

# **Why do We Gain Fat, and How do We Lose it?**

An introduction to the science of body fat

by Dan Pardi and Stephan Guyenet, Ph.D.

# Introduction

By Dan Pardi

It was 2007 when I realized that I needed to lose weight again. I have needed to be conscientious of my weight for most of my life, having been obese as a child. I was always very active, even obsessed with performing well at sports, so I was able to partially control my weight through high levels of activity as a youth. However, the fear of gaining weight again was always lurking in the back of my mind, and I would regain quite easily. This undoubtedly shaped my academic and professional interests, and it now drives me to help myself and others be healthy and lean.

Why did I need to lose weight in 2007? It was simple: I had stopped doing the things that kept me lean. Job pressure had made it difficult for me to maintain the healthy patterns that had worked for me in the past. I committed myself once more to a consistent training program, and I tracked my exercise for six months. But I only gained more weight.

Back to the drawing board. I went back to the scientific literature, changed my approach, and tried again. I decided to take a more balanced approach that included a focus on diet. I planned my meals and ate according to the structure I had developed. I also made sure to exercise several times a week, but instead of longer workouts, I did shorter bursts of activity throughout the day. I also set a strict bedtime goal and did my best to attain it. I tracked my weight every day in a spreadsheet and set milestones for myself.

The results shocked me.

I was putting in the same amount of effort as I had previously, but in a smarter way, and I was losing weight rapidly — I lost 30 pounds (14 kg) in 53 days. Best of all, it felt like an approach I could stick with for the long haul.

Seven months later, I was still at my target weight. My weight maintenance strategy was working. Then, my wife and I went on a trip. I decided to buy box of cookies for the trip and ended up eating the entire box within a day. This was the moment when my weight started to climb once again. It's not as though I hadn't had a cookie in the previous seven months, but something about this moment either stimulated or correlated with a sudden departure from the lifestyle I had been happily maintaining. Several weeks later, I had gained 12 lbs and everything had changed. It was like a switch had flipped, and now it was hard to control my weight again.

What happened? I had once again stopped doing the things that kept me lean, and my weight reflected this. I made a commitment to go back on my weight loss diet, and I was able to regain my former weight after a few weeks.

More than six years later, I remain at my target weight. I've refined my weight maintenance strategy over the years, but it's continued to work. A 30-pound reduction in weight may not be exceptional, but maintaining it over six years certainly is.

What did I take away from this experience? My weight is a reflection of my behavior. There are two key components to weight control. The first is to use weight loss methods that are effective, and the second is to use strategies that help you consistently apply these methods in a way that is sustainable for you.

In 2011, I met Stephan Guyenet, an obesity researcher at the University of Washington and author of the popular health website [Whole Health Source](#). We decided to team up, adding his

expertise in body weight regulation and diet to the cutting-edge behavior modification platform I had developed. Together, we re-designed the Ideal Weight Program from the ground up. Today's Ideal Weight Program is built upon our analysis of the scientific literature, identifying the factors that offer the greatest influence on body fatness per unit effort. We offer evidence-based strategies that turn this knowledge into practice, and tools that motivate healthy behaviors and cultivate mindfulness on a daily basis.

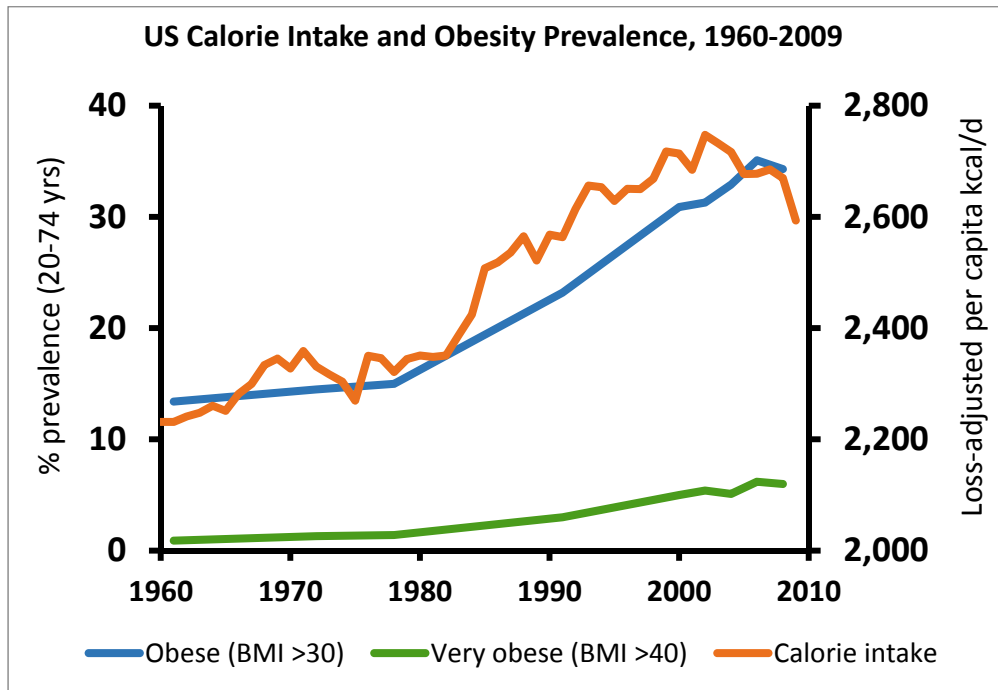
We've put together this document to introduce you to the science of fat gain and fat loss. These are the core concepts that underlie the Ideal Weight Program, and that triggered my own successful weight loss and maintenance. This document is a shorter, streamlined version of a fully referenced e-book we provide as part of the Ideal Weight Program. Enjoy!

## **What Determines Body Fatness?**

### Calories

Fat tissue is the body's main calorie storage site, and without this calorie buffer we would starve to death in a few days without food. To a close approximation, changes in the amount of fat we carry depend on how many calories we eat, minus how many we burn through normal metabolism and exercise. If we eat more calories than our bodies use, we gain fat. This is called 'overeating' if it occurs in a person who doesn't need to gain fat, and it's the fundamental cause of fat gain.

When we keep this principle in mind, it's not hard to understand why obesity has become much more common since the 1970s in the United States: we eat more calories per day than we used to.

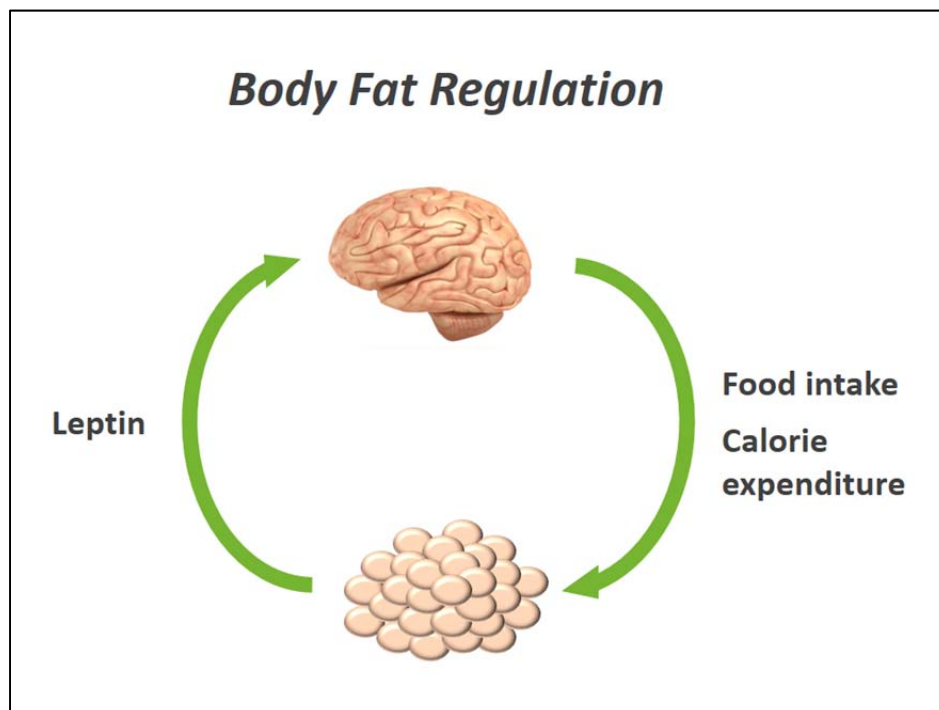


Just as fat gain requires a sustained calorie surplus, fat loss requires a sustained calorie deficit. In both instances, it makes no difference whether the source of calories is carbohydrate, fat, or protein. However, the calorie source does impact appetite, making it more or less difficult to eat fewer calories, as we will see.

Fat loss requires that the number of calories leaving the body exceed the number entering for an extended period of time—short of liposuction, there is no way around this math! Fundamentally, to lose fat, one must either reduce calorie intake, and/or increase calorie expenditure. Easy, right? Actually, the concept is simple but implementing it isn't necessarily easy. Simply providing guidance to 'eat less, move more' is rarely effective in the long run. Why is this, and is there a better way?

## Body Fat Regulation

In 1840, a German doctor named Bernard Mohr reported that one of his patients had sustained severe damage to a specific part of the brain called the hypothalamus—and that she had rapidly become obese. Over the ensuing century and a half, researchers gradually uncovered a sophisticated system in the brain that regulates body fatness. This system works a lot like your home thermostat, which detects temperature using a thermometer, and keeps it close to a specific temperature using heat and air conditioning (this is called a ‘negative feedback system’). Similarly, a ‘fat thermostat’ in the brain detects how much fat you carry using hormones such as leptin, and attempts to keep body fat relatively stable by adjusting food intake and energy expenditure over long periods of time. If body fat goes down, hunger goes up, and energy expenditure and the desire to exercise go down. This continues until the fat comes back.



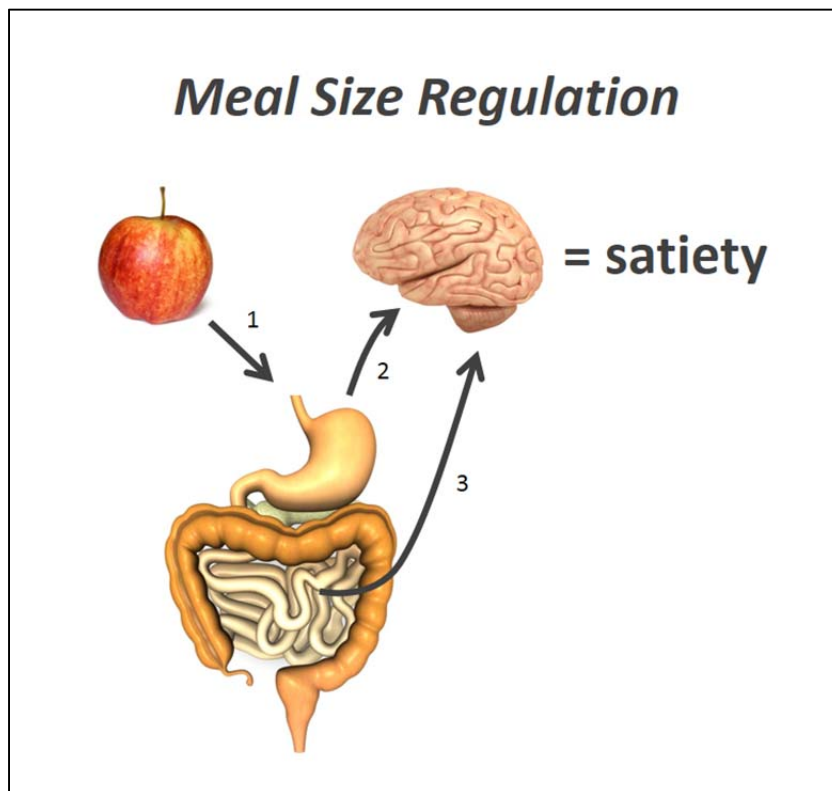
(You can find a more detailed discussion of this concept in in part 2 of the Ideal Weight Program video series titled “Understanding Body Fatness”)

This is one of the key reasons why fat loss is hard: people who carry excess body fat have a fat thermostat that’s set to a higher level than lean people, and their brain actively fights back when they try to lose fat, by increasing hunger and decreasing calorie expenditure. This system

operates unconsciously, making it difficult to lose fat by simply eating less food and exercising more, and it ultimately undermines long-term fat loss.

## Meal Size Regulation

The brain also contains a 'satiety system' that regulates food intake on a meal-to-meal basis. Satiety (fullness) develops as meal-related signals travel from the gut to the brain. As the meal progresses, the strength of these signals builds, and hunger is gradually replaced by satiety, shutting off your desire for food. Satiety lasts for a period of time after the meal, but is eventually replaced by the sensation of hunger once again, and the cycle repeats at the next meal.



(You can find a more detailed discussion of this concept in in part 2 of the Ideal Weight Program video series titled "Understanding Body Fatness")

The satiety system responds to a variety of specific food properties, and understanding how this system works helps explain why we overeat in the modern food environment. It also allows us to design a diet that satisfies hunger on fewer calories. This means better results with less discomfort.

The fat thermostat influences the satiety system, such that if we're losing fat, we'll feel hungrier and we'll need to eat more calories at a meal to feel full. On a standard calorie-restricted diet, the more fat we lose, the more this effect will build, and the harder it will be to lose additional fat or even maintain our loss. Therefore, to lose fat sustainably, it helps to have a strategy that addresses the fat thermostat.

## **Influences on Calorie Balance**

Many factors impact how many calories we eat, how many we use, and consequently whether we gain or lose body fat. Some of these have a major impact on body fatness, while other have a small impact. In this section, we discuss some of the factors that research suggests are the most important in gaining and losing fat.

## **Meal Composition**

In a controlled research setting, it's easy to make a person overeat substantially without even realizing it, and it's equally easy to make a person undereat without realizing it—it all depends on what you serve them. The satiety system responds strongly to protein, meaning that protein-rich foods such as meat and Greek yogurt make you feel more full than an equal number of calories from foods rich in carbohydrate or fat, and people who eat protein-rich foods tend to

naturally eat fewer calories without feeling hungrier. Protein also acts directly on the fat thermostat in the brain, lowering the level of fat that the body holds on to and making fat loss easier and more sustainable. For these reasons, protein is one of the most powerful tools in the fat loss toolbox. However, the optimal amount of protein for fat loss depends on a variety of factors, including a person's lean mass, gender, and physical activity level. Eating less than this amount may make it more challenging to lose fat, while eating more does not provide additional benefit.

## **Beyond Macronutrients**

Much of the popular discussion about dieting focuses on the never-ending debate over which macronutrients (fat, carbohydrate, or protein) are best and worst for weight loss. Besides the ability of protein to reduce hunger and food intake, there's little evidence that changes in carbohydrate or fat intake per se have a meaningful impact on fat loss, and neither low-fat nor low-carbohydrate diets show particularly impressive long-term results in weight loss studies. Low-carbohydrate diets are typically more effective than low-fat diets in studies lasting up to a year, and subjects tend to report a reduced appetite, but this may actually be due to the fact that low-carbohydrate diets are usually higher in protein, and they make it difficult to eat many fattening processed foods and sweetened beverages. While each diet style boasts individuals who have lost a large amount of weight without much effort, when these diets are objectively studied by researchers, they find that most peoples' long-term weight loss is modest, typically 12 pounds (5.5 kg) or less at the one year mark.

To get the best results, it helps to think outside the macronutrient box. Adopting a broader view of the factors that influence appetite regulation and calorie balance allows us to design a multi-pronged strategy with a higher efficacy than approaches that rely exclusively on macronutrient restriction.

The calorie density of a meal also has a strong impact on satiety. The more concentrated the calorie source, the less fullness it delivers per calorie. Foods that are rich in water and fiber tend to fill us up better than foods that are low in water and fiber. For example, one cup of oatmeal is much more filling than four saltine crackers, despite containing the same number of calories (165 vs. 168 kcals, respectively). You may have to eat twice as many calories from crackers than from oatmeal to feel full, despite the fact that the calories in both come mostly from carbohydrate.

Fiber has the additional benefit of feeding the beneficial bacteria in your digestive tract, and research suggests that our gut bacteria influence body weight and health. Eating a variety of fiber-rich foods such as vegetables and fruit, and avoiding unnecessary antibiotics (with the approval of a doctor) can help maintain the health of our friendly bacteria and promote leanness and health.

Added fats such as margarine, butter and oils are one of the most insidious ways to increase calorie density, leading to a higher calorie intake. The modern diet is characterized by foods rich in refined starches, sugars, and fats, such as cookies, potato chips, white bread, and sweetened beverages. These foods have a very high calorie density and low fiber content, leading most people to overeat without even realizing it due to the low level of satiety these foods provide per calorie.

Conversely, an effective fat loss diet should be lower in calorie density, lower in refined carbohydrates, and lower in added fats. This allows a person to feel satisfied while eating fewer calories—often without even realizing it. One caveat is that low-fat diets tend to be unsatisfying, so it also makes sense to obtain a moderate amount of fat from whole natural foods, such as meats, seafood, avocados, and strained yogurts that have a high satiety value per calorie.

Eating order is another related factor. When we eat the most satiating foods at the beginning of a meal, it tends to reduce the overall amount we eat, and improve blood sugar control following the meal. For example, studies have shown that simply eating a piece of fruit at the beginning of each meal increases weight loss, and eating a vegetable reduces post-meal blood sugar.

## **Food Palatability**

Palatability is the pleasure we derive from food. While most people seek enjoyable food, what they may not realize is that highly palatable foods can drive us to make poor food choices, overconsume calories, and develop unhealthy food habits. Highly palatable foods and beverages trigger cravings that cause us to eat or drink even when we aren't hungry, consuming snacks or beverages for pleasure rather than energy. The sight, smell, or taste of desirable food acts as a cue to eat—most of us have experienced the sensation of suddenly becoming 'hungry' when we encounter certain foods we love. These foods can also cause us to eat more calories at a sitting, for example when dessert appears after a large meal. This is because they have a pleasure appeal that's independent of hunger. When we eat or drink for reasons other than hunger, we're usually overeating.

### **Stomach Share**

In the United States and worldwide, food manufacturers jockey for consumer "stomach share", ratcheting up the palatability and calorie density of food to drive the purchase and consumption of their products. This is one of the reasons for the gradual proliferation of calorie-dense convenience foods and restaurants, which have increased in parallel with our waistlines and now make up the majority of US food spending. 'Hyper-palatable' foods like pizza, pastries, soda, and deep-fried items are particularly fattening because their calorie density makes it easy to

overconsume calories without realizing it, and because they encourage us to eat past fullness. Once viewed as occasional treats, these foods are now inexpensive and widely available, leading them to become dietary staples in the US and other affluent countries.

The power of these foods to influence behavior is remarkable: rats will endure pain and extreme cold to obtain human junk foods, even when their normal healthy food is freely available! If allowed free access to these foods, they will consistently overeat and rapidly become obese.

Likewise, for humans, eating highly palatable foods stimulates strong cravings to eat more of these foods in the future, even when hunger is absent. At that point, the goal of eating is no longer to satisfy hunger, but to satisfy a craving. Common examples of this are eating dessert after a large meal, and grazing on foods in the afternoon out of boredom or pleasure seeking.

Although weight gain isn't caused by one ice cream sundae or cookie, over time these seductive foods can shape our eating habits, insidiously changing our overall diet pattern. Since habits are formed by the repetition of rewarding actions, eating these foods can cause an eating style to emerge in which overeating happens at most meals, and snacking is common. Eating highly palatable foods changes what we eat and how we eat.

Understanding the impact of highly palatable processed foods on behavior goes a long way toward explaining overeating in the modern world. Why do some people habitually buy a pastry and 300 calorie latte in the morning? Why do people crave a soda or sweet snack in the afternoon? Why are we tempted by ice cream in the freezer after dinner? These foods shape the preferences and eating habits of our society, favoring habitual overeating in most people.

We don't usually overeat simple foods such as oatmeal and raw apples. These foods are most appealing when a person is hungry, and they cease to be appealing once hunger is satisfied. Fortunately, research suggests that we don't have to eat boring food to avoid the pitfalls of calorie-dense highly palatable foods. By focusing on simple, unrefined, high-quality foods, we can eat satisfying food that also supports leanness and good health.

## **The Unfair Depiction of Obesity**

A common depiction of overweight and obesity is a person eating a huge meal of unhealthy food. Yet being overweight doesn't necessarily imply that a person binges on fast food and soda. Individuals vary in their predisposition to gain fat, and some people grow overweight despite a conscientious effort to eat well. In these cases, overconsumption may simply be due to a hunger control system and/or eating style that causes them to eat as little as 10 percent more calories than they need, an amount that would hardly be noticeable at a meal. This is facilitated by modern food culture where tempting, calorie-dense food and food cues are often present. Overeating doesn't necessarily imply a lack of self-control, but consuming more calories than required to stay lean is nevertheless a necessary precondition of becoming and remaining overweight. Establishing new eating habits and a more supportive food environment can address this problem.

## **Alcohol**

Alcoholic beverages increase calorie intake in multiple ways. Alcohol itself contains a surprising number of calories, and it's almost always consumed for pleasure rather than for calories, meaning that it often contributes to overeating. Alcohol also increases hunger and undermines

constructive choices about food. A drunk person, despite having consumed hundreds of excess calories of alcohol, will frequently seek out additional food, usually of the high-calorie variety. Even moderate alcohol consumption can have similar, less pronounced effects.

## **Food Environment**

Despite the fact that fat loss centers around creating a calorie deficit, there are easier and harder ways to create that deficit. Let's do a thought experiment. Imagine yourself surrounded by a variety of delicious desserts, deep fried foods, pizza, chocolate, soda, and alcohol, in addition to healthy food, at all times. Now, imagine a different scenario: you never come across highly processed, highly palatable foods in your daily life—the only foods in your personal environment are unrefined and based on high-satiety ingredients, and even these are out of sight except at mealtime.

Which scenario best describes the modern food environment? Many of us are frequently surrounded by a variety of food choices, ranging from healthy to unhealthy. Calorie-dense, highly palatable foods are easy to obtain and consume, both because they're widely available and because they often require no preparation to eat. The sight, smell, and taste of certain foods acts as a cue to the brain, triggering cravings that are often difficult to control, particularly when there is no clear goal to resist the impulse. These cravings are hard to resist when food is visible and easy to eat, often leading to overeating.

We know it's physically possible to lose fat in either of the scenarios above by simply limiting calories. But which scenario will support a fat loss goal most effectively, minimize the amount of willpower you have to expend to achieve it, and ultimately maximize your chances of losing fat and maintaining a leaner figure?

As this thought experiment illustrates, cultivating a supportive food environment is a key strategy for achieving and maintaining leanness. Relying on willpower to restrain ourselves from eating tempting foods that are right under our noses is a losing strategy in the long run. Controlling food cues is easier and more sustainable. This requires clarifying what foods we do and don't want to eat, establishing a favorable food environment at home and at work, and designing our surroundings so that the right options are easily accessible and poor options are absent or inconvenient. A little bit of planning can spare a lot of willpower.

## **Physical Activity**

Muscular contraction uses calories, and therefore physical activity seems to be an obvious determinant of body fatness. Yet depending on who you ask, physical activity ranges from a highly effective way to lose fat and maintain leanness, to useless for fat loss. Where does the truth lie? There is an overwhelming amount of evidence in humans and animal models that regular physical activity protects against fat gain over time. In addition, many studies demonstrate that exercise alone causes fat loss in most people who carry excess fat, although on average the effect is modest. This is because while exercise burns calories, it also tends to increase appetite and calorie intake. However, exercise doesn't increase appetite enough to make up for the extra calorie expenditure, and therefore it typically results in some degree of fat loss.

An important caveat is that exercise can become ineffective or even counterproductive if it's viewed as a justification to overeat. It's possible to overeat at any level of calorie expenditure, but in most cases overeating does become less likely with habitual physical activity.

Physical activity comes in many forms, and all of them are valuable. We know that Americans 100 years ago didn't have treadmills and spinning classes, yet life itself was more physically demanding. People had to walk to get around, care for farm animals, do the dishes and laundry

by hand, harvest crops, work manual jobs in factories, and many other tasks that today are partially or entirely mechanized. Most people used a substantial number of calories just going about their daily lives, never set foot inside a gym, and managed to be leaner than we are today. Our lower level of physical activity today shrinks this extra calorie buffer, making it easier to overeat.

We can learn a lot about natural physical activity patterns by observing traditional societies that tend to remain lean throughout life. By modern standards, people in traditional societies are physically active but not excessively so, and spend much less of the day sitting. They tend to perform a high volume of light activity such as walking, a moderate volume of medium-intensity exercise such as jogging, and a small volume of heavy exercise like sprinting and lifting heavy objects. These patterns align well with the evidence-based physical activity recommendations of the US Department of Health and Human Services.

Physical activity is an important part of a complete fat loss strategy, because it increases the total number of calories you burn in a day, increases the effectiveness of dietary interventions, supports fat loss maintenance, and is indispensable for general health and well-being. In addition, if you do happen to overeat, physical activity increases the number of calories you have to eat to begin gaining fat, and strongly protects against the harmful metabolic consequences of overeating.

Our bodies are made for movement, and they perform best when provided with regular stimulation from physical activity. Research has suggested that regular physical activity helps maintain the fat thermostat in the brain, regulating appetite control and preventing gradual fat gain over time. The combination of adequate physical activity and the right diet is a powerful way to achieve and sustain fat loss, but regular exercise without the right diet will likely yield suboptimal results.

# Sleep

Imagine for a moment how it feels to sleep half as much as you need for a week. Miserable, right? It turns out there's an important reason for that: it's bad for your health. A large and growing body of research suggests that insufficient or poor quality sleep promotes fat gain and undermines health in multiple ways. Insufficient sleep increases food intake, increases impulsivity around food, reduces vitality and motivation for physical activity, and changes energy-regulating hormones in a direction that promotes fat storage.

Sleep restriction even undermines fat loss efforts, causing weight to be lost from muscle mass rather than fat tissue! This leads us to the remarkable conclusion that sleep may be the difference between losing weight from your belly or your biceps.

Insufficient or poor-quality sleep undermines your ability to make constructive choices about food, facilitating decisions that favor short-term desires over long-term goals. For example, if you haven't slept enough, the desire to eat a fattening food at lunch may be stronger than usual and outweigh your desire to eat a food that supports your fat loss goal. Dan Pardi's research recently showed that sleep-deprived subjects are more likely to eat food they perceive as less healthy. Also, similar research has shown that the brain's response to highly palatable foods is magnified after sleep deprivation, increasing the likelihood of consumption.

It may not come as a surprise that over the same period of time that waistlines have increased at an alarming rate, sleep times have declined as well. Over the last 40 years, average sleep times have dropped 20%, which is equivalent to missing one night of sleep each week. People who get insufficient sleep tend to gain more fat over time, and have a harder time losing fat when they diet. Good sleep is a key strategy for controlling body fat, and one that tends to be overlooked.

## Other

A variety of other factors can influence calorie intake, calorie expenditure and the likelihood of overeating. These include genetics, age, stress, emotions, smoking cessation, social factors, and many others. While these can be important in certain contexts, they're beyond the scope of this document, and they don't lessen the importance of the factors we've reviewed.

## Overeating Schematic

The following schematic visually summarizes the key influences on body fatness we've discussed. Follow this video link for a walk-through: <http://bit.ly/WhyWeGainFatVideo>



# How do I Lose Fat Sustainably?

Strictly speaking, all you have to do to lose fat is change the number of calories entering your body, and/or the number leaving. Yet we know that for most people, focusing on calories is a losing long-term strategy, because counting calories is tedious and inaccurate, limiting calorie intake without changing the diet and food environment is challenging, and this strategy doesn't address the biological systems that oppose fat loss. A well-designed fat loss program can help you navigate these roadblocks in an effective, sustainable, and cost-effective way. Here's how we do it.

The Ideal Weight Program is a web-based system that combines cutting-edge fat loss techniques with our unique behavior modification strategy, designed to cultivate and sustain behaviors that will keep you healthy and lean. It's structured around the core Dan's Plan philosophy of Knowledge, Direction, and Feedback:

**Knowledge.** Why is this approach valuable? We provide a variety of resources that explain why we designed the program as we did. From our fully referenced e-book, to podcasts and video tutorials, we help you gain deeper insight into the science and practice of body fat modification. This gives you the confidence you need to invest in our approach, which will help you stay on course.

**Direction.** How do you apply this information? We synthesized the most effective evidence-based fat loss strategies into a simple, practical set of guidelines. Our guidance helps you construct and sustain your own daily health practice around the diet and lifestyle principles of our program. We help you focus on three key determinants of body fat:

1. **Diet:** Choose one of three diets. For rapid fat loss, select the Fat Loss and Sustainable Health (FLASH) diet. For a more flexible approach, choose the Simple Food Diet. Once you've achieved your goal, The Lean Maintenance Diet helps you maintain it. All three

diets leverage evidence-based strategies that help you eat the appropriate number of calories for your goal while eating to fullness. Our diet program teaches you healthy, efficient cooking skills that will support your goal for life.

2. **Lifestyle:** Our unique strategies help you consistently get the sleep and physical activity you need to achieve and sustain your ideal weight.
3. **Environment:** We're products of our environment. We help you design environments at home and at work that make sticking to the program a breeze.

**Feedback.** How well do your daily actions align with your fat loss goal? The Dan's Plan Dashboard gives you objective feedback on how well you're meeting your daily lifestyle goals, which is captured by your Zone of Health™ score. Our weight loss chart helps you focus on your next milestone, see the progress you've made, and nudges you if you get off track. The Dashboard syncs with multiple tracking devices and apps – like wireless step counters and body weight scales - making it easy to track your daily progress.

We're totally committed to helping you get results, and we're passionate about our program. For a one-time fee, you get lifetime access to the Ideal Weight Program, plus updates. We also provide a 30-day refund period in case the program isn't right for you. Sign up now at [dansplan.com](https://dansplan.com).