

## Assessment of psychological predictors of weight loss: How and what for?

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of obese subjects and the influence of psychological factors on treatment outcome. The aim of the present narrative review is to critically analyze the current literature, in order to point out the most common psychological constructs studied in obesity and to give an overview of the main existing tools investigating psychological features which have been considered significant for the prediction of success in weight loss and maintenance programs in obese patients. In this framework, the most common psychological constructs studied are: self-motivation, self-efficacy, locus of control, health related quality of life, self-esteem, self-control, concerns about body image, outcome expectations, and personality traits. These features have been explored through a wide variety of psychometric instruments. However, as an overall, studies evaluating the association between psychological features and treatment outcome failed to give consistent results. A possible explanation may consist on the fact that many tools widely used to explore psychological features were not specifically designed for obese patients and none of them was comprehensive of all possible psychological features involved. The identification of well-defined sub-groups of patients and the validation of more reliable and comprehensive tools, specifically designed for obese subjects, should be forecasted in order to reach a better knowledge of psychological functioning of obese individuals and to improve the outcome of weight loss programs.

**Key words:** Obesity; Eating behaviors; Psychometrics; Psychological assessment; Psychological predictors

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**Core tip:** A wide range of psychological conditions are bi-directionally linked to obesity. Psychological features may account for poor compliance and outcome in weight control programs but the current knowledge regarding this topic of research seems to be largely incomplete as

### Abstract

Obesity is a multifactorial disease and the prominent factors playing a role in its pathogenesis are biological, environmental and psychological. There is a growing interest in understanding psychological functioning

studies investigating whether psychological factors could be reliable treatment predictors failed to give consistent results. The aim of the present narrative review is to critically analyze current literature in order to better identify which psychological features can predict outcome in weight loss and maintenance programs, and to summarize the psychological tools most widely used for this purpose.

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## INTRODUCTION

In the last decade obesity and overweight have become a global burden: the World Health Organization estimates that in 2005 approximately 1.6 billion people worldwide were overweight, 400 million adults were obese and at least 20 million children under the age of 5 years were overweight<sup>[1]</sup>. While in the foretimes overweight and obesity were widespread only in high-income countries, these conditions have now dramatically risen in low- and middle-income countries<sup>[2]</sup>. These countries are now facing a "double burden" of disease: they continue to deal with infectious diseases and under-nutrition, but they are also experiencing a rapid upsurge in risk factors for cardiovascular diseases and diabetes due to the increase of obesity and overweight. Experts believe that, if the current trend will continue, by 2015, approximately 2.3 billion adults will be overweight and more than 700 million will be obese<sup>[1]</sup>.

Obesity has a number of serious consequences for individuals and governmental health organizations. In addition to the implications for the health of individuals, obesity enhances the risk of many diseases, which can contribute, directly or indirectly, to premature death and severe disability<sup>[3,4]</sup>. For this reason, overweight and obesity have a significant economic impact on health systems. The medical costs associated to overweight and obesity are represented by both direct (prevention, diagnosis, and treatment) and indirect costs (decreased productivity, restricted activity, absenteeism, and bed days).

Obesity is a complex disease since a great number of factors play a role in its pathogenesis: behaviors, environment, culture, socioeconomic status, genetic and biological features. All these aspects play a role and may have an effect in determining people to be overweight and obese<sup>[5]</sup>. However, the prominent factors involved in the recent worldwide epidemic diffusion of obesity are likely to be an increased intake of energy and the decreased physical activity or sedentary lifestyle<sup>[4]</sup>. It has been observed a

global shift in diet towards energy-dense foods that are high in fat and sugars. Conversely, vegetables and fruits, which are rich in vitamins, minerals and other micronutrients, are less consumed, and this occurs along with a trend towards decreased physical activity<sup>[2]</sup>. For these reasons, it has been suggested that "obesity is the result of people responding normally to the obesogenic environments they find themselves in"<sup>[6]</sup>.

In addition to environmental factors, also a genetic predisposition to obesity has been observed. Single gene mutations are responsible for rare forms of monogenic obesity<sup>[7]</sup> and common genetic variants of single-nucleotide polymorphisms may significantly increase the risk to develop obesity during lifespan<sup>[8,9]</sup>. Some of these obesogenic genes might also affect weight loss and weight loss maintenance. It has been demonstrated that polymorphisms of several obesity candidate genes have been shown to influence the outcome of weight management<sup>[9]</sup>.

Psychiatric disorders and psychological features have been also reported as conditions which may play a significant role in developing obesity. With respect to psychiatric disorders, the highest comorbidity rates have been obviously reported for Binge Eating Disorder and other atypical Eating Disorders<sup>[10,11]</sup>. However, also Depression and Anxiety Disorders have been associated to obesity. This association seems to be bidirectional since depression and anxiety are associated with unhealthy behaviors including higher caloric intake, alcohol abuse and physical inactivity, which are risk factors for obesity. Conversely, obesity leads to an increased lifetime risk of both Depression and Anxiety<sup>[12,13]</sup> and it is well known that most of the antidepressant treatments can induce weight gain<sup>[14]</sup>.

Moving to psychological correlates of obesity, some studies aimed primarily at identifying domains of psychological dysfunction associated with obesity have been published<sup>[15-17]</sup>. However, in the last years, the emphasis has shifted to look at the causal relationships between body weight and psychological distress and how this may affect treatment outcome<sup>[18]</sup>. Again, the association with obesity seems to be bidirectional: obese individuals face stigmatization and discrimination in many domains of their lives, and their psychological well-being is usually compromised<sup>[19]</sup>. On the other hand, it has been proposed that specific aspects of psychological functioning may increase the risk of developing obesity<sup>[20]</sup>.

A significant proportion of obese patients do not display psychiatric comorbidities<sup>[15,21]</sup>. However, also in these cases, it has been hypothesized that the psychological asset may be strictly associated to unhealthy behaviors, to a fickle compliance and to a worse outcome of weight loss programs<sup>[22,23]</sup>. As unhealthy behaviors are considered the prominent factors in developing obesity, in order to improve the treatment of obesity, the processes that promote successful behaviors and the adoption of healthy

habits should be better acknowledged.

Despite the growing interest in understanding psychological functioning of obese subjects, the current knowledge regarding this topic of research seems to be largely incomplete. One of the main obstacles to research in the field of psychological features interfering with obesity onset and management is represented by the heterogeneity of potentially relevant factors, usually explored through a wide variety of psychometric instruments.

Given these premises, the aim of the present narrative review is to critically analyze the current literature, in order to point out the most common psychological constructs studied in obesity and to give an overview of the main existing tools investigating psychological features which have been considered significant for the prediction of success in weight loss and maintenance programs in obese patients.

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## PSYCHOLOGICAL FEATURES USED AS TREATMENT PREDICTORS AND THE MAIN TOOLS FOR PSYCHOLOGICAL ASSESSMENT

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Psychometric instruments in the field of obesity research are used to evaluate the psychological health of obese patients before, during, and after treatment. Psychometric questionnaires are important to compare the results of different weight management programs, and to understand the connection between medical and psychological factors in obesity<sup>[24]</sup>.

The identification of factors accounting for good compliance and positive outcome in weight control programs is a major topic of research. Psychological features seem to play a key-role in the treatment of obesity and have been frequently investigated in order to reduce the lack of compliance and to improve effectiveness of dietary treatment, suggesting that a good psychological functioning may be associated with higher success rates in treatment and that weight loss may be associated to beneficial effects on many different areas of psychological functioning<sup>[25]</sup>.

The psychological constructs most commonly investigated are: self-motivation, self-efficacy, locus of control, HRQL, self-esteem, self-control, concerns about body image, outcome expectations, and personality traits. Table 1 summarizes the questionnaires which have been more commonly used for the evaluation of these psychological features, as well as their main acknowledged limitations (if reported).

Teixeira *et al.*<sup>[22]</sup>, in a comprehensive *review* summarizing studies published from 1995, has evaluated which psychosocial aspects can be considered as potential predictors of weight loss and weight management<sup>[22]</sup>. Authors organized these predictors into three groups on the basis of the evidence found in literature: (1) with consistent evidence; (2) with mixed evidence; and (3)

with suggestive evidence. Only a few predictors met the criteria to be included in the first group: less previous dieting, fewer weight loss attempts, self-motivation, general self-efficacy (in contrast to eating-related self-efficacy), and autonomy<sup>[22]</sup>.

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## SELF-MOTIVATION

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Self-motivation is a trait-like construct conceptualized as "a behavioral tendency to persevere independently from situational reinforcements"<sup>[26]</sup>. The instrument most widely used to measure motivation in obesity is the Self-Motivation Inventory (SMI), which has been generated to predict adherence to therapeutic exercise in preventive and rehabilitative medicine programs<sup>[26]</sup>. SMI has been frequently used in literature and it has demonstrated to predict treatment success in weight loss programs<sup>[27]</sup>.

Other questionnaires that evaluate self-motivation have been rarely used in the field of obesity. For this reason, they have not been included in Table 1. The Weight Loss Readiness Test<sup>[28]</sup>, a questionnaire developed to assess weight loss readiness and motivation, failed to predict weight loss and weight maintenance<sup>[27,29]</sup>. Recently, a new questionnaire evaluating motivation and readiness to treatment has been created and validated<sup>[30]</sup>. This test seems to be capable to identify those individuals with high desire to overcome the problem and with low obstacles in pursuing the treatment. Under these conditions, obese patients reach the goal of losing weight more frequently than obese subjects who did not display these traits. However, in a more recent study, the same authors found that the test seems to be capable to predict weight loss only in men, suggesting that in women, other psychiatric or psychological factors may play a greater role<sup>[31]</sup>. Since the questionnaire has been published in the last few years, it has not been widely used or tested in populations different from those used for its validation.

As already said, self-motivation has been considered as a predictor of success with consistent evidence<sup>[22]</sup> and the findings of Teixeira *et al.*<sup>[22]</sup> are in agreement with earlier findings<sup>[27]</sup> and with more recent studies which reported an association of self-motivation with weight loss and weight loss maintenance (*e.g.*, Cresci *et al.*<sup>[32]</sup>).

Furthermore, motivational interviewing used to increase motivation for change and to improve treatment outcomes, appears to enhance weight loss in overweight and obese patients<sup>[33,34]</sup>.

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## SELF-EFFICACY

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Bandura has defined self-efficacy as the combination of outcome expectancies and efficacy expectancies and has suggested that behavioral changes require both the belief that the changes will result in the desired outcomes (outcome expectancies) and the belief that each individual is capable of making the change

**Table 1 Summary of the tests most commonly used in the evaluation of psychological condition**

	Areas of evaluation	Uses	Domains/subscales	NO. of items	Limits
Self Motivation Inventory <sup>[26]</sup>	Self motivation	Community samples, clinical populations	Tendency to persevere, finish tasks initiated, maintain self-discipline, motivate oneself	40	Not specific for obese subjects Assesses only the trait-like construct of self-motivation Does not include specific items to investigate expectations about health or weight
General Self-Efficacy Scale <sup>[37]</sup>	General self-efficacy	Community samples, clinical populations		10	Not specific for obese subjects
Eating Self-Efficacy Scale <sup>[38]</sup>	Perceived control over food consumption	Dieting and/or overweight individuals	Two dimensions of efficacy to control overeating: Negative affect, socially acceptable circumstances	25	-
Weight Efficacy Life-Style Questionnaire <sup>[39]</sup>	Self-efficacy in weight management	Patients with obesity	Five dimensions of efficacy for weight management: Negative emotions, availability, social pressure, physical discomfort, positive activities	20	Neither the total, nor the five subscales scores were associated with either program attendance or weight loss <sup>[57]</sup>
Internal-External Scale <sup>[46]</sup>	Locus of control beliefs	Community samples, clinical populations	-	23	Not specific for obese subjects Does not include specific items to investigate expectations about health or weight
Multidimensional Health Locus Of Control Scale <sup>[47]</sup>	Locus of control in relation to specific health conditions and behaviors	Community samples, clinical populations	Internality, chance externality, powerful others externality	18	Not specific for obese subjects Does not include specific items to investigate expectations about health or weight Individuals could no longer be classified as "internals" or "externals" (compared to other questionnaires evaluating locus of control)
Dieting Beliefs Scale <sup>[48]</sup>	Locus of control with respect to personal weight	Dieting individuals	-	16	-
Weight Locus Of Control Scale <sup>[49]</sup>	Locus of control with respect to personal weight	Dieting individuals	-	4	-
Medical Outcomes Study: Short Form-36 <sup>[56]</sup>	Health-related quality of life	Clinical populations	Physical function, role limitations (physical), vitality, general health perceptions, bodily pain, social function, role limitations (emotional), mental health	36	Not specific for obese subjects Does not measure disease-specific domains Lacks in sensitivity to detect small treatment effects It is recommended that it be used in conjunction with an obesity specific questionnaire <sup>[56]</sup> Does not include specific items to investigate expectations about weight Considers all individual psychological symptoms equally relevant in the determination of the patients' well-being
Impact Of Weight On Quality Of Life Questionnaire <sup>[57]</sup>	Health-related quality of life	Patients with obesity	Health, social/ interpersonal life, work, mobility, self-esteem, sexual life, daily activities, living, comfort with food	74	Considers all individual psychological symptoms equally relevant in the determination of the patients' well-being
Impact Of Weight On Quality Of Life Questionnaire-Lite <sup>[58]</sup>	Health-related quality of life	Psychiatric patients, patients with obesity	Physical Function, self-esteem, sexual life, public distress, work	31	Considers all individual psychological symptoms equally relevant in the determination of the patients' well-being
Obesity Related Well-Being (ORWELL) 97 Questionnaire <sup>[59]</sup>	Health-related quality of life	Patients with obesity	Perceived psychological status and social adjustment, physical symptoms and impairment	18	Weaknesses were found when trying to correlate Body Mass Index with subscores of the questionnaire

Rosenberg Self-Esteem Scale <sup>[65]</sup>	Global self-esteem	Community samples, clinical populations	-	10	Not specific for obese subjects Does not include specific items to investigate expectations about health or weight Measures global self-esteem and not the sub-domains of self-esteem
Tangney Self Control Scale <sup>[71]</sup>	General self-control	Community samples, clinical populations	-	36	Not specific for obese subjects
Three-Factor Eating Questionnaire-R18,-R21 <sup>[76,77]</sup>	Domains of eating behavior	Community samples, obese individuals	Cognitive restraint, uncontrolled eating, and emotional eating	18; 21	
Body Attitude Questionnaire <sup>[87]</sup>	Body attitudes	Patients with eating disorders	Feelings of overall fatness, self-disparagement, strength, salience of weight, feelings of attractiveness, consciousness of lower body fat	44	Not specific for obese subjects Originally developed only for women
Body Shape Questionnaire <sup>[88]</sup>	Concerns about body shape and "feeling fat"	Community samples, patients with eating disorder	-	34	Originally developed for use in Anorexia Nervosa and Bulimia Nervosa Not appropriate for assessing body dissatisfaction in males
Physical Self-Perception Profile <sup>[89]</sup>	Self-evaluations in the physical domain	Community samples, clinical populations	Sport competence, perception of physical condition and fitness, perception of an attractive body, perception of physical strength, physical self-worth	30	Not specific for obese subjects
Body Cathexis Questionnaire <sup>[90]</sup>	Body dissatisfaction	Community samples, clinical populations	-	46	Not specific for obese subjects
Body Satisfaction Scale <sup>[91]</sup>	Body dissatisfaction	Community samples, patients with eating disorder, overweight subjects	-	16	Not specific for obese subjects
Body Parts Dissatisfaction Scale <sup>[92]</sup>	Body dissatisfaction	Community samples, clinical populations	Parts wished were smaller, parts wished were bigger, parts with which content	7	Developed for use in adolescents girls
Goals And Relative Weights Questionnaire <sup>[94]</sup>	Factors that influence selection of a weight goal, weight loss goals as "dream weight", "happy weight", "acceptable weight", "disappointed weight"	Overweight and obese patients	-	-	
Temperament And Character Inventory <sup>[107]</sup>	Normal and abnormal personality traits	Community samples, clinical populations	Novelty seeking, harm avoidance, reward dependence, persistence, self-directedness, cooperativeness, self-transcendence	240	Not specific for obese subjects
Karolinska Scales Of Personality <sup>[108]</sup>	Personality traits associated with vulnerability for psychological deviance	Patients with various psychiatric and psychosomatic disorders	Guilt, indirect aggression, irritability, suspiciousness, verbal aggression, inhibition of aggression, muscle tension, psychasthenia, psychic anxiety, somatic anxiety, socialization, social desirability, detachment, impulsiveness, monotony avoidance	135	Not specific for obese subjects Designed to evaluate abnormal personality, rather than variations of normal personality
Toronto Alexithymia Scale-20 <sup>[111,112]</sup>	Alexithymia	Community samples, clinical populations	Difficulty describing feelings, difficulty identifying feeling, externally-oriented thinking	20	Not specific for obese subjects
Revised Neo Personality Inventory <sup>[116]</sup>	Five broad personality domains	Community samples, clinical populations	Extraversion, neuroticism, agreeableness, conscientiousness and openness to experience; six specific facet scales in each of five broad domains	240	Not specific for obese subjects

(efficacy expectancies)<sup>[35,36]</sup>. Both general self-efficacy and eating-related self-efficacy have been measured

in obesity research. The first one is mainly assessed using the General Self-Efficacy Scale (GSES) originally



developed by Schwarzer *et al.*<sup>[37]</sup>. GSES measures how an individual judges his/her own competence in order to complete tasks (by the means of behaviors, thoughts, and emotions) and reach desired goals. Eating self-efficacy has been frequently assessed in obese individuals with the Eating Self-Efficacy Scale<sup>[38]</sup> and the Weight Efficacy Life-Style Questionnaire<sup>[39]</sup>, which are considered useful tools to measure self-efficacy in obesity, especially for clinicians working with weight control programs. In fact, almost all the studies on self-efficacy have led to the conclusion that high self-efficacy towards eating behaviors is associated with success in weight management<sup>[40-44]</sup>.

## LOCUS OF CONTROL

Locus of control refers to the extent to which individuals believe they can control events affecting them. Locus of control is one of the four dimensions of core self-evaluations along with neuroticism, self-efficacy, and self-esteem<sup>[45]</sup>. The most commonly used instruments for measuring locus of control in obesity are the Internal-External (I-E) scale<sup>[46]</sup>, the Multidimensional Health Locus of Control (MHLC) Scale<sup>[47]</sup>, the Dieting Beliefs Scale (DBS)<sup>[48]</sup> and of the Weight Locus of Control (WLOC) scale<sup>[49]</sup>. The I-E scale was the first tool specifically designed to assess locus of control, but it does not include specific items to investigate expectations about health or weight.

In the last decades, a large body of literature has investigated the role of health-related control beliefs in influencing the course of chronic diseases, medication compliance and health promoting behaviors. The vast majority of studies have used different forms of the MHLC Scales developed by Wallston *et al.*<sup>[47]</sup>. While the A and B forms were constructed to measure general health-related control beliefs without being specific to any health behavior or condition, form C was developed to investigate health-related control beliefs of individuals with an existing medical condition<sup>[50]</sup>. MHLC measures three possible localizations of health control: internal localization, called "internality" (internal locus of control, measured by a subscale named IHLC) and two external localizations called "powerful others externality" (measured by the subscale PHLC) and "chance externality" (measured by the subscale CHLC)<sup>[50]</sup>. Patients with high internality believe that their health status depends only on their own behaviors; patients with high powerful others externality are convinced that their individual health status is the consequence of the actions performed by powerful people, *e.g.*, doctors, family members, friends; patients with high chance externality believe that mainly chance, fate, or luck determine their health status<sup>[50]</sup>. Despite a large use of the MHLC Scale in obesity, information retrieved by its administration does not seem to add specific or accurate knowledge concerning weight-related control beliefs.

Two questionnaires more specifically designed for overweight and obesity are the DBS<sup>[48]</sup> and the WLOC scale<sup>[49]</sup>. These tests investigate weight-related control beliefs and have been frequently used in obesity research. Allison and Engel<sup>[51]</sup> reported that an internal locus of control is a beneficial trait regarding weight management and conclude that health- and weight-specific locus of control are more predictive than more general measures<sup>[51]</sup>. Wamsteker *et al.*<sup>[44]</sup> found that less weight reduction is associated with the beliefs that obesity has a physical origin and is not under behavioral control. Wiltink *et al.*<sup>[52]</sup> identified the attribution of overweight to eating habits as a factor predicting long-term weight loss in severe obese patients attending psychotherapy; whereas Nir and Neumann<sup>[53]</sup> found that an internal locus of control was related to a lower weight regain after a weight reduction program.

However, some studies failed to identify differences between "internals" and "externals" in terms of weight loss and weight maintenance<sup>[54]</sup>.

## QUALITY OF LIFE

HRQL refers to the "psychological, physical and social domains of health, seen as distinct areas that are influenced by a person's experiences, beliefs, expectations, and perceptions"<sup>[55]</sup>. Studies addressing HRQL as a pre-treatment predictor of weight outcomes have used instruments which may be divided into generic and disease-specific tools. The most widely generic tool used is the SF-36<sup>[56]</sup>, which measures eight not-disease-specific domains. SF-36 has been frequently used in obesity research, but its main limitation consists in the fact that it has not been designed to detect the effect of overweight on quality of life (QoL)<sup>[5]</sup>.

The instruments specifically developed for obese subjects include the Impact of Weight on Quality of Life (IWQoL) questionnaire<sup>[57]</sup> and the Impact of Weight on Quality of Life questionnaire-lite (IWQoL-lite)<sup>[58]</sup>, which assess the effects of weight on QoL in eight areas and five areas, respectively; and the Obesity related well-being (Orwell 97) questionnaire<sup>[59]</sup>, which assesses QoL across three areas and proposes that symptoms of similar intensity can have a different impact depending on the individual (items about the occurrence, severity, and relevance of each impairment on its own life are included in the test).

From one side, there is evidence that weight loss improves HRQL in obese subjects<sup>[60-62]</sup>. On the other hand, there is poor evidence for QoL as treatment predictor. Only few studies explored QoL as a predictor of success in obesity treatment and Teixeira *et al.*<sup>[63]</sup> found an association between pretreatment quality of life measures and long-term outcomes of a lifestyle weight loss programs; whereas Rotella *et al.*<sup>[31]</sup> did not confirm this result.

## SELF-ESTEEM

Self-esteem has been defined as “a personal judgment of the worthiness that is expressed in the attitudes the individual holds towards himself”<sup>[64]</sup>. The main assessment tool used to evaluate self-esteem in obesity is the Rosenberg Self-Esteem (RSE) scale<sup>[65]</sup>. RSE measures global self-esteem, whereas other instruments such as the Coopersmith Self-Esteem Inventory and the Tennessee Self-Concept scale<sup>[64]</sup>, which have been used only sporadically in obesity research (not included in Table 1), are multidimensional, as they measure self-concept (of which self-esteem is just one component) and the sub-domains of self-esteem (performance, social, and physical self-esteem).

Usually, clinical samples show lower self-esteem than community samples (both normal- and overweight)<sup>[66,67]</sup>, and studies that investigated the impact of weight loss treatment on self-esteem typically report improvements in almost all its dimensions<sup>[68,69]</sup>. As a possible predictor of success, self-esteem has not been frequently investigated. However, a recent study reported that lower self-esteem may be related to unhealthy weight control behavior in women<sup>[70]</sup>.

## SELF-CONTROL

Self-control is the ability to refrain from acting on undesired behavioral tendencies<sup>[71]</sup>. The 36-item Tangney Self Control Scale measures general self-control and although it has been used in a number of studies to measure self-control in relation to eating behaviors and weight management<sup>[72-74]</sup>, the control over eating is often measured by using the revised shortened versions of the original Three-Factor Eating Questionnaire (TFEQ)<sup>[75-77]</sup>, which measures three domains of eating behaviors: cognitive restraint (control over food intake to influence body weight and body shape), uncontrolled eating (tendency to lose control over eating when feeling hungry or when exposed to external stimuli), and emotional eating (propensity to overeat in relation to negative mood states). The two shortened versions have been developed in an obese population after it has been demonstrated that the original three factor structure lost its sensitivity in those samples<sup>[76]</sup>.

Control over eating, measured with the subscales of the TFEQ, has been associated with weight reduction and successful weight maintenance<sup>[54,78-80]</sup>, whereas a decreased eating restraint and increased disinhibition have been found in those regaining body weight after the end of a weight loss program<sup>[81,82]</sup>. However, some studies failed to demonstrate the ability to predict weight loss based on pre-treatment TFEQ scores<sup>[83,84]</sup>.

## BODY IMAGE AND OUTCOME EXPECTATIONS

Body image is a multidimensional construct which

includes: (1) the perceptual component, which refers to a person's skill to estimate precisely the actual size and shape of the body; (2) the attitudinal component, including one's cognitions and affect, having reference to the body; and (3) the behavioral component, which concerns a person's engagement in specific actions and the potential shunning of particular situations/environments<sup>[85]</sup>. The difference between the individual perception of his/her current body size and ideal body size is related to body satisfaction<sup>[86]</sup>. Up to 74% of obese patients have body image dissatisfaction and distortion<sup>[11]</sup>, so this construct has been frequently assessed in pre-treatment psychological batteries. Several instruments are available to measure body image, concerns about body shape and body satisfaction. The most widely used are: the Body Attitude Questionnaire (BAQ)<sup>[87]</sup>, the Body Shape Questionnaire (BSQ)<sup>[88]</sup>, the Physical Self-Perception Profile (PSP)<sup>[89]</sup>, the Body Cathexis Questionnaire<sup>[90]</sup>, the Body Satisfaction Scale (BSS)<sup>[91]</sup> and the Body Parts Dissatisfaction Scale (BPDS)(Corning *et al.*, 2010)<sup>[92]</sup>. The BAQ explores a broad range of attitudes that subjects hold toward their body; its subscales encompass six distinct aspects of body experience. The BSQ is one of the most valid psychometric instruments for the assessment of distress related to body image and weight in obese individuals seeking weight reduction. The PSP is widely used to measure self-evaluations in the physical domain and its validity has been supported in a wide range of samples; it assesses five subdomains of physical self-perceptions. The Body Cathexis Questionnaire assesses feelings towards various body parts or characteristics. In the BSS respondents are asked to rate each of 16 body parts on a seven-point scale ranging from “very satisfied” to “very dissatisfied”; the scale was designed for work in health-related fields: in particular the scale was used to assess body dissatisfaction in eating disorders and to monitor changes in body satisfaction in subjects undergoing surgical treatment for breast cancer<sup>[91]</sup>. The BPDS lists 7 body parts and asks whether there is a desire to change any part.

Finally, the Body Uneasiness Test<sup>[93]</sup> can be considered a really valuable tool to assess and measure body dissatisfaction. However, this test has been largely used only in Italy and for this reason it has not been included in Table 1.

More recent studies investigating possible predictors of weight outcome in obese patients used the Goals and Relative Weights questionnaire<sup>[94]</sup>. Briefly, this test takes into account weight expectations asking subjects to indicate their “dream” weight, and weight values that they would be “happy” with, they would consider “acceptable”, and that they would be “disappointed” with, at the end of the weight loss program. The test does not include other areas of satisfaction or dissatisfaction linked to body weight or shape, and therefore it gives information of outcome expectations only related to the above mentioned parameter.

Many studies have found a link between body image, health and eating behaviors. Mond *et al.*<sup>[95]</sup> suggested that shape concerns are an important mediator of the relationship between obesity and impairment in psychosocial functioning in obese women. Myers *et al.*<sup>[96]</sup> found that obese individuals with higher rates of body dissatisfaction used more maladaptive coping strategies, Traverso *et al.*<sup>[97]</sup> reported that body image is a pretreatment variable significantly associated to weight loss and Teixeira *et al.*<sup>[63]</sup> reported that weight loss treatment completers displayed more positive scores for body image than non-completers. With respect to treatment strategies, Schwartz *et al.*<sup>[98]</sup> identified body image intervention as a key point of weight loss treatments. Moreover, the tendency to evaluate oneself "worth" in terms of weight and shape has been identified as a factor characterizing the "weight regainers" in a retrospective study<sup>[99]</sup>.

As already said, a dimension which is linked to body weight and image is "outcome expectations" in terms of weight modifications during treatment. The evaluation of outcome expectancies as possible predictors of weight loss has produced divergent results. Some authors have found that unrealistic expectations concerning weight loss frequently result in weight management failure and treatment discontinuation<sup>[9,63,100-102]</sup>. Conversely, different studies did not confirm these negative consequences of having unrealistic expectations for weight loss and weight loss maintenance<sup>[103,104]</sup> and did not support the hypothesis that obese patients should be encouraged to set lower weight-loss goals<sup>[105,106]</sup>.

## PERSONALITY TRAITS

Personality traits in the field of obesity research have been widely assessed using the Temperament and Character Inventory (TCI)<sup>[107]</sup> and the Karolinska Scales of Personality (KSP)<sup>[108]</sup>. The TCI was developed to provide a comprehensive evaluation of personality; it measures four dimensions of temperament (novelty seeking, harm avoidance, reward dependence and persistence) and three dimensions of character (self-directedness, cooperativeness and self-transcendence). On the other hand, the KSP was designed to evaluate abnormal personality, rather than variations in normal personality. It was originally developed to assess the personological traits associated to vulnerability for psychological deviance. In a number of studies personality traits in obese individuals have been assessed using the Five-Factor Model of personality (FFM, also known as the Big Five), which assesses five broad dimensions of human personality<sup>[109]</sup>.

Alexithymic personality traits, which can be defined as the difficulty in describing feelings to others and in sharing inner experiences, are a psychological feature frequently observed in obese patients<sup>[110]</sup>. Alexithymia is usually assessed with the Toronto Alexithymia Scale<sup>[111,112]</sup>.

A great number of studies have investigated the link between personality traits and weight loss with varying degrees of success. Teixeira *et al.* in the above mentioned review reported that personality traits may be unrelated to obesity risk and weight management<sup>[22]</sup>. On the other hand, more recent studies have reported an association between personality traits and weight outcomes in weight loss programs: high scores in novelty seeking and low scores in reward dependence (assessed using TCI) were associated to decreased success in achieving weight loss; whereas the presence of lower narcissistic personality traits (assessed using TCI) has been reported as a positive predictor of weight loss<sup>[113,114]</sup>. Moreover, neuroticism has been associated to successful weight loss in obese patients following a very low energy diet<sup>[74]</sup>.

A recent meta-analysis using inventories of the FFM and evaluating personality as a factor potentially explaining individual differences in long-term obesity risk or the likelihood of reversion from obese to non-obese, shows that the personality trait "conscientiousness" is robustly associated with the development and persistence of obesity<sup>[115]</sup>. Individuals with high conscientiousness are described as self-disciplined, task oriented and well organized, whereas low conscientiousness is characterized by poor self-control, impulsivity and lack of long-term planning<sup>[109]</sup>. Compared to individuals with low conscientiousness, individuals with high conscientiousness have almost 40% lower odds of being obese, and obesity was less persistent. Authors concluded that their findings lend support for conscientiousness being a prognostic factor for the reversion of obesity to non-obesity in initially obese individuals<sup>[115]</sup>. There is also evidence that individuals with high conscientiousness (measured with the revised NEO Personality Inventory which is intended to measure the Big Five personality traits<sup>[116]</sup>) lose more weight with pharmacological obesity treatment using orlistat<sup>[117]</sup>.

Finally, in a study performed by De Panfilis *et al.*<sup>[114]</sup>, it has been suggested that obese patients with a co-occurrent psychiatric disorders showed a poorer outcome when displaying higher alexithymic traits.

## CONCLUSION

In obesity treatment, weight loss is very difficult to achieve and, once achieved, to maintain, and long term dietary compliance rates are usually very low. It is a matter of fact that more effective strategies to improve compliance rates for weight loss and weight maintenance are required.

Obesity is an heterogeneous and multi-factorial disease and pre-treatment psychological (as well as biological and environmental) differences among the obese subjects which are going to start a weight loss program may interfere with treatment outcome.

A major challenge for successful weight management is to specifically design weight loss programs to individual needs. It has been proposed that obesity



treatment should be individually tailored taking into account age, sex, degree of obesity, individual hormonal, metabolic and hereditary factors, but also to psychobehavioral characteristics<sup>[9]</sup>. A good assessment of the psychological functioning could be used to identify "what fits whom" and therefore match individuals to a compatible weight loss program that would maximize weight loss. On the other hand, it could also be useful to identify subjects that should be put out of treatment because their likelihood of success is estimated as very low. In both cases, a reliable identification of psychological predictors of weight loss could lead to more efficient treatments and could help public health services to save time and resources.

However, the use of instruments measuring psychological functioning to identify appropriate weight loss and weight management strategies just remains an intriguing possibility. To date, none of the above mentioned associations seem to be reliable enough to base treatment regimens on them. The lack of evidence on this field is due by both conceptual and methodological factors.

First of all, only a small number of the questionnaires described in this review have been specifically designed for obesity or for weight-related problems<sup>[38,39,48,49,57-59]</sup>. For this reason, in obesity research the same construct is often assessed with many different instruments across studies, which are usually not specific for obese subject. Furthermore, a tool designed to address the more significant psychological constructs "all in one" does not exist. In other words, the psychological tools used in obese population are often inadequate and too heterogeneous.

Authors' opinion is that research and clinical attention should be focused on two key-aspects: the definition of specific sub-groups of patients which may display different clinical features and psychological assets; and the identification of more reliable and comprehensive tools specifically designed on obese subjects. From one side these objectives could be reached through a wider and comprehensive psychological assessment of obese subjects, including features which are usually almost neglected in clinical settings. On the other hand, those traits which appear to be more strictly related to a better outcome in terms of weight loss and weight loss maintenance should be identified and highlighted during treatment programs for obese subjects. However, the final goal of this line of research should be to use these information in order to develop a specific psychometric instrument, more accurate in predicting responses to weight loss programs and which can be easily administered in a clinical setting, thus allowing clinicians to save time and energies and, at the same time, enabling sanitary institutions to save money.

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