



**PUBLIC HEALTH APPROACHES TO WEIGHT MANAGEMENT: EFFECTIVENESS OF  
RECOMMENDED METHODS**

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DOI: <https://doi.org/10.5281/zenodo.17746988>

**How to cite this Article:** \*Ram Krishna Mehta, Prof. Dr. N. Hasan, Dr. Ajay Kumar Yadav. (2025). PUBLIC HEALTH APPROACHES TO WEIGHT MANAGEMENT: EFFECTIVENESS OF RECOMMENDED METHODS. European Journal of Biomedical and Pharmaceutical Sciences, 12(12), 150–164.



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Article Received on 03/11/2025

Article Revised on 24/11/2025

Article Published on 01/12/2025

**ABSTRACT**

**Background:** Overweight and obesity are today recognized to be amongst the major public health problems of our society. The long-term weight loss results in weight loss programs are usually modest. Most patients who lose weight will regain the weight. Thus, clearly, we need to better understand why weight maintenance is so difficult and how it can be promoted. Weight loss is difficult to achieve, and maintaining the weight loss is an even greater challenge. The identification of factors associated with weight loss. **Aim:** The aim of this project is to measure weight loss and other outcome measures in overweight and obese individuals when a weight management program is delivered face-to-community, compared to the same program presented in written information only. The study will be undertaken over a period of 24 weeks. **Objective:**

- i. To evaluate the effectiveness of various public health strategies and recommended interventions in promoting sustainable weight management across diverse populations.
- ii. To identify and categorize the most commonly recommended public health approaches to weight management, including behavioral, environmental, and policy-level interventions
- iii. To assess the short-term and long-term effectiveness of these approaches in reducing overweight and obesity prevalence.

**Maintenance:** It can enhance understanding of the behaviors and prerequisites that are crucial in sustaining a lowered body weight. In this paper we have reviewed the literature on factors associated with weight loss maintenance and weight regain. We have used a definition of weight maintenance implying intentional weight loss that has subsequently been maintained for at least 4 months. **Methodology:** Participants are those who are suffering from heavy weight and need to reduce their weight according to their Body Mass Index (BMI) recommended by the World Health Organization (WHO); data will be obtained from them. Around 300 participants were identified and matched with public health approaches to weight management: This study is a community-based prospective study carried out over 6 months. **Conclusion:** According to my review, successful weight maintenance is associated with more initial weight loss, reaching a self-determined goal weight, having a physically active lifestyle, a regular meal rhythm including breakfast and healthier eating, control of overeating, and self-monitoring of behaviors. Weight maintenance is further associated with an internal motivation to lose weight, social support, better coping strategies and ability to handle life stress, self-efficacy, autonomy, assuming responsibility in life, and overall, more psychological strength and stability. Factors that may pose a risk for weight regain include a history of weight cycling, walking, disinhibited eating, binge eating, more hunger, eating in response to negative emotions and stress, and more passive reactions to problems.

**KEYWORDS:** Eating behavior, obesity, overweight, psychology, weight loss, outcome.

### 1.1 BACKGROUND

Overweight and obesity are today recognized to be amongst the major public health problems of our society. The long-term weight loss results in weight loss programs are usually modest. Most patients who lose weight will regain the weight. Thus, clearly, we need to better understand why weight maintenance is so difficult and how it can be promoted. The identification of factors associated with weight loss maintenance can enhance our understanding of the behaviors and prerequisites that are crucial in sustaining a lowered body weight. Such knowledge has implications for what strategies should be trained and encouraged in treatment and the advice given at the weight maintenance phase, as well as the selection of persons with a reasonable prospect for long-term success in obesity treatments. The latter is a necessity for effective use of the limited resources available to treat the increasing number of obese people today. It also enables a professional awareness of the risk of exposing a patient to additional adverse psychological consequences of experiencing failure in treatment. We were interested in describing research findings on factors of potential importance for weight maintenance. A further aim was to attempt to reach a coherent model of factors affecting weight maintenance, as this research area is often characterized by scattered findings without comprehensive frameworks. **Obesity** can be defined as a condition of abnormal or excess fat accumulation in adipose tissue, to the extent that health may be impaired. Body Mass Index (BMI), which is calculated as  $[(\text{weight in kg}) / (\text{height in m})^2]$ , is considered to be the most useful population-level measure of obesity, and it is a simple index to classify underweight, overweight, and obesity in adults. The WHO has classified overweight and obesity in adults based on various BMI cutoffs. These cutoffs are set based on comorbidities risk associated with BMI. However, the use of BMI does not distinguish between weight associated with muscle and weight associated with fat, and the relationship between BMI and body fat content varies according to body build and proportion. In contrast, the measure of intra-abdominal or central fat accumulation to reflect changes in risk factors for cardiovascular diseases and other forms of chronic diseases is better than BMI.

### 1.2 Hypothesis

Public health approaches that integrate behavioral, environmental, and policy-level interventions are more effective in promoting sustainable weight management outcomes than individual-focused strategies alone.

### 1.3 OBJECTIVE

- i. To evaluate the effectiveness of various public health strategies and recommended interventions in promoting sustainable weight management across diverse populations.
- ii. To identify and categorize the most commonly recommended public health approaches to weight management, including behavioral, environmental, and policy-level interventions.

- iii. To assess the short-term and long-term effectiveness of these approaches in reducing overweight and obesity prevalence.
- iv. To compare the outcomes of individual-focused interventions (e.g., counseling, education) versus population-level strategies (e.g., taxation, urban planning).
- v. To examine the role of sociocultural, economic, and environmental factors in shaping the success of weight management programs.
- vi. To provide evidence-based recommendations for improving the design and implementation of public health weight management initiatives, especially in resource-constrained settings.

### 1.4 AIM OF THIS STUDY

The aim of this project is to measure weight loss and other outcome measures in overweight and obese individuals when a weight management program is delivered face-to-community, compared to the same program presented in written information only. The study will be undertaken over a period of 24 weeks.

### 1.5 Purpose of the Review

The purpose of this review is to critically evaluate the effectiveness of various public health strategies recommended for weight management, with the aim of identifying evidence-based interventions that can be scaled, adapted, and sustained across diverse populations and settings.

- **To synthesize** existing literature on behavioral, environmental, and policy-level interventions targeting overweight and obesity.
- **To assess** the comparative impact of individual-focused versus population-level strategies on long-term weight outcomes.
- **To inform** future program design, policy formulation, and community-based initiatives by identifying best practices and gaps in current approaches.

### 1.6 Recent Findings

Recent findings highlight that multi-level public health strategies, especially those combining behavioral, environmental, and policy interventions, are significantly more effective in promoting sustainable weight management than isolated individual efforts.

### 1.7 Policy-Level Recommendations by Pan American Health Organization (PAHO) and World Health Organization (WHO)

Obesity and being overweight are defined as an abnormal or excessive accumulation of fat that can be detrimental to health. A simple weight-for-height index commonly used to classify overweight and obesity in adults is the body mass index (BMI). It is calculated by dividing a person's weight in kilograms by the square of the height in meters. Experts from WHO's Demonstration Platform on Obesity Management emphasized that obesity must be treated as a chronic condition and

integrated across all levels of healthcare: primary, secondary, and tertiary. Countries like Ireland and Portugal are now embedding obesity prevention into national health systems, focusing on food environment regulation, school nutrition policies, and urban design.

### 1.8 A brief review of the work already done in this field

Overweight and obesity affect almost two-thirds of New Zealand adults, and rates continue to climb in some ethnic and demographic groups. The inability of many individuals to lose significant weight by themselves or for most to keep it off is due to a myriad of factors, including making changes to lifestyle that are too drastic and therefore not sustainable, the widespread availability of energy-dense foods and sedentary pastimes, changes to work and leisure-time energy expenditure, and insufficient support structures. One of the major barriers to effective weight management is that we eat for a variety of complex and interrelated reasons other than hunger, including taste, social interaction, and emotional cues. Observational studies demonstrate that many environmental and situational cues influence our eating, but those who eat in response to hunger, recognize satiety signals, and give themselves unconditional permission to eat foods of their choosing (intuitive eaters) are more likely to be a healthy weight than those who do not. While people can be trained to eat more intuitively (in response to hunger and satiety), whether this increases weight loss relative to other techniques remains uncertain.<sup>[1-2(8)]</sup> Considering the growing prevalence of obesity, the majority of patients should be managed by primary caregivers. Unfortunately, PCPs and health professionals often feel that they are unable to help their patients lose weight, and their self-efficacy in obesity treatment is poor. As a result, obesity tends to be neglected when compared to other chronic conditions like hypertension and diabetes. When auditing medical records from PCPs, obesity is definitely underreported, and recommendations for weight control interventions are reported even less. It stands to reason that if obesity is not mentioned in a patient's record, it is unlikely that any intervention is ongoing. This only highlights the need for major changes with respect to medical practice regarding this important health problem (page 2-3 (9); Numerous studies have compared the appropriateness of various anthropometric indices for assessing obesity and predicting obesity-related health risks, including BMI, waist-to-hip ratio (WHR), waist circumference (WC), and waist-to-height ratio (WHtR). However, there is no agreement on which index should be applied universally for defining obesity. Of all physical health problems, type II diabetes has the strongest association with obesity. A meta-analysis examined the relative risk of incidence of various comorbidities related to obesity and overweight from 89 studies. Elevated BMI and WC were significantly associated with the incidence of type II diabetes in men and women. Obesity, as defined by BMI, showed the strongest association with incidences of type II diabetes as compared to other co-morbidities. The

pooled relative risks (95% confidence interval) across categories of BMI were 6.75 (5.55–8.19) in men and 12.41 (9.03–17.06) in women.<sup>[2(10)]</sup>

#### (a) The Array of Potential Approaches

The number of available treatments for obesity is enormous. There would be many options if one considered only the diet guides available in bookstores. One common approach is the distribution of booklets and pamphlets on nutrition, exercise, and weight loss by government agencies, private groups like the American Heart Association, insurance companies, and even food companies. No systematic evaluation has been done on the impact of this distribution of information (page 525<sup>[11]</sup>); Over the last three decades, overweight and obesity and the associated health consequences have become global public health priorities. Worldwide rates of overweight and obesity continue to rise, despite the growing awareness of the importance of this issue in recent years among health professionals, as well as the general public. Indeed, there is a widespread lack of acceptance of obesity in the general community, perhaps relating more to the physical appearance of people with obesity rather than the associated health risks. It is also well-established that being socioeconomically disadvantaged increases the risk of overweight and obesity. The health consequences of excessive weight gain include an increased risk of the metabolic syndrome and such chronic diseases as diabetes, cardiovascular disease, obstructive sleep apnea, and some cancers, all potentially leading to increased mortality. The psychosocial consequences of obesity include stigmatization in the workplace, compromised health care and personal relationships, and reduced quality of life (2-9, 12).

#### (b) Physical activity

Physical activity is related to long-term weight maintenance, according to many findings. Physical activity can facilitate weight maintenance through direct energy expenditure and can also improve physical fitness, which facilitates the amount and intensity of daily activities. Physical activity can also improve well-being, which may in turn facilitate other positive behaviors needed for weight maintenance. Walking is one of the most frequent aspects of physical exercise reported by study participants; cycling and weight lifting also have some popularity. In the Sibutramine Trial on Obesity Reduction and Maintenance study (STORM study), leisure time activity predicted weight maintenance in sibutramine treatment. Such leisure-time physical activity included time spent in walking and cycling and also implied less time spent in watching television. It is suggested these factors can discriminate a sedentary lifestyle from a more active one even better than a measure of sports activity. A higher number of pedometer-recorded daily steps<sup>[28]</sup> and other measures, including everyday activities, has likewise been found among weight maintainers. A more impaired physical functioning in daily life, implying limitations in the

ability for ambulation, such as walking, has correspondingly predicted later weight relapse.<sup>[30]</sup> Perceiving barriers in the life situation for carrying out physical activity has also been related to poorer weight maintenance, whereas confidence seen in self-efficacy concerning exercise may promote long-term weight management (69<sup>[13]</sup>);

### (c) Diet

To determine current dietary intake, registry members were asked on entry into the registry to complete the Block Food Frequency questionnaire. On average, participants reported consuming 1381 kcal/day (5778 ± 2200 kJ/day), with 24% of calories from fat, 19% from protein, and 56% from carbohydrates.<sup>[22]</sup> There were no differences in the quality of the diet reported by participants who lost weight on their own compared with those who used weight loss programs. Both groups ate a diet that satisfied the Daily Reference Intakes for calcium, vitamin C, vitamin A, and vitamin E. Recently, because some popular diets recommend restricting carbohydrates to lose weight, data from registry participants were analyzed to determine carbohydrate intake. Only 7.6% of registry members reported eating fewer than 90 g of carbohydrate/day; for many of these individuals, total daily energy intake appeared unreasonably low. Additional analyses were done to determine the proportion of subjects eating diets with less than 24% carbohydrates (1500 calories = 190 g of carbohydrate). Less than 1% of registry participants consumed such low-carbohydrate diets. Compared with registry members who had higher carbohydrate intake, those ingesting less than 24% carbohydrates maintained their weight loss for less time and were less physically active. Thus, the low-fat, high-carbohydrate, low-calorie eating pattern appears to be what characterizes the majority of registry participants.<sup>(327<sup>[14]</sup>)</sup> Increasing awareness of the complexity of public health problems, including obesity, has led to growing interest in whole systems approaches (WSAs), defined as those that consider the multifactorial drivers of overweight and obesity, involve transformative coordinated action across a broad range of disciplines and stakeholders, and operate across all levels of governance and throughout the life course. This paper reports a systematic review of WSAs targeting obesity and other complex public health and societal issues, such as healthy lifestyles for prevention of non-communicable disease.<sup>[15]</sup> Concerns regarding the harmful effects of unrealistic goals are now widely accepted among practitioners, and treatments that include counseling toward modest goals are commonplace. However, empirical support for the idea that moderating weight goals would benefit people trying to lose weight has been mixed. Cross-sectional comparisons have found that unrealistically high goals are associated with psychological distress and dissatisfaction with weight loss outcomes. However, the premise that unrealistic goals have an adverse effect on short- and long-term weight loss has received little support (569-570<sup>[16]</sup>).

### (d) Summary of Literature Review

Weight loss is difficult to achieve, and maintaining the weight loss is an even greater challenge. The identification of factors associated with weight loss maintenance can enhance our understanding of the behaviors and prerequisites that are crucial in sustaining a lowered body weight. In this paper we have reviewed the literature on factors associated with weight loss maintenance and weight regain. We have used a definition of weight maintenance implying intentional weight loss that has subsequently been maintained for at least 6 months. According to our review, successful weight maintenance is associated with more initial weight loss, reaching a self-determined goal weight, having a physically active lifestyle, a regular meal rhythm including breakfast and healthier eating, control of overeating, and self-monitoring of behavior. Weight maintenance is further associated with an internal motivation to lose weight, social support, better coping strategies and ability to handle life stress, self-efficacy, autonomy, assuming responsibility in life, and overall, more psychological strength and stability. Factors that may pose a risk for weight regain include a history of weight cycling, disinhibited eating, binge eating, more hunger, eating in response to negative emotions and stress, and more passive reactions to problems.

## 1.1 METHODOLOGY

This study is a community-based prospective study carried out over six months. Participants are those who are suffering from heavy weight and need to reduce their weight according to their BMI recommended by the WHO; data will be obtained from them. Around 300 participants were identified and matched with public health approaches to weight management: This data was collected during the study period of the master of public health (MPH) for study purposes. The Om Sterling Global University study was carried out in Juglan, Hisar, Haryana, India.

After taking informed consent, the collection of data in a structured proforma from patient record files, such as age, gender, height, body mass index (BMI), and brief, relevant clinical details, was recorded. Collection of such information from the patient or their relatives was done if any relevant information was missing in the patient's record file. Measurement of the height and weight for the calculation of the body mass index (BMI) of the patient was also done in those cases where it was not provided.

The data were entered in MS Excel 2019 and converted into SPSS 11.5 for statistical analysis. For descriptive statistics, frequency, percentage, mean, and SD were used along with graphical and tabular presentation. The analysis tests used in this study were the independent samples t-test, paired sample t-test, and Pearson's correlation. A p-value < 0.05 was considered statistically significant.

## 2.2 Research Design

A descriptive cross-sectional study design was used for this study.

## 2.3 Study Setting

The study setting was the Juglan, Hisar, India.

## 2.4 Study Population

This study was conducted among participants who are coming to their treatment district hospital of Juglan, Hisar, India, which was the population for this study.

## 2.5 Sample Size

Community of Juglan, Hisar, and district hospital of Hisar, India. Calculation of the sample size: The sample size was calculated for this study as considering a confidence interval of 95% and an allowable error of 10%. Sample size is calculated by applying the following formula:

## 2.6 Sampling Technique

The non-probability convenience sampling technique was used for the study.

## 2.7 Study Duration

As mentioned on the work plan, the total study duration was 6 months, and data collection periods were 18 weeks.

## 2.8 Inclusion criteria

- Patients without any other diseases or abnormalities.
- Patients who are very cooperative with the study.
- Satisfactory results will be selected after discussing with diabetologists and other physicians.

## 2.9 Exclusion criteria

Patients with malignancy in the kidneys and heart.

## 3.1 STATISTICAL METHODS APPLIED

Data was analyzed using the statistical package for social sciences (SPSS) version 20.0. Descriptive statistics like percentage, frequency, mean, and standard deviation were applied to describe independent variables. For inferential statistics, chi-square was applied to find associations between awareness and sociodemographic variables and health status and health-related behavior.

## 3.1 Ethical Clearance

Ethical principles have been considered and followed throughout the study. Informed written consent was obtained from each participant. Confidentiality of the subject was maintained, and obtained data was used only for research purposes. Privacy was maintained by collecting data in a separate room.

## 3.1 Obesity and Its Methods in Evaluating Weight Loss Maintenance

Eyeing weight loss goals can be important for subsequent results. Others have, however, questioned such a conclusion, arguing that the critical factor for long-term outcome may rather be the greater initial weight loss in those reaching their goal weight. According to a small pilot study, having the participants seek only modest initial weight loss did not improve the weight maintenance. Another recent study has related the self-reported goal weight to later long-term weight loss and found no detrimental relationship, as suggested in earlier literature. A higher dream weight loss was, on the contrary, weakly associated with a greater long-term weight loss and also with better mood, confidence in success, and optimism at baseline. This suggests there can even be a role of optimism to be considered in the desire to reach a lower body weight. Unrealistic optimism is known to be a common psychological mechanism that can be healthy and adaptive and that can also promote better health behaviors. A conclusion on weight loss goals is therefore that it can be a good prognostic sign to reach a self-determined goal weight, but we do not know enough about the mechanisms in this to state any clinical advice yet. Weight loss patterns: Initial weight loss has been identified as a predictor for later weight loss and also for weight loss maintenance in various treatments, further illuminated in an overview. The greater the initial weight loss, the better the subsequent outcome. Such a predictor tells us that there is a consistent weight loss pattern from the beginning of the treatment. Initial weight loss can also reflect a better compliance with the treatment. It has been noted that the findings on the initial weight loss challenge the clinical opinion that weight loss achieved at a slow rate would be better. According to other results, larger amounts of weight loss during the total intentional weight loss phase have predicted more weight regain. It is still unclear how the early weight loss response that predicts long-term outcome should be defined. The complexity in evaluating the predictive value of weight loss patterns can be illustrated by a recent analysis of two long-term clinical trials with orlistat. In this analysis, weight loss of >5% body weight after 12 weeks of diet and/or exercise was a good indicator of 2-year weight loss, whereas  $\geq 2.5$  kg initial weight loss during the 4-week lead-in<sup>[22]</sup> and  $\geq 10\%$  weight loss after 6 months did not add significantly to the prediction of the 2-year outcome. The time of duration of weight loss has also been studied. The longer the weight loss has been maintained, the better the chances for further continuation of a lower body weight are. The subjects who have maintained weight losses for a longer time report that they use less effort in continued weight control. The pleasure derived from controlling weight was not changed over time, suggesting a shift in balance towards overall greater pleasure that can promote further maintenance of body weight. Physical activity is related to long-term weight maintenance, according to many findings. Physical activity can facilitate weight maintenance through direct

energy expenditure and can also improve physical fitness, which facilitates the amount and intensity of daily activities. Physical activity can also improve well-being, which may in turn facilitate other positive behaviors needed for weight maintenance. Walking is one of the most frequent aspects of physical exercise reported by study participants; cycling and weight lifting also have some popularity. In the Sibutramine Trial on Obesity Reduction and Maintenance study, leisure time activity predicted weight maintenance in Sibutramine treatment. Such leisure-time physical activity included time spent in walking and cycling and also implied less time spent in watching television. It is suggested these factors can discriminate a sedentary lifestyle from a more active one even better than a measure of sports activity. A higher number of pedometer-recorded daily steps and other measures, including everyday activities, has likewise been found among weight maintainers. A more impaired physical functioning in daily life, implying limitations in the ability for ambulation, such as walking, has correspondingly predicted later weight relapse. Perceiving barriers in the life situation for carrying out physical activity has also been related to poorer weight maintenance, whereas confidence seen in self-efficacy concerning exercise may promote long-term weight management. According to one review, the results on physical activity and weight gain are, however, not consistent. Prescribing exercise in experimental designs was, for example, only modestly related to later outcomes. Poor compliance in carrying out the exercise protocol was discussed as one reason for such discouraging results.

#### a) Factors in weight loss maintenance

Weight loss is a goal. It seems common for patients to have unrealistic expectations about the weight loss that will be achieved in treatment. In one study, none of the participants achieved the dream weight that they had hoped for, and most of them even ended up with a weight loss that before treatment they had considered as a failure, even though the standard treatment program was well designed and executed. Heavier patients, especially men, had lower target weights. That expectations about goal weights can be unrealistic has been confirmed in other studies. However, according to these results, men were more realistic in their approach to what could be achieved with a weight loss regimen than women. The weight goals may be one factor to consider with regard to weight maintenance. Those who later maintained their weight have been found to have achieved their self-determined goal weight. It has been suggested that the failure to reach a self-determined weight may discourage the person's belief in their ability to control their weight, which will result in an abandonment of weight maintenance behaviors.

#### b) Methods in evaluating weight loss maintenance

A definition of what constitutes weight maintenance should first be considered. Weight loss maintenance implies keeping a weight loss result that has been

accomplished by treatment interventions or by one's own efforts. This would be the general definition shared across studies performed. The specific criteria used, however, differ. Examples of definitions are 'achieving an intentional weight loss of at least 10% of initial body weight and maintaining this body weight for at least one year, or 'losing at least 5% of baseline body weight between baseline and follow-up and maintaining that weight or less for a further two years. Others have classified 'winners' and 'losers' based on losing or regaining. Another common approach is to retrospectively identify those who can be classified as successful weight loss maintainers and describe the behavioral characteristics of these persons as they manifest at the time of 'success.' Changes during treatment based on repeated measures have also been analyzed in studying weight maintainers. The latter approaches can give information on the behaviors and strategies that could be more focused and encouraged in treatment programs rather than on treatment assignment. In our evaluation of factors affecting weight maintenance, we have included studies with these different methodological approaches. The studies include patient samples as well as general population samples. With this rather broad inclusion criterion, a fuller description of possible factors in weight maintenance could be derived. The aim of this paper was to make a conceptual review of factors in weight maintenance that can contribute to an understanding of the critical individual characteristics and that could lead to a model to be further considered. The focus is mainly on behavioral and psychosocial factors that could describe the person succeeding or failing to maintain a weight loss. It has been suggested that behavioral and psychological factors can be of particular importance for weight maintenance and should receive more attention.

#### c) Reformulated Conceptual Model of Weight Loss Behavior

A hypothetical model begins with the individual's conscious decision to pursue weight loss, typically motivated by the desire to achieve positive outcomes such as increased self-confidence, improved physical health, and sustainable weight management. This model integrates a range of behavioral, psychological, and social determinants that influence the trajectory of weight loss and maintenance:

##### i. Initiation and Motivation

- Decision to lose weight based on personal or medical reasons.
- Desire for improved self-image, confidence, and health outcomes.
- Influence of external factors (e.g., family, healthcare providers).
- Stability in personal life and readiness for change.

##### ii. Behavioral Patterns

- Achievement of initial weight loss goals.
- Engagement in physical activity versus sedentary lifestyle.

- Regular meal rhythm and breakfast consumption.
- Lower dietary fat intake and preference for healthier foods.
- Increased hunger and reduced snacking frequency.
- Self-monitoring of eating and activity behaviors.

### iii. Cognitive and Emotional Regulation

- Attribution of obesity to medical or external factors.
- Perceived barriers to weight loss behaviors.
- Flexible control over eating in response to stress or negative emotions.
- Self-efficacy and autonomy in managing health behaviors.

### iv. Psychosocial Influences

- Exposure to psychosocial stressors.
- Availability and quality of social support.
- Ability to manage cravings and emotional triggers.
- Psychological traits such as low self-confidence, healthy narcissism, and underlying psychopathology.

### d) Dietary intake

Weight loss maintenance is obviously associated with lower total caloric intake and reduced portion sizes. More specifically, weight maintenance is also associated with reduced frequency of snacks and less dietary fat. Reduction of particular food types such as French fries, dairy products, sweets, meat and cheese, butter, high-fat snacks, fried foods, and dessert has also been seen in persons better maintaining their weight. The importance of high-quality foods such as fruits and vegetables and healthy eating has also been noted. Changes towards a more regular meal rhythm have been identified as helpful in long-term weight loss, and regularly eating breakfast has furthermore been reported more often among weight maintainers. It is suggested that breakfast can reduce hunger, making the breakfast eaters choose less energy-dense foods during the rest of the day, as well as giving better energy to perform physical activity during the day. Eating patterns Generally, eating behavior has been evaluated during ongoing treatments. The most common measure of eating behaviors is the Three Factor Eating Questionnaire (TFEQ), measuring eating restraint, disinhibition, and hunger. Restraint means trying to resist eating by conscious determination in order to control body weight. Disinhibition measures loss of control over eating, and the hunger scale shows the experience of hunger feelings and cravings for food. Eating restraint is known to be associated with a lower amount of food intake, and the restraint increases with successful weight loss in behavior modification treatments. This means restriction of food intake is accompanied by weight loss. The contrary pattern, a decrease in eating restraint and an increase in disinhibition, has accordingly been found for those regaining their body weight. These types of data tell us that restraint in food intake leads to less food consumed and thus more weight loss, and that the control over food intake is crucial for weight development in programmers, emphasizing the participants' efforts to

reduce food intake by will. Attempts to use data on eating patterns somewhat more prospectively, by comparing the eating patterns at the time of discharge from treatment in evaluating subsequent weight development, have also been made. In line with the earlier information on eating patterns, this revealed that reduction of disinhibited eating and increase in cognitive restraint during active treatment were positive predictors of post-treatment weight reduction and weight maintenance. Higher levels of dietary disinhibition assessed after an intentional weight loss phase or during weight maintenance have, in accordance with this, predicted weight regain. More hunger, according to the TFEQ at discharge, has also been shown to be a negative predictor of post-treatment weight development. This means more intense hunger and disinhibited eating pose a problem for subsequent overconsumption. Another study has analyzed pre-treatment data on eating behaviors as predictors of weight development after treatment. These results revealed that a high pretreatment score on the TFEQ hunger scale predicted weight regain at follow-up after very low-calorie diet (VLCD) treatment. With more intense hunger initially, a VLCD treatment has thus not provided a solution to the participants' eating behavior on a more long-term basis. Often, however, the pre-treatment TFEQ scores have not provided predictive information on subsequent weight loss. On the issue of control over eating behaviors, it has furthermore been suggested that more flexible control over eating behavior is associated with weight maintenance rather than rigid control. Although eating restraint is often reported to be related to weight loss in behavioral treatments, such restraint has also been associated with periods of overeating and is suggested to be a risk factor for the development of eating disorders. The rigid controls that could be considered as risk factors for such a subsequent total breakdown of controls can be described as dichotomous 'all or nothing' approaches to weight and eating. It implies extreme behaviors such as attempts to totally avoid sweets and liked foods. The flexible controls are rather characterized by a 'more or less' approach that can be adopted as a more long-term task. Retainers have described that during dieting; they did not permit themselves any of the food they really enjoyed and therefore felt deprived. Recent research results show that maintaining initial treatment changes towards more flexible control predicts better long-term weight loss results, and flexible and rigid controls have been related to lower and higher body weights, respectively. This suggests that rigid controls should not be encouraged in the treatment of obese patients and that flexible controls should rather be supported. Binge eating constitutes a more pronounced problem in obese eating behavior that has been recognized in the last few decades. The prevailing suggested definition of binge eating, although still not a formal diagnosis, includes the consumption of large quantities of food without being in control of this behavior and also the experience of distress about the binge eating. Binge eating as assessed after weight loss has predicted more subsequent weight

regain. Gainers had more binge episodes per month in the initial assessment and had also increased their number of binge episodes at one-year follow-up. A more profound disturbance in obese eating behavior such as this can thus pose a problem in weight maintenance. Binge eating has also been related to a history of weight cycling, which would reflect prior failures in maintaining weight loss. In obesity surgery, the weight regain after 5 years has been found to be considerably higher in binge eaters than in the patients without binge eating. However, others conclude that binge eating status seems to be a weak prognostic indicator of weight regain, but that this relationship can be mediated by psychological dysphoria. In yet other studies, binge eating was not related to long-term weight loss outcome. Such a finding would suggest that although binge eating obviously implies more profound difficulties with eating behavior, the binge eaters could also benefit from standard obesity programs. Self-monitoring means observing oneself and one's behavior. Self-monitoring of body weight and food intake are important factors in weight loss as well as weight loss maintenance. Weight maintenance seems to require an ongoing adherence to weight-related behaviors. Regularly weighing oneself is an example of self-monitoring, as is recording the food intake consumed. Self-monitoring of food intake is suggested to reflect one component of cognitive restraint known to be important for weight control. It could also be suggested that these persons continue to use self-monitoring strategies that have been learned during the treatment phase. In weight retainers, self-monitoring has been shown to decline with time. Being more aware and vigilant with regard to weight control has likewise been found to characterize weight maintainers according to interviews. The maintainers were, for example, more conscious about their dietary intake and made more conscious decisions with regard to food selection. Maintainers were also more aware that they needed to be conscious of their weight-related behaviors. The retainers, on the other hand, found it too difficult to remain in the state of prolonged consciousness needed to watch themselves over time. Life events and social support, the surrounding environment, and the life events facing the person trying to lose and maintain weight can facilitate as well as hamper the outcome. Experiencing stressful life events or rating one's life as stressful has been associated with weight regain. In follow-up assessments, the patients who regained weight after treatment have reported more psychosocial crises, including major illnesses and bereavements and personal or family stress and a busy schedule. Interviews with successful persons suggest that their maintenance of weight may depend on stable circumstances after the active behavior changes. The critical life events in this study included areas such as family relations and social activities. Social support is considered to be an important aid for weight maintenance. Participating in a maintenance support group, as well as receiving support from friends and having people available for social support, has been related to better weight maintenance.

According to a systematic review of family involvement in weight control, there are, however, mixed results for spouse's involvement. Sometimes there is an improved outcome at follow-up; sometimes there are better results for treating the members alone. In one study, weight maintenance was better for women treated together with their spouse, both being targeted for weight loss and social support strategies, whereas the men did better when treated alone. In two other studies including the spouses to provide support, comprising female and male participants, respectively, weight maintenance was better for the women treated alone. For the men treated alone, a better outcome was seen in one-year maintenance but with no difference at 2-year follow-up. Although support from a close life partner is therefore not always unequivocally positive and can, for some persons, even interfere with long-term outcome. Receiving prolonged treatment interventions and continuous professional support in the weight maintenance phase has often been found to improve treatment outcomes. Professional contact may, for example, enhance vigilance and motivation and provide encouragement and support. Such interventions, however, constitute a prolonged treatment phase based on the view of obesity as a chronic condition rather than factors in weight maintenance. A question has been raised whether such interventions can lessen the patient's motivation to take responsibility for lifestyle changes. An essential component in an alternative view is instead to support the patient's full responsibility for lifestyle changes from the onset of treatment. Stress and coping: Stress as an important risk factor has received additional attention. It can be more specifically the ability to cope with the stress that is crucial for the individual possibility to sustain the weight rather than the actual number of life changes and circumstances that are potential stressors. A common definition of coping refers to cognitive and behavioral efforts used to manage external and internal demands that are appraised as taxing or that exceed the resources of the person. The research findings on retainers describe poor coping strategies. A common characteristic identified in restrainers is that they tend to eat in response to stressful or negative life events and negative emotions that can be evoked by controlling food intake. Rather than using direct ways to handle problems in life, it was further common to use escape-avoidance ways of coping that included eating, sleeping more, and passively wishing that the problem would vanish. Persons likely to regain their weight have also reported being more help-seeking as a way to cope with dietary lapses, such as seeking help from a friend, spouse, or family member, or starting a weight-loss program. This finding was discussed as suggesting a lack of self-sufficiency or self-efficacy. Others, however, have shown contrary results on help-seeking and weight maintenance. Maintainers, as compared with retainers, have been reported to be able to cope more easily with cravings and to use direct coping in relapse situations. Such direct coping included treating the relapse as a small mistake, recovering and losing

again, increasing exercise, and starting to control food intake. Being active and doing something (anything) rather than being passive in response to an overeating episode and regaining control quickly has also predicted better weight maintenance.<sup>[56]</sup> The maintainers, furthermore, seem more prone to use effective problem-solving skills and confrontive ways of coping with demands in life. This included finding new solutions, using concepts taught in treatment, or using other strategies such as relaxation techniques or even working more. Overeating clearly is an unfortunate coping strategy in obesity, and it can reflect the absence of a mobilization of more efficient coping. Having a passive orientation can sometimes represent a less successful approach than finding one's own solutions and being more active. Personality factors can be important for the ability to find coping strategies to be used in various life situations rather than reverting to old eating habits. Coping capacity has also been shown to increase during treatment of obese patients. The improvements in coping were considered to be general treatment effects, as they were not dependent on the type of treatment. Greater improvements in coping were found among the patients who had lost the most weight. Attitudes: Persons who were less prone to attribute the reason for their obesity to medical factors have been shown to be more successful in later maintaining weight loss. Moreover, the successful persons were more motivated to lose weight for reasons that related to having confidence in oneself rather than pressures from others or medical reasons. The confidence factors more specifically included increasing self-esteem, liking oneself more, and feeling better with oneself. Retrospective studies of successful weight maintainers have shown more concern with weight, shape, and appearance in women successfully maintaining a lower body weight. The women were described as having developed a 'healthy narcissism' about their appearance and physical condition. Pride in appearance has been rated among the top four factors facilitating weight maintenance in another study, although it did not differ between weight maintainers and weight retainers. Caring about one's appearance and physical condition can thus be important for the motivation to control body weight. The natural weight increase in female adolescents has also been shown to be somewhat less with higher physical appearance self-esteem as well as social self-esteem. It is suggested these young women can have higher levels of self-efficacy in weight-controlling behaviors. A tendency to evaluate self-worth in terms of weight and shape has, however, been associated with weight regain. Weight retainers have been found to see themselves as not just heavy, but also ugly. Another study has described how women who had maintained their achieved weight loss were more self-confident and capable of taking responsibility over their lives and were found to assume responsibility for their need to lose weight. They had developed their own personally individualized diets and exercise and maintenance plans and had also become more active outside the home. Personal strategies in weight

maintainers have also been described by others. These women used strategies for weight control that were specific to the individual lifestyle in personal weight loss plans that fit their lives. Finding such personally adjusted strategies in weight control could be considered a sign of psychological strengths and coping abilities as well as an awareness of one's own role in weight control. Other results agreeing with the notion that taking responsibility for one's life is important for weight development have shown that maintainers attribute their success to their own determination and patience. The specific responses given were often related to having a definitive commitment and making up one's mind. Motivation for weight reduction would be one of the most obvious aspects in weight control, and it has been suggested from a literature search that many studies do find that a higher pre-treatment motivation is related to greater weight loss, although a few studies have found no relationship. In our search, we found few results on direct measures of initial motivation for weight loss with regard to subsequent weight maintenance, though. In one study weight retainers more commonly reported low motivation as an obstacle than the weight maintainers in follow-up assessments. A test developed to assess weight loss readiness and motivation, the Weight Loss Readiness Test (WLRT) has, however, failed to predict weight loss, with no data found on the test in relation to weight maintenance. Unpublished data from the WLRT at our obesity unit revealed no expected relationship to weight loss nor weight loss maintenance. Locus of control concerns the extent to which control over one's life is experienced as internal or external. With an internal locus of control, the outcome in life is perceived as a consequence of one's own actions, and it is hence possible to influence how the future will turn out. An external locus of control rather means perceiving life as being determined by fate, chance, or luck or being under the control of powerful others. There are varying results concerning the relationship between locus of control and weight reduction. Some studies found that an internal locus of control is related to more weight loss, whereas other studies failed to identify a difference between 'internals' and 'externals' on locus of control. With regard to weight maintenance, some studies have likewise reported that those with an internal locus of control are more successful, interpreted as a better ability to assume full responsibility over one's own actions. A more specific measure of the locus of control over health was, however, unrelated to weight maintenance. Another specific locus of control scale targeting body weight has also been constructed, the Weight Locus of Control Scale (WLCS), showing some relationship with weight loss but with no information on weight maintenance. More internal control on this WLCS has, in later research, been related to having more confidence in weight loss behaviors, whereas external control was related to perceiving external reasons for being overweight, perceiving several barriers to physical activity, and being dissatisfied with the social support received. Autonomy seen in autonomous motivation has predicted more

regular attendance to a weight loss program and better weight loss maintenance. Such autonomy implies an internal locus of causality for behavior as opposed to controlled behaviors that have an external locus of causality. According to the self-determination theory, the probability that a person will persist with a behavior or not depends on the extent to which they believe the idea for initiating and subsequently continuing to regulate the behavior comes from within themselves. The participants who wanted to take part in the program and lose weight by their very own decision were thus more successful. To conclude, locus of control, or at least some aspect thereof, can sometimes be beneficial for later outcome. An internal locus of control would also have some resemblance to the concept of 'self-efficacy' that has also received much attention in weight management. Self-efficacy means a confidence in the personal ability to manage life obstacles and accomplish an achievement such as weight loss. Self-efficacy also entails the expectation of success. Self-efficacy regarding weight loss, the ability to handle emotions and life situations, and exercise have been related to later weight loss maintenance. Follow-up data on weight maintainers have also shown that they have more confidence in the ability to manage the weight than the weight retainers. With higher self-esteem, weight reduction was furthermore subsequently maintained over a longer period of time. In another study, being more 'assured' was found to describe a subset of patients. These 'assured' were more independent and goal-directed, and they had greater self-confidence about weight control, felt they 'had what it takes' for weight control, and were not prone to give up easily. This would describe a greater self-efficacy. These more assured participants retained a lower body weight than the other subgroup, described as 'disbelievers,' but only until 2 years post-treatment, when they had regained just as much as the disbelievers. Being a disbeliever implied a lower faith in the ability to control weight and giving up easily. Moving from being such a disbeliever to becoming more assured during treatment was also linked to a more favorable weight loss outcome. This shows that treatment interventions can also strengthen self-confidence during treatment, leading to better outcomes. Improvements in self-efficacy in obesity treatments have also been described by others. The personality characteristics enabling a more comprehensive understanding of the various behavioral manifestations are so far insufficiently studied in research on weight development. This means a more complete personality development with regard to relating to other people. More perceived initial dysfunctions in social interactions have furthermore predicted weight relapse. Higher anxiety and monotony avoidance, which were negatively related to weight loss maintenance in one of the studies, have also been found to describe the obese as compared to reference groups, along with more impulsivity, according to the KSP and other personality inventories. This personality pattern has been compared to an impulsivity syndrome with ego weakness and to drug addiction. Others using the KSP report a profile

similar to the ones found for bulimics and alcoholics, and the possibility of similar personality factors being associated with excessive eating and drinking has been discussed. Although the major theories in personality psychology during the last decades have covered obesity and the psychology of eating to a very small extent, repeated impulse breakthroughs for the immediate satisfaction of drives have been described within the borderline personality organization for some types of psychogenic obesity as well as for drug addiction. Other studies on personality specifically aiming at weight loss maintenance are sparse. The data from self-report inventories such as the Minnesota Multiphasic Personality Inventory (MMPI or MMPI-2) have generally given little or no predictive information about weight loss maintenance, although some sparse findings have been reported, such as hypochondria predicting poorer treatment outcome in bariatric surgery, as rated by the surgeons 4 years later rather than in a measure of weight maintenance. For weight loss results only, there are some more research findings, often revealing a trend towards psychopathology being associated with poorer weight loss in obesity treatments. Such psychopathology has been assessed with personality inventories such as the Clinical Inventory-III and the Rorschach test. Psychopathology, defined as more general symptoms on the Symptom Checklist 90, however, showed no relationship to later weight loss results. Still, the subsequent 'winners' in weight maintenance had more improvements in symptoms of psychopathology during the treatment phase, and the authors therefore suggest there is some relationship between psychopathology and successful weight reduction. More generally, persons with psychopathology are, of course, considered to be more difficult to treat. Dichotomous thinking, implying a simplified 'black-and-white' approach, has been described to characterize weight retainers, whereas more flexible thinking characterized the maintainers. This would also describe an aspect of personality functioning with more mature thinking and balance in the maintainers. To summarize, these trends suggest that healthier traits reflect a more completely developed and integrated personality, including areas such as relating and ego strengths, with impulse control and overall better functioning, which can imply better chances to maintain the weight loss. In accordance with this psychological pattern, research has shown that middle-aged women who had stayed slim had better psychosocial adaptation and psychological health. However, the research findings in this area were sparse. And many of the personality instruments used are very sensitive to capture psychopathology, implying risks for over-pathologizing. Personality inventories covering variations in the normal personality could reveal personality patterns that include adaptive traits and strengths. Depression, mood, and psychiatric diagnoses: Depression is a central aspect in obese patients entering treatment, as there is an overlap between obesity and mood disorders. Depression has sometimes been associated with weight regain. More self-reported depressive symptoms at an initial

assessment after weight loss have been associated with weight regain, although they did not contribute as a predictor, and psychiatric diagnoses seem to interfere with long-term weight control. Lower degrees of depression have been found among the persons recovering from weight relapses than in those who do not, also suggesting that a relative ‘success’ in body weight control is related to fewer depressive symptoms than a further increase in body weight development. However, several studies have reported no relationship between depression and weight maintenance or even contradictory findings, with a positive relationship between initial depression and weight loss outcome after gastric bypass. Lower initial well-being has also been associated with better weight maintenance in nonsurgical treatments. Taken together, some negative impact of depression and more severe dysfunctions, but maybe not overall mood, on weight loss maintenance could be considered. More detailed research is needed on the specific aspects and reasons for initial depression and long-term outcome. One reasonable possibility is that being dissatisfied and even experiencing suffering about the present obese condition implies greater motivation for making changes, whereas more pathology and severe depression having another etiology can interfere with weight control. Weight cycling refers to the repeated loss and regains of weight, although there is no standard definition for weight cycling. A history of weight cycling has been found to be associated with weight regain after obesity treatment. It has been suggested that weight maintenance behaviors such as reduced dietary fat and physical exercise should be trained before new weight reduction attempts are made for these patients. Patients reporting repeated dietary attempts that would be related to weight cycling have also been found to be more prone to regain weight, but a lack of association between the number of previous slimming attempts and weight maintenance has also been reported.

#### e) Association of Exercise and physical activity to maintain a healthy weight

##### i. Cycling

Cycling is important to consider here, as it represents failure in weight maintenance followed by renewed attempts to reduce weight. Cycling has sometimes been associated with mental distress and psychopathology, although others who found no such relationship concluded that weight cycling does not seem to impact psychological health in an adverse way. Considering the research findings linking weight cycling with distress, mental distress could, of course, also characterize the person being more prone to diet and having more difficulties in sustaining the weight lost rather than being a consequence of the weight cycling. More disturbed eating behaviors and a higher prevalence of binge eating have also been noted among weight cyclers. The greater the number of weight loss efforts, the greater the occurrence or severity of binge eating. Whether weight cycling causes binge eating or vice versa could not, however, be resolved. The body weight variation in

weight cycling has furthermore been related to negative health outcomes such as cardiovascular disease and increased mortality. Some results also suggest that short-term changes in weight may be related to long-term increases in body weight and more obesity.

##### ii. Walking

###### ❖ Walk Briskly

➤ Aim for a pace where talking is possible but singing is difficult. This ensures moderate-intensity aerobic activity.

###### ❖ Add Intervals or Hills

➤ Incorporate short bursts of faster walking or uphill routes to increase calorie burn and cardiovascular challenge.

###### ❖ Use a Weighted Vest

➤ This adds resistance and increases energy expenditure without changing your pace.

###### ❖ Walk Regularly

➤ Target at least 150 minutes per week (e.g., 30 minutes a day, five days a week) to meet physical activity guidelines.

###### ❖ Track Your Steps

➤ Using a pedometer, which some mobiles have as a feature, or a smartwatch or fitness tracker can help you stay motivated and gradually increase your daily steps.

###### ❖ Considerations and Safety

➤ Moderate walking isn’t suitable for everyone—especially people with heavy weight, knee joint problems, or certain medical conditions.

##### iii. Swimming

How Swimming helps maintain a healthy body weight by burning calories, building lean muscle, and improving metabolism, all while being gentle on the joints. Here’s a detailed breakdown of how swimming supports weight management and overall health: Swimming engages nearly every major muscle group, including arms, legs, core, and back. This full-body effort increases energy expenditure. Depending on intensity and body weight, swimming can burn 400–700+ calories per hour. Different strokes (freestyle, butterfly, and breaststroke) vary in intensity, allowing for tailored workouts.

###### ❖ Cardiovascular and Metabolic Boost

➤ Swimming is a moderate-to-vigorous aerobic activity, which improves heart and lung function.

➤ Regular aerobic exercise like swimming enhances metabolic rate, helping the body burn more calories even at rest.

#### ❖ **Muscle Toning and Strength**

- Water provides 12–14% more resistance than air, making swimming a natural form of resistance training.
- This resistance helps build lean muscle mass, which is metabolically active and supports long-term weight control.

#### ❖ **Low-Impact and Sustainable**

- Swimming is easy on the joints, making it ideal for people with arthritis, obesity, or injuries.
- Because it's low-impact, people are more likely to stick with swimming long-term, which is key for weight maintenance.

#### ❖ **Mental Health and Appetite Regulation**

- Swimming can reduce stress and improve mood, which may help prevent emotional eating.
- It also supports better sleep, which is linked to healthier weight regulation.

#### ❖ **How Much Is Enough**

- The CDC (center for disease control and prevention) recommends at least 150 minutes of moderate-intensity aerobic activity per week swimming fits perfectly into this guideline.

#### iv. **Fasting**

Fasting helps maintain a healthy body weight by reducing calorie intake, improving insulin sensitivity, and enhancing fat metabolism especially when practiced consistently and safely. Here's a structured breakdown of how fasting contributes to weight management:

##### ❖ **Types of Fasting and Their Impact**

- Intermittent fasting (IF) involves cycling between eating and fasting periods (e.g., 16:8, 5:2). It's the most studied and widely practiced form.
- Time-restricted eating (e.g., eating only within an 8-hour window) aligns with circadian rhythms and may improve metabolic outcomes.
- Alternate-day fasting or prolonged fasts (24–72 hours) are more intense and should be approached cautiously.

##### ❖ **Metabolic Benefits**

- Caloric reduction: Fasting naturally limits the time available for eating, often leading to lower overall calorie intake.

##### ❖ **Improved insulin sensitivity**

- Fasting helps regulate blood sugar levels and reduces insulin resistance, which supports fat loss and prevents weight gain.

##### ❖ **Hormonal shifts**

- Fasting increases levels of norepinephrine and growth hormone, which promote fat breakdown and preserve lean muscle.

#### ❖ **Appetite and Behavior Regulation**

- Fasting may help reset hunger cues, reducing cravings and emotional eating.
- It encourages mindful eating, especially when paired with nutrient-dense meals during eating windows.

#### ❖ **Cellular and Hormonal Adaptations**

- During fasting, the body shifts from glucose to fat as a primary fuel source, enhancing fat oxidation.
- It may trigger autophagy, a cellular cleanup process that supports metabolic health and longevity.

#### ❖ **Considerations and Safety**

- Fasting isn't suitable for everyone—especially people with diabetes, eating disorders, or certain medical conditions.
- Hydration and nutrient quality during eating periods are critical to avoid nutrient deficiencies.
- Long-term success depends on sustainable habits, not just short-term restriction.

#### ❖ **Local Relevance**

- We considering that fasting as part of a public health intervention or behavioral study, it could be integrated with culturally appropriate dietary patterns and religious practices (e.g., Ramadan, Ekdashi). Community education should emphasize safe fasting practices, especially for individuals with chronic conditions.

## 6.2 DISCUSSION

Methodological considerations in research on weight loss maintenance: Some methodological issues in studying weight maintenance should be mentioned. Our main interest was to make a conceptual review that could give more understanding for behavioral and psychosocial factors in weight maintenance. We have made no attempt to establish the relative importance of each factor or the interaction among them. Physical activity is, for example, not always related to weight loss maintenance or is not important in overall models including other factors. Very few dietary factors, such as fat and energy density, have been shown to be clearly associated with obesity using evidence-based principles and long-term evaluation of weight loss. It is often difficult to understand whether fat reduction, high-fiber or protein diets, physical activity, or behavioral changes play the major role in achieving the desired effects. Isolating the individual importance of each contributing factor using improved methodology has been suggested to facilitate understanding of the strategies for successful long-term weight loss maintenance. Trying to establish the relative importance of different factors would, however, also impose problems. Some factors may turn out to be strongly related to weight maintenance, such as more initial weight loss and reducing calorie intake, but they provide little understanding for the underlying processes that were important for these manifestations. There is also a need to consider the total situation of critical factors in weight maintenance simultaneously. Weight

control is a very complex process that depends more on changing the whole personal life than on changing single behaviors. Long-term weight reduction was, for example, better in those who had made five or more behavioral improvements compared with those who had made fewer changes. An interaction among all these factors is also likely. A combination of psychology and physiology may, for example, give us more understanding of the mechanisms in weight loss maintenance. Moderators, mediators, and matching the factors we have reviewed can also be described as moderators and mediators. Moderators are the pretreatment characteristics that can identify for whom a treatment works. Mediators are the mechanisms that can identify why a treatment effect is achieved. We have described moderators as well as mediators for weight maintenance. The moderators were the pre-treatment characteristics, such as internal motivation, binge eating, and weight cycling. Examples of mediators were the important behavioral changes, such as increasing cognitive restraint and reducing the intake of dietary fat. Some characteristics were moderators as well as mediators. Self-efficacy and self-confidence, for example, lead to better outcome results but can also be improved during treatment. Moderators identify for whom, but also under which circumstances, treatments have different effects. This is the principle that would allow the information needed to match patients to treatment, for which there has been a call in obesity research. The role of different treatments and the patient-treatment interaction is obviously of importance in the management of obesity. Factors in weight loss and weight loss maintenance are often considered to be very general. This would likely be the case with some factors, but other predictors of treatment outcomes in obesity Weight maintenance in the city could be more specifically related to the type of treatment evaluated. One type of treatment approach can suit some persons well, whereas quite another approach would suit others, and this would lead to different patterns concerning maintenance of weight loss. For example, obesity surgery creates quite another situation for weight maintenance than behavior modification does, and each of these situations can be better suited to patients with different characteristics. One study has shown that patients with substantial weight loss through surgical means compared with patients using non-surgical means differed in their behaviors to maintain weight loss. The surgical group reported eating considerably more dietary fat and less carbohydrate and protein than the non-surgical controls and further had lower levels of physical activity. Another study reported that persons who had chosen liquid formulas through formal programs to reduce their weight rely more on dietary strategies such as counting calories and higher dietary restraint in order to maintain their weight loss, whereas persons who lost weight by their own means used more physical exercise and also weighed themselves more often to maintain their weight loss. Different pretreatment factors characterizing the patients succeeding in such different treatment conditions could provide even more valuable

knowledge, helping us to guide patients to suitable treatments. Weight loss programs with therapeutic interventions helping the patient to recognize and deal with emotions would further help some patients to eat less, whereas receiving nutritional knowledge and help in creating more structure over eating and lifestyle behavior will target the needs of others, manifested as different weight loss patterns. Pharmacological treatments also create very specific prerequisites for weight loss and weight maintenance if the drug is used on a more prolonged basis. A satiety-enhancing drug, for example, may give the most striking results for patients who are particularly vulnerable to the need for food and the influence of physical demands such as hunger. A drug working locally by reducing the fat absorption could be more efficient for others. As the drug creates adverse side effects if dietary prescriptions are not adhered to, the forced necessity to pay more attention to food consumed and the adherence to better eating habits could perhaps provide help related to self-monitoring and meal structure. These are examples to illustrate how future research could more specifically consider the type of treatment interventions in relation to the individual characteristics. Increasing such knowledge could make optimal individual treatment choices possible, leading to better long-term results. Concluding the model, we have described factors that may act as moderators and mediators in promoting weight maintenance or act as obstacles for long-term success. The majority of studies described are based on behavior modification treatments or individual dieting efforts in samples predominantly consisting of women, as can be seen in the appendix.

### 6.3 Appendix

The conclusions may therefore foremost be generalized to women in such traditional weight loss conditions. a hypothetical model would include that the person has reached a decision about wanting to lose weight. he or she has a desire to lose weight to achieve something positive, like becoming more confident and feeling better about weight maintenance. Weight regain an achieved weight loss goal attribution of obesity to medical factors more initial weight loss perceiving barriers for weight loss behaviors physically active lifestyle history of weight cycling regular meal rhythm sedentary lifestyle breakfast eating disinhibited eating less dietary fat, more healthy foods more hunger reduced frequency of snacks binge eating flexible control over eating in response to negative emotions and stress self-monitoring psychosocial stressors coping capacity lack of social support capacity to handle cravings more passive reactions to problems self-efficacy poor coping strategies autonomy lack of self-confidence 'healthy narcissism' psychopathology motivation for weight loss: more confidence motivation for weight loss: medical reasons, other persons stability in life dichotomous thinking, capacity for close relating.

#### 6.4 CONCLUSION

Factors associated with weight loss maintenance and weight regain after intentional weight loss, according to a literature review. This decision is internal and accompanied by a sense of confidence in the ability to make it. There is less focus on external hindrances such as medical reasons, dissatisfaction with lack of support, or hindrances to exercise, but rather an internal focus on the inherent ability, power, and also responsibility to make changes. Although the direct findings of motivation were sparse, this is a description of a firm motivation. Depression and psychiatric disorders may be obstacles for weight control, but some dissatisfaction with the present life situation seen in persons feeling less well may motivate them to make changes. Pronounced initial weight loss and having reached a goal weight may illustrate the successful start in carrying out the decision to lose weight. The behavioral changes made, on which weight loss depends, confirm what is essential and obvious for weight control, to eat healthier, with more regularity and with improved control over eating, and more physical activity. The psychological part of a model can be further elaborated, as inferred from overall findings in the literature. The balance, stability, and maturity of the person appear to be important for the outcome. A consistent pattern emerges where the person likely to succeed in maintaining a lower body weight has a personality functioning with more strengths and stability. Such strengths include a capacity for control and also the ability to handle relapses in a balanced way and to recover again. The thinking style inherent in flexible control implies greater maturity. Personality factors would also contribute to the ability to find coping strategies to be used in various life situations rather than to revert to old eating habits. Finding coping strategies to handle cravings and stressful situations in life reflects an ability to use creativity and thinking and to come up with one's own solutions. The personally adjusted weight control strategies in the weight maintainers likewise reveal creativity and strengths such as autonomy and self-sufficiency. Trying out various solutions and doing other things rather than eating, which could be a variety of things, could also facilitate success. The ability to create and sustain a meal structure and alter food habits can also imply psychological resources such as a more organized personality functioning. Self-monitoring suggests self-awareness and a self-inspective ability, and self-efficacy would likewise constitute a strength. 'Healthy narcissism,' implying that there is at least some energy invested in oneself, with caring for oneself, one's appearance, and physical status, can also be considered as an asset. On the other hand, the retainers had more problems and difficulties in self-management and had less efficient ways to handle obstacles in weight maintenance, as seen in difficulties in managing internal demand states such as cravings. The possibility of biological disturbances causing greater hunger contributing to the factors found in the weight retainers should also be considered. Struggling with hunger would lead to some of the behavioral manifestations, such as

disinhibition, binge eating, and cravings, and also to an overall discouragement and impaired self-confidence. There are some cautions in giving clinical recommendations. It seems quite likely that a person with better prospects to succeed in long-term outcomes has more determination, strengths, and capacities. However, patients with poorer prospects could indeed be considered to be in greater need of help. Some patients may, however, need treatment interventions targeting other areas of their life before they have a chance to be successful in a standard weight loss program. Others, as we can see, can actually improve in critical areas such as self-confidence and problematic eating behaviors during a weight loss program. Yet others may not have reached a decision about losing weight. There is too much complexity to allow simplified recommendations. Thorough pretreatment assessments of the patients may lead to better professional decisions, and taking the time for such careful evaluations before treatment assignment may prove to be cost-efficient in the end. The findings on autonomy, assuming responsibility, and creating personal weight control plans in the maintainers should also be considered. These trends suggest that fixed weight loss plans on eating and living may not lead to successful long-term outcomes. The patients should rather be encouraged to find their very unique personal solutions and inner capacities. 'The successful weight maintainer' To illustrate the factors affecting weight loss maintenance that we have described, a profile characterizing the 'successful weight maintainer' can also be suggested. This ideal person starts losing weight successfully quite early in treatment and reaches the self-determined weight loss goal. Our ideal weight maintainer leads an active life with less television watching and rather more leisure time activities such as walking and cycling. He or she continues to monitor the weight-related behaviors, is in control over eating behavior, and is not overly disturbed by hunger. Food intake is kept at a lower level, the meal rhythm is regular, always including breakfast, and healthy foods are chosen in favor of high-fat food. Snacking is reduced. Cravings can somehow be dealt with. If experiencing a relapse, though, our weight maintainer can manage to handle this in a balanced way without exaggerating this as a detrimental failure. Controls are flexible rather than rigid, and there are self-sufficiency and autonomy. Not surprisingly, this ideal weight maintainer has less problematic functioning and instability, such as depression, binge eating, and weight cycling, but instead more stability of weight patterns, eating, and emotions. The life situation is also more stable, with fewer stressful life events. Support is provided by the social context, although our weight maintainer may prefer to rely on his or her own solutions. It seems that approaching the issue of weight control from a psychological viewpoint could give a better understanding of obesity behaviors. To summarize, we have reviewed a variety of potential factors in weight maintenance and have made an attempt to synthesize these in a comprehensive model. Although there are many methodological challenges associated

with reviewing factors in weight maintenance, such attempts are needed to enable more understanding for weight management. Our review can contribute to further hypothesis testing and a conceptual framework in this area.

### 6.5 ACKNOWLEDGEMENT

This Article would not have been possible without guidance and help of several people, who contributed and extended their valuable suggestions in the preparation and completion of this study. So, I am here to acknowledge and profund gratitude. First and foremost, I would like to express my sincere gratitude and appreciation to department of public health of Om sterling Global university Hisar, Haryana, India for providing me this opportunity. It's my immense pleasure to extend my deep sense of gratitude towards to all faculty, batchmates and junior, Master of public Health, for there immense support, encouragement and valuable suggestions throughout the study. I am equally indebted to my Brother Er. Parmanand Mehta for his encouragement for this article and I would like to extend my thanks to my Patients & community those who involved in this study and give their valuable time, inspiration and encouragement throughout the study.

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