RUNNING ON EMPTY

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**Why Obesity is Not a Problem of Excess Weight—
It's a Brain Convinced Fuel Is Running Out.**

A New Framework for Understanding Obesity—and Why
Understanding This Changes Everything

SANDRA CORTINA, MD, MPH, DABOM

Running on Empty

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To anyone living with obesity who has been searching for answers, questioning themselves, and wondering why it has always felt so hard. May these pages replace confusion with understanding.

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The views expressed in this book are those of the author and are intended to help readers better understand obesity as a chronic disease and the principles of evidence-based medical weight management, including the use of GLP-1 and other anti-obesity medications. Reading this book does not establish a physician–patient relationship with the author, nor should it be used to diagnose or treat any medical condition or to start, stop, or change any medication without consulting a qualified healthcare professional.

Individual circumstances vary, and treatment decisions should always be made in partnership with your own healthcare provider. References to medications, products, or treatment approaches are provided for educational purposes only and should not be interpreted as endorsements or guarantees of specific outcomes. While this book aims to challenge common misconceptions surrounding obesity and weight management, no treatment can guarantee a particular amount of weight loss or health outcome. The author and publisher disclaim responsibility for any loss, injury, or damages arising from the use or misuse of the information contained in this book.

PREFACE

If you are reading this book, chances are you've spent years trying to understand your weight—and recently, you've realized the story is changing.

Perhaps you are wondering why glucagon-like peptide-1 (GLP-1) medications like semaglutide or tirzepatide suddenly seem to be everywhere. Maybe you've started one yourself and found that the experience wasn't what you expected. Or perhaps you've watched someone close to you begin treatment and realized that everything you thought you understood about weight loss no longer seems to fit.

For many people, the GLP-1 era has brought something unexpected: confusion.

Confusion about why obesity is suddenly being treated with medication after decades of people being told to simply eat less and exercise more. Confusion about what these medications are supposed to do, and how they manage obesity. Confusion about what we're supposed to experience while taking them, only to be met with endless and often conflicting advice online.

For many people, starting a GLP-1 medication brings hope, but it also brings new questions. What should hunger feel like now? Is it normal to still enjoy food? Why has my weight stopped changing? Has the medication stopped working? If you've ever wondered these things, you're not alone. They're some of the most common questions I hear in my practice, and one of the reasons I wrote this book.

The problem isn't that we are asking the wrong questions. The problem is that we are trying to answer new questions using an old way of thinking.

The modern understanding of obesity – and what these medications are supposed to do – has never been fully explained to most people. Not because anyone is trying to keep it from you, but because the science is complex and it has evolved remarkably quickly. Many healthcare professionals completed their training before obesity medicine became the rapidly advancing field it is today, and public understanding has lagged even further behind. In that gap, social media has stepped in, often relying on the only framework it knows: diet culture.

For decades, most conversations about obesity focused on what people were doing: what they ate, how much they exercised, and whether they had enough motivation to stay on track. Far less attention was paid to what the body itself was doing to regulate weight.

As science advanced, so did our understanding.

Over the past several decades, researchers have transformed our understanding of obesity. Today, we recognize it as a chronic disease in which the brain plays a central role in regulating body fat, fullness, metabolism, and energy balance. This system is shaped by the complex interaction between our genes and our environment. Rather than simply storing excess energy, body fat is continuously monitored by the brain as an energy reserve. In obesity, the brain begins to underestimate how much energy is actually available. As a result, it activates biological mechanisms that increase hunger, conserve energy, and defend a higher amount of body fat than is healthy.

This new understanding changed how we thought about obesity, but it didn't immediately change how we treated it.

For years, obesity medicine was filled with frustration. Most medications produced only modest, sometimes short-lived results, and several promising drugs were withdrawn because of safety concerns. For many people with significant obesity, bariatric surgery – a hormonal surgery, by way of bypassing part of

the small intestine or reducing stomach size that can both increase and decrease fullness and hunger hormones respectively – remained the only treatment that consistently produced meaningful and lasting weight loss.

The arrival of GLP-1 medications marked a turning point.

For the first time, we have medications that directly target the biology involved in regulating body weight. For clinicians, they have transformed what is possible in obesity care. For patients, they have introduced an entirely new experience with food, one that many people have never been taught how to understand.

Eating begins to feel different. Fullness comes sooner. Satisfaction lasts longer. The constant mental negotiation around food often becomes quieter. Those changes naturally lead to new questions. *Should I still feel hungry? Is it normal to think about food? Has the medication stopped working?*

These questions don't mean something is wrong. They mean we're finally asking better questions about obesity. This book is about answering those questions and understanding the biology behind them.

As an internal medicine physician specializing in obesity medicine, I have cared for thousands of people living with obesity. As an internal medicine physician specializing in obesity medicine, I've come to appreciate just how common these questions are. They arise because our understanding of obesity has changed dramatically in a relatively short time, while much of the conversation around it has not.

Today, obesity specialists practice within a modern scientific framework, but much of the public conversation about obesity is still shaped by decades of diet culture. At the same time, GLP-1 medications have rapidly expanded beyond obesity specialty clinics, making it difficult for patients to receive consistent education about what obesity is, how these medications work, and what to expect from treatment. In the absence of

clear guidance, many people turn to social media, where simple messages often spread more quickly than accurate ones. It's no surprise that so many people are left feeling overwhelmed and confused.

This book is my attempt to bring clarity to that confusion.

It is not a diet book. It is not a list of food rules. And it is not a promise of rapid weight loss.

It is a guide to understanding the biology of body-weight regulation and how it influences nearly every aspect of living with obesity, including hunger, weight plateaus, weight regain, and the changes many people experience after starting treatment.

The title, *Running on Empty*, reflects one of the central ideas you'll encounter throughout these pages. In obesity, the brain is perceiving less available energy than actually stored, much like a fuel gauge that reads closer to empty than the tank really is. When that internal fuel gauge approaches "empty," the brain responds exactly as it was designed to: It increases hunger, conserves energy, and defends body weight.

Understanding that biology changes more than the way we think about obesity. It changes the way we think about ourselves.

My hope is that, as you read this book, confusion gives way to clarity. Not because obesity is simple – it isn't – but because understanding the biology helps experiences that once felt frustrating, mysterious, or even shameful finally make sense.

May these pages leave you with a deeper understanding of not only obesity, but also of your own body, with greater clarity, greater compassion, and far fewer unanswered questions.

AUTHOR'S NOTE

Transparency matters. I believe readers should understand any professional relationships that could reasonably be perceived as influencing the perspectives presented in this book.

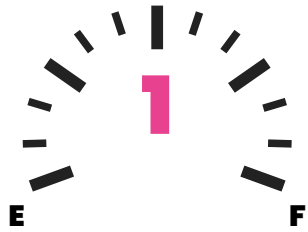
I have received honoraria for speaking engagements from Bausch Health and Novo Nordisk. I have also served on advisory boards and speakers' bureaus for Bausch Health and Novo Nordisk.

The opinions expressed throughout this book are my own and are based on my clinical experience, interpretation of the scientific evidence, and commitment to evidence-based obesity medicine. I have not received funding from any pharmaceutical company for the writing of this book, and no company reviewed, edited, or approved its contents before publication.

PART I

UNDERSTANDING OBESITY

These Are the Conversations About Obesity You Never Got



CHAPTER

WHY OBESITY NEEDED A DIFFERENT ANSWER

YOU PROBABLY NEVER IMAGINED that managing your weight would require medical treatment. Most people don't. But obesity needed a different answer than another diet.

Perhaps you resisted medical treatment for years – whether that was medication, bariatric surgery, or both. Maybe you were skeptical. Maybe you felt treatment was a last resort. Or perhaps you had simply grown tired of hoping after so many disappointments.

For many people, the availability of highly effective obesity medications has dramatically expanded access to treatment. More importantly, it offered a possibility that had become difficult to imagine after years of trying – that this time might be different.

When you finally started treatment, you might have also felt something you had not felt in a long time: hope. Perhaps the constant negotiations about cravings became quiet and less exhausting. But underneath that hope was a quieter voice asking: *Why can't I do this on my own? What is wrong with me? What if this stops working?* These questions are so common that

they have become part of the experience itself. They are also built on one of the greatest misunderstandings about obesity. If any of that feels familiar, I want you to pause for a moment and hear this clearly:

There is nothing wrong with you, and you did not fail your body.

An Outdated "Weight Loss" Map

What's been missing isn't discipline or a lack of effort. It's an explanation of how your biology regulates weight and why you're susceptible to this regulation becoming disrupted over time. For decades, most people have navigated obesity using a weight-loss map built on a simple premise: That body weight was simply a matter of "calories in, calories out," and that the number on the scale reflected your personal choices, discipline, and effort. The scale became the measure of whether treatment was working. A lower number signalled "success." A plateau or regain meant you were told to be more disciplined, more consistent, or more in control. The explanation never seemed to change: The answer was always more discipline, more effort, and more sacrifice. But the old map was built from diet culture logic. It placed personal choices at the centre of the story while leaving out much of what actually governs body weight in the first place. What rarely entered the discussion was the possibility that body weight is governed by a biological system that does not perfectly obey math or discipline.

SIDEBAR

Meet Sarah

Sarah is a patient who started working with me two years ago. Throughout this book, I'll share Sarah's story because many of her experiences are common among people living with obesity. During our first consultation, she walked me through her experiences with weight management and dieting over the years.

Sarah had been on a diet for as long as she could remember. Like many people, it happened in cycles. Starting, stopping, then restarting again. Each time with a new diet plan and determination to be more vigilant than the last, as well as a quiet hope that it would be the last one she could stick to for the rest of her life.

Initially, they all worked. She had lost over forty pounds on three different attempts. On all of those occasions, she felt like she had control – in the beginning. But eventually, something always changed. A holiday season. A stressful work month. A family death. Life would reenter the picture. What had once felt manageable slowly became rigid, exhausting, and eventually impossible to sustain. The mental effort it took to manage her weight on top of everything else eventually became too much. Then the weight would creep back. Every. Single. Time.

Despite years of repeated dieting, Sarah never viewed those experiences as evidence that dieting was an ineffective way to manage her weight. Instead, Sarah blamed herself and never the diet, because the diet seemed to work at first, at least in the beginning. Instead, she had convinced herself that if she had only been more disciplined, the diet would have continued to work.

The last three to five years had been different. Something was slowly eroding her belief system. Glucagon-like peptide-1

(GLP-1) medications were making headlines as breakthrough treatments. The Kardashians were using them. Apparently, so was everyone at the Oscars. Then, in a single week before her family doctor referred her to see me, she learned that her friend, her boss, and her neighbour were all taking a GLP-1 medication.

At the same time, she couldn't ignore how much space dieting occupied in her mind. The constant thinking about food. Planning around meals. Negotiating choices in social settings. The quiet calculation of macros or calories (depending on the diet she was on) running in the background all day. She was tired.

Sarah wanted relief from the mental effort of managing her weight just as much as she wanted to lose weight. So when more and more people around her started using GLP-1 medications with visible success, she began to feel hopeful. But almost immediately, another question followed: *Is this something I will have to rely on for the rest of my life?*

The question of whether we'll have to "rely on medication" doesn't emerge out of nowhere. It is shaped by years of exposure to diet culture. Our expectations about treatment have often followed a temporary model: start, stop, "succeed," or "fail." A typical black-and-white framework. Needing treatment for the long term? That felt like failure.

But what if the expectation of finite treatment from diet culture *is* the problem? What if the very reason this has felt so hard for Sarah for so long is because she has been trying to manage a biology that was never meant to be managed consciously in the first place?

That's hard to accept when we're constantly being sold stories of people who supposedly lost significant amounts of weight through diet and exercise alone.

The Truth About Diet and Exercise

It is important to acknowledge that some people do lose a significant amount of weight through changes in diet and physical activity alone, and some are able to maintain that weight loss long term. These stories are real and should not be dismissed. In fact, research suggests that approximately 20 percent of people who lose at least 10 percent of their body weight maintain that loss for at least one year. Studies of long-term weight-loss maintainers also show that many continue to follow highly structured eating patterns and engage in about an hour of physical activity on most days of the week.

What is often overlooked, however, is the magnitude of change that usually accompanies these success stories. Significant weight loss rarely comes from a single small adjustment. More often, it reflects a substantial transformation in daily habits. Imagine someone who spends most of the day gaming, eats fast food several times a week, rarely exercises, and drinks sugary beverages every day. If that person begins exercising regularly, dramatically improves the quality of their diet, reduces highly processed foods, and becomes more physically active overall, meaningful weight loss is entirely possible. The greater the change in behaviour, the greater the potential effect on body weight.

The challenge is that many people seeking obesity treatment are not starting from that place. They are already trying. They may be preparing most of their meals at home, walking regularly, limiting restaurant food, and making thoughtful food choices. Their lives do not contain obvious sources of processed food and drink waiting to be removed. For these individuals, being told to "eat healthier" or to eliminate a weekly milkshake is unlikely to produce the kind of weight loss they are hoping for.

This is where many people begin to blame themselves. They look at someone who lost a large amount of weight through lifestyle changes and conclude they must not be trying hard enough. But that comparison is often unfair. The question is not whether lifestyle changes can work. Clearly, they can. The more important question is whether there is enough room left in your current lifestyle to create the degree of change needed to meaningfully alter your body's weight regulation system. For a few people, the answer is yes. For most people – especially those who have already spent years making healthy choices – the answer is no. Their obesity persists because their disease is defending their current weight, a concept we'll explore shortly.

Perhaps you already understand that obesity is a chronic disease and far more complex than most people realise. But understanding something intellectually does not always make living with it any easier. You may still feel frustrated that you need medication. You may still wonder why this feels harder for you than it does for other people. And if you've already started treatment, you may feel confused when your experience doesn't match what you expected. Maybe your weight loss has slowed. Maybe your hunger has become stronger. Maybe you've reached a plateau and are wondering if you're doing something wrong.

The truth is that these experiences are usually not signs that treatment is not working. They are signs that obesity is a complex disease, one that behaves very differently from the simple "calories in, calories out" story many of us were taught.

Why Diet Culture Still Shapes How We Think About Obesity

Even when we understand that obesity is a complex, chronic disease, it can be difficult to let go of the beliefs we learned from decades of weight-loss messaging. For years, we were

taught that weight loss should be temporary, yet predictable. If you were doing the right things, the scale should keep moving down. If weight loss slowed, plateaued, or reversed, something must have gone wrong. We were taught that success came from consistency, discipline, and effort, and that long-term treatment shouldn't be necessary if we were doing things "properly."

These ideas have become so familiar that they still feel like common sense. They continue to appear in conversations with friends, weight-loss programs, social media, and sometimes even in healthcare. We're still told that weight loss should be linear and that hard work should always be rewarded on the scale. We have simply shifted from obsessing over calories to obsessing over protein, often under the banner of "optimizing health." When diet culture goes unchallenged, it reinforces old beliefs about weight that never served us.

Sarah is the everyday person who followed that advice. She tried diets. She lost weight. She regained it. Then she tried again. The cycle repeated. Looking back, the repeated cycles of weight loss and regain might have raised questions about the framework itself. It's like following a GPS map that repeatedly takes you to the wrong destination. At some point, we would start blaming Apple or Google, but we would never blame ourselves, the driver. This is rarely the case for obesity. Instead, like many people, Sarah concluded that the problem was *her*. Partly because effective obesity treatments were limited, and partly because the prevailing narrative offered few explanations beyond personal responsibility.

Nostalgia Is Not a Strategy

For decades, the dominant explanations for obesity were rarely questioned. Then came the GLP-1 era, forcing many of us to reconsider what we thought we knew about obesity and how it should be treated.

Medicine evolves when new treatments reveal that our understanding of a disease was incomplete. Before effective treatments for stomach ulcers became available, ulcers were often attributed to stress, personality, diet, or lifestyle. Patients were told to avoid certain foods, reduce stress, and change their habits, yet many continued to experience recurrent ulcers and serious complications.

The discovery of *Helicobacter pylori* (a stomach bacteria) and the development of effective antibiotic treatment transformed the field. We no longer tell patients that changing their personality or reducing stress is the treatment for stomach ulcers.

Obesity is beginning a similar transformation. The introduction of GLP-1 medications is forcing us to rethink explanations that once seemed like common sense.

The GLP-1 Era: What Incretin Therapy Revealed About Obesity

Geologists divide Earth's history into eras – periods marked by events that permanently changed life on our planet. The asteroid that ended the age of the dinosaurs is one example. If obesity medicine had its own geologic time scale, we are standing at one of those boundaries right now, watching a new era begin.

The biological basis of obesity has been misunderstood for decades, and we're still only beginning to understand it. Researchers identified many of the key hormonal systems involved in body-weight regulation only about twenty years ago. Effective obesity medications have existed for little more than a decade, and it has been only within the past five years that medications have produced weight loss approaching that seen with bariatric surgery.

We do have an early, evolving collection of therapies now centred around GLP-1 hormone signalling. GLP-1 is one member of a larger family of hormones called incretins – hor-

mones your gut releases after you eat to help tell your brain and pancreas that food has arrived. Incretin-like therapies are not a cure for obesity but rather a key input needed to sustain long-term weight management in an otherwise complex, chronic disease. Helping the brain regulate its long-term fuel supply is an essential part of treating obesity. No matter who you are, helping the brain regulate its long-term fuel supply is always part of treating obesity. That is true 100 percent of the time. All effective anti-obesity medications, including GLP-1 medications, work by enhancing the biological signals that tell your brain how much fuel is available in ways that dieting alone cannot. In short, these medications strengthen fullness signals, creating room for weight loss even as the brain continues to monitor and defend its energy stores. As a result, fullness increases, cravings often decrease, and eating becomes easier to regulate. Together, these therapies form the foundation of modern obesity treatment.

SIDEBAR

"GLP-1s": Quick Note About the Term

The media often uses "GLP-1s" as shorthand for today's obesity medications. Strictly speaking, GLP-1 is only part of the story. Many newer medications combine GLP-1 with other hormones, and future therapies may work through entirely different biological pathways. Throughout this book, I'll use the term "GLP-1 medications" because it's the name most readers are already familiar with. But these medications represent something much bigger. They are the beginning of a new generation of treatments that work by influencing the biological systems that regulate body weight. The medications themselves will continue to evolve, but the principle behind them is unlikely to change.

GLP-1 medications work, in part, because they interact with this appetite regulatory system. They increase fullness by enhancing satiety signalling in the brain and by slowing stomach emptying. For many people, the result feels almost startling. Profoundly fuller. Fewer intrusive thoughts about food. A sense that the volume has finally been turned down, and that quiet can feel life-changing.

At first glance, it may seem as though these medications have finally solved obesity. But it is important to understand what is actually happening. These medications do not cure or reverse obesity. They help manage obesity. They strengthen signalling pathways that were already there. They help rebalance parts of a system that have become misregulated. They are powerful medications that work within your biology, not in place of it. That may help explain why the early experience can feel dramatic, while the later experience often becomes more nuanced. To understand why, we first need to understand what obesity is and how the brain makes sense of the body's energy reserves.

Obesity: A Brain Convinced Fuel Is Running Low

The word *obesity* originates from the Latin *obesus*, and translates to "having eaten oneself fat." By modern standards, it is a terrible definition—one that is judgmental, simplistic, and stigmatizing. Yet buried within that outdated description is an important clue. I'm not defending the definition, but it points us towards significant information. It recognizes obesity as not simply about the presence of fat tissue. It is about a biological system that regulates eating behaviour.

Fundamentally, body fat is regulated through a communication system between three main players: the brain, fat tissue, and the gut (Figure 1.1). Together, they constantly exchange signals about nutrient availability and energy storage. Their

collective job is to maintain energy balance and ensure the body has enough fuel to survive.

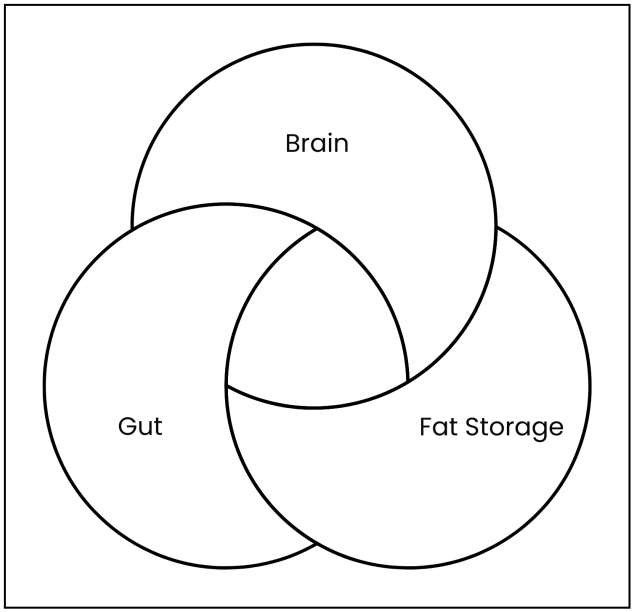


Figure 1.1. The Weight Regulation System. Weight is regulated through a complex communication system involving the brain, fat storage, and gut.

Which raises an important question: If someone is carrying abundant energy stores in the form of fat tissue, why does the brain still trigger appetite signals such as early fullness waning, food cravings, and constant thoughts about food? Aren't these systems supposed to be talking to each other?

This is the central paradox of obesity. The body has plenty of stored energy, yet the brain behaves as though fuel is running low. It's as if communication between the brain and fat tissue has become uncoupled. As a result, the brain defends an inappropriately high amount of body fat. In obesity, the core problem is not a lack of stored energy; it is that the brain has become convinced that fuel is running out.

Weight Loss Turns on the Brain's Starvation Alarm

At first, this sounds backwards. If obesity is a disease in which the brain behaves as though fuel is running low, why would losing weight activate the body's starvation response? The answer is that this apparent contradiction is actually one of obesity's defining features. In obesity, the biological systems that regulate body fat defend against weight loss far more aggressively than they defend against weight gain. As a result, the body protects an amount of fat that can ultimately harm health.

To understand why this happens, it helps to look at one of the brain's most important biological messengers: a hormone called leptin. Produced by fat tissue, leptin tells the brain how much energy is stored. This surprises many people because fat tissue isn't just where the body stores energy; it's also one of the body's largest hormone-producing organs. Leptin is often described as a long-term fullness signal, but a more accurate way to think about it is as the brain's anti-starvation signal. As fat mass increases, leptin levels rise. In theory, this should tell the brain that energy stores are plentiful, increasing feelings of fullness.

However, people living with obesity have *very high* leptin levels. If leptin simply worked as a "fullness" signal, very few people would develop obesity. Instead, many people continue to experience blunted satiety, cravings, and food preoccupation despite having both abundant energy stores and high leptin levels.

These observations led researchers to propose the idea of leptin resistance – the idea that the brain stops responding normally to leptin's signal, even when leptin levels are high. Today, many researchers believe it is more helpful to think of leptin differently. Rather than acting primarily as a fullness

signal, leptin appears to function mainly as an *anti-starvation signal*.

A more useful way to think about communication between the brain and fat tissue is this: The brain mainly pays attention to leptin when levels fall. Rising leptin levels are largely ignored. Falling leptin levels are not.

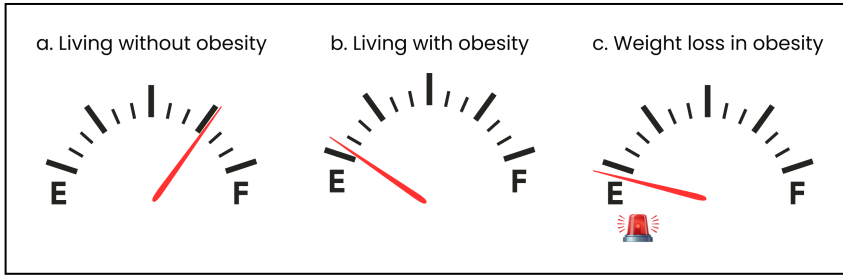


Figure 1.2. The Brain's Fuel Gauge in Obesity. The brain continuously monitors available energy stored in the body, much like a fuel gauge: (a) In people without obesity, the brain perceives adequate energy reserves and does not activate a starvation response until energy stores become substantially depleted; (b) in people living with obesity, the brain interprets the same amount of stored energy as less available, shifting the fuel gauge closer to "empty"; and (c) as weight is lost, the brain reaches its internal "low-fuel" threshold sooner, activating a biologically programmed starvation response characterised by increased hunger, reduced energy expenditure, increased food reward, and other adaptations that defend body weight. This response reflects how the brain regulates perceived energy availability – not the actual amount of body fat.

Whenever we lose weight, our fat stores shrink. As they do, leptin levels fall. Because leptin acts primarily as an anti-starvation signal, the brain interprets that drop as a sign that fuel is running low. It responds by activating a biologically programmed starvation response. Fullness decreases. Hunger becomes stronger. Energy expenditure falls. The drive to regain the lost weight intensifies.

This is why maintaining weight loss after dieting is so difficult. Weight loss activates the very starvation response that

obesity is already primed to defend against – even when the body still has plenty of stored energy.

This process can be difficult to picture, so it helps to think of your brain as using an internal fuel gauge. In a healthy system, that gauge accurately reflects how much stored energy is available. In obesity, however, the gauge becomes miscalibrated and reads lower than it should. As weight is lost, the needle falls even further, eventually crossing the brain's starvation threshold and triggering the powerful biological defenses that increase hunger, reduce energy expenditure, and make maintaining weight loss so difficult. Figure 1.2 illustrates how this fuel gauge changes before obesity, during obesity, and after weight loss.

How We Learned to Work Around the Starvation Response

Weight loss is not the hard part. Defending weight loss against the brain's anti-starvation response is the hard part. That raises an obvious question: What if we could prevent the brain from switching into starvation mode during weight loss? For a time, researchers thought they had the answer. After all, leptin is the body's primary anti-starvation hormone. If weight loss lowers leptin levels and triggers the brain's starvation response, wouldn't replacing leptin solve the problem?

Well, we tried that, and it turned out to be a bit of a doozie.

Researchers gave people with obesity extra leptin, expecting it would tell the brain that energy stores were plentiful, strengthen feelings of fullness, and produce meaningful weight loss. Instead, very little happened. People living with obesity already have high leptin levels because leptin is produced by fat tissue. Giving even more leptin was like shouting through a megaphone at someone who had already stopped listening.

To make matters worse, some participants developed antibodies – proteins the immune system makes to recognize and

attach things it sees as foreign – against the medication, making the treatment even less effective. What began as one of the most promising ideas in obesity medicine ended as a disappointing dead end for obesity treatment.

Dead ends can be informative. If people with obesity already had plenty of leptin, perhaps the problem wasn't that there was too little leptin – or even that leptin itself was broken. In fact, what if I told you there is nothing wrong with leptin in obesity? Leptin isn't designed to protect us from obesity. It's designed to protect us from starvation. By that measure, it is working remarkably *well*. That realisation would send obesity research in an entirely new direction.

The Problem Was Never Weight Loss; It Was the Starvation Response That Followed

For decades, obesity research focused on a simple question: How do we help people lose weight? But over time, we learned that weight loss was not the hardest part. Many people could lose weight for a period of time. The real challenge was keeping it off. Every time body weight falls, the brain responds as if food has become scarce: Weight loss triggers a biological starvation response. This shifted the focus of obesity research. The goal was no longer simply to help people lose weight. It became finding ways to prevent the brain from interpreting weight loss as a threat to survival – a response driven in large part by falling leptin levels.

One of leptin's jobs is communicating with the brain's fullness circuits, deep in a region called the hypothalamus – a small area near the base of your brain that acts like a control centre for hunger, body temperature, and other automatic functions. This is partly why leptin has often been mislabelled as a "fullness hormone," even though its primary role is protecting against starvation during weight loss. But leptin's job description doesn't end at the hypothalamus. We'll come back

to that in a moment. For now, here's the question that mattered most to obesity researchers: if leptin talks to the brain's fullness circuits, could they reach those same circuits through a different pathway? Instead of targeting leptin directly, perhaps they could work around the leptin system by using incretin hormones.

There was one problem. Natural incretin hormones were never designed to provide long-lasting signals. They're released after a meal and disappear within minutes. But what if we could create a version that lasted for days instead of minutes – perhaps even an entire week? Could that provide the kind of sustained signalling needed to help work around the brain's starvation response?

That idea became the foundation of modern obesity medicine. Researchers found that long-acting GLP-1 medications reach many of the same brain cells leptin normally reaches – a cluster of neurons in the hypothalamus called the arcuate nucleus. Once there, GLP-1 medications turn on the same fullness circuits leptin is supposed to turn on, without needing leptin to deliver the message. In other words, these medications found a workaround for the fullness message that leptin can no longer deliver once its levels fall. They step in to tell the brain's appetite centre that fuel is available, even when leptin levels are low.

This is exactly why obesity needed a different solution.

We needed an answer to the drop in appetite-related signalling that occurs with weight loss. We needed to stop the brain's appetite centre from interpreting weight loss as a sign that fuel was running out. Only then could weight loss become more tolerable and sustainable – more in line with the standards we expect from treatments for other chronic diseases.

But "workaround" is an important word, and an honest one. GLP-1 medications don't replace leptin. They step in for one part of its message. And it turns out leptin's message goes to more places than the appetite centre alone.

Medical treatments should be tolerable. Dieting alone asks people to live with a biologically programmed starvation response. Modern obesity medications offer a different approach. Instead of asking people to lose weight while feeling hungry, they help people lose weight while feeling fuller.

How We Manage the Fuel Gauge

At this point, you may be wondering: *If obesity is a disease of a brain convinced that fuel is running low, how do we fix that?* The answer can be frustrating at first because it challenges many of the ideas we've been taught about weight loss. But it also offers something far more valuable: an explanation.

We do not currently know how to permanently "fix" the lower fuel gauge. If we did, obesity medicine would look very different. I recognize that this can feel discouraging or disappointing. Most of us have been taught to think of weight loss as a temporary phase with a finish line, so that expectation is understandable. The reality, however, is that obesity behaves much more like other chronic diseases, where long-term management is part of treatment.

A brain convinced that fuel is running low lies at the heart of what makes obesity a chronic disease. As a result, it actively defends a higher level of body fat. While we cannot permanently correct this underlying misregulation, medications and bariatric surgery can shift the brain's fuel gauge in our favour. By working around leptin's fullness message and strengthening the brain's own fullness signals, these treatments help reassure the appetite centre that fuel remains available, reducing the pressure to defend excess energy stores.

A Workaround, Not a Replacement

Here is where it's worth being honest about what we do and don't yet know.

Leptin's job isn't only to talk to the brain's appetite centre. When leptin falls during weight loss, it also quietly turns down other systems in the body, including how much energy you burn at rest and how actively your thyroid gland works. Researchers have shown this directly: Giving weight-reduced volunteers just enough leptin to bring their levels back to where they were before they lost weight reverses the drop in energy burned at rest and restores thyroid hormone levels, without changing what anyone eats. In other words, falling leptin doesn't just turn up hunger. It also quietly turns down the body's metabolic engine.

This is the part of leptin's job that GLP-1 medications have not been clearly shown to replace. Even though these medications help the brain's appetite centre feel reassured that fuel is available, current research does not show that they reliably prevent the drop in resting energy expenditure that comes with weight loss. That's an important distinction, and an honest one: we have found a workaround for what falling leptin does to appetite. We have not yet found one for what falling leptin does to metabolism.

If you've ever felt like your progress slowed over time, even while staying consistent with your medication, this may be part of why. It isn't a sign that the medication has "stopped working," and it isn't a reflection of your effort or willpower. It's a reminder that these medications solve one piece of a much larger biological puzzle – a real and current gap in obesity medicine, not a personal shortfall.

That gap is one of the reasons obesity research keeps moving forward. Finding a workaround for leptin's fullness message was a major breakthrough. Finding one for its effect on metabolism may be the next one.

SIDEBAR

Fullness vs. Hunger: A Quick Note on the Terms

Before we move on, it is worth paying close attention to the following word: fullness.

Many people assume obesity treatments work by eliminating hunger. They do not. In fact, no effective or ethical obesity treatment is trying to remove hunger altogether. Hunger is a normal biological signal. It is an essential part of survival. Without feeling hungry at appropriate times, we would forget to eat and eventually become malnourished.

Instead, effective obesity treatments work by enhancing fullness. They help the brain receive a clearer message that fuel is available, reducing the need to prepare for starvation. This distinction between hunger and fullness is *incredibly* important, and we will return to it throughout the rest of the book.

Once you understand that obesity is not simply a problem of excess weight but a problem of how the brain regulates and defends energy stores, many common assumptions begin to fall apart. The language of diets, finish lines, and quick fixes starts to feel less useful. In its place emerges a different way of understanding obesity, one that is more consistent with both the science and the lived experience of people managing the disease.

A Fuel Gauge Framework for Understanding Obesity

The purpose of this book is not simply to explain the biology of weight regulation. It is to offer a different way of understanding obesity – one that more accurately reflects how the disease behaves and makes that biology easier to understand.

Many of the frustrations people experience come from trying to navigate obesity with a map that was never designed for the terrain. When obesity is viewed through the lens of chronic disease rather than weight loss, experiences that once felt confusing, discouraging, or deeply personal begin to make sense.

This book is an invitation to leave behind diet culture's expectations that no longer serve you and adopt a framework grounded in biology rather than personal responsibility. Throughout the chapters ahead, we'll use a new framework to make sense of the common experiences that accompany medically managed weight loss. Many of the experiences that once felt confusing, discouraging, or deeply personal begin to make more sense when we stop viewing obesity as a problem of willpower and start seeing it as a disorder of energy regulation. To understand why, it helps to think of obesity as a malfunctioning fuel gauge.

When the Brain Starts Asking for More Fuel

If obesity is a disease in which the brain becomes convinced that fuel is running low, the next question is obvious: How did the brain fall out of balance in the first place?

Obesity develops when genetic susceptibility meets layered environmental pressures. These pressures can include weight-promoting medications, disordered eating, poor sleep, easy access to ultra-processed foods (packaged foods made mostly from refined ingredients and additives rather than whole foods), or repeated cycles of weight loss and regain. Over time, they interact in ways that signal the brain to store more energy without generating the normal fullness signals that would reassure it that enough fuel is available. As a result, the fuel gauge needle remains closer to empty. Because genetic susceptibility differs from person to person, so does the threshold at which the brain begins defending a higher fuel reserve. For some

people, relatively small pressures are enough to keep the gauge reading low despite abundant energy stores. For others, it takes much more.

At its core, the brain is doing exactly what it believes it needs to do: asking for more fuel. It does this by encouraging the body to store more energy while keeping the fuel gauge needle near empty. From the brain's perspective, this is a protective response. It is trying to build a larger fuel reserve that can be drawn upon during a future crisis. The problem is that the anticipated catastrophe never arrives, yet the brain continues to behave as though it is just around the corner.

Obesity emerges when the brain begins defending a larger fuel reserve. As these pressures build, the fuel gauge shifts closer to "empty," signalling the need to store more energy even when the body already has abundant fuel available. Over time, this new setting can become the brain's default, allowing it to defend higher levels of body fat long after the original pressures have disappeared.

Why We Must Target the Fuel Gauge, Not the Fuel Tank

Think of your body's weight-regulation system as the fuel gauge in a car. In obesity, the problem isn't the size of the fuel tank; it's the accuracy of the gauge reading it.

Now, imagine driving a car with a faulty gas gauge. The tank is full, but the gauge keeps hovering near empty. Every time you look down at the dashboard, it warns you that you're running out of fuel. You know the tank is full. The problem is that the system responsible for measuring the fuel isn't reporting accurately.

What is likely to happen?

You would probably still stop at gas stations more often. You would think about fuel more frequently. You might even feel anxious about running out. Not because the car lacks energy, but because the gauge keeps telling you that you soon will.

This is remarkably similar to what happens in obesity.

The body contains abundant stored energy in the form of body fat, yet the brain behaves as though energy reserves are running low. Hunger becomes more frequent. More food is needed to feel full. Thoughts about food become more persistent. The biological drive to acquire fuel remains activated despite abundant energy already being available.

You may have already done many of the things you were told would solve the problem. You became more selective about the fuel entering the tank and worked to reduce the forces pushing the system toward storing more fuel. Yet despite all that effort, the needle still hovers near empty – not because you didn't try hard enough, but because the problem lies with the fuel gauge itself.

Improving these environmental pressures – such as eating fewer ultra-processed foods or getting better sleep – still matters. These changes reduce some of the pressures that encourage the brain to store more energy. But they do not correct the faulty fuel gauge itself. The brain continues to signal that more fuel is needed, and when weight loss begins, the starvation response is activated. That is why obesity is not simply a disease of behaviour.

How Medical Treatments Target the Fuel Gauge

A common question I hear is this: If medication amplifies fullness, reduces cravings, and makes weight management feel easier, will the brain eventually learn to do this on its own?

It's a reasonable question, and one many people hope has a different answer. Unfortunately, the brain's weight-regulation system doesn't appear to work that way. It doesn't respond to reasoning, determination, or repeated experience. We can't train it to behave differently. We wouldn't expect someone to take blood pressure medication for a year and then expect their

body to permanently remember how to regulate blood pressure once the medication is stopped.

Like many medical treatments, current obesity therapies work by recalibrating biology. In obesity, they recalibrate how much weight your brain is comfortable defending. They enhance fullness and help the brain perceive its fuel reserves differently. As the gauge moves farther from empty, fullness lasts longer, food occupies less mental space, and the biological pressure to refuel begins to ease. When the dashboard starts displaying a more accurate reading, the driver naturally stops pulling into gas stations so often because the system is no longer signalling that fuel is running low.

Recalibration may sound intrusive, but it is actually reassuring. It means we understand where the problem lies. We are no longer chasing every possible external pressure or blaming ourselves for a lack of discipline. Instead, we are targeting the signalling system responsible for regulating the interpretation of fuel availability. The goal is to recalibrate the level of fuel reserves the brain defends, allowing the body to settle at a lower weight.

Obesity is far more complex than any analogy can fully capture. Even so, the fuel gauge provides a useful framework for understanding what obesity is, how it behaves, and how current treatments fit into that picture. It also helps us understand why obesity must be managed as a chronic disease.

Why Obesity Must Be Managed Like a Chronic Disease

Once obesity is understood as a chronic disease, my hope is that the conversations we have about it begin to change as well. It is completely understandable to ask "How do I lose another twenty pounds?" After all, that's the question most of us have been taught to ask. But as our understanding of obesity deepens, a different question becomes more valuable: "How do I

manage this disease in a way that supports my health and quality of life for years to come?"

This may sound like a subtle distinction, but it fundamentally changes how treatment is approached and experienced. It marks the difference between diet culture and medicine. Diet culture is organized around weight loss at all costs. Medicine is organized around the long-term management of disease and the improvement of health. Although these perspectives sometimes overlap, they are built on very different assumptions and often lead to very different expectations.

For decades, body weight has been treated as the primary measure of success. Progress was defined by how much weight was lost, how quickly it happened, and whether it could be maintained indefinitely. When weight loss slowed or weight was regained, the explanation usually rested on the individual's perceived shortcomings. This framework only "makes sense" when obesity is viewed as a problem of excess body weight. It is much harder to defend when obesity is recognized as a chronic biological disease.

Consider how medicine evaluates other chronic diseases. We do not consider asthma treatment a failure because symptoms return when therapy is withdrawn. We do not expect chronic diseases to disappear simply because they have been successfully managed for a finite period of time. Instead, treatment is evaluated according to disease control, symptom burden, functional improvement, health outcomes, and long-term sustainability.

Obesity should be approached no differently.

Once obesity treatment is viewed as a way to recalibrate the level of body weight the brain defends, weight becomes one outcome among many rather than the sole objective. If the number on the scale has a role in chronic disease management, it is to provide clinical feedback to your healthcare provider. It helps us evaluate how effectively treatment is modifying your

physiology. Weight still matters, but it is no longer the only measure of success. Equally important are questions such as these: Is food occupying less mental space? Is the treatment sustainable over years rather than weeks?

These questions are central to chronic disease management because they focus on the disease itself rather than the numbers alone.

This distinction also helps explain why the GLP-1 era has generated so much confusion. While these medications are relatively new, the way many people think about weight loss is not. They are often viewed through the same weight-loss lens that has shaped dieting conversations for decades. As a result, people naturally ask these questions: How much weight have I lost? Why has the scale stopped moving? When can I stop treatment? These are understandable questions, but they arise from a weight-loss mindset rather than a chronic disease mindset.

The Hidden Cost of Weight-Loss Thinking

The shift from weight-loss thinking to chronic disease management may be the greatest challenge facing obesity medicine. Until that shift occurs, it stands in the way of fully understanding obesity with compassion, providing care that is both evidence-based and ethical, and redefining what successful treatment truly looks like.

In fact, I would argue that "successful" may not be the right word at all.

Successful implies a finish line. Treatment has been completed, the problem has been cured, and a permanent state has been achieved. This is the language of *transformation* – the same language that has shaped weight-loss narratives and dominated conversations about obesity for decades. Today, transformation is simply being rebranded to sell subscriptions, programs, and products tied to GLP-1 treatments.

The use of transformational language in obesity care may seem like an odd thing to focus on, but it helps explain many experiences that leave people feeling frustrated, confused, or as though they have done something wrong. Once obesity is understood as a chronic disease that misreads energy stores, the question is no longer whether someone has succeeded or failed; it is whether the disease is being effectively managed.

So, why do we continue answering the weight-loss industry's call to chase a final definition of success?

Why the Confusion Persists

As GLP-1 medications have entered mainstream practice, they have collided with two powerful and deeply entrenched forces: diet culture and weight bias. Here's the fundamental problem: Neither recognizes obesity as a chronic disease. Instead, both depend on the public believing that excess weight can be managed simply by subscribing to their messaging, services, or products.

Diet culture is not simply a collection of weight-loss products or nutrition rules. It is an ideological framework for interpreting excess body weight – what it represents, what causes it, and how it should be addressed. At its core, it divides outcomes into two categories: success and failure. If weight decreases, the individual is praised for discipline, motivation, and commitment. If weight returns or does not decrease as expected, the individual is assumed to have lost focus, made poor choices, or simply not tried hard enough. The biology never changed; only the explanation did. The reality that body weight is regulated by powerful biological systems is rarely part of the discussion because it complicates the simpler story often told by people who have never been trained in obesity biology.

Unfortunately, the prescribing of GLP-1 medications within a medical model did not automatically displace this older way

of thinking. In many ways, diet culture has simply adapted to a new set of expectations around weight loss *with* medications. Instead of counting points, there are "GLP-1 point programs." The language sounds more medical, but the underlying assumptions remain remarkably familiar.

The clearest evidence is online. Scroll through social media and you'll find physicians, dietitians, and health influencers who support obesity medications while still focusing on maximizing weight loss, accelerating results, "breaking through plateaus," avoiding adaptation, or eventually discontinuing treatment. Some sell protocols for "optimizing" outcomes. Others promote supplements, protein products, fasting strategies, body composition programs, or metabolic "boosters" designed to enhance weight loss.

The persistent obsession with optimization reveals a deeper tension in how obesity treatment is discussed. If GLP-1 medications are helping manage a chronic disease, why does so much of the conversation remain focused on pursuing ever-greater weight loss and continual optimization, even at the expense of quality of life? The pursuit of perfection creates a new cognitive load: more rules, more monitoring, more self-surveillance, and more sacrifice. Although many of these messages are presented as medical guidance, they reveal a deeper allegiance to a diet-centric framework. The weight bias is both subtle and obvious: The medication is never enough; more optimization is always required.

Medicine and chronic disease management ask a different question: not "How do I lose more weight?" but "How do I manage this disease more effectively over time?" One question is rooted in weight loss. The other is rooted in chronic disease management.

This distinction matters because social media has increasingly become many people's primary source of health information – a space that rewards content reinforcing weight-loss nar-

ratives. The patient who loses one hundred pounds becomes the featured "success" story. Dramatic before-and-after photographs become clickbait. Physicians whose patients achieve extraordinary results gain attention and credibility. Meanwhile, the far more common experiences of obesity management – weight loss slowing, stabilizing, partially returning, or requiring ongoing treatment – receive far less attention. People whose experiences do not match these extraordinary expectations gradually disappear from view. Perhaps they stop attending follow-up appointments, leave treatment programs, or simply move on. What remains are the exceptional outcomes, creating the illusion that they represent the typical experience.

The arrival of GLP-1 medications should have challenged many of these assumptions. Rather than prompting a shift toward chronic disease management, however, these treatments have largely been evaluated using the same measures that have long defined weight-loss culture: how much weight was lost, how quickly it happened, and whether treatment can eventually be discontinued. Until obesity is understood first as a chronic disease and only secondarily as a weight-loss concern, we will continue to ask the wrong questions, celebrate the wrong outcomes, and misunderstand what "successful" treatment actually looks like. We will continue to focus on endpoints instead of management, and transformation instead of regulation. The future of compassionate, ethical obesity care depends on our willingness to move beyond the assumptions of diet culture and adopt a framework grounded in biology, medicine, and long-term disease management.

A better framework begins with a simple idea: Obesity is a disease of a brain convinced that fuel is running low. Once we understand that, many of the assumptions that have tradition-

ally shaped conversations about obesity begin to change. From there, two important questions naturally follow:

1. How do we determine when this process has crossed the threshold into disease?
2. What causes the brain's internal fuel gauge to become miscalibrated in the first place?

The next two chapters explore these questions by examining how obesity is defined and diagnosed, followed by the environmental pressures most capable of pushing the fuel gauge toward empty.