The Blueprint for Sustainable Weight Management

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(*Updated June 1, 2025*)

This document was originally created as a personal note to preserve my accumulated knowledge and experience in body weight management since November 2024. Throughout the process, I continually revised my notes, not only to update my understanding but also to make it available for those who may find the information useful. While the content is primarily grounded in scientific research, it may include personal opinions which are solely my own.

1. What is sustainable weight management?

In general, weight management refers to the practice of adjusting body weight through diet, physical activity, and lifestyle changes. It is considered essential because it directly impacts physical and mental health, reduces the risk of diseases and injuries, improves physical and cognitive performance, and enhances quality of life. Despite its benefits, achieving and maintaining healthy weight requires sustained effort. Sustainable weight management is about paying attention to the fundamental principles of body weight change. Instead of relying on short-term fixes like medications or trendy diets, understanding why and how our body weight changes can transform what might feel like a tedious challenge into a sustainable, lifelong journey of self-discovery that rewards our body and mind for the long-term.

2. The blueprint

The basic concept of sustainable weight management is nothing special, just an ordinary routine that everyone knows, yet few can consistently execute. Most people already know the basics: eat well, stay active, and make a plan. There is nothing groundbreaking about them, yet so few manage to apply them consistently. Why? Because we are socially pressured to seek instant gratification without recognizing the invisibles: the foundations.

A well-designed blueprint ensures a house stands strong over time. Our personal weight management framework should also be built on solid foundations. The key lies not in doing something special, but in creating a structure that makes ordinary actions easy and ready to apply. The ability to use the knowledge effectively and adapt to challenging circumstances is the skill we all need to acquire.

The blueprint for sustainable weight management is built on biological foundations of why and how body weight changes. Top athletes apply the principles to prepare for competitions. Clinicians apply them to instruct patients for pre-surgery preparation and post-surgery recovery plans. Foundations are always the key to lasting success.

While foundations provide structure and stability, the true mastery comes from exploration. Everybody is built differently and experiences different environments and circumstances. You explore and figure out how your unique body responds to different choices, adapt to challenges, and uncover the unique rhythm that works best for you. Consider an analogy: why do people love to travel? Because discovering new places and learning new things is stimulating and exciting. Sustainable weight management is like that; it is a journey into the most fascinating world: your own body, guided by your personalized roadmap. This document lays the groundwork for your roadmap and kick-starts your journey of lifelong learning.

3. Core principles of sustainable weight management

- *Your body is an energy reservoir*; it reflects your calorie balance.
- *You are what you eat*; quality and quantity count.
- *Minimize your mental effort*; sustainability starts with one focus each day.
- *You have to want it for yourself*; lasting change begins with your desire, not someone else's.

4. Basic elements of sustainable weight management

- **Hydration**: Water is essential for life and supports overall body functions, particularly key players in weight management: the brain, kidneys, liver, and pancreas. Inadequate hydration strains these organs and hinders their critical functions, including filtering toxins, breaking down fat, balancing blood sugar levels, reducing mood swings, and maintaining metabolic processes necessary for health. Start each day by drinking water and maintain hydration throughout the day. Proper hydration also helps curb the urge to consume unnecessary calories.
- **Nutrition:** Balanced nutrition is foundational, as carbohydrates, proteins, and fats provide macronutrients for energy, while fiber, minerals, and vitamins support proper bodily function. Carbohydrate intake can directly affect weight fluctuations, as carbohydrates bind with water. Adequate protein intake is essential for muscle growth and tissue repair, as the body cannot synthesize essential amino acids. Alcohol and foods high in salt, sugar, and saturated fat put stress on vital organs. Minimizing these can help the body function more efficiently.
- **Physical activity:** A key factor in thriving health, as it increases calorie expenditure, enhances strength and endurance, and improves overall metabolic function. Alternate between cardio and strength training, allowing 48 hours for muscle recovery. Non-structured activities, such as yard work or walking to the store, can also contribute significantly to calorie burn. This is known as non-exercise activity thermogenesis (NEAT) and plays a substantial role in total daily energy expenditure.
- **A simple plan and iterative refinement:** A simple plan is a daily routine that's easy to follow and maintain. A plan only succeeds if it is sustainable and adaptable to changing circumstances. Create a meal and exercise plan in advance so that each day, your focus is only on when to eat and exercise, not what to eat or do. Be curious with an open mind; instead of worrying about today's weight, focus on the habits that will shape tomorrow's progress. Track your weight, food intake, and activity to identify areas for improvement. Continuously experiment, refine, and adjust your plan to achieve lasting success.

5. Deep dive into a journey of self-discovery and life-long learning

The rest of this document is a collection of appendices, starting with case studies and diving deeper into metabolic processes, the brain and endocrine systems, fasting strategies, strength training, and many other relevant topics. In particular, for those ready to embark on their own weight management journey, the case studies provide insightful examples of how one can successfully lose weight, build strength, and maintain their progress. These resources offer a comprehensive and practical guide to understanding and applying sustainable weight management principles.

- Appendix A: Case Study I - losing weight and gaining strength
- Appendix B: Case Study II - keeping weight off (*in progress*)
- Appendix C: Simplified biochemistry of how human body stores and releases energy
- Appendix D: How your brain makes you crave food
- Appendix E: Healthy fasting and diet for effective weight loss and strength gain
- Appendix F: Strength, power, endurance, and calorie burn: the role of resistance training
- Appendix G: Aerobic and anaerobic metabolisms and maximum heart rate
- Appendix H: Mastering the art of keeping weight off
- Appendix I: Setpoints and settle points
- Appendix J: Metabolic and neural adaptations (*under construction*)
- Appendix K: Social events, travels, and illnesses: managing unavoidable disruptions (*under construction*)
- Appendix L: Technologies for sustainable weight management (*under construction*)

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Appendix A: Case Study I - losing weight and gaining strength

Introduction: This appendix explores the practical application of sustainable weight management principles through a case study. It specifically addresses two key aspects: losing weight and gaining strength.

Background: A 65-year-old male (the author) had struggled for years with weight gain and diminished strength due to a sedentary work life, poor eating habits, inconsistent exercise routines, frequent knee injuries, and a declining metabolism associated with his age. In November 2024, he decided to take action. At the time, he weighed 83.2 kg (183 lb), with a BMI of 27.6 (classified as overweight) and a waist circumference of 40.5 inches. He set the following goals:

1. Reduce his weight to 72.7 kg (160 lb, 12% weight reduction, BMI of 24).
2. Regain muscle mass and strength to ensure that 10.5 kg (23 lb) of weight loss comes from fat elimination.
3. Once achieved, maintain his target weight long-term.

Methods:

1. **Estimate daily calorie needs:** Calculate theoretical BMR (basal metabolic rate) by using the Mifflin St Jeor equation to estimate daily calorie needs. Use the derived value (1,500 calories) to establish a baseline calorie deficit condition.
2. **Set eating schedule:** Eat twice daily at 11am~12 noon and 6~8pm and maintain a 16-hour fasting window (16:8 intermittent fasting). Set a calorie input target for lunch at 700~800 and dinner 700~800. The total daily calorie intake of 1,500 matches the BMR estimate. Emphasize fresh vegetables for soluble and insoluble fiber, vitamins, and minerals. Choose quality protein sources to ensure the intake of all nine essential amino acids. Reduce carbohydrates to minimize glycogenesis and promote lipolysis.
3. **Set exercise schedule:** Set a daily calorie output target from planned exercise at 500. With BMR of 1,500 and food intake of 1,500, this establishes a theoretical calorie deficit of 500. Exercise once a day between 3pm and 5pm (3 hours after lunch, 1 hour before dinner) for optimal amino acid utilization. Alternate cardio and strength training to give a 48-hour rest for muscle recovery.
4. **Visualize the road ahead and adjust plans:** Create a spreadsheet and draw a graph of 1 lb/week and 2 lb/week guidelines (see Fig. A-1). Measure and keep a record of body weight each morning. Calculate 7-day and 21-day moving averages to track trends. Compare measured data to the envisioned guidelines. Make adjustments to food consumption and exercise intensity based on how the body feels and how the body weight is trending.
5. **Set hydration and alcohol rules:** Begin each day with 16 fl oz (473 ml) of water and maintain hydration by consuming about 96 fl oz (3 liters) throughout the day. No alcohol on strength training days to allow the liver to prioritize metabolic processes related to muscle recovery.

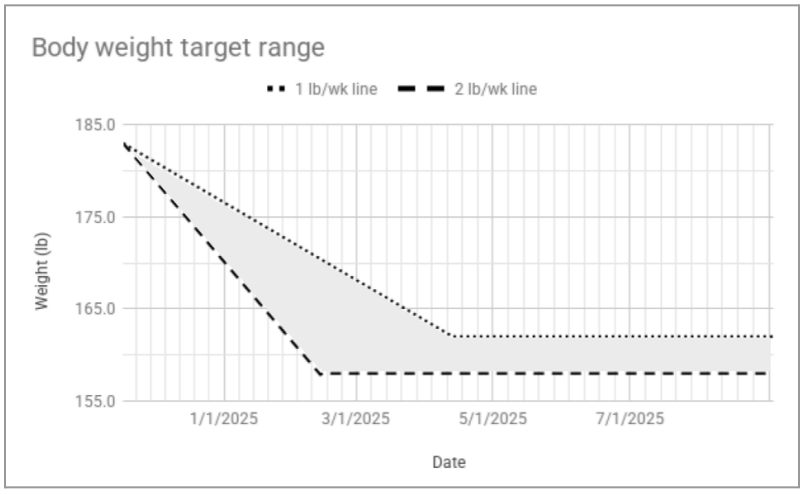


Figure A-1: Visualizing the roadmap by drawing a body weight target range

Results after 6 months:

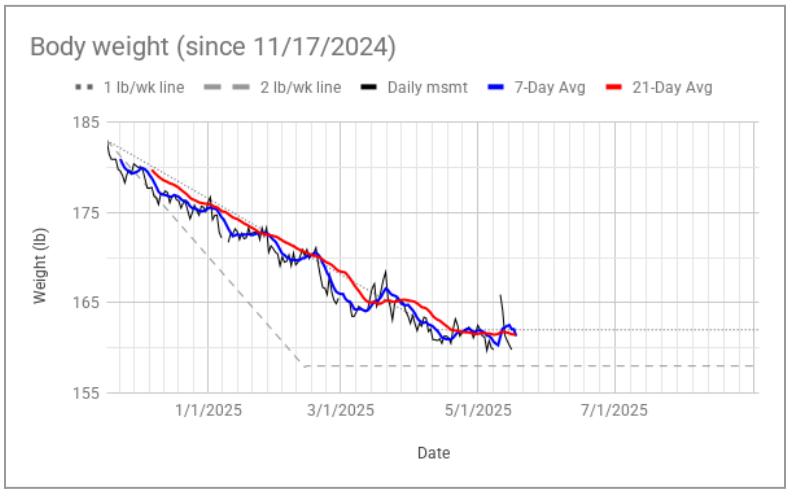


Figure A-2: Measured body weight from 11/17/2024 to 05/16/2025

Fig. A-2 shows the body weight trend for the 6-month period from 11/17/2024 to 05/16/2025. The black solid line in the figure represents the measured body weight. The solid blue line indicates the 7-day moving average, while the red line shows the 21-day moving average. The gray short dotted line represents a hypothetical guideline for a weight loss rate of 1 pound (0.45 kg) per week, and the gray large dotted line represents a guideline for a rate of 2 pounds (0.9 kg) per week. After six months, he observed the following changes:

- Reduced weight **from 83.2 kg (183 lb) to 72.7 kg (160 lb)** (12% reduction).
- Reduced waist circumference **from 40.5 inch to 34.0 inch** (15% reduction).
- Reduced body fat percentage **from 26% to 15%** (estimates by bioelectrical impedance analysis).
- Improved blood lipid profile:
    - Cholesterol level **decreased to 168 mg/DL** (normal <= 239 mg/DL) from the past 17-year value range of 213~253 mg/DL.
    - Triglyceride level (non-fasting) **decreased to 63 mg/DL** (normal <= 879) from the past 6-year value range of 101~144 mg/DL.
    - LDL (Low Density Lipoprotein) level (non-fasting) **decreased to 97 mg/DL** (normal <= 159 mg/DL) from the past 6-year value range of 143~157 mg/DL.
    - HDL (High Density Lipoprotein) level remained at 58 mg/DL (normal >= 40 mg/DL) within the past 17-year value range of 54~60 mg/DL.
- Improved strength, endurance, flexibility, and mobility. Specifically, he can do:
    - **Plank for 2+ min** (both forearm and extended arm high plank, previously < 30 seconds).
    - **Dead hang for 1+ min** (previously < 20 seconds).
    - **50+ push-ups** in 60 seconds (previously < 30).

- **7+ pull-ups** in 60 seconds (previously unable to do a pull-up).

Discussion:

1. **What worked in this experiment?**
   - Time-restricted eating made it easy to stay on track because the only thing to think about was when to eat. The limited eating opportunities heightened the sense of appreciation for food.
   - Having a visual roadmap (Fig. A-1) and tracking data everyday (Fig. A-2) helped make effective adjustments in food intake and exercise intensity. Inspecting weight data sparked curiosity and led to further research and learning, which further helped make informed adjustments.
   - Successfully gained muscle without taking protein powders or creatine supplements.
   - Having a home gym with a stationary bike and free weights made it easy to approach exercising.
2. **What did not work in this experiment?**
   - Due to another knee injury during the experiment, certain physical activities were restricted.
   - Social occasions disrupted daily routines and impacted body weight changes. Fig. A-3 illustrates the immediate impacts on body weight due to social occasions and associated diet changes (3/13 - 3/25). Notice how much and how quickly body weight changes. If it were not addressed quickly, it would have become a long-term problem with fat accumulation.
3. **What are the main lessons learned from this experiment?**
   - If an overweight 65-year-old male can lose weight and gain strength while having fun doing it, anyone with reasonable health can easily do the same and even more.
   - Keeping things simple made the effort sustainable.
   - Gaining muscle while losing weight is not as difficult as people think, and supplements like protein powders and creatine are NOT necessary.
   - Discovering and understanding why and how his body weight changes was the key factor of success. For example, he had knee surgery in May which disrupted his daily routine. However, the lesson learned in March about the effect of carbohydrates and glycogen (Fig. A-3) helped him apply the knowledge positively to optimize his metabolic processes for effective recovery. Fig. A-4 illustrates how he controlled his diet before and after surgery to condition his body for optimal tissue healing processes while effectively returning to his desired body weight.
4. **What is next for this study?**
   - Now that the target weight has been achieved, the focus shifts to maintaining the body within the target range while continuing to enhance strength, power, endurance, flexibility, and mobility.

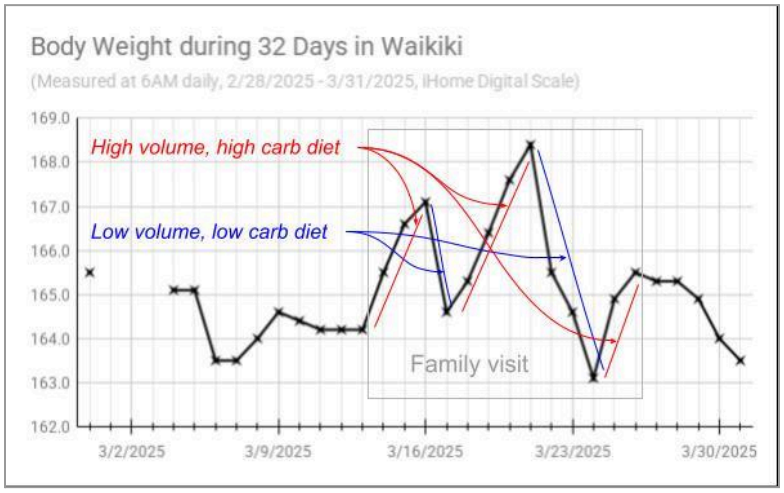


Figure A-3: Immediate impact of food volume and carbohydrates on body weight

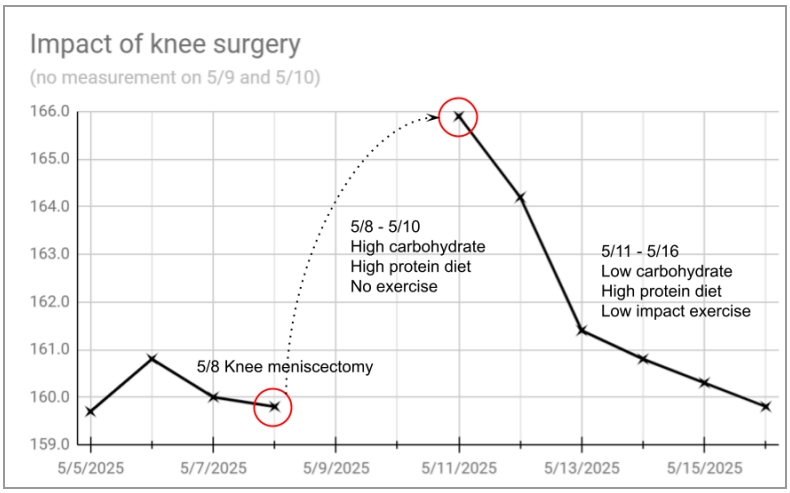


Figure A-4: Impact of surgery and carbohydrates on body weight

Conclusion: The case study demonstrates the essence of sustainable weight management. Keeping things simple and understanding why and how body weight changes are key success factors. The principles apply to all ages, and they are effective not only for weight loss but also for weight and strength gain. This is particularly beneficial for older individuals with sarcopenia. The study is ongoing, and an updated case study for maintaining weight is described in Appendix B.

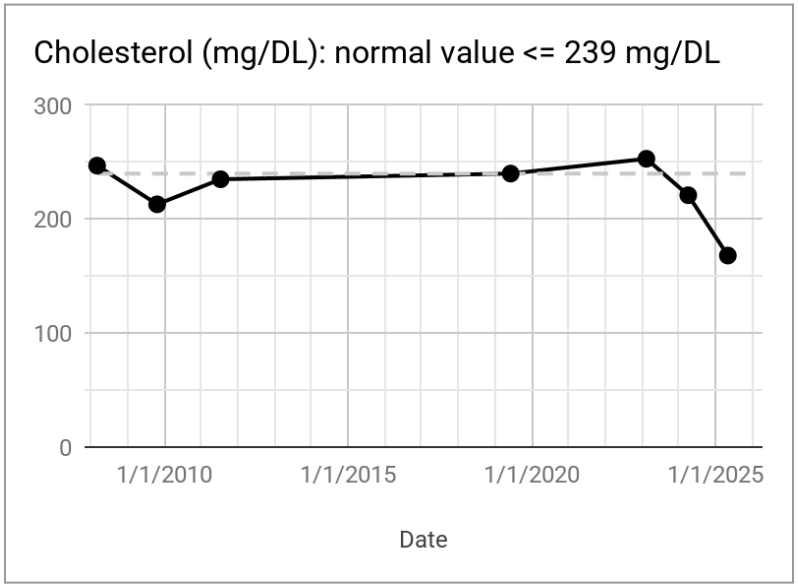
Supplemental information: sample meal plans and nutrition intake during the experiment

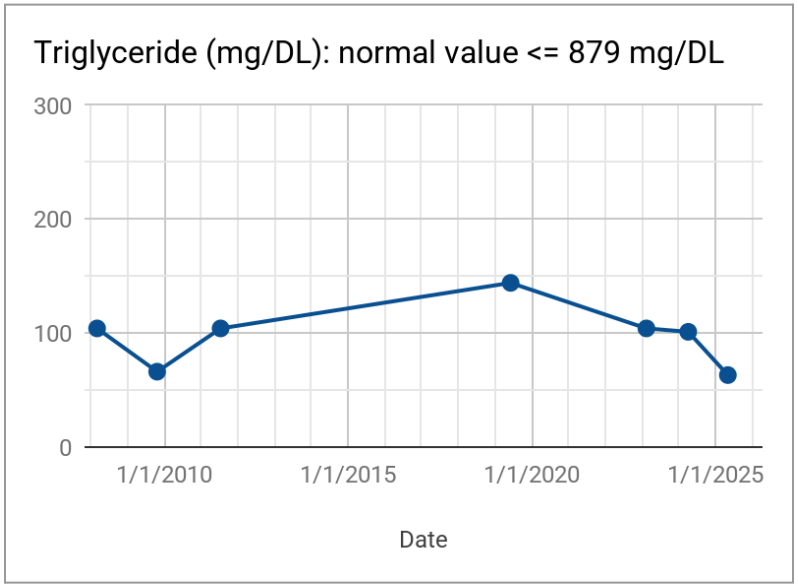
Lunch 11am~12 noon														
Food Item	Calories	Protein (g)	Carbs (g)	Fat (g)	Fiber (g)	Vitamin C (mg)	Calcium (mg)	Iron (mg)	Potassium (mg)	Folate (mcg)	Vitamin D (mcg)	Vitamin B12 (mcg)	Vitamin A (mcg)	Magnesium (mg)
Trader Joe's Oat Beverage (1 cup)	110	2	22	2	3	0	110	0.6	150	0	2.9	0.9	280	0
Non-fat Greek Yogurt (3/4 cup)	100	18	6	0	0	0	200	0.2	240	0	0	0.6	0	25
Lentils (1/2 cup)	115	9	20	0.5	8	0	20	3	365	180	0	0	0	36
Black Beans (1/2 cup)	114	7	20	0.5	7	0	23	1.8	305	128	0	0	0	60
Medium Banana	105	1	27	0.3	3	10	5	0.3	422	24	0	0	0	32
Vital Proteins Collagen Peptides (4 tbsp)	70	18	0	0	0	0	0	0	0	0	0	0	0	0
Medium Orange	73	1.3	16.5	0.2	2.8	82.7	60.2	0.13	232	24	0	0	14	13
Total	**687**	**56.3**	**111.5**	**3.5**	**23.8**	**92.7**	**418.2**	**6.03**	**1714**	**356**	**2.9**	**1.5**	**294**	**166**
% RDI (Recommended Dietary Intake)	-	113%	37%	5%	85%	103%	42%	50%	49%	89%	19%	63%	33%	39%

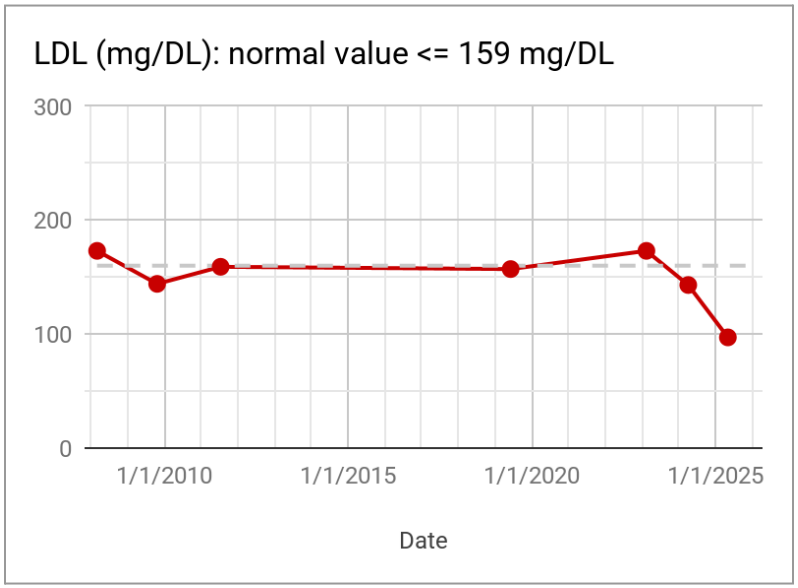
Dinner (1st segment) 6pm~7pm														
Food Item	Calories	Protein (g)	Carbs (g)	Fat (g)	Fiber (g)	Vitamin C (mg)	Calcium (mg)	Iron (mg)	Potassium (mg)	Folate (mcg)	Vitamin D (mcg)	Vitamin B12 (mcg)	Vitamin A (mcg)	Magnesium (mg)
Raw Broccoli (1/2 cup)	15	1.3	3	0.2	1.2	40.6	21	0.33	144	57	0	0	14	19
Raw Cauliflower (1/2 cup)	13	1.1	2.6	0.1	1.1	26.8	11	0.2	150	27	0	0	0	8
Raw Carrots (1/2 cup)	25	0.5	6	0.1	1.7	3.6	20	0.2	195	12	0	0	459	9
Raw Celery (1/2 cup)	8	0.4	1.5	0.1	0.8	1.5	16	0.1	160	17	0	0	0	7
Raw Baby Bell Peppers (1/2 cup)	20	0.6	4.8	0.1	1.2	47.5	10	0.2	160	25	0	0	190	8
Raw Baby Spinach (2 cups)	14	1.8	2.2	0.2	1.4	16.9	60	2	334	58	0	0	281	48
Hummus (2 tbsp)	70	2.1	4	5	1.5	0	11	0.6	50	15	0	0	0	15
Total	**165**	**7.8**	**24.1**	**5.8**	**8.9**	**136.9**	**149**	**3.63**	**1193**	**211**	**0**	**0**	**944**	**114**
% RDI	-	20%	8%	8%	32%	152%	15%	20%	34%	53%	0%	0%	105%	27%

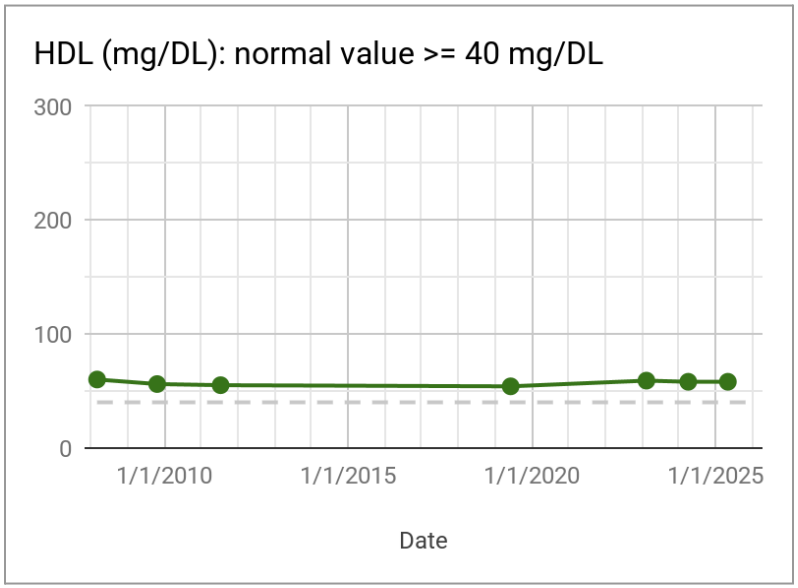
Dinner (2nd segment) 7pm~8pm														
Food Item	Calories	Protein (g)	Carbs (g)	Fat (g)	Fiber (g)	Vitamin C (mg)	Calcium (mg)	Iron (mg)	Potassium (mg)	Folate (mcg)	Vitamin D (mcg)	Vitamin B12 (mcg)	Vitamin A (mcg)	Magnesium (mg)
Boiled Egg (1 medium)	68	5.5	0.5	4.7	0	0	22	0.5	55	44	74	1.1	0.6	5
Avocado (1 medium)	240	3	12	22	10	10	24	0.8	708	90	7	0	0	58
Cooked Chicken (1 cup)	231	43	0	5	0	0	21	1.5	358	8	0	0	0	21
Cooked Quinoa (1 cup)	222	8	39	3.6	5	0	31	2.8	318	77	9	0	0	118
Total	**761**	**59.5**	**51.5**	**35.3**	**15**	**10**	**98**	**5.6**	**1439**	**219**	**90**	**1.1**	**0.6**	**202**
% RDI	-	119%	17%	50%	54%	11%	10%	31%	41%	53%	10%	11%	29%	48%

Supplemental information: Blood lipid profile trend data









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Appendix B: Case Study II - maintaining weight loss *(in progress)*

Introduction: This appendix explores the practical application of sustainable weight management principles through a case study. It specifically addresses the most challenging aspect of weight management, keeping weight off.

Background: The author, a 66-year-old male, previously applied the principles of sustainable weight management, achieving weight loss and gaining strength in six months (see Appendix A). As of May 16, 2025, his new objective is to maintain his weight while continuing to improve strength and mobility.

Methods:

1. **Continue core routines:**
    a. **Visualize the road ahead:** Use the graph created in the previous phase to visualize the timeline and desired weight range, as shown in Fig. B-1.
    b. **Continue daily measurement and monitoring:** Maintain the established daily routine of monitoring calorie intake, energy expenditure, how the body feels, and how the body weight is trending.
    c. **Continue hydration and eating schedules:** Maintain the established daily schedules of hydration and eating with a relaxed 16/8 time-restricted eating pattern.
    d. **Continue exercise routine:** Maintain the established exercise regimen. Continue to experiment and incorporate new exercises and activities.

2. **Add a new routine: periodic refeeds:** Periodically replenish and increase the glycogen level with a high-carbohydrate diet. Experiment by adjusting the timing and volume of carb consumption. (See Appendix H for the principles behind this choice)

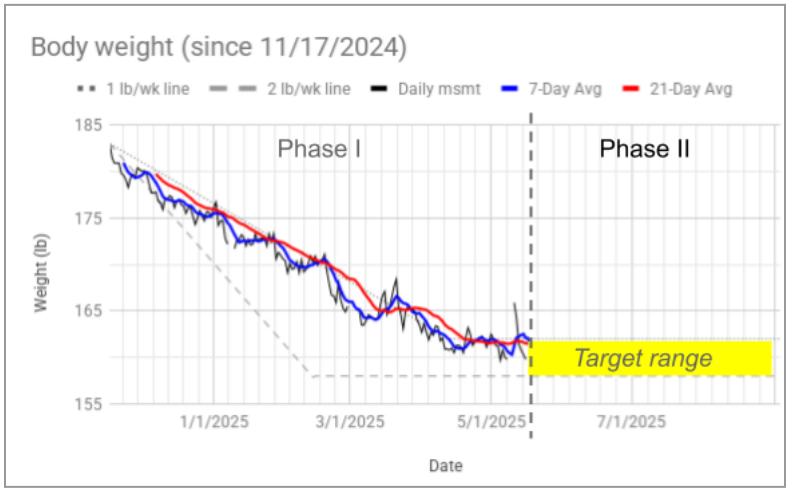

Figure B-1. Visualizing the roadmap

Remarks:

The key difference between phase I (losing weight) and phase II (maintaining weight) is the attention on glycogen level. In phase I, the glycogen level was constantly kept at a low level to promote lipolysis for fat burning. In phase II, it is no longer necessary to stay in a calorie deficit state, therefore, the glycogen level can increase from time to time. However, if the glycogen level stays high for a period of time, lipogenesis will kick in and begin to store fat, resulting in weight gain. To avoid this situation, the glycogen level must be in check so that it does not stay high for a long period of time.

The primary reason for introducing periodic refeeds is to have a controllable element to adjust the glycogen level at will while maintaining the rest of the established routines. For this reason, in phase II, the subject plans to keep the same lifestyle routines from phase I on most weekdays and adds refeed days on weekends.

It is interesting to note that the subject prefers to maintain the core routines from phase I. This is because, by the time he reached phase II, he was so used to the routines that he felt comfortable and confident in choices he makes in diet and exercise. Unlike the early days in Phase I, he no longer felt stress or had an uncontrollable craving.

Results:

Fig. B-2 shows the body weight trend since phase II began on 05/16/2025 (*in progress*).

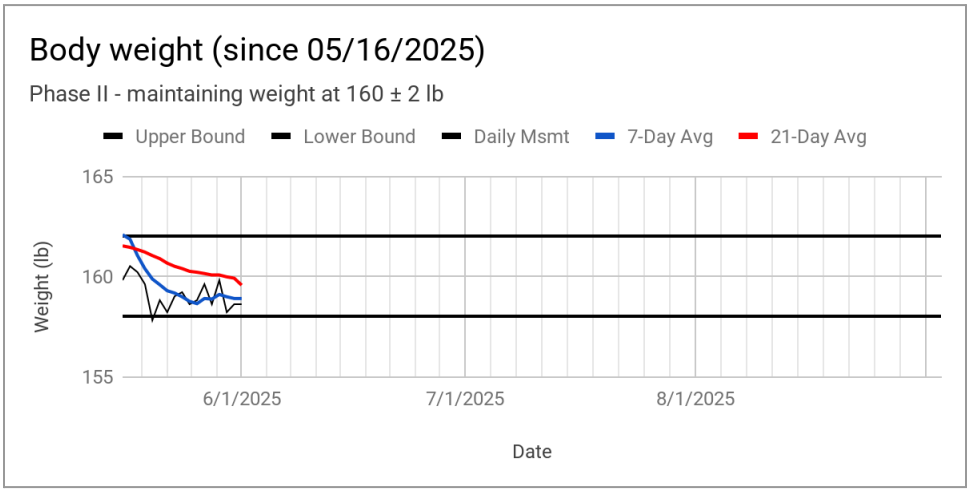

Figure B-2. Measured body weight since 05/16/2025

Discussion:

What is working well in maintaining weight so far?

- Keeping the daily routines from phase I has not been as difficult as anticipated.
- Informed decisions and adjustment on a daily basis, which were made possible by continued self-learning, especially on the following topics (to be added as appendices):
    - metabolic and neural adaptations
    - social events, travels, and illnesses: managing unavoidable disruptions
    - technologies for sustainable weight management

What is not working well in maintaining weight so far?

- It is still early in phase II to comment on this.

Appendix C: Simplified biochemistry of how human body stores and releases energy

Introduction: Why do we gain or lose weight? It is because human bodies are, like a rechargeable battery, an input-output energy reservoir where body weight is influenced by food intake and physical activity. Unlike batteries, the human body can expand to accommodate excess calories. Due to differences in environment, genetic disposition, and lifestyle, no single diet or exercise program works for everyone. Therefore, understanding the biochemistry of energy storage and release is essential. This brief article identifies six essential metabolic processes: *glycogenesis* and *lipogenesis* (energy storage), and *glycogenolysis*, *glycolysis*, *lipolysis*, and *gluconeogenesis* (energy release).

Glycogenesis is the metabolic process that converts excess glucose into glycogen, which is stored in muscles and the liver [1]. The storage capacity for glycogen is limited to approximately 15 grams per kilogram of body weight [2]. Each gram of glycogen contains approximately 4 calories [3]. Therefore, a body weighing 75 kg can store up to 1.125 kg of glycogen, providing 4,500 calories—potentially enough to sustain two or three days of activity without eating. Glycogen binds with water at a ratio of 1:3, meaning each gram of glycogen holds 3 grams of water [3][4]. Combined with water, 1.125 kg of glycogen results in 4.5 kg of total weight. This explains why one might gain a few pounds overnight after consuming a significant amount of carbohydrates.

Glycogenolysis is the metabolic process that breaks down stored glycogen to release glucose in response to low blood sugar and muscle energy demands [1]. The liver breaks down its glycogen stores, releasing glucose into the bloodstream to maintain blood sugar homeostasis. In muscles, glycogen is broken down into glucose for further processing by muscle cells for energy. As stored glycogen decreases, so does the bonded water. This explains why one might lose a few pounds overnight after significant physical activity or severe calorie deficit.

Glycolysis is a metabolic process that takes place in the cytosol, the fluid within cells to convert glucose to pyruvic acid (pyruvate) [1]. This process also produces small amounts of high-energy molecules called adenosine triphosphate (ATP), the body's primary energy currency [5]. Since glycolysis does not require oxygen, it becomes the primary producer of ATP in the absence of oxygen.

When oxygen is present (aerobic respiration), pyruvate produced by glycolysis enters the mitochondria, where beta oxidation converts it into ATP. In the absence of oxygen (anaerobic respiration), pyruvate does not enter the mitochondria and instead undergoes fermentation in the cytosol, generating lactate or ethanol [6]. The byproducts of these cellular respiration processes—carbon dioxide and water—are excreted from the body through breathing, urination, and sweating.

Lipogenesis is the metabolic process in which the liver converts excess glucose or fatty acids from food digestion into triglycerides [7]. These excess calories are stored as triglycerides in fat cells, serving as long-term energy reserves. Unlike glycogen, the body has no limit to the amount of fat that can be stored. This is why severe obesity can occur.

Lipolysis: Under prolonged calorie deficit conditions, the body begins using stored fat for energy. Lipolysis is the metabolic process where the liver breaks down triglycerides into fatty acids and glycerol, which are then released into the bloodstream. Fatty acids then enter the mitochondria in cells and are converted to ATP [8].

Gluconeogenesis is the metabolic process that produces glucose from non-carbohydrate sources [9]. Glycerol from lipolysis and lactic acids from anaerobic respiration are non-carbohydrates. The liver breaks them down and converts them into glucose, which is then released into the bloodstream and transported to cells for glycolysis.

Conclusion: The key takeaway is that the whole process begins with excess calorie intake and the liver plays an important role in metabolic processes. Glycogen and triglycerides are released by different triggers, mechanisms, and timings. Therefore, daily awareness of energy accumulation from food intake and physical activity becomes important. An effective and holistic diet and exercise program can be developed based on knowledge of the metabolic processes outlined in this article.

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Appendix D: How your brain makes you crave food

Introduction: The most challenging aspect of weight management is controlling appetite. The desire for food is an instinctive and natural part of survival, but if not managed, it can contribute to unhealthy eating habits and weight gain or loss. Therefore, managing appetite is a key component of successful weight management. Body weight is shaped by metabolic processes, but appetite is driven by signals from the brain and organs. There is an intricate process that translates physiological signals into tangible feelings of hunger or fullness, which drive food intake and cravings. In this appendix, we explore how appetite is regulated in the body and how understanding these principles can help improve appetite management.

The control center and hormonal signals: The hypothalamus is a region of the brain, known to serve as the control center for appetite regulation, as part of its role in regulating vital physiological functions, including body temperature, heart rate, mood, hunger, and hormone balance. Hormones are chemical messengers that circulate through the bloodstream, orchestrating numerous physiological processes and functions. Five key hormones (or hormone-like peptides) are known to influence appetite by carrying specific trigger signals to the hypothalamus.

- *Ghrelin*: produced in the stomach and released when the stomach is empty. Ghrelin travels to the brain and signals the hypothalamus that the body needs food, increasing appetite. For this reason, Ghrelin is known as the hunger hormone.
- *Cortisol*: produced in the adrenal glands, located on top of the kidneys, and released in response to stress. Cortisol travels to the brain and signals the hypothalamus that the body needs more energy, increasing appetite. Often called the stress hormone, Cortisol triggers cravings for calorie-dense foods during stress.
- *Leptin*: produced by fat cells and travels to the brain, signals the hypothalamus that fat stores are sufficient, reducing appetite. For this reason, leptin is known as the satiety hormone.
- *Insulin*: produced in the pancreas and released when you eat food and the blood glucose level rises, travels to the brain, signals the hypothalamus to reduce appetite.
- *Glucagon-like peptide-1* (GLP-1): produced in the small intestine and released in response to meal intake. GLP-1 travels to the brain and signals the hypothalamus to reduce appetite. Some medications like Ozempic™ and Wegovy™ mimic the function of GLP-1 to aid weight loss by pharmaceutically suppressing appetite.

Neural signals: When these hormonal signals are received, the hypothalamus activates neurotransmitters to stimulate or suppress appetite-related neurons. Neurotransmitters are chemical messengers that relay signals throughout the nervous system, shaping essential functions such as cognition, emotion, movement, and appetite regulation. When activated, the following neurotransmitters generate the subjective experience of hunger or satiety.

- *Neuropeptide Y* (NPY) and *Agouti-related peptide* (AgRP): These neurotransmitters stimulate hunger. When *Ghrelin* levels rise, they activate NPY and AgRP neurons in the arcuate nucleus of the hypothalamus, making you feel hungry and increasing food-seeking behavior.
- *Orexin*: produced in the hypothalamus, enhances hunger and energy levels when nutrient stores are low, promoting wakefulness and food-seeking behavior.
- *Pro-opiomelanocortin* (POMC) and *Cocaine-* and *amphetamine-regulated transcript* (CART): These neurotransmitters promote satiety. When *Leptin* levels rise, they activate POMC and CART neurons, reducing appetite and making you feel full.
- *Serotonin*: helps regulate satiety and mood-related eating behaviors. Higher Serotonin levels reduce cravings, while lower levels can lead to increased appetite.
- *Dopamine*: involved in food reward and cravings, reinforcing pleasurable eating experiences and driving motivation to seek food rewards. Dopamine can also help suppress appetite by promoting feelings of fullness and satisfaction.
- *Gamma-aminobutyric acid* (GABA): plays a role in appetite regulation but its specific function is complex and it can both stimulate and suppress food intake depending on the specific brain regions and pathways involved.

What do these mechanisms mean for appetite management?

The foregoing explanation confirms that our body is biologically programmed to crave food under certain conditions, such as an empty stomach, a calorie deficit state, or periods of stress. Appetite and satiety are the brain's translation of physiological signals from internal organs into neural cues that we perceive as hunger or fullness. While we cannot directly control these internal signals, except when altered by medical interventions, we can influence our behaviors to regulate appetite effectively.

- Hydration: staying well-hydrated helps reduce unnecessary food cravings.
- Mental engagement: keeping the mind occupied can minimize the urge to eat out of boredom.
- Physical activity: various activities like yard work, exercise, and hobbies can suppress appetite by influencing hunger-related hormones.
- Quality sleep: proper rest supports hormonal and neurotransmitter balance, aiding appetite regulation.
- Consistent eating schedule: a regular meal pattern reduces anxiety around food and promotes satiety.

Conclusion: By understanding and leveraging these biological processes, we can adopt strategies that support appetite control and overall well-being.

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Appendix E: Healthy fasting and diet for effective weight loss and strength gain

What is healthy fasting? Healthy fasting refers to intentionally limiting food intake to specific periods while ensuring sufficient nutrient consumption during eating windows to support bodily functions. Unlike extreme diets or starvation-based approaches that simply force the body to shed calories, healthy fasting emphasizes creating a balanced and sustainable cycle of fasting and eating. It is tailored to individual needs and goals, aiming not only to promote weight loss but also to improve strength.

Types of fasting: While many fasting methods exist, they can essentially be categorized into two types:

- Intermittent fasting, also known as time-restricted eating, limits daily food intake to specific hours—such as from 12 noon to 8 p.m.—while fasting during the remaining hours.
- Periodic fasting restricts eating for extended periods, such as 24 hours once or twice a week, while maintaining regular eating patterns on other days.

Benefits of fasting: Fasting has several benefits. For weight loss, the body depletes glycogen stores during fasting and begins utilizing fat for energy. For metabolic health, fasting helps regulate blood sugar levels and reduces insulin resistance. For strength training, fasting boosts human growth hormone levels which supports muscle repair and strength gains. By shifting between energy sources, fasting improves the body's ability to adapt to changing conditions. For sustainability, establishing eating and fasting windows creates a routine that minimizes mental effort by simplifying the focus on when to eat.

Balanced nutrients for healthy fasting: Because you are in a calorie deficit state with limited eating windows, special attention must be paid to ensure adequate nutrient intake every day.

- Hydration: This should be the top priority to support metabolic processes and overall well-being.
- Proteins: The body cannot synthesize essential amino acids, so focus on quality protein sources and adequate amounts to meet your specific needs.
- Carbohydrates: The primary source of energy but also high in calories. Control portions and choose complex carbohydrates, such as whole grains, legumes, and vegetables, to sustain energy levels.
- Fats: Essential for cell structure, hormone production, and brain function, but also high in calories. Focus on healthy fats from sources such as avocados, nuts, seeds, and fish, while minimizing saturated fats.
- Fibers: Aid digestion and promote gut health by regulating bowel movements and preventing constipation. Focus on soluble and insoluble fiber sources like fruits, vegetables, whole grains, and legumes to maintain a healthy digestive system.
- Minerals and vitamins: Support countless biochemical and physiological functions in the body, including immune defense, energy production, and bone health. Ensure variety in your diet to cover essential micronutrients.

Key considerations for healthy fasting

- Individual needs: It is prudent to consult your doctor before engaging in fasting and physical exercise programs. There is no single method that works for everyone. Consider factors like age, activity level, and health conditions when determining fasting schedules.
- Avoid over-fasting: Excessive fasting can lead to fatigue, muscle loss, or nutrient deficiencies.
- Exercise timing: Align workouts with eating windows or just before breaking the fast to optimize fat burning and muscle growth and retention.

Conclusion: When practiced responsively, healthy fasting is a powerful tool for weight management and strength development. Understanding metabolic responses and tailoring fasting to individual needs allows for effective fat loss and strength gains without compromising health. Combined with hydration, balanced nutrition, and exercise, fasting evolves into a sustainable lifestyle strategy.

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Appendix F: Strength, power, endurance, and calorie burn: the role of resistance training for sustainable weight management

Introduction: People often ask—is it difficult to gain muscle mass while losing weight? The answer depends on your diet and exercise routine, but the more important question is: why do you want to gain muscle mass? This article explores the role of resistance training by examining the elements of gaining and losing muscle mass, strength, power, and endurance. By understanding the underlying mechanisms, achieving strength, power, and endurance while losing weight becomes more effective than focusing solely on muscle gain.

How muscles grow: Muscle growth (hypertrophy) occurs when the body is subjected to mechanical stress, typically through resistance training or strenuous activity. This stress stimulates muscle protein synthesis, leading to an increase in the size of existing muscle fibers [1]. Key elements contributing to muscle hypertrophy include:

- Protein intake: Muscles require sufficient dietary protein to grow.
- Rest and recovery: Muscle growth occurs during rest, particularly during sleep, as growth hormones are released to support rebuilding. Overtraining without adequate rest can hinder this process.
- Progressive overload: Gradually increasing resistance or intensity during workouts ensures ongoing muscle stimulation and growth.

How muscles shrink: Muscle loss (atrophy) occurs when the body breaks down muscle tissue due to inactivity, inadequate nutrient intake, or aging.

- Inactivity: Extended periods of immobility, such as during recovery from an injury, lead to reduced muscle engagement and eventual shrinkage.
- Calorie deficit without protein: Sustained calorie restriction, particularly without adequate protein, forces the body to use muscle for energy.
- Aging: natural decline in muscle mass due to aging, typically starts around age 30 and accelerates over time [2].

Two types of muscle fibers [3]**:**

- Slow-twitch fibers (Type I): Play a smaller role in muscle hypertrophy but crucial for endurance and supporting structural stability.
- Fast-twitch fibers (Type II): Primary contributors to muscle hypertrophy. Responsible for explosive movements and high-intensity activities but fatigue more quickly.

Strength, power, endurance, and calorie burn: Not all resistance training achieves the same objectives or results, as various factors determine whether strength, power, endurance, or calorie burn is targeted.

- Strength: Refers to a maximum voluntary force, a multifaceted quality influenced not only by muscle size but also by neurological efficiency, connective tissue strength, and motor control adaptations [1]. Strength is typically developed by repeatedly subjecting muscles to tension through lifting heavy weights, consequently promoting muscle hypertrophy. However, beginners experience rapid strength gains from resistance training more from neurological adaptations than muscle hypertrophy [4].
- Power: The ability to exert force quickly. While strength focuses on the maximum force applied regardless of time, power combines speed and force. Plyometric training (e.g., jump rope) [5], ballistic training (e.g., throwing medicine balls) [6], and dynamic effort training (e.g., submaximal loads with faster movement) [7] are effective methods to improve power.
- Endurance: Relies more on cardiovascular, cellular, and neurological adaptations than on muscle hypertrophy [8]. To enhance endurance, low-intensity, high-repetition weight-lifting is effective. Endurance athletes, such as marathoners, utilize this type of resistance training to maintain structural stability, prevent injuries, and optimize overall efficiency, rather than to build large muscles.
- Calorie expenditure: Any resistance training burns calories, but compound exercises (e.g. pull-ups, push-ups, and squats) that engage multiple muscle groups are particularly effective at increasing calorie expenditure. In

addition, functional resistance training with movements like bending, pulling, lunging, pushing, squatting, and core exercises, enhances the movement patterns required for daily activities.

Ligaments, tendons, and supporting tissues: Resistance training also strengthens supporting tissues by promoting adaptations in their structure and function.

- Tendons and ligaments adapt to the forces applied during training, enhancing their elasticity and stiffness, which allows them to become more efficient at transferring force and stabilizing joints [9][10].
- Strengthened ligaments and tendons contribute to improved joint stability, reducing the risk of injuries. This is particularly beneficial for older individuals, but resistance training can also damage connective tissues if not done carefully. Proper warm up, technique, and adequate rest are necessary.
- Supplements such as collagen combined with vitamin C may help strengthen tendons and ligaments, but the scientific evidence supporting their effectiveness remains inconclusive [11].

Conclusion: Resistance training is a versatile and impactful tool for achieving diverse fitness goals. For sustainable weight management, resistance training offers the following benefits:

- Increase calorie expenditure to promote fat loss
- Improve strength to perform physical tasks
- Enhance fatigue resistance and reduce the risk of injuries
- Strengthen tendons, ligaments, and supporting tissues
- Increase muscle mass to provide a physical foundation

Whether you aim to gain strength and power, improve endurance, or build bigger muscles, understanding the mechanisms of muscle growth and loss ensures a more effective and sustainable approach to physical health and performance. This knowledge helps in designing specific exercise programs tailored to your objectives.

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Appendix G: Aerobic and anaerobic metabolisms and maximum heart rate

Introduction: Many exercise programs exploit the idea of aerobic and anaerobic metabolism zones to achieve effective performance and weight loss. They commonly use Maximum Heart Rate (Max HR) as the basis for determining such zones. For example, the American Heart Association uses the formula "Max HR = 220 - age" and recommends 50-70% of Max HR as the target aerobic metabolism zone for effective exercises. While this type of recommendation has become standard in the exercise industry, the method itself is not reliable. Strict adherence to such a measure should not be encouraged for the following reasons.

Reason 1: The presumed correlation between Max HR and metabolic state has not been scientifically proven. Some may still be in an aerobic metabolic state at 80% of Max HR, while others may experience an anaerobic metabolic state at well under 60% of Max HR.

Reason 2: The value of Max HR varies significantly among individuals and conditions, is difficult to measure, and cannot be accurately estimated by a simple formula based on a person's age. The commonly used formula (Max HR = 220 - age) can serve as a guideline for some purposes but should not be interpreted as a reliable estimate.

Reason 3: Metabolic states are influenced by various factors such as temperature, hydration, and types of activities and are not always accurately reflected in heart rates.

Let us elaborate on reason 3 and the metabolic processes that result in aerobic and anaerobic states.

Definitions:

- "Aerobic" means living in the presence of oxygen, etymologically derives from Greek *aero* (air) + *bios* (life).
- "Anaerobic" means living in the absence of oxygen, etymologically derives from Greek *an* (without) + *aero* (air) + *bios* (life).
- "Metabolism" refers to the biochemical process that produces energy in organisms to sustain life. Thus, "aerobic metabolism" refers to the biochemical process that produces energy with oxygen while "anaerobic metabolism" refers to the biochemical process that produces energy without oxygen.

Why oxygen? The presence or absence of oxygen changes the way bodies produce energy. It is a reactionary change caused by the cells' demand for energy. To provide energy to cells, glucose must be converted to adenosine triphosphate (ATP), the high-energy molecule that cells need. There are two pathways to produce ATP: the slow "citric acid cycle" and the faster but inefficient "Cori cycle." The choice of pathways depends on the supply and demand for oxygen as well as the availability of glucose.

Assuming that there is a sufficient level of glucose in the bloodstream, when the oxygen supply sufficiently meets the demand of cells, the cytoplasm (a gel-like component inside the cell membrane) breaks down glucose into pyruvic acid, which then goes to the mitochondria, a structured component within cells that promotes the citric acid cycle to produce ATP. This is an aerobic metabolic state. However, when the oxygen supply does not meet the demand of cells, such as during intense exercise, the citric acid cycle cannot produce enough ATP, and the cytoplasm builds up lactic acid. To supplement, the lactic acid is sent via the bloodstream to the liver, where it is converted back to pyruvic acid and then to glucose, which is sent back into the bloodstream for cells to process. This pathway is called the Cori cycle, and the body enters into an anaerobic metabolic state.

The availability of glucose is a key assumption for these processes because the Cori cycle can be triggered even in the presence of oxygen. A good example is hypoglycemia. When the glucose level in the bloodstream drops—potentially due to a lack of food consumption, depleted glycogen in the muscles, or underlying metabolic disorders—the level of lactic acid increases, and the body enters the Cori cycle, resulting in an anaerobic metabolic state. Such a condition cannot be predicted by HR alone because it may not rise as high.

Conclusion: Heart rate can be a useful indicator of physical condition; however, relying solely on Max HR to determine aerobic or anaerobic metabolic states is not recommended. Alternative measures, such as respiratory rate, may provide valuable insights.

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Appendix H: Mastering the art of keeping weight off

Author's Note: *This appendix intentionally adopts first-person sentences to present a personal view of body weight maintenance. While extensive scientific studies exist on this topic, I believe their methodologies, findings, analyses, and implications are largely irrelevant and misleading to the general public. Although these studies acknowledge the complexity of weight management, they focus narrowly on specific elements such as dietary influences or specific populations while failing to design research that effectively addresses its multifaceted nature. Consequently, I find that no credible scientific framework currently exists to establish a meaningful method for successfully maintaining lost weight. In my view, maintaining lost weight is an art rather than a science. It demands a dynamic, individualized approach based on adaptation, creativity, empathy, and exploration rather than rigid scientific formulas. Hence, the title: mastering the art of keeping weight off. To ensure accountability and transparency, I have chosen to write in first person in this appendix.*

1. Introduction: the hard reality of sustaining weight loss

Most people would agree that losing weight is hard. But even if we successfully lose weight, the journey does not end. Unlike climbing a mountain, we cannot stop the effort required to keep weight off. There is no summit to reach, no end in sight, and we must keep putting in effort, whatever that effort is. Keeping weight off could actually be more challenging than losing weight.

Statistics support this reality: more than half of the lost weight is regained within two years, and over 80% is regained in five years (Hall and Kahan 2018). I can attest to the statistics from my own experience. I tried to lose weight multiple times in the past and each time, I regained weight in two years or less. Because of the repeated failure, it has been psychologically taxing to even think about losing weight.

There are possibly many reasons for the difficulty in keeping weight off. It could be mental and physical fatigue after a long period of dieting, exercise, and lifestyle changes. It could be the psychological stress of a long-term commitment to keeping weight low rather than a limited short-term effort to lose weight. It could also be an evolutionary trait passed down from our ancestors that our bodies naturally resist losing fat and try hard to regain the lost fat.

Whatever the reasons, it is important to keep weight off because, after all, what is the point of losing weight if we cannot keep it off? Unfortunately, while there are many sources of information advising how to lose weight, there is not much advice out there on how to keep it off. This appendix addresses this issue.

2. Metabolic and psychological differences between losing and keeping weight

The metabolic difference lies in daily caloric balance. To lose weight, we must be in a caloric deficit; to maintain weight, we must keep our caloric balance. In other words, we gain or regain weight because we fail to keep our daily caloric balance in check.

Recall Appendix C about how our body stores energy. First, there is glycogen, a short-term energy source with limited storage capacity. Then, there are triglycerides, a long-term energy source with almost unlimited storage capacity. If we consume more calories than we need, our body is programmed to store the excess. Triglycerides are much harder to expend than glycogen, so if we want to maintain our weight, we must prevent extra calories from turning into fat cells. This metabolic process is something we must keep in mind at all times. Unfortunately, our memory resides in our brains, which have other priorities.

Recall Appendix D about how our brains make us crave food. Hormonal signals from the stomach, adrenal glands, intestines, and fat cells trigger the hypothalamus to activate or suppress neurotransmitters that influence our cravings. When we feel a strong urge to eat, we listen to that impulse rather than recalling our knowledge of biochemistry and metabolic processes. Dopamine effectively attracts us to rewards, yet no other neurotransmitter offers a compelling counterbalance with alternate rewards.

This leads to the psychological difference between losing and maintaining weight. When we engage in weight loss, we are motivated by one or more reasons that drive our thoughts and actions, often overriding the biological urge to eat. However, once we reach our goal, this motivation fades. We no longer have the mental reinforcement necessary

to override biological impulses. To make matters worse, the metabolic process tends to restore lost weight, triggering even stronger hormonal signals to encourage eating rather than maintaining weight.

This mental aspect cannot be ignored and must be addressed in any effort or program aimed at sustaining weight loss after reaching a target weight. No trendy diet or exercise can solve this issue.

3. Core principles of sustainable weight management still apply

Whether losing weight or keeping it off, the core principles remain the same. You are what you eat, your body weight reflects your caloric balance, and lasting change begins with your own desire, not someone else's. Perhaps the most relevant principle for maintaining weight is this: minimize your mental effort.

The fundamental elements of sustainable weight management also remain the same: hydration, nutrition, exercise, and, most importantly, a plan. In fact, the presence or absence of a plan may be another key difference between losing and maintaining weight. Most people create a plan to lose weight, but how many actually plan to maintain it? Reflecting on my own experience, I did not make a follow-up plan after losing weight. I wish I had.

No plan can achieve its goal if it does not endure or adjust as circumstances change. Since we have already established a daily routine to lose weight, our good habits should work to our advantage. Why not create a plan to sustain weight?

4. A weight maintenance plan with periodic refeeds

Here, I am proposing an idea of how to maintain weight. Why not continue our plan of losing weight as if we have not reached a goal, but with a slight tweak to the plan to make it easier to deal with hormonal signals?

Through our self-discovery journey of sustainable weight management, we have gained valuable knowledge about how our body responds to food intake and energy expenditure. Specifically, we understand the intricate balance between carbohydrate intake and energy levels, as well as the resulting weight changes. This knowledge is precious and can only be attained by paying close attention to the principles of why and how body weight fluctuates and applying them daily.

The key to maintaining weight loss is managing glycogen levels so they remain low most of the time but not always. Keeping glycogen levels low minimizes the promotion of lipogenesis, meaning the body does not gain weight by storing fat. However, consistently low glycogen levels also trigger hormonal signals that increase appetite (review Appendices C and D if this does not make sense to you). The question is, how do we achieve this balance?

There are three known ways to break the daily calorie deficit: cheat days, diet breaks, and refeeds. While they all involve temporarily increasing calorie intake, they differ in their purposes and effects.

Cheat Days

- Purpose: Psychological relief from dieting, allowing unrestricted eating.
- Duration: Usually 1 day
- Macronutrient focus: No restrictions, eat whatever you want.
- Uncontrolled Intake: Often leads to overeating, sometimes far beyond maintenance calories.

Diet Breaks

- Purpose: To give the body a longer recovery period from dieting.
- Duration: Several days to weeks.
- Macronutrient focus: Balanced intake of carbs, proteins, and fats.
- Controlled Intake: Calories are increased to maintenance or slightly above.

Refeeds:

- Purpose: To restore glycogen levels, boost metabolism, and regulate hormones (like leptin).
- Duration: Typically 1-2 days.
- Macronutrient focus: Primarily carbohydrates.
- Controlled intake: Calories are increased strategically to maintenance levels, avoiding excessive overeating.

Cheat days are often employed by those who need a mental break from dieting. The consequence is that it can slow progress if done too frequently. Diet breaks are used for those who have been dieting for a long time and need a

metabolic reset. The consequence is that, because of its long period of diet breaks, it can result in weight gain and make it difficult to go back to the weight loss regimen again. Refeeds combine the short duration of cheat days and controlled calorie intake of diet breaks. Refeeds are ideal for short-term metabolic boost without excessive fat gain. For this reason, periodically applying refeeds can be a good tool for maintaining weight.

5. Example of a weight maintenance plan with weekly refeeds

Here is a plan that I am currently using to maintain my weight.

Monday – Friday (regular diet and exercise)

- Diet: Low-carb, high-protein, low-fat intake to keep glycogen levels below maximum.
- Exercise: Alternating cardio and strength training ensures balanced muscle maintenance and endurance.
- Caloric balance: Intake matches expenditure, preventing fat gain while maintaining muscle.

Saturday (Refeed + activity)

- Diet: High-carb intake (70-80% of total calories) to replenish glycogen stores.
- Exercise: optional intense strength training, cardio, or long hike, benefits from higher glycogen availability, improving performance and recovery.
- Caloric intake: Slightly above maintenance (~5-10% increase) to maximize glycogen replenishment.

Sunday (Refeed + rest / activity)

- Diet: Continued high-carb intake to fully restore glycogen.
- Exercise: Rest day allows muscle recovery and hormonal balance.
- Caloric intake: At maintenance or slightly above to support recovery.

Fine-tuning based on observations

- If strength training days feel sluggish, increase carbs slightly on refeed days.
- If cardio performance suffers, tweak electrolytes and hydration.
- If weight fluctuates excessively, adjust calorie intake slightly up/down as needed.

6. Conclusion

In this appendix, I proposed an approach to maintain weight by continuing the habits that led to weight loss but with strategic adjustments. This allows for consistency while addressing the biological challenges of long-term weight management, particularly hormonal fluctuations that drive appetite and energy storage. By incorporating periodic refeeds, we give ourselves short, controlled periods of increased calorie intake, helping to regulate hunger hormones, sustain metabolic function, and prevent feelings of deprivation. Instead of following an entirely different strategy after reaching our goal weight, this method keeps our routine familiar, reducing the mental and emotional strain of transitioning from weight loss to maintenance. I am currently using this approach to maintain my own weight, and I plan to update new findings and results in the case study, Appendix B.

Reference

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Appendix I: Setpoints and settling points

1. Introduction

Figure I-1 illustrates weight management from a control system perspective. In this view, you are the controller of your body, adjusting diet and exercise to bring and keep your weight at a desired point. The difficulty of losing weight and keeping it off is often explained by a pseudoscience called setpoint theory [1]. This theory hypothesizes a predetermined homeostatic weight range in individuals, in which physiological mechanisms resist deviations from such a setpoint. Figure I-2 illustrates a systems view that includes the hypothetical biological control mechanism counteracting manual weight management efforts.

There is no scientific evidence supporting the claim of hypothetical setpoint weights. However, the presumed existence of preprogrammed weight values has served as an underlying assumption, leading some scientists to believe that obesity is a disease caused by genetics. While genetic predispositions cannot be ignored, fixating solely on genetics as the primary causal factor in the highly complex and heterogeneous system of body weight is not scientifically prudent. Furthermore, viewing obesity as a disease skews perspectives on body weight, treating it as a medical problem seemingly beyond an individual's control. This prevalent assumption, lacking scientific proof, often leads to a misguided approach to weight management.

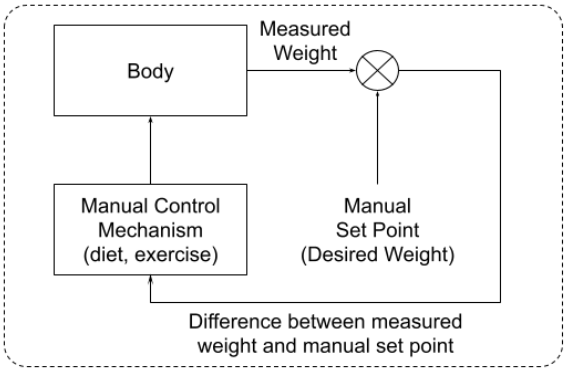

Figure I-1. A control system view of typical weight management effort

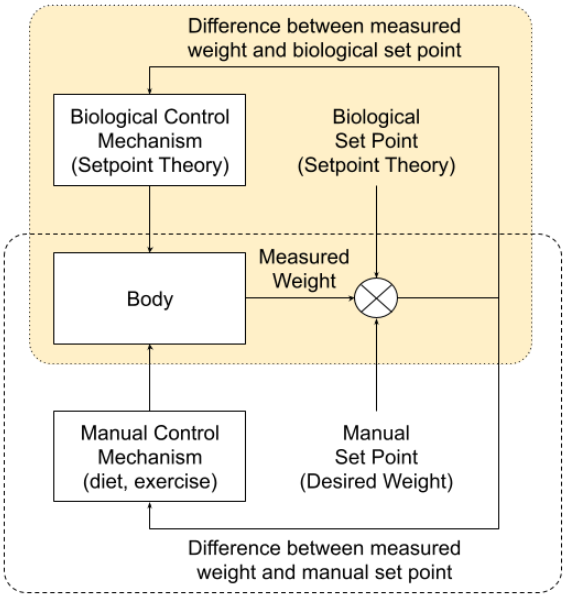

Figure I-2. A control system view of the setpoint theory that hypothesizes a biological control mechanism that counteracts manual weight management effort. Since the hypothesized mechanism is implicit and part of the body, the existence or non-existence of such a hypothesized mechanism is irrelevant to manual control mechanism.

2. Settling points

A more credible explanation for how the body resists weight changes than the set-point theory is the concept of settling points [2]. Figure I-3 illustrates the observed settling points in my weight data. Based on this observation, the challenge of keeping weight off can be framed as the problem of achieving and sustaining a settling point.

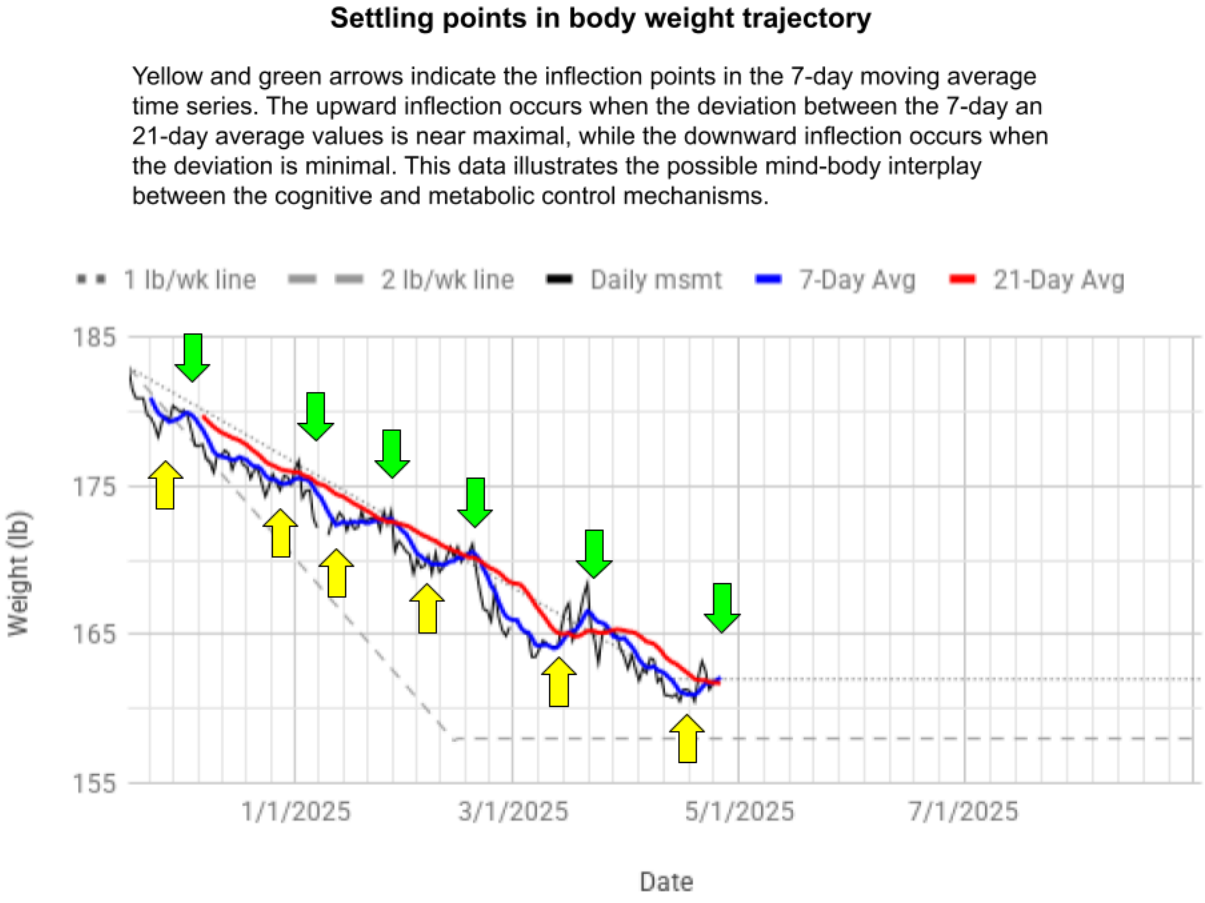

Figure I-3. Settling points from observation data

The observation of repeated cycles of settling points may imply possible settling points that the body can establish after a long-term accumulation of small metabolic adaptations in energy expenditure and fat oxidation. This idea could potentially be applied to establishing a robust settling point of body weight that is more resilient to metabolic influences and with minimal psychological stress. However, it also implies continuous effort to avoid gradual shifts in increased food intake and/or decreased energy expenditure. If age is taken as a single factor of reduced energy expenditure, then naturally, food intake must be adjusted accordingly. Calorie-dense food has negative impacts on the aging population.

3. Breaking through plateaus means establishing a new settling point

When losing weight, the body naturally reacts by slowing metabolism and increasing hunger. It takes time for the body to adjust and stabilize hormonal and metabolic adaptations, but eventually it settles. As illustrated in Fig. I-3, breaking through weight-loss plateaus consistently required at least a few weeks. Overcoming these stalls is a matter of patience and a sustainable approach by prioritizing long-term habits over quick fixes.

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Appendix J: Metabolic and neural adaptations

(under construction)

Appendix K: Social events, travels, and illnesses: managing unavoidable disruptions

(under construction)

Appendix L: Technologies for sustainable weight management

(under construction)

Author biography

Although weight management, diet, and exercise are not his areas of expertise, Satoru is applying his knowledge and experience in science and engineering to uncover the fundamentals of body weight management. He has been applying his discovery to his own lifestyle and this document reflects his thinking and processes.

Satoru Isaka has spent over three decades solving real-world problems in the automation industry. His primary research interest is machine autonomy, exploring the principles and mechanisms of why and how machines could learn skills independently without human oversight. Granting autonomy to machines is a choice by humans, yet its implications are far more profound than most realize. For this reason, unlike AI and cognitive science, his research does NOT aim to understand human cognition or replicate human capabilities. Instead, it is dedicated to uncovering the systems and processes that enable autonomy from the machine's own perspective. See his recent publications on this topic below.

Satoru received his B.S., M.S., and Ph.D. degrees in systems science from the University of California, San Diego, in 1984, 1986, and 1989, respectively. His original research focused on adaptive control systems and artificial intelligence. From 1990 to 1998, he was a research scientist at OMRON in factory and healthcare automation. From 1998 to 2004, he served as Chief Technology Officer and Chief Scientist in the fields of service automation, natural language processing, speech automation, and data analysis automation at venture startups in the San Francisco Bay Area. In 2004, he founded Vision Del Mar, LLC where he continues his research.

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