Weight Management

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Introduction
Rising obesity increasingly threatens the United States in terms of health risk to the overall population (17; 77). The current rate of weight gain and the medical costs associated with it have caused the government to create a formal initiative to combat the alarmingly steady rise in obesity (62). Estimates indicate that an obese individual costs six times more money in managed health care than a non-obese person (32). The obesity rate is climbing by 1% a year, and the World Health Organization predicts that America will reach a 70% obesity rate within the population by 2030 (75). This state of affairs could be economically catastrophic if it occurs (50).

The prevalence of overweight and obesity in America has pushed weight management to the forefront of personal trainers’ job responsibilities. Most clients who hire personal trainers do so to look and feel better. Although the desire to lose weight is often vanity driven, the health outcomes associated with attaining a healthy weight are far more important. Weight loss is a relatively easy task to accomplish, in theory, because it is simply a reduction of energy consumed and an increase in energy expended. In reality though, most people find it very difficult to lose weight due to the number of factors associated with successful weight loss. Social, economic, physiological, psychological, and emotional factors can each play a part in creating barriers to adherence and success in a weight management program (28; 42; 57; 74). Addressing one factor alone may be ineffective due to the fact that the other factors may potentially create obstacles independent of the controlled variable, or the factors may compound, increasing the effort needed to comply with the original weight loss strategy. Therefore, an understanding of how each factor interacts with energy balance can assist in successfully managing a client’s weight.

Social Factors
Social factors that affect weight stem from many different aspects of American tradition, behaviors, and lifestyle activities (59). Traditionally, food and drink have long been associated with celebrations, family gatherings, special events, and social environments. Linked with sensations of pleasure, the tendency for many people to indulge themselves with more calories than the body needs often occurs when eating during social activities. High calorie beverages, appetizers, large meals, and desserts are all part of normal eating patterns at weddings, holidays, get-togethers, and family events. Likewise, weekend activities often cause variations in eating habits and calorie intake compared to the more structured work week. Visits to restaurants, social clubs, and gatherings with friends routinely dismantle efforts made during the week, as calories burned from exercise and conscious dietary restraint are easily replaced in a short period of time.

To contend with the additional caloric consumption associated with social events, weight management strategies should identify the specific problems and seek remedies to prevent or decrease the negative actions. Assessing the client’s behaviors via interview can help identify common problem areas that warrant intervention or education. Some common habits that present obstacles to weight loss include:

Obstacles to Weight Loss
1. Over-consumption of food in attempts to try all the food dishes presented.
2. Eating large portions by loading the plate at a buffet or self-serve bar.
3. Consuming food and drink in response to boredom or social nervousness.
4. Location eating: close proximity to food increases likelihood of consumption.
5. Pressures to try dishes to acknowledge preparation effort by the party host.
6. Ordering multiple dishes or very large portions based on appetite at restaurants.
7. Not realizing the calorific density of foods prepared by others.
8. Throwing out restrictive habits due to the environment.
9. Allowing alcohol to skew judgment.
10. Eating or drinking in response to peer pressure.

There may be many contributing environmental factors that cause people to overeat when in social settings. Acknowledging the risks and obstacles in each environment helps clients to be conscious of the possible errors that can be made and the consequent limitations they place on goal attainment. Strategies to avoid these pitfalls should be discussed and documented as an ongoing part of the weight management program.

Economic Factors
Certain economic factors serve as obstacles to weight management as well (60). Recent identification of the impact of some of these factors has led to criticism of corporate and government practices (7; 30; 66). High calorie, low-cost foods have become a staple of many American diets, particularly for those in the lower socioeconomic income bracket (49). Fast food
restaurants offer convenience, low price, and an abundance of calories. For individuals living within budgetary restraints, fast food has become an important dietary option. Higher quality food is often more expensive and harder to keep fresh than inexpensive alternatives. Fruits and vegetables, fish, lean meats, and whole grain products require a larger food budget for daily consumption, and they frequently have a shorter shelf-life. If shopping on a budget, boxed processed foods and lower quality foods high in fats and preservatives are a more cost-effective alternative. Sugar, for instance, is an excellent preservative. Americans from the low socioeconomic brackets have less opportunity to eat healthy because their selections are limited to what they can afford (18).

The level of nutrition education and knowledge has also been linked to socioeconomic status (13; 44). Less affluent Americans have limited access to education resources compared to wealthier classes. Consequently, relative familiarity with nutrient value, caloric density, and healthy dietary practices are often lower in poorer communities, and the information availability is more limited. For instance, the USDA provides quality education and applications on the internet, but without a computer, this information is difficult to access. Risk for obesity has been linked to socioeconomic status, and the behaviors learned early in life tend to stay with an individual into adulthood. Those with less opportunity during the years of their youth may be more susceptible to weight gain as adults, regardless of their later economic status (43).

**Physiological Factors**

Hunger is the primary physiological determinant of eating behaviors. Stimulated by the hypothalamus, hunger is defined as the physiological sensation that leads to the urge to eat (6). It is a subjective feeling and therefore, does not discriminate the exact caloric intake needed. Response to hunger and subsequent satiety, or feeling of fullness, is multi-faceted, and as a result, variations in eating response often occur. Satiation is experienced when the body has consumed adequate food to satisfy its need, thereby shutting off the hunger response. Due to the large number of variables affecting the body’s regulatory system for food intake, it is not a very concise mechanism (15; 29). The sensation of fullness may be attributed to the type of calories consumed, the amount of food in the stomach, or the extent food intake satisfies the demand created by the brain. Due to the variability in the regulatory response, a person may over-consume food before the mechanism to turn off eating occurs (21; 41).

Peripheral mechanisms are used to regulate food consumption via chemoreceptors and hormones (23; 33). The efficiency of these mechanisms is not always consistent, which is one reason why variations in eating patterns exist (24). One problem is that it is possible to consume calories at a rate faster than the food intake information can be processed. Likewise, different foods affect the speed and magnitude of satiation (27). Certain foods trigger peripheral mechanisms more efficiently than others. According to the University of Sydney’s satiation index, over a two-hour period, fish, fruits such as apples and oranges, and potatoes yield more efficient and effective satiety than croissants, cakes, donuts, peanuts, candy bars, and yogurt (38). Fibrous foods have also been linked with sensations of fullness due to the bulk they add in the diet. The duration of fullness seems to be tied to gastric emptying time (how long food remains in the stomach), fluid content, and overall bulk (54). According to laboratory results, the less water ingested and the longer the digestive process, the more hunger is staved off. In addition, biochemical evidence exists that suggests fat and protein content affects satiety as well.

When hunger is not addressed in a reasonable period of time, the perception of the food needed by the body will often increase. Regularly consuming food throughout the day reduces the hunger mechanism, and therefore, may reduce total caloric intake. Selecting foods that quickly increase satiety, like apples and oranges, can help to regulate eating patterns when used as snacks. The inconsistencies in hunger satisfaction rates also suggest that foods should be consumed at slower rates and with adequate fluid to allow the body to recognize the nutrients and use the information to better regulate the chemical shut off valve in the hypothalamus.
Psychological Factors

Appetite differs from hunger in that appetite is the primary psychological mechanism controlling eating, though it is often associated with the level of hunger experienced by the body (22). It represents a desire to eat based on the thought of food in the presence of hunger, but it can also occur without a physiological mediator. A person’s appetite may be for a type of food, particular nutrient, or craving from environmental sights, smells, or thoughts. Planning to order a particular meal before getting to a favorite restaurant or craving a hot dog at a ball park are common examples. Appetite is often blamed for overconsumption because it is linked with the psychological perception of satisfaction from food. Many people order a large entree at a restaurant, but after consuming the appetizer, table breads, and their drink, actual hunger has subsided. When the additional food is delivered the pleasurable sights and smells stimulate appetite again, which often consequently help to motivate the person to further indulge in calories they probably do not need.

The psychological pleasure of eating contributes greatly to high calorie diets. Sensations associated with favorite foods cause chemicals to be released, driving people to eat (25). People find pleasure in tastes, textures, and sensations associated with certain foods or the environments where the food is consumed. This association causes people to desire the foods even when they are not hungry or to over consume the foods after they are full. High calorie foods rich in fats and sugar are often the foods with the most desirable tastes, and therefore present problems in a diet aimed at weight loss (26).

Psychological considerations also include behavior patterns, environmental cues, learned eating behaviors, and the psychological assignment of dollar value. Behavior eating patterns are commonly related to an association between locations, times, and events. A common example of this behavior is eating chips or popcorn while watching television or a movie. Events trigger eating responses as well: the Sunday football game, a trip to the fair, or even an ice cream stop while shopping at the mall has food-event associations. Familiar sites and sounds can trigger appetite without any presence of hunger (67).

Learned eating behaviors also contribute to psychological factors that surround consumption. Eating everything on the plate is a lesson taught early in life that sticks with people into adulthood. In some cases, these behaviors stem from cultural norms that instigate particular eating patterns or food choices. Families that

### The Satiety Index

Each of the following foods are rated by how much food people consumed in order to satisfy their hunger.

<table>
<thead>
<tr>
<th>Bakery Products</th>
<th>Snacks and Confectionary</th>
<th>Breakfast Cereals with Milk</th>
<th>Carbohydrate-Rich Foods</th>
<th>Protein-Rich Foods</th>
<th>Fruits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Croissant</td>
<td>Mars candy bar</td>
<td>Mueslix</td>
<td>White bread</td>
<td>Lentils</td>
<td>Bananas</td>
</tr>
<tr>
<td>47%</td>
<td>70%</td>
<td>100%</td>
<td>100%</td>
<td>133%</td>
<td>118%</td>
</tr>
<tr>
<td>Cake</td>
<td>Peanuts</td>
<td>Sustain</td>
<td>French fries</td>
<td>Cheese</td>
<td>Grapes</td>
</tr>
<tr>
<td>65%</td>
<td>84%</td>
<td>112%</td>
<td>116%</td>
<td>146%</td>
<td>162%</td>
</tr>
<tr>
<td>Doughnuts</td>
<td>Yogurt</td>
<td>Special K</td>
<td>White pasta</td>
<td>Eggs</td>
<td>Apples</td>
</tr>
<tr>
<td>68%</td>
<td>88%</td>
<td>116%</td>
<td>119%</td>
<td>150%</td>
<td>197%</td>
</tr>
<tr>
<td>Cookies</td>
<td>Crisps</td>
<td>Cornflakes</td>
<td>Brown rice</td>
<td>Baked beans</td>
<td>Oranges</td>
</tr>
<tr>
<td>120%</td>
<td>91%</td>
<td>118%</td>
<td>132%</td>
<td>168%</td>
<td>202%</td>
</tr>
<tr>
<td>Crackers</td>
<td>Ice cream</td>
<td>Honeysmacks</td>
<td>White rice</td>
<td>Beef</td>
<td></td>
</tr>
<tr>
<td>127%</td>
<td>96%</td>
<td>132%</td>
<td>138%</td>
<td>176%</td>
<td></td>
</tr>
<tr>
<td>Jellybeans</td>
<td>All-Bran</td>
<td>White rice</td>
<td>Grain bread</td>
<td>Ling fish</td>
<td></td>
</tr>
<tr>
<td>118%</td>
<td>151%</td>
<td>136%</td>
<td>154%</td>
<td>225%</td>
<td></td>
</tr>
<tr>
<td>Popcorn</td>
<td>Oatmeal</td>
<td>Wholemeal bread</td>
<td>Brown pasta</td>
<td></td>
<td></td>
</tr>
<tr>
<td>154%</td>
<td>209%</td>
<td>157%</td>
<td>188%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Potatoes, boiled</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


Disclaimer: The formula does not account for all known contributing factors for satiety. The formula is derived from a small data set. The data set is based on subjectively reported, rather than directly measured, criteria.
center their relationships on food and togetherness encourage large portions and longer time periods spent eating. There may be expectations to eat as a sign of affection and appreciation among the family members. Providing extra food to a son, daughter, or spouse is viewed as showing care for that person, as is eating all the food presented to acknowledge the appreciation for the offering.

In some cases overeating occurs to avoid wasting the food. The psychological and tangible value assigned to food can drive people to eat portions that they do not want or need. Commonly, people consume all the food presented at a restaurant because they paid for it, even though their hunger is satisfied before the meal was completely consumed. People routinely eat the last portions left in the serving containers to avoid having to deal with the leftovers. When food in the refrigerator reaches its termination date, it is often pushed for consumption, so it does not get thrown out and wasted.

Certain emotions or mental states can also drive people to consume food when they are not hungry (51). When people are in a state of boredom, eating provides a diversion. Without an alternate distraction, people often look through the kitchen and eat to pass the time. Likewise, particular emotions can drive people to eat (69). Depression, low self-worth, or sadness can cause people to find comfort in food because it provides pleasure (40). In other situations, people may eat as a reward for accomplishing something or because they have been good. Emotionally-driven food consumption may occur with or without hunger. The food choices selected are commonly associated with pleasure and often lead to indiscriminate eating. Personal trainers should identify these causes to help clients realize and recognize emotionally triggered eating patterns.

Energy Balance

When food is routinely consumed without the presence of hunger or above the caloric requirements of the body, the energy balance can become uneven. Energy balance is simply a comparison of the calories consumed versus the calories expended. Due to the fact that energy can neither be created nor destroyed, it must transfer into some appreciable form when it enters the body. If body energy is not used for enzymatic reactions or converted into heat and released into the air, it will likely be stored in cells or become a component of tissue. When the number of calories consumed is higher than the number of calories metabolized, the body experiences a positive caloric balance. Positive caloric balance leads to weight gain because the abundance of energy remains within the body. When the calories consumed match the calories expended, the body is isocaloric, or in a neutral caloric balance, and consequently, weight should remain unchanged. When the calories expended by the body exceed the number of calories consumed, the body is in negative balance. Negative caloric balance is necessary for the reduction of body weight and body fat.

Concerns of Significant Caloric Restriction

Significant caloric restriction causes weight loss. However, much of this weight loss is accounted for by water and lean mass reduction (72). Defense mechanisms are in place so that when the body does not consume enough energy, it becomes catabolic. This is likely attributed to survival needs by early humans, who could not eat as regularly as we do today. When food was not available, their bodies reduced metabolic activity by reducing the tissue that required the most calories (i.e., muscle). Today, the same phenomenon occurs. Significantly cutting calories often leads to a reduction in metabolism due to lean mass diminution (71).

Some physicians prescribe very low calorie diets (VLCD) for severely obese clients even though the caloric intakes are below the recommended minimums. Diets containing only 800-1200 calories are prescribed and closely monitored for appropriate nutrients (53). These diets are completely inappropriate for individuals not suffering from life-threatening ailments or risk attributed to their weight (1). The diets are used in conjunction with metabolic, blood, and vital sign monitoring in hospital-based settings to prevent any significant negative health consequences from occurring. When individuals attempt to duplicate the VLCD plan by utilizing starvation type diets they risk damaging their metabolism and placing their organs under considerable stress (2). The minimum recommended caloric intake to maintain adequate nutrient composition is 1200 kcal/day. For many people, this value is still insufficient and can lead to negative outcomes if individual nutrient requirements are not met.

Yo-Yo Dieting

Physiological detriment has also been observed in people who routinely follow low calorie “fad” diets. The Yo-Yo dieting effect may be linked with reduced metabolism and increased body fat with age (11; 12; 65). The “10 lbs. off, 10 lbs. back on” trend commonly occurs in American dietary practices. People lose the weight in two months and gain it back in the four to six months following the diet’s conclusion. Due to the restrictive nature of dieting, particularly without exercise, a loss of muscle may occur every time a new diet is employed. Lean mass is one of the primary
Contributors to an individual’s metabolic rate. The reduction in lean mass associated with dietary practices solely emphasizing caloric restriction increases the susceptibility of subsequent weight gain as a person ages.

Food Recalls and Logs
To appropriately manage weight, the correct balance between caloric expenditure and caloric intake must be attained on a routine basis. The resultant difference needs to be appropriate for the desired incremental changes to take place. To accomplish successful weight loss or weight gain, the values which contribute to the balance must be identified and managed correctly. To determine the caloric intake of an individual, a personal trainer can perform a dietary energy assessment. There are several protocols designed to identify or estimate the actual number of calories being consumed in a typical day. They are divided into food logs and food recall assessments. Food recalls are easily implemented and require minimal effort. The assessment requires a client to recall all of the food and drink consumed over a selected period of time. In most cases a 24-hour recall is used so that the information is still fresh in the mind of the client. The client is asked to record every calorie containing food or beverage by the serving or portion size consumed. It is important that the information be complete, recalled in detail, and measured as concisely as possible. To help enhance the accuracy of the information, personal trainers should use descriptions, household containers, or models to show clients what serving sizes and normal portions or food quantities are, as well as the standard household measures. If the client is inaccurate with the quantity of the food or drink consumed, the data collected may be invalid and skew any subsequent recommendations.

Food logs use a similar assessment protocol, but differ in the fact that the client records the foods as they are consumed. This difference in the data collection methodology increases potential accuracy above the recall method because the recording is done at the time of the intake, thereby reducing forgetfulness or inaccurate recall. Food records can be done for a 24-hour period, but the preferred method is to use three days of dietary consumption. The purpose of using a multiple day log is to identify variations in eating patterns and identify changes that occur between days in the week. Generally the days used should represent the beginning, middle, and end of the week. Commonly Monday, Thursday, and Saturday are designated for review. Including one weekend day is helpful because of common differences in eating habits on weekends compared to weekdays. This strategy enhances typical representation because it reflects the dietary habits consistent with different eating locations and frames of mind when consuming the foods. It is prudent to have the client identify the location where they consumed the food or drink and their feelings at the time of the

### Sample Food Log

<table>
<thead>
<tr>
<th>Amount</th>
<th>Food Description</th>
<th>Location</th>
<th>Feeling</th>
<th>Time of Day</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Cup</td>
<td>Kellogg’s Corn Flakes</td>
<td>Home Breakfast table</td>
<td>Hungry</td>
<td>8 am</td>
</tr>
<tr>
<td>1/2 Cup</td>
<td>Low Fat milk 2%</td>
<td>Home Breakfast table</td>
<td>Hungry</td>
<td>8 am</td>
</tr>
<tr>
<td>1 Cup</td>
<td>Decaf Coffee</td>
<td>Home Breakfast table</td>
<td>Hungry</td>
<td>8 am</td>
</tr>
<tr>
<td>1</td>
<td>Banana</td>
<td>Home Breakfast table</td>
<td>Hungry</td>
<td>8 am</td>
</tr>
</tbody>
</table>
Food recall and log data can be analyzed using a number of different computer diet analysis programs or performed manually using food composition tables. The government offers a free user-friendly database of foods as part of the USDA Food Guide Pyramid (www.choosemyplate.gov). The analysis program provides a detailed breakdown of foods’ energy and nutrient composition. It also compares the nutrient intakes with the current food guide pyramid and identifies possible deficiencies that may negatively influence health.

Once the data is compiled, it needs interpreting for both quantifiable and non-quantifiable information. Quantifiable information includes the food source and nutrient contents. Location and size of meal, why it was selected, and the time it was consumed represent non-quantifiable information. Both types of data are useful in identifying intake and food-selection patterns or habits.

The data should be evaluated for energy content, energy nutrient distribution, quality food choices, variety, and nutrient balance. Although the total caloric intake will be used in determining energy balance, particular nutrient quantities should also be evaluated for health purposes.

These nutrients can paint a broader picture of the diet’s value as it pertains to health and may provide details that are useful to subsequent weight management strategies and recommendations. A diet high in fat, sugar, and processed carbohydrates will likely contribute as much to dietary problems as excess calories.

**Metabolism**

Identifying caloric intake provides information for half of the energy balance equation. The next step in completing the evaluation involves determining the consumption. This may provide data related to behavioral patterns and help identify intervention strategies. Food records require the same attentiveness and client education as the 24-hour recall. Clients should be clearly instructed on the protocol and advised to be conscious of the common errors found with the assessment. Clients should be convinced that they are not being judged nor will their food intake reflect negatively upon them. It is important for goal attainment to have accurate information. Otherwise, it may be a costly waste of time and effort.
daily caloric expenditure. Daily caloric expenditure is calculated by adding an individual’s resting metabolic rate and their voluntary metabolism created from daily activity participation. Voluntary metabolism represents those calories expended through activity. The sum of the two measures is referred to as an individual’s daily need. Daily need reflects the number of calories required for a neutral balance and weight maintenance.

**Components of Metabolism**

![Components of Metabolism](image)

**Resting Metabolic Rate**

Resting metabolic rate (RMR) generally represents between 60-70% of the total caloric expenditure in a given day (46). It is defined as the rate at which the body expends energy to support vital functions including heart contractions, digestion, and various cellular activities. Metabolic rates vary from person to person and are affected by several factors, including genetics, gender, age, height, weight, lean body mass, and hormone activity. In addition, certain conditions can cause increased metabolic activity at rest such as fever, stress, starvation, recovery from exertions, and malnutrition.

Several available methods can measure or predict metabolic rate in humans. Measurements are most commonly done in clinical environments using indirect calorimetry. Indirect calorimetry uses respiratory measurements of oxygen consumption and carbon dioxide production to calculate caloric expenditure. Although more accurate than predictive equations, the technique is not always practical for the personal trainer because the expensive equipment needed to perform the analysis and a complete understanding of the scientific protocol are not available. For logistical purposes, metabolic rate is more commonly predicted from equations. The use of equations to predict RMR allows for close estimations based on known factors. The predictions are founded on the principles that 1) RMR is proportionate to body size, 2) RMR decreases with age, and 3) muscle is more metabolically active than fat. This relationship is reflected in all equations used to predict RMR. Two commonly used RMR equations are the Cunningham Lean Mass Equation and the Revised Harris-Benedict Equations.

The Lean Mass Equation is used to predict RMR when an individual’s body composition has been accurately identified. It is not gender specific because it is calculated by the relative lean mass of an individual and therefore does not require adjustment for gender differences in fat storage. The value is useful for weight loss or weight gain programs because it focuses on the metabolically active lean mass. Identifying and using the quantity of lean mass in the calculation reduces the overestimation of RMR associated with the fat mass contribution to body weight found in other equations. One limiting factor to the calculation is that it does not account for age, which is known to affect metabolism independent of lean mass. Therefore, the predicted value will be more accurate for younger individuals.

The Revised Harris-Benedict Equations may be more appropriate when lean mass cannot be accurately determined. Unlike the lean mass equation, the Harris-

~Key Terms~

**USDA**- The United States Department of Agriculture.

**Hypothalamus**- The part of the brain that lies below the thalamus. The hypothalamus regulates bodily temperature, certain metabolic processes, and other autonomic activities.

**Very Low Calorie Diet (VLCD)**- A diet of 800 kilocalories a day or less.

**Resting Metabolic Rate (RMR)**- The rate at which the body expends energy to support vital functions including heart contractions, digestion, and various cellular activities.

**Cunningham Lean Mass Equation**- An equation used to predict resting metabolic rate (RMR) when an individual’s body composition has been accurately identified.

**Revised Harris-Benedict Equations**- An equation used to predict resting metabolic rate (RMR) and may be more appropriate when lean mass cannot be accurately determined.
Benedit equations are multifactoral, utilizing gender, weight, height, and age to individualize the measurement and account for specific variations. Although it does not differentiate lean mass from fat mass, the equation does use weight and height based on predictive norms for body composition for a given age, and additionally, uses gender specific equations. It is important to note that the calculation of both equations uses the metric system.

Resting metabolic rate represents the largest portion of caloric need but does not completely cover the total daily need for calories. Physical activity generally accounts for 20-30% of a person’s daily expenditure (47). This value contributes the most variability in total caloric need and therefore has the most manipulability for increasing caloric expenditure. Predicting the average energy expenditure related to physical activity adds to the error of estimation unless it is measured using more direct means. Activity multiplier ranges have been developed to calculate daily need based on daily activity norms. When using the equations to predict daily need, estimates of calorie per kilogram of bodyweight have been established to enhance the accuracy of the prediction. Standard deviations of the RMR predictions are usually between 100-200 kcal, which may increase to 300-400 with inappropriate activity multiplier selection (31).

A third contributor to caloric expenditure is the thermic effect of food or dietary induced thermogenesis. It has been well documented that increasing caloric intake heightens metabolic functions related to digestion, transportation, and assimilation of nutrients. More complex foods or foods high in capsaicin like hot peppers cause increases in metabolic rate above that of the normal American diet (19; 73). Lean proteins, vegetables, and whole grains are more difficult to breakdown and therefore, require more energy to digest. Depending on the contents of the diet, the thermic effect of food accounts for approximately 5-10% of caloric expenditure (48). Certain dietary intakes can have more pronounced effects from both obligatory and facultative thermogenesis. The additional heat produced from the breakdown contributes as much as 12% of total caloric expenditure. Eating a lean diet high in complex carbohydrates, fruits, and vegetables helps contribute to weight loss through these mechanisms.

Subtracting caloric expenditure from caloric intake will predict the energy balance. This value is an important number, as it represents a predictable physiological outcome for the body. If a person consumes 2500 kcal in their diet and expends 2200 through total energy expenditure (TEE) the net gain is a positive 300 kcal. If this individual continually experiences a positive caloric balance, he or she is going to gain weight. It takes 3500 kcals to add a pound of fat and 2500 kcal for a pound of lean mass. Gains in lean mass occur with participation in fairly rigorous, high-volume resistance training. Any individual who experiences positive caloric balance without the addition of routine resistance exercise will likely gain fat mass at a rate consistent with their genetic predisposition. For a person prone to weight gain, every time the calories add up to a positive 3500 kcal, an additional pound of fat will potentially be added.

Most people will increase metabolism by overeating, partly in response to the thermic effect of the food. For the majority of people, this acute adjustment does not completely prevent the additions of fat mass. Additionally, individuals who do not dramatically overeat, but routinely maintain a positive caloric balance of as little as 50-100 kcal per day can wind up gaining weight over time.
over 5 lbs. of weight in a single year. This gradual increase in weight from a positive caloric balance as a person ages is referred to as creeping obesity.

~Quick Insight~

Metabolism is based on how much oxygen the body needs each day. Therefore, the factors that affect the amount of oxygen used can be manipulated to increase a person’s net caloric expenditure. RMR is primarily dependent upon a person’s size or more importantly, their relative lean mass. Engaging in activities that promote lean mass maintenance or muscle hypertrophy can enhance metabolic expenditure. It is estimated that one pound of lean mass represents 11-15 calories of expenditure during rest per day. A two-pound addition of lean mass can equate to more than a 5,000 kcal expenditure per year at resting levels. This number increases when that same tissue is put to work.

Physical activity can represent more than a third of caloric need when hard work is performed. Increasing the physical demands on the body through exercise or adding more activity throughout the day will increase metabolism. When vigorous exercise becomes routine, the post-exercise recovery demands also increase metabolic function. Excess post-exercise oxygen consumption (EPOC) can contribute positively to mean metabolic rate (64).

When prudent food choices are made in the diet this value again increases through thermic effects associated with the digestive processes. The combination of resistance training, routine high intensity exercise, and a healthy diet rich in complex foods can cause a person’s mean metabolism to increase dramatically. Although resting metabolic rate is approximately 40% uncontrollable, 60% can be manipulated for improved metabolic fitness.

Weight Management Strategies

When weight management strategies are aimed at weight loss, the energy balance must be tipped to the negative side. Most people utilize dietary adjustment as a single means to create a caloric deficit. Dieting independent of other lifestyle changes has proven, in countless clinical trials, to be ineffective for long-term weight management. For fat weight to be reduced and remain under control, diet alone is not the answer. When additional factors that influence energy dynamics (i.e. exercise) are included in a weight loss strategy, the odds of success are increased proportionately.

Due to the inverse relationship that exists between a positive and negative energy balance, the factors that cause weight gain represent the same variables that must be controlled for successful weight loss. These variables can be categorized into three primary areas: energy output, energy input, and influential lifestyle behaviors. Each area alone serves as a contributing factor to weight loss, but when employed in a unified manner, they become far more effective than when applied independently. Energy output includes all actions that expend calories, including resting metabolic rate, diet-induced thermogenesis, daily activity, and structured physical activity or exercise. Energy input includes all energy that enters the body, the particular form the energy is in, and the specific quantities that are ingested at a given time. Influential behaviors represent all actions that affect the previous two categories.

Increasing physical activity in general relates importantly to total caloric output. Individuals who are sedentary except for the 30-40 minutes of exercise they perform three days a week may actually have a greater risk for weight gain than those who do not engage in any structured exercise but are physically active throughout most days of the week. This phenomenon occurs because the mean caloric output is higher with ongoing activity than it is with intermittent engagement of exercise combined with sedentary behaviors. This explains why a person who follows a structured exercise program may not lose weight, as energy balance is comprised of the sum of the total energy expended throughout the day. Combining structured exercise with regular physical activity improves caloric expenditure dramatically compared to exercise alone. Physical activity can be added into any lifestyle at varying dosages based upon the situation. Biking instead of driving, using the stairs instead of the elevator, and
playing tennis instead of going to the movies are all examples of ways to infuse physical activity into an everyday lifestyle.

Structured exercise prescribed for weight loss should emphasize continuous activity aimed at maximal caloric expenditure. The body burns far fewer calories at rest than when active. For this reason, aerobic activity is often used for weight loss instead of weight training. The non-stop aerobic activity often burns more calories at a lower force output than the total calories accumulated through resistance training using high force outputs with intermittent rest periods. This occurs because the rest periods used between sets of resistance exercises are longer in duration than the time actual work is performed. In most 60 minute resistance training sessions, only about one-third of the time (20 min.) is actually used for activity. When total resistance training work is compared to aerobic training for the same duration, resistance training burns more calories per minute of activity due to the higher intensity of the work.

To yield the greatest contribution to a negative caloric balance, an exercise plan should focus on performing the maximum amount of work in the allotted time. Different activities can be combined to form a complete exercise program that flows with only minimal transitional rest. Aerobic training, resistance training, and flexibility activities can be combined using various techniques to use the full amount of workout time. Resistance training can be performed in circuit formats, flexibility training can be made dynamic, and aerobic exercise can be employed at any time in the bout, consistent with the program structure. Maximizing the use of time available for structured activity is a key component of any exercise-related weight loss strategy.

Ideally, the actions and modalities used for exercise aimed at weight loss should include both resistance training and aerobic activities. The maintenance or addition of lean mass is an important consideration for TEE (5; 36). Equally important, aerobic activity should be employed to encourage additional caloric expenditure and improved fitness, so greater training intensities can be attained (20). Individuals who reach elevated levels of fitness are better able to burn additional calories during the exercise bout primarily due to an ability to handle higher exercise intensities. The contribution of post-exercise metabolism encouraged by high intensity training also warrants attention, as it enhances fat utilization throughout the body (10).

**Quantity of Work**

The quantity of physical activity is fundamental to the dietary strategies used to create the negative caloric balance. Lower intensity workouts require longer exercise duration to achieve the same caloric expenditure as higher intensity workouts. If one pound of weight loss is to be attained per week, the amount of physical activity and its intensity will determine the number of calories that will be removed from the diet. Low intensity activity participation requires a larger dietary deficit. An individual who burns 500 calories per week through exercise must eliminate 3000 kcal from their diet. This assumes they are currently maintaining a neutral energy balance. Personal trainers should encourage their clients to burn between 1,000 and 2,000 kcal per week.
Spot Reduction

Weight loss will occur at the body’s discretion as determined by the severity of the caloric restriction, total energy expenditure, and the genetic predisposition of the individual. Exercise cannot dictate lipid metabolism in any particular area. Therefore, what is commonly referred to as “spot reduction” is not possible in humans. Emphasizing leg training will not ensure lower extremity body fat loss in the same way performing abdominal work will not increase lipid use around the trunk. In general, fat loss patterns are controlled via genetic predisposition rather than by the areas that are exercised. For example, running may cause one person to initially lose fat around the abdomen whereas a different person experiences the body fat changes in the lower body.

Gimmicks aimed at spot reduction include ab-isolation machines, low frequency electrode units, sweat suit devices, and cellulite creams. For fat loss to occur, the body must attain a negative caloric balance while maintaining adequate energy to prevent lean mass loss.

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through physical activity per week. This reduces the emphasis of dietary change to between 200-300 kcal per day. When the dietary restriction is too significant, compliance is reduced and goal attainment becomes less likely. Caloric deficit requires daily changes to the diet. Overly aggressive caloric restriction programs do not work for most people. A 10-15% reduction of total caloric intake is reasonable, assuming the client can manage the physical activity requirements to create the appropriate total negative balance. When calories are removed from the diet, they should come from areas which are not nutritionally dense. Reducing fat, sugars, and processed carbohydrates are most desirable because the foods containing these nutrients are generally nutrient poor and are energy sources that often cause the most metabolic problems. Most people respond far better to incremental reductions in particular types of calories, compared to significant caloric restriction where the percentage of nutrient contents remain consistent. Studies show better compliance to significantly reduced fat in the diet compared to reduced calorie diets that include fat.

Providing proper distribution in meal frequency and size can be almost as important as the energy distribution itself. Large meals place heavy demands on the metabolic system and reduce the efficiency of nutrient utilization, thereby increasing risk for fat storage. High glycemic loads combined with long durations between feeding encourage lipogenic behavior. On the contrary, smaller meals consumed throughout the day reduce hunger, are utilized more efficiently without excess insulin, and encourage metabolic activity. Eating throughout the day also reduces the likelihood that hunger will lead to episodes of overeating.

The adjustments to the diet and physical activity are part of behavioral modification strategies, but they do not completely represent the full spectrum of behavioral considerations. Stress and social behaviors both affect weight management outcomes but through different means. Unregulated emotional or psychological stress causes cortisol to be released, increasing available energy to manage the fight or flight response. Derivatives of protein and fat storage are mobilized into the blood and sent to the liver for conversion to readily available fuel. This fuel is meant for the physical activity required for fight or flight. However, in modern times, stress exists without a need for physical action. The excess fuel is then stored proximal to the liver as visceral fat or stored in other areas of the body (56). Avoiding or better coping with stress reduces its detrimental effects on weight loss. To properly manage stress, one must know where the potential for stress exists. Creating viable strategies to avoid or alter the environment to reduce the severity or impact of the stress is part of a complete management approach.

Social Behaviors and Weight Management

Social behaviors do not affect weight management through hormonal means, but rather as obstacles to diet and physical activity adherence. As stated earlier, social activities often promote increased caloric consumption and are usually not physical in nature. This increases the likelihood that a positive energy balance will replace the potential negative contributions from the diet and impede weight loss.

Alcohol consumption is commonly used as part of social entertainment or to facilitate a feeling of relaxation for many Americans. At 7 kcal per gram, the caloric density of alcohol is almost as high as that of fat. Alcoholic beverages range between 100 kcal in a light beer to 450 kcal in some mixed drinks. Four or five alcoholic beverages over a weekend can potentially add a large number of calories to one’s diet. Likewise, the foods that are served in the presence of alcohol are also commonly high in calories. Foods consumed with alcohol have a greater propensity to be stored as lipids compared to when digested without the presence of alcohol (68). Alcohol is preferentially
metabolized in the body with absorption starting in the stomach. This causes other foods to enter circulation without a demand for oxidation, leading to an increased likelihood of greater fat storage.

To reduce the consequential effects of social behavior on weight loss success, alternatives or compensatory actions should be considered. If high-calorie consumption is a problem for a client, the personal trainer should plan for preventative action. Asking people to stop engaging in socially stimulating environments is inappropriate. Adding accountability and ways to avoid the pitfalls is warranted. Providing strategies to avoid poor food choices and behaviors when in social environments will help reduce the impact of social events.

Weight Gain
Not every person wants to lose weight. For some people, gaining weight is just as challenging as losing weight can be for others. Proper weight gain is accomplished in the same manner as proper weight loss, but instead of a negative caloric balance, the emphasis is on intelligently creating a positive energy balance. It would seem a positive caloric balance would be easily attained by simply eating high calorie food. Ideally however, weight gain should be from lean mass. Emphasizing a high caloric intake alone will likely increase fat mass and place the person at a higher risk for unhealthy blood lipid profiles.

Weight gain goals are often vanity or performance related. Healthy weight gain works on an incremental basis, inversely consistent with weight loss. If done

Quick Insight

Fad Diets
The popularity of fad diets has increased dramatically in recent years due to media promotion, elevations in body weight throughout the American population, and the misconception that weight can be reduced quickly with minimal effort. New books and remedies guaranteeing effective weight loss bombard consumers routinely and drive the message that there are alternatives to caloric restriction and exercise for weight management. It should be fairly obvious that singling out a particular energy nutrient or engaging in wholesale changes do not work. If any particular method did work only one diet book or diet strategy would be needed and everyone would gravitate towards it. Some common indications of unsound weight loss promotions include:

- Rapid or dramatic results
- A diet advertised as working without exercise
- Emphasis on short-term change
- Dramatic changes to normal patterns
- Celebrity, Athlete, or “Doctor” endorsed
- Claims of research such as “Independent studies prove”
- Claims to replace, or add to, metabolic or hormone function
- Emphasis on one nutrient or limited food choices
- Lack of emphasis on caloric reduction and behavior modification
- Assertion claiming to reduce cellulite or fat in specific locations
aggressively, both yield consequential results. Diets emphasizing excess calorie reduction frequently cause lean mass loss, while diets with excess calorie consumption cause fat mass gain. To avoid both scenarios, controlled changes in the diet and the activities engaged in will allow for the proper tissue to be affected. Weight gain attempts should emphasize resistance training combined with prudent caloric additions to the diet. An addition of 150-300 kcal per day with a focus on protein should be sufficient to encourage lean mass gain in conjunction with the adaptations associated with physical activity (3; 35). Some recommendations are more aggressive for individuals who find it extremely difficult to gain weight. Adding 500-750 kcal above caloric expenditure may be warranted for very lean clients who struggle with adding mass (63). Body composition should be tracked along with caloric intake to identify variations associated with excess or insufficient intakes.

Protein should represent the majority of the calories increased in the diet as long as the value stays below the 1.6-2.0 grams per kilogram of body weight upper limit. If additional caloric requirements are required, individuals should come from nutrient dense carbohydrates. High fat foods are a good choice as they can lead to increased risk for negative blood lipid adjustments even though the foods are calorically dense. Feeding throughout the day may also positively contribute to the weight gain goals. For individuals who find it difficult to eat frequently, meal supplements may aid in fulfilling the calorie requirements. If protein supplements are used, whey protein is ideal for post-exercise consumption and casein protein can be used at night due to its slower absorption rate. Personal preferences will ultimately define the ideal dietary strategy.

**Eating Disorders**

Whenever clients attempt weight loss, personal trainers should consciously identify inappropriate behaviors. Disordered eating patterns are commonly associated with weight loss attempts, even in cases involving those educated about healthy strategies and weary of inappropriate behaviors. Two of the most common disordered eating patterns include restrained eating and binge eating behaviors. Although both behaviors characterize diagnosed eating disorders, individuals who engage in these behaviors are not necessarily suffering from a psychiatric disorder. Hoping to accelerate weight loss, individuals attempting to control calories often engage in episodes of severe restriction. This may be to compensate for overeating, to cause a negative caloric balance, or to prepare for an environment where the client knows they are likely to consume more calories than is appropriate for their weight loss goals. Not uncommonly, people intentionally do not eat all day, knowing they have an event that evening that will provide an abundance of food and drink.

Severe restriction is one of the worst habits to engage in because it changes the internal metabolic environment by promoting the loss of lean mass and increasing the likelihood of fat storage. Restriction is also likely to lead to bingeing: eating due to the psychological wear on the body from prolonged physiological signals of hunger. Binge eating occurs when people significantly surpass their caloric need. It commonly occurs due to the stress and fatigue of aggressive dieting or a temporary emotional lapse. For this reason, weight loss should be part of lifestyle changes that are not aggressively applied. Small changes do not cause significant stress on a person’s normal behavior patterns and are thus, less likely to trigger an event.

When disordered eating patterns become routine, the behaviors may be psychologically motivated beyond the client’s control. Eating disorders can start from attempts at weight modification that grow into damaging physiological patterns with roots in more significant underlying psychological pathology. Eating disorders are classified as psychological disorders by the American Psychological Association due to their potential for harm. They are complex, multi-faceted
conditions that are presumed to stem from internal conflict and biochemical variations in the brain (34; 52). Unmet personal needs and issues of control are often linked to compensatory eating behaviors which attempt to cope with the emotional dysfunctions (8; 61).

The three most common eating disorders include anorexia nervosa, bulimia nervosa, and binge-eating disorder. Each has a specific diagnostic criteria listed in the Diagnostic and Statistical Manual of Mental Disorders of the American Psychological Association (16). A stereotypical physical characteristic does not exist for people with eating disorders except for severe, later-stage anorexia, where a person is visibly emaciated. A person may be of normal weight or even overweight and suffer from the afflictions of one of the disorders.

**Anorexia Nervosa**

Anorexia is probably the most well-known eating disorder. It is characterized by significant body image disorder, intense fear of becoming fat, and a preoccupation with weight (14). Although anorexia is most commonly diagnosed in females, nearly 10% of anorexics are male (37). Anorexia’s most obvious symptoms include severe weight loss from caloric restriction, strict dietary practices, and heavy exercise participation (9). Although anorexics may engage in other compensatory activities, including vomiting and laxative use, caloric restriction is most common (45). Anorexia is a serious condition that results in death in 10% of the cases from suicide, cardiac arrest, or metabolic complications. Personal trainers who suspect an individual may suffer from the disorder should discuss it with their client and recommend counseling. Personal trainers should discuss the suspicions with the individual’s designated emergency contact person in the case of clients under 18 years of age due to the severity of the disorder. Individuals suffering from anorexia will not be able to cure themselves and therefore require psychological counseling or medical intervention (4).

**Bulimia Nervosa**

Bulimia Nervosa is more difficult to identify than anorexia because it is shadowed in secrecy; in fact, many bulimics are of normal weight or may be slightly overweight (39). Bulimia is often characterized by binge-eating and purging, seen in about 80% of the cases, or inappropriate compensatory actions, including heavy use of diet pills and laxatives (76). Weight changes may be limited in bulimics, so symptomatic identification is difficult. Estimates suggest that between 1-3% of the population is bulimic, with females showing a greater propensity for the disorder, representing 9 out of every 10 cases (37). Bulimics may experience episodes of severe compensatory behavior followed by periods of reduced symptomatic activity. Low self-esteem and body dissatisfaction are tied to weight, so body image often dictates the severity of the behavior (70). Fortunately most bulimics who seek counseling do so on their own to reduce their mental suffering.

**Binge-Eating Disorder**

Binge-eating disorder involves the consumption of large amounts of food followed by feelings of guilt, depression, and low self-worth (58). Binges may occur between 3-5 times per week. Compensatory actions may be taken, but are done so on an irregular basis. It is estimated that binge-eating disorder affects up to 4% of the population (55). Binge eaters are more likely to be overweight or obese and experience feelings that they cannot control their eating (14). Most bing eaters have a long history of dieting or weight loss struggle and are not happy with their bodies (58). Caucasian women seem to represent the largest group of sufferers, but men and women of all races may suffer from the disorder.

Personal trainers should be knowledgeable as to the signs and symptoms of eating disorders. Individuals who are overly pre-occupied with exercise or feel the need to exercise every time they eat are candidates for these dysfunctions. Discussing concerns with clients may shed some light on the situation and help them identify negative behaviors.


