking treatment for the first time.

The study has both limitations and strength. The major strength is the very large number of obese patients, interviewed using a standard protocol in different obesity centers. Our protocol for weight history is similar to the validated Weight and Lifestyle Inventory used by Kuehnel and Wadden[28] in obese binge eaters, based on recall of previous diets. Its validity was tested in a single center, and agreement with a detailed weight history carried out by a

qualified dietitian was good. The centers participating in the study were scattered all over Italy, and recruited patients according to different protocols. A few were centers specifically involved in the treatment of diabetes, others were more specifically involved in the treatment of obesity by means of different therapeutic protocols.[24] This guarantees a complete picture of treatment-seeking obesity. A second strength is the number of self-administered questionnaires used to have a complete picture of psychiatric distress. Both restrained eating and disinhibition have been associated with weight cycling,[27,29,30] and recently the score of BES entered a path analysis of symptoms of binge eating in both gender, in strict correlation with weight cycling.[31]

The major limit is the purely retrospective assessment of diet history, which cannot be used to solve the unsettled question as to whether binge eating is a cause or an effect of weight cycling.[1] Although limited by the small number of never-treated subjects, the small difference observed compared with previously treated subjects suggests that the effects of treatment on eating disorders are small or absent.

An unsolved question is also a definite classification for weight cycling. Kuehnel and Wadden[28] only considered weight loss in excess of 10 lb (approximately 5 kg). We included in the analysis any weight loss, also <5 kg, provided it was due to a specific weight losing program. This approach increased the number of cycles, but also time was included in the analysis. The number of cycles is dependent on time since first dieting, and the probability of being considered a weight cycler increases with increasing age. We standardized cycle number for years since first dieting, and age became negatively associated with weight cycling. This means that the frequency of cycles decreases with increasing age, and young patients are more likely to be involved in repeated weight-reducing programs. Older patients might feel a sense of burnout with repeated failures, and reduce their drive to change dietary pattern in spite of age-related somatic complications favoring the process of change. It might also be argued that older patients might underestimate the exact number of weight-reducing programs they have been involved in, a definite bias of recall inventories.

We considered the possibility that weight cyclers might be identified by psychological or psychiatric distress, as measured by questionnaires. Although the BES scale was significantly associated with the frequency of cycling and cumulative weight loss and gain, the response to BES or SCL-90 scale cannot be used for diagnosis. The sensitivity, specificity and positive predictive value of a high (>16) BES score were too low for identifying high-rate cyclers, and the use of a stricter cutoff (BES >26) was by no means better. These data confirm the hypothesis that a subgroup of patients, labeled 'episodic overeaters' by Wadden *et al*,[32] really exists. These patients do not experience overeating as a loss of control or depression, but nonetheless they regularly discontinue treatment or regain weight following therapy.

The magnitude of cumulative weight gain and loss was impressive, in excess of 400 kg in a few cases. It is hardly conceivable that this may occur without medical, metabolic and psychological consequences.[33] An association was previously reported between weight cycling and major illnesses in different population studies,[6,8,34] contributing to cardiovascular morbidity and mortality. In the cross-sectional analysis of the QUOVADIS population, we failed to demonstrate an independent effect of weight cycling on the prevalence of diabetes and hypertension,[35] but failure to maintain weight loss does not limit its negative effects on somatic diseases. Repeated failures might reduce self esteem, thus contributing to dietary depression and negative emotional responses,[36] although conflicting data were reported.[37,38] The prevalence of psychological distress is high, as also confirmed in the present study, and not uniformly increased. Weight cycling might be either the cause or the effect of poor mental well being,[15,39] but only longitudinal studies might solve this issue.

Finally, our study while confirming the association of BES with weight cycling opens the question as to the best and most effective treatment of obesity. Dieting may promote disinhibition and weight cycling, and nondieting approaches to weight control have been tested,[40] to improve mood, self-esteem and positive body image. Specific nondieting approaches (food selection, physical exercise) and protocols for the treatment of binge eating are in use in a few centers participating in the QUOVADIS study, and follow-up data are accumulating. They will be useful to identify the best way to treat subjects seeking a new treatment after repeated failures.

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