Predictors of weight maintenance.

Predictors of Weight Maintenance

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Abstract

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Objective: To obtain predictors of weight maintenance after a weight-loss intervention.

Research Methods and Procedures: An overall analysis of data from two-long intervention studies [$n = 67$ women; age: 37.9±1.0 years; body weight (BW): 87.0±1.2 kg; body mass index: 32.1±0.5 kg·m^{-2}; % body fat: 42.4±0.5%]. Subjects were measured before a very low energy diet (month 0), after the very low energy diet of 2 months (month 2) and after a 14-month follow-up phase (at 16 months), in which fiber or a carbohydrate-containing food supplement was supplied. The baseline measurements and the changes in parameters induced by the diet intervention were used to predict the changes in BW in the follow-up phase [ΔBW(2–16)].

Results: Multiple regression analysis revealed that 50% ($p<0.001$) of the variability in weight regain could be explained by pphysiological and behavioral factors. These were: frequency of previous dieting ($r^2 = 0.27$, $p<0.05$), hunger score (measured with the three-factor eating behavior questionnaire), and change in 24-hour resting metabolic rate (RMR). Frequent dieters showed significantly more weight regain than less frequent dieters (8.8±1.0 kg vs. 5.1 ±0.8 kg, $p<0.01$). Subjects having parents with obesity regained almost significantly more weight than subjects with lean parents (8.5±0.2 kg vs. 5.1±1.5 kg, respectively; $p = 0.06$).

Discussion: Physiological (ΔRMR-24 hours) and behavioral factors (previous frequency of dieting and hunger score) predicted failure of weight maintenance and, as such, can be used to identify women who are at risk for weight regain.

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Key words: weight regain, resting metabolic rate, eating behavior, diet history

Introduction

The prevalence of obesity has increased considerably in the United States and Europe in the last decade (1,2). More and more subjects will therefore start a diet intervention to achieve a healthier body weight (BW). However, weight cycling and relapse of BW are common features after a weight loss intervention (3,4). It is clinically important that we understand which factors are related to regain of BW after a weight-loss intervention. These factors could be used as predictors of the degree of possible weight regain and enable identification of subjects who are at risk for relapse to support them more intensively to prevent weight gain (5).

In the past, a number of studies have addressed this issue. The postabsorptive respiratory quotient (RQ) has been found to predict relapse of BW (6). After discontinuation of a low-energy diet, an elevated postabsorptive RQ showed that the endogenous lipid oxidation is low, a condition favoring weight gain (6). Identification of a variable early in a weight-loss program that predicts weight changes later on is clinically interesting, because estimation of risk of weight regain can be used to determine the amount of subsequent support given to the subject. Resting RQ in weight-stable subjects was also used as a predictor of weight regain in both men and women Pima Indians (7). Twenty-four-hour respiration chamber data have shown that, after dietary weight loss, subjects are prone to weight regain, because of a low ratio of fat-to-carbohydrate (CHO) oxidation, which can result in a positive energy balance and subsequent weight gain. The higher the RQ measured, the more weight was regained (7,8). In The Baltimore Longitudinal Study on Aging, results of resting RQ in relation to weight gain were presented in 775 nonobese males (9). A relatively high RQ was a predictor of weight gain also for nonobese subjects, which suggests a similar mechanism for weight gain and weight regain. The resting metabolic rate (RMR) was also tested and was not found useful for prediction of relapse, although Ravussin and colleagues reported a decade ago that this parameter is useful for prediction of weight changes (9,10). Recently, a high RQ measured on the last day of a very low energy diet (VLED)

lasting 28 days (RQ_{28}) was found to predict weight regain at 1 month, 3 months, and 6 months of follow-up (11). The measurement of RQ was recommended as a simple and inexpensive predictor. An even more simple predictor was suggested by Kramer and coworkers (12), who found that the change in BW during a diet intervention is a good indicator for the estimation of long-term weight changes. French and coworkers (13), as well as Herman and Polivy (14), found that frequency of dieting prior to a weight-loss intervention is related to BW changes. The history of dieting can easily be investigated by the Herman and Polivy questionnaire and therefore also be used as a predictor for weight regain.

Not only physiological, but also psychological, parameters have been studied for prediction of weight changes. Long-term weight maintenance could be predicted using the Stunkard and Messick (15) Three Factor Eating Behaviour Questionnaire (TFEQ) (16). Karlsson and colleagues (16) found that the disinhibition (factor 2) score of the TFEQ changed during dieting and in the weight maintenance phase of their female subjects with obesity who participated in their 24-month study. Disinhibition could be used as a predictor for relapse. Others also found this questionnaire useful for relating eating behavior to weight maintenance (17,18). Westerterp-Plantenga and colleagues (19) found that an increase in the cognitive restraint scores during a VLED was negatively correlated with weight regain and can thus be used as predictor for successful weight maintenance. Other questionnaires with respect to eating behavior might also contain items that are related to BW changes. Besides the Herman and Polivy questionnaire (14) and the TFEQ (15), the Eating Disorder Examination Questionnaire (EDE-Q) (20) and the Dutch Eating Behavior Questionnaire (DEBQ) (21) were used in this study to determine if they revealed new predictors.

The question arises whether the absolute values measured before or after an energy-restricted period should be used for prediction of BW regain or whether changes in these parameters (caused by the energy restriction) are more meaningful. We have examined whether physiological and/or psychological parameters can be used as predictors of the degree of relapse. The aim of the present study was to evaluate the predictive value of available variables from two long-term weight maintenance studies, to obtain insight into the factors that affect the success of weight maintenance.

Methods and Procedures

Subjects

In this study, results of two long-term intervention studies were used for analysis of predictors of weight regain. Data from a long-term intervention with fiber supplementation (fiber study) (22) and a long-term intervention with a food supplement containing carbohydrates, fiber, caffeine and chromium-picolinate (CHO study) (23) were evaluated. In the fiber study, 34 female subjects with obesity participated [age: 41.0±1.3 years; BW: 88.5±1.7; body mass index (BMI): 33.0±0.6 $kg \cdot m^{-2}$; % body fat: 42.7±0.7%], and in the CHO study, 33 female subjects with obesity participated (age: 34.8±1.2 years; BW: 85.5±1.7 kg; BMI: 31.2±0.7 $kg \cdot m^{-2}$; % body fat: 42.0±0.7%). Data from 67 subjects were pooled (age: 37.9±1.0 years; BW: 87.0±1.2 kg; BMI: 32.1±0.5 $kg \cdot m^{-2}$; % body fat: 42.4±0.5%). Written informed consent was obtained from each subject at the start of the original studies. The study protocols were reviewed and approved by the Medical Committee of Maastricht University (22,23).

Study Design

The subjects participated in a long-term intervention study to maintain BW after a weight-loss period. Subjects adhered to a VLED for 2 months. After the weight-loss program, a weight maintenance intervention of 14 months followed. In both studies, during the 14-month intervention period, two intervention groups and a control group were involved. In the fiber study, one group received 20 g of fiber, one group 10 g of fiber, and a control group received no fiber (22).

In the CHO study, a food supplement containing CHOs, fiber, caffeine, and chromium-picolinate (CHO+), or a CHO supplement or no food supplement at all (control group) was examined (23). For the weight maintenance period, after the 2 months of VLED, no specific exercise and food prescriptions were given, nor did the subjects receive behavioral treatment. Compliance to supplement intake varied between the studies. In the fiber study, all fiber-supplemented subjects were instructed to consume 20 g of fiber. From the monthly check of sachets left over and the questionnaire about fiber intake, it became clear that two groups with different levels of fiber intake could be distinguished. A poor compliance group with an average consumption of 10 g of fiber daily and a high compliance group in which >80% of the sachets supplied were consumed. Data of compliance of the CHO study revealed that the subjects receiving CHO-containing food supplements complied very well (86±15% of the sachets supplied were consumed in the CHO+group and 84±18% in the CHO group) (a detailed description of the study designs are presented elsewhere) (22,23).

Measurements

Before the VLED (0 months), after the VLED (2 months), and at the end of the study (16 months), physical measures and eating behavior questionnaires were obtained. Subjects came to the lab after an overnight fast at 8:00 AM, by car or public transport to minimize physical activity (no walking and cycling was allowed), at 0 months, 2 months, and 16 months.

Physiological parameters of importance measured in this study were: BW; BMI ($BW \cdot height^{-2}$) ($kg \cdot m^{-2}$); and

RMR and RQ measured using an open-circuit ventilated hood system (Oxycon Beta, Jaeger, Breda, The Netherlands). The RMR measured ($kJ \cdot minute^{-1}$) was calculated and presented as 24-hour RMR ($mJ \cdot day^{-1}$).

Eating behavior was analyzed with the DEBQ (15). The first factor represents cognitive restrained eating [i.e., control of food intake by thought and will power (restrained eating)]. The second factor measures emotional eating and disinhibition, an incidental inability to resist eating cues (disinhibition). The third factor examines the subjective feeling of hunger (hunger). The Herman and Polivy questionnaire (14) was used to investigate the frequency of dieting before the study. Frequency classification was: 1 = never; 2 = sometimes; 3 = often; and 4 = always. Whether a subject smoked or not was determined at the beginning of the study. With respect to obesity of the parents, subjects indicated that they had or did not have parents with obesity (number of parents with obesity and amount of overweight were not examined).

Follow-up Data

Subjects of the fiber study and the CHO study were sent additional eating behavior questionnaires after cessation of the study (4 months to 24 months after month 16 measurement). The eating behavior questionnaires sent were: the EDE-Q (20) and the DEBQ (21). The EDE-Q is used for examination of restrained eating, eating concern (preoccupation with food), shape concern (importance of body shape), and weight concern (importance of BW). The DEBQ, which is almost similar to the TFEQ, was used to investigate emotional eating, external cues, and dieting-related eating behavior. The scores of the questionnaires were used to evaluate characteristic eating behavior with respect to weight regain.

Number of Subjects

Most of the data obtained in both long-term studies was based on all subjects ($n = 67$). However, in the CHO study, not all subjects were measured with the ventilated hood system. Data related to RQ and RMR are therefore presented from 58 subjects. We further sent the questionnaires to all participating subjects, but they were returned only by 54 persons (81%). Data of the EDE-Q and the DEBQ are therefore based on 54 subjects. The TFEQ and the Herman and Polivy Questionnaire were used at the beginning of the long-term study and therefore obtained from all subjects. Because of this varying number of subjects, the number of subjects used in the different calculations will be shown continuously.

Data Analysis

The main aim of the study was to examine whether physiological and/or psychological parameters measured correlated with the absolute weight change during the 14-month intervention phase [ΔBW(2–16)].

1. *Changes over time:* First of all, changes in BW and eating behavior over time were examined with analysis of variance (two way). When significant differences were found, post hoc testing with paired *t*-tests were performed to determine which time points differed.
2. *Predictors:* Correlation of physiological and/or psychological factors with ΔBW (2–16) were examined. This parameter could subsequently be used as a predictor. Simple regression analysis was performed to test these relations. The significant correlations found were used together in a multiple regression analysis to study the explained variance of the factors used. Stepwise regression analysis was performed to obtain the most powerful predictor.
3. *Categories of subjects:* Some items of the TFEQ and the Herman and Polivy questionnaire were used to categorize subjects and compare these categories in relation to weight regain more closely. Frequency of dieting, smoking habit, and obesity of parents were examined in categories. Unpaired *t*-tests were conducted to test whether these categories showed differences in weight regain or physiological or psychological variables. Data presented in the text, figures, and tables are given as means±standard error of the mean.

Results

Because the frequency distribution of weight regain was similar for both long-term interventions, the women of the fiber study and the CHO study were taken together as one group.

Physical and eating behavioral characteristics of the participating women before the VLED, after VLED, and at 16 months are presented in Table 1. BW, 24-hour RMR, RQ, and eating behavior changed significantly over time because of the strict dietary regime. Most of the parameters shown returned to baseline levels at 16 months, during the 14-month intervention phase (see Table 1).

Significant correlations of parameters with weight regain were found for initial BMI (before the study) ($r = 0.24$, $p = 0.05$); the change in RMR during VLED (ΔRMR) ($r = 0.28$, $p < 0.05$) (Figure 1): frequency of dieting before the study ($r = 0.46$, $p < 0.01$); shape ($r = 0.47$, $p < 0.01$) and weight ($r = 0.51$, $p < 0.01$) concern scores of the EDE-Q; and disinhibition ($r = 0.26$, $p < 0.05$) of the TFEQ. A tendency with regain of BW was found for hunger of the TFEQ measured at the beginning of the study ($r = 0.23$, $p = 0.065$).

A multiple regression analysis was conducted with the six variables that correlated with weight regain [BMI(0), ΔRMR-24 hours, prior diet frequency, TFEQ disinhibition TFEQ hunger, and EDE weight concern score]. EDE shape

Table 1. Physiological and psychological parameters at different time points of the study

	Month 0	Month 2	Month 16	
Physiological parameters				
BW (kg)	87.0±1.2	77.3±1.1	84.3±1.4	abc
RMR–24 hour* ($mJ \cdot day^{-1}$)	6.94±0.11	6.33±0.10	6.94±0.11	ac
RQ	0.83±0.01	0.79±0.01	0.84±0.01	ac
Eating behavior parameters (TFEQ)**				
Restraint eating	9.5±0.5	13.8±0.5	10.9±0.6	abc
Disinhibition	6.7±0.4	5.5±0.4	6.2±0.4	a
Hunger	5.0±0.4	2.9±0.4	3.5±0.4	ab

*24 hour resting metabolic rate
**Three factor eating behavior questionnaire
a-month 0 vs. month 2, $p<0.05$; b-month 0 vs. month 16, $p<0.05$; c-month 2 vs. month 16, $p<0.05$.

concern was left out of the analysis because it was closely related to EDE weight concern. The overall relation of these six variables with weight regain was $r=0.71$, explained variation $r^2=0.50$, $p<0.0001$. In Table 2, the individual coefficients, standard errors, and probability are shown. Stepwise regression analysis revealed that the prior diet history is the most powerful predictor for unsuccessful weight maintenance ($r^2=0.27$). The hunger score and ΔRMR-24 hours increased the explained variation significantly to 0.42 (see Table 2).

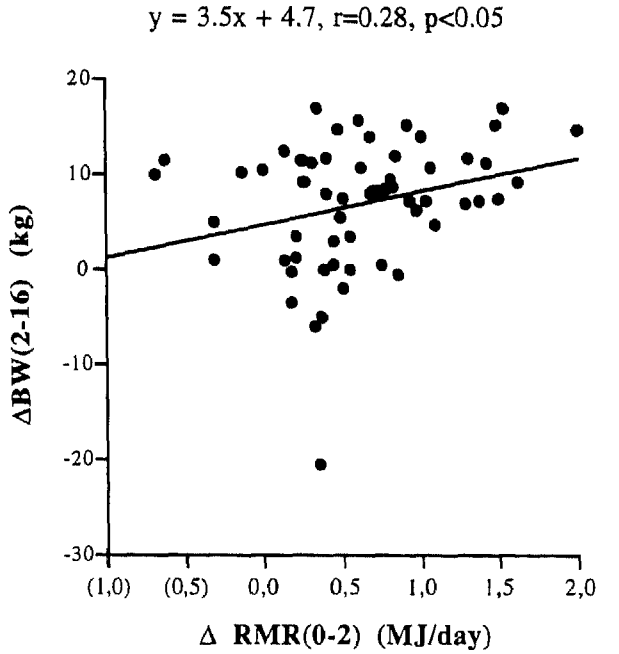

Figure 1: The relation between the change in RMR during the VLED [ΔRMR(0–2)] and the change in BW in the weight maintenance phase [ΔBW(2–16)] is shown. Data of 58 subjects are presented.

The frequency of dieting was used as a category variable with four groups: one group that had never dieted before the intervention ($n=1$); a group that dieted sometimes ($n=21$); a group that had dieted often before the study ($n=30$); and one group that always dieted ($n=3$). Because of the small number of subjects in subclass 1 and subclass 4, only subclass 2 and subclass 3 were compared. This subjective variable was very effective in differentiating specific eating behavior characteristics (Table 3). The group that "often" dieted lost significantly more weight during the diet intervention, but also regained significantly more weight in the weight maintenance phase (Figure 2). They showed, however, also a significantly higher BW at the beginning of the study (Table 3).

No relation was found in RQ measured after the VLED and the amount of weight regain from 2 months to 16 months. The RQ after the VLED (at 2 months) was lower in the regular dieters, compared with the less frequent dieters ($p=0.06$). However, the lower RQ with increased fat oxidation at rest was not related with less weight regain in the weight maintenance phase. Eating behavior scores were characteristic for both diet groups. All EDE-Q items were scored significantly higher for the group that often dieted, in comparison with the less frequent dieters. For restrained eating and disinhibition of the TFEQ, significantly increased scores were found for the regular dieters, as was found for the DEBQ, the emotional eating scores, and dieting-related eating behavior scores (Table 3). When data were analyzed according to smoking habit, a significant difference in the amount of weight loss was found during the VLED. The smokers lost significantly less weight (8.2±0.6 kg), compared with the nonsmokers (10.0±0.4), although there were no differences in initial

Table 2. Multiple regression and stepwise regression analysis of the factors related to weight regain

Predictor	Coefficient	SE	p
Multiple regression (all factors: $r=0.71$, $r^2=0.50$, $p<0.0001$)			
Intercept	−1.32		
BMI(0)	−2.35	0.28	0.41
Diet frequency	2.33	0.99	0.02
ΔRMR-24 hour*	4.24	1.56	0.01
TFEQ—Disinhibition**	−0.33	0.33	0.32
TFEQ—Hunger**	0.85	0.35	0.02
EDE—Weight***	1.35	0.78	0.07

Predictor	Coefficient	SE	F	r^2	p
Stepwise regression					
Intercept	−6.51				
Step 1: diet frequency	2.39	0.73	10.7	0.27	<0.05
Step 2: TFEQ—Hunger**	0.75	0.31	5.92	0.32	<0.05
Step 3: ΔRMR-24 hour*	3.57	1.55	5.33	0.42	<0.05

SE = standard error.
*Change in 24-hour RMR (month 0 vs. month 2).
**Three factor eating behavior questionnaire
***Eating disorder examination questionnaire

BW (87.2±3.0 kgfor the smokers vs. 85.7±1.5 kg for the nonsmokers; NS).

To estimate the influence of obesity of the parents on weight maintenance, the categories parents with obesity and nonobese parents were compared. Subjects with one or two parents with obesity ($n=29$) were found to regain more weight in the 14-month intervention phase (8.5±1.1 kg), when compared with subjects with lean parents ($n=25$; 5.1±1.5 kg) ($p=0.06$). The weight loss during the VLED was not significantly different. It was further found that the group having parents with obesity was significantly more preoccupied with their BW (EDE weight) (3.1±0.3 vs. 2.4±0.3, $p<0.05$ for the parents with obesity vs. lean parents-subjects, respectively). No other physiological or behavioral differences were found between the "parents with obesity" and "lean parents" groups.

Discussion

The present study identifies predictors for weight regain in women. The most powerful predictor was the frequency of dieting before the study. Information about the frequency of dieting is easily determined using the Herman and Polivy restraint questionnaire (14). French and coworkers (13) also reported that history of dieting is an effective predictor of weight gain in women. Two other important predictors for weight regain, the hunger score of the TFEQ, and ΔRMR-24 hour during the VLED, improved prediction of weight regain significantly. These three factors were found to be of primary importance for an adequate prediction of unsuccessful weight maintenance. Besides an increased amount of weight regain in subjects with a long history of diet attempts, we also found differences in eating behavior characteristics between the groups. Although the group that dieted "often" showed more restrained eating behavior, and was highly weight and shape concerned, more regain of BW was found in this group than the group that "sometimes" dieted. These data are in agreement with the results of Karlsson and coworkers (16) and Perkkarinen (18). Psychological dysfunction at the beginning of the study, in combination with difficulties in resisting emotional and social eating cues (less control over their eating), would result in poor weight maintenance in the follow-up phase. The significantly higher BWs at the beginning of the study for the frequent dieters already indicate that weight regain had taken place after before diet interventions. It is remarkable that this subjective qualification of dieting frequency results in clear physical and psychological differences.

Physiological predictors found in the present study were the BMI before the study and the change in RMR induced by the VLED. The fact that BMI was related to

Table 3. Frequency of dieting used as a category

	Sometimes	Often	*p*
BW(0)	82.8±1.7	89.3±1.7	<0.01
ΔBW(0–2) (kg)	8.6±0.4	10.4±0.5	<0.01
ΔBW(2–16) (kg)	5.1±0.8	8.8±1.0	<0.01
RMR(0) ($mJ \cdot day^{-1}$)	6.7±0.1	7.1±0.2	0.08
RQ(0)	0.83±0.01	0.83±0.01	0.78
RQ(2)	0.80±0.01	0.78±0.01	0.06
TFEQ			
Restraint eating	6.7±0.7	10.8±0.6	<0.01
Disinhibition	5.8±0.7	7.7±0.5	<0.02
Hunger	4.7±0.6	5.2±0.5	0.44
EDE-Q			
Restraint eating	1.2±0.2	2.3±0.2	<0.01
Eating concern	0.8±0.2	1.6±0.2	<0.05
Shape concern	2.3±0.4	3.7±0.3	<0.01
Weight concern	2.1±0.3	3.4±0.2	<0.01
DEBQ			
Emotional eating	2.4±0.1	2.9±0.1	0.02
External influences	2.6±0.1	2.6±0.1	0.80
Dieting	3.1±0.1	3.5±0.1	0.02

Physical and psychological scores of subjects who underwent a diet intervention "sometimes" ($n=21$) or "often" ($n=30$) before the present study.
*Three factor eating behavior questionnaire
**Eating disorder examination questionnaire
***Dutch eating behavior questionnaire

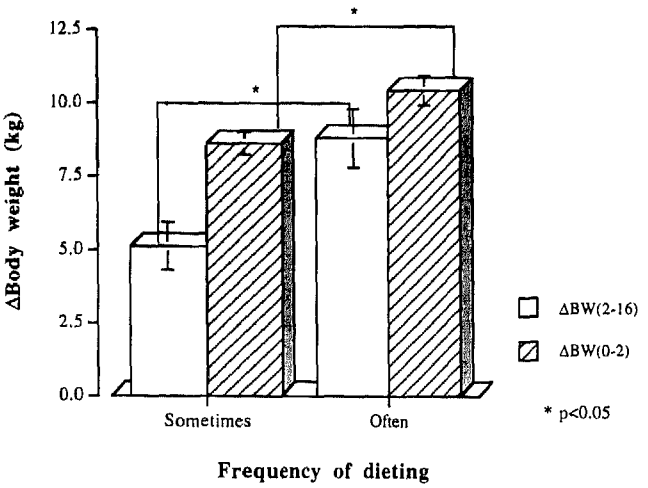

Figure 2: The amount of weight gained in the weight maintenance phase [ΔBW(2–16)] (white bars) and the weight lost during the diet period [ΔBW(0–2)] (hatched bars) is shown for subjects who diet "sometimes" ($n=21$) and subjects who diet "often" ($n=30$). Significant differences in weight loss and weight regain were found (*$p<0.05$).

weight regain might be explained by the set point theory (12,24,25). Kramer and colleagues (12) thoroughly discussed the biological model of BW set point (and thus BMI set point, because the height remains the same), as an alternative explanation for maintenance failure. The defense of BW and body fat already predict return to baseline weight. The predictor suggested [ΔBW(0–2)] was, however, not related to weight regain for our data ($r=0.17$, $p=0.17$).

The decrease in RMR during dieting was positively correlated with weight regain; the more RMR adapted to the negative energy balance due to the VLED, the more weight regain was found afterward. This physiological result of dieting has been mentioned to be related with the loss in fat-free mass. The relation between fat-free mass and RMR before the VLED was in this study $r=0.76$, $p<0.0001$, and after the VLED was $r=0.72$, $p<0.0001$. The changes in both variables during the VLED correlated less well ($r=0.21$, $p=0.11$). The decrease in RMR may make subjects vulnerable for weight regain, because they become more energy efficient. However, this aspect of weight control is still under debate (8,26,27).

The often-reported predictor of weight regain, the RQ, was not at any time point related with weight regain. The RQ measured just after VLED has also been used as a predictor of weight changes (11), but this was not confirmed in the present study. The RQ measured after 2 months of VLED was not related to weight regain. The RQ data did not suggest that a lowered fat oxidation will result in a fat imbalance and therefore lead to weight gain, as was suggested by Seidell and colleagues (9), Froidevaux and colleagues (6), Zurlo and colleagues (7), and Schutz (28). The explanation for differences in RQ values after the VLED in our study, compared with that of Valtuena and colleagues (11) after 28 days, might be that not all of our subjects were still on a VLED at 2 months. Some subjects had already stopped the VLED at 6 weeks and switched smoothly to normal food intake during the final 2 weeks. Another difference between the studies is the time period subjects were on a VLED (1 month vs. 2 months). However, we have no explanation why the RQ data obtained at the start of the study is not at all related with BW changes later on, as has been found in many other studies.

We further found clear simple correlations between the EDE shape and weight score with weight regain; however, the multiple regression analysis revealed no significant contribution of the EDE weight score. The score could perhaps be used as a predictor for weight changes in a long-term trial. It should be stressed how-

ever that, in our study, the EDE-Q was given after the long-term trial to identify the eating behavior characteristics of the subjects. It is unknown whether the same results would have been obtained if these questionnaires were used before the long-term studies started. However, the results obtained with the EDE-Q (weight and shape concern) and of the DEBQ (hunger factor) in relation to weight regain, measured after completion of the study, were similar to the same items of the Herman and Polivy Questionnaire and the TFEQ, respectively.

Another problem with the use of the eating behavior questionnaires was the fact that only 54 subjects of the 67 subjects returned the questionnaires. Although the 81% response is high, missing values with respect to eating behavior might give a disturbed image of the other factors measured of all subjects. No further inquiries were performed to find out why subjects did not return the questionnaires. We feel confident, however, that 80% of the subject population is a good representation of the total group of women. Although the results found with the questionnaires of only 54 subjects could be different than if all women had filled in the questionnaire, the results found were highly significant, suggesting that these findings are probably representative for the whole group of subjects.

The almost significant difference in weight regain between subjects with lean parents and parents with obesity suggests that this might be a very simple predictor of weight regain. The groups split according to the obesity of the parents and share, at a general level, the same sociocultural environment. This means that there were no significant differences in social stratification. Of course the present West European environment is an important contributor to failure of weight maintenance after weight reduction. However, behavioral responses to the environment need to be taken into account. From the different responses between subjects with lean parents and parents with obesity, we may conclude that, besides BW, weight maintenance is also subject to the interplay between genetic predisposition and environmental factors.

In this study, different factors related to weight changes after dietary intervention. Frequency of dieting before the study was found to be a powerful predictor of unsuccessful weight maintenance. The additional predictive information obtained from the hunger score of the TFEQ and ΔRMR-24 hours showed that weight regain can be explained by behavioral and physiological parameters. The clinical relevance of simple and useful predictors of weight regain is to identify women who are at risk for relapse of BW, enabling better support to prevent relapse. These "at-risk" women could perhaps be treated effectively with a relapse prevention program, containing dietary and physical activity support, as well as behavioral treatment to improve self-esteem and control.

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