

## The Metabolic Equation - Chapter 24

### Chapter 24: The Metabolic Quarter and Beyond

#### Playing the Long Game

Let me tell you what the data shows when people actually follow this protocol long-term.

The published literature on metabolic intervention low-carb, time-restricted eating, seed oil elimination, resistance training shows a remarkably consistent pattern in people who start in the typical American metabolic profile: 44-inch waist, fasting insulin in the 20s, triglycerides north of 300, hemoglobin A1C in the prediabetic range, multiple medications, and a general sense that their body is falling apart and there's nothing to do about it except take pills.

The first 30 days are the hardest. White-knuckling through week one, complaining through week two, starting to feel different in week three, and by week four, the brain fog begins to lift.

Study after study shows this same trajectory.

At 90 days, the numbers move dramatically. Published intervention data consistently shows fasting insulin dropping from the 20s to single digits. Triglycerides falling by 50-70%. hemoglobin A1C moving from prediabetic back to normal range. Weight loss of 10-20 pounds, predominantly from visceral fat. Many participants are able to reduce or eliminate metformin under medical supervision because their numbers no longer justify it.

At one to two years, the compounding effects become truly striking. Fasting insulin in the optimal 5-7 range. Waist circumference down 6-8 inches. NMR LipoProfile showing dramatic shifts from small dense to large buoyant LDL. Blood pressure medication doses cut in half or eliminated.

Here's the critical pattern in this data: the magic doesn't happen in 30 days. The 30-day reset was the ignition. The real transformation happened over quarters and years. The first 30 days removed the metabolic insults. The next 60 days allowed the body to begin repairing. The following year allowed the deep structural changes mitochondrial biogenesis, improved insulin receptor sensitivity, increased lean mass, reduced visceral fat, restored metabolic flexibility to compound.

This chapter is about the long game. Because this isn't a 30-day diet. It's not a 90-day challenge. It's a life architecture. And the tools you need for year two are different from the tools you need for week two.

#### The 90-Day Lab Recheck: The Moment of Truth

At the 90-day mark, you should rerun your metabolic labs. This is not optional. This is where the rubber meets the road ? where subjective improvements ("I feel better") become objective confirmation ("your numbers prove it").

Run all Tier 1 and Tier 2 markers from Appendix A: fasting insulin, fasting glucose, hemoglobin A1C, HOMA-IR, triglycerides, HDL, triglyceride-to-HDL ratio, hs-CRP, and Vitamin D. Optimal targets for every marker are listed in Appendix A.

Why 90 days specifically? Hemoglobin A1C reflects your average blood glucose over a full red blood cell lifecycle ? it takes approximately 90 days to see the change. Triglycerides respond faster (often within 30 days), but the full panel at 90 days gives you the complete picture. If you started above a fasting insulin of 12, even a drop to 8-10 is significant progress. And if you began supplementing Vitamin D3, 90 days is enough to see the response and calibrate your dose.

What to expect:

If you've been consistent with the lifestyle changes protein-forward eating, seed oil elimination, time-restricted eating, resistance training, sleep optimization the typical 90-day results in published intervention studies look like this:

- Fasting insulin: drops 30-60% from baseline
- Triglycerides: drops 30-50%
- hemoglobin A1C: drops 0.2-0.5 percentage points
- Waist circumference: decreases 2-4 inches
- Body weight: decreases 10-20 pounds (though this varies enormously based on starting point, muscle gain, and individual factors)
- Energy, sleep quality, mental clarity: substantially improved (hard to quantify, easy to feel)

If your numbers haven't moved at 90 days, don't panic, but do troubleshoot. More on that in the next section.

How to order these labs:

If your doctor is cooperative, simply request them. Print out the lab reference guide in Appendix A and bring it to the appointment. Many physicians will order fasting insulin and advanced lipids if you ask the ones who won't are getting fewer by the year as more doctors wake up to the metabolic health paradigm.

If your doctor pushes back or if you want to avoid the insurance dance, direct-to-consumer lab services like Ultra Lab Tests, Life Extension, or Walk-In Lab allow you to order blood work yourself, walk into a local lab (typically Quest or LabCorp), and get results directly. It's often cheaper than insurance copays, and it removes the gatekeeper.

For the Omega-3 Index, OmegaQuant.com offers a direct-to-consumer finger-prick test for approximately \$50. I recommend testing at 90 days and then annually. As William Harris documented in his research on the Omega-3 Index (Preventive Medicine, 2009), this marker takes approximately three to four months of consistent supplementation to shift meaningfully, because it reflects red blood cell membrane composition and RBC turnover takes about 120 days. A single month of fish oil won't move the needle. Three to four months will.

Troubleshooting Plateaus at 60-90 Days

Around the two- to three-month mark, many people hit what feels like a wall. The initial rapid improvements slow. The scale stops moving. The excitement of the early results fades into the reality that this is, in fact, a long-term project and not a quick fix.

Welcome to the plateau. Everyone hits it. Here's how to diagnose and break through it.

Scenario 1: Weight loss has stalled, but labs are still improving.

This is the most common scenario, and it's usually not a problem at all. What's happening is body recomposition you're gaining muscle (from resistance training) while losing fat. Muscle is denser than fat. You may weigh the same but be leaner, smaller, and healthier. Check your waist circumference. Check how your clothes fit. If the waist is still shrinking and the pants are looser, the scale is lying to you. Ignore it.

This is why I told you in Chapter 22 that body composition (DEXA scan, InBody, or even the mirror) is a better metric than body weight. The scale measures your gravitational relationship with the earth. It says nothing about your metabolic health.

Scenario 2: Everything has stalled weight, labs, energy.

Here's the troubleshooting checklist, in order of likelihood:

1. Sleep. Are you actually getting 7-9 hours of quality sleep? Not time in bed actual sleep. If your Oura ring or Apple Watch says your deep sleep is under 60 minutes, or your total sleep is consistently under 7 hours, this is your bottleneck. As Walker has documented, sleep deprivation impairs insulin sensitivity by up to 30% per night. You cannot out-diet or out-train poor sleep. Fix sleep first. Everything else follows.

2. Hidden calories. You'd be amazed how many calories hide in things that feel healthy. The olive oil you're "drizzling" on your salad is actually 400 calories of pouring. The nuts you're snacking on "just a handful" are 600 calories by 3 PM. The protein smoothie with almond butter and coconut cream is a 900-calorie meal. I'm not asking you to count calories forever that's not sustainable and not the point. But if you're stalled, track your food meticulously for five days. Not to restrict. To see. The data usually reveals the gap.

3. Stress and cortisol. Chronic stress keeps cortisol elevated, which directly promotes visceral fat storage, increases appetite for hyperpalatable food, impairs glucose disposal, and disrupts sleep. If your life stress hasn't been addressed if you're working 60-hour weeks, fighting with your spouse, doom-scrolling before bed, and running on adrenaline your body is in survival mode. Survival mode is not compatible with metabolic optimization. The physiological sigh (double inhale through the nose, extended exhale through the mouth, documented by Balban and colleagues in Cell Reports Medicine, 2023) is the fastest known real-time cortisol reduction technique. But the bigger fixes are structural: boundaries at work, honest conversations at home, therapy if needed, and a serious audit of what's actually driving your stress.

4. Overtraining. Yes, this is a thing. More is not always better. If you're training six or seven days a week, doing HIIT three times a week, barely sleeping, and wondering why your body won't cooperate, the answer is that your body thinks it's under attack and is hoarding energy. Pull back to three resistance sessions and two Zone 2 sessions. Take two full rest days. Watch what happens.

5. Calories too low for too long. If you've been in a significant caloric deficit for 60-90 days, your metabolism has adapted. Basal metabolic rate decreases. Thyroid output downregulates. NEAT (non-exercise activity thermogenesis the fidgeting, standing, walking you do unconsciously) drops. The solution is a diet break: one to two weeks eating at maintenance calories while keeping protein high and continuing to train. This is not failure. It's metabolic strategy. Your body needs a signal that the famine is over.

6. Medical causes. Thyroid dysfunction (subclinical hypothyroidism is common and underdiagnosed), hormonal imbalances (low testosterone in men, perimenopause in women), medications that promote weight gain (certain antidepressants, beta-blockers, corticosteroids), or an undiagnosed condition. If you've addressed the lifestyle factors and nothing is moving, get a comprehensive workup. Optimal TSH is 0.5-2.5 mIU/L, not the standard 0.4-4.5 range.

#### Reintroduction of Gray-Area Foods

After 90 days of clean eating, your body has reset. Your taste buds have changed (food actually tastes like food again). Your insulin sensitivity has improved. Your gut has had time to heal. Now is the time if you want to ? to strategically reintroduce some of the foods you eliminated. I call these "gray-area foods" because they're not universally harmful (like seed oils or refined sugar, which stay out permanently) but they affect different people differently.

The reintroduction protocol:

1. Choose one food at a time. Don't reintroduce dairy, gluten, and alcohol all in the same

week. That tells you nothing.

2. Eat it twice over two days. A moderate portion not a binge.

3. Track how you feel for 72 hours. Energy, digestion, sleep quality, joint pain, skin, brain fog, mood. Many food sensitivities have a delayed reaction of 24-72 hours.

4. If you feel fine: that food is in. Add it back to your rotation in moderation.

5. If you feel worse: that food is out. Or at least, out for now. You can retest in another 90 days.

Common gray-area foods to test:

- Dairy (full-fat, quality sources): butter and ghee are usually fine for most people. Cheese and cream: test individually. Milk: many adults don't tolerate well. Yogurt and kefir (fermented): often better tolerated than straight dairy.

- Gluten-containing grains (sourdough bread, pasta): some people tolerate these well, especially sourdough, which has been partially pre-digested by fermentation. Others notice immediate bloating, brain fog, or joint pain. The only way to know is to test.

- White rice: actually one of the better-tolerated starches for most people. Low in anti-nutrients, easy to digest, and a useful carbohydrate source for active individuals. As a post-workout carb, white rice is hard to beat.

- Legumes (beans, lentils): well-tolerated by most people when properly prepared (soaked, rinsed, cooked thoroughly). Good source of fiber and resistant starch.

- Alcohol: I'll be direct. Alcohol is not metabolically beneficial. There is no dose at which it improves your health. The "a glass of red wine is good for you" narrative has been thoroughly debunked by more rigorous epidemiological analyses. That said, social drinking in moderation is a reality for most adults, and I'd rather give you a harm-reduction framework than a prohibition you'll ignore. If you drink: dry red wine or clear spirits with soda water are the lowest-impact options. One drink, not three. Not with dinner if possible earlier in the evening gives your body more time to process it. And as Ebrahim and colleagues (Alcoholism: Clinical and Experimental Research, 2013) documented, stop at least three to four hours before bed. Alcohol is a sedative, not a sleep aid it fragments sleep architecture, suppresses REM, and activates the sympathetic nervous system in the second half of the night.

- Sweeteners (stevia, monk fruit, allulose): these have better metabolic profiles than sugar or artificial sweeteners. Stevia and monk fruit don't raise blood glucose or insulin. Allulose may actually improve glucose metabolism in some studies. If you need sweetness, these are the options. But notice whether they trigger cravings for more sweet food for some people, the taste of sweetness, regardless of the source, keeps the sweet-seeking behavior alive.

Foods that stay out permanently:

- Seed oils (soybean, corn, canola, sunflower, safflower, cottonseed, grapeseed). Always. Forever. There is no reintroduction protocol for these. The Ramsden data (BMJ, 2013) showing a 600-680 day half-life of linoleic acid in adipose tissue means you're still clearing the damage from your pre-reset diet. Don't add more.

- Refined sugar and high-fructose corn syrup. The Lustig research (Nature, 2012) on fructose metabolism and hepatic de novo lipogenesis is clear. These are not food. They are metabolic disruptors.

- Ultra-processed foods (NOVA Class 4). The Hall study (Cell Metabolism, 2019) showing 500 extra calories per day consumed on ultra-processed diets tells you everything you need to know. These products are engineered to override your satiety signals. You cannot moderate something

designed to make moderation impossible.

### The Annual Metabolic Physical

The annual metabolic physical is like an oil change for your body. Skip it, and eventually something expensive breaks.

I'm not talking about the standard annual physical where your doctor listens to your heart for twelve seconds, glances at a basic metabolic panel, and says "everything looks normal." I'm talking about a comprehensive metabolic assessment that actually tells you where you stand.

The annual metabolic physical should include:

1. Full metabolic blood panel: all Tier 1, Tier 2, and Tier 3 markers from Appendix A, plus a thyroid panel if symptoms warrant or if you have never had one.
2. Body composition: DEXA scan (ideal) or InBody measurement. This gives you lean mass, fat mass, visceral fat, and bone density. It is the report card that the bathroom scale wishes it could be.
3. Blood pressure and resting heart rate: trends over time, not isolated readings.
4. Waist circumference: measured at the navel, standing, after exhale. Track this number year to year. As Janssen and colleagues (CMAJ, 2004) demonstrated, waist circumference is a better predictor of cardiometabolic risk than BMI.
5. Functional fitness assessment: Can you get off the floor without using your hands? Can you carry two bags of groceries up a flight of stairs without stopping? Can you hang from a bar for 30 seconds? These are Attia's Centenarian Decathlon markers ? practical physical capacities that predict functional independence as you age.

Compare your results to your baseline and to last year. This is the trend that matters. Not where you are relative to population averages (remember, 88% of the population is metabolically broken). Where you are relative to you last quarter, last year, five years ago. The trajectory is the message.

### Seasonal Adjustments

Your body doesn't exist in a laboratory. It exists in a world with seasons, and those seasons affect your metabolism.

Winter (shorter days, less sunlight, colder temperatures):

- Vitamin D: Increase supplementation. If you're north of the 37th parallel (roughly a line from San Francisco to Richmond, Virginia), you cannot synthesize adequate Vitamin D from sunlight between October and March. The angle of the sun is too low. As Forrest and Stuhldreher (Nutrition Research, 2011) documented, 42% of U.S. adults are Vitamin D deficient, and the rate is higher in winter and at higher latitudes. Test your levels in late winter and dose accordingly to maintain 40-60 ng/mL.
- Light exposure: Use a 10,000 lux light box for 15-20 minutes each morning during the dark months. Place it at arm's length, slightly above eye level, during breakfast. This is not a replacement for outdoor light, but it's a meaningful supplement when the sun rises at 7:30 AM and you need to be at work by 8.
- Training: Move workouts indoors as needed. A home gym (even minimal: a set of adjustable dumbbells and a pull-up bar) pays for itself in consistency during the months when driving to the gym in the dark and cold becomes the excuse to skip.
- Carbohydrate intake: Some people naturally crave slightly more carbohydrates in winter. If you're metabolically healthy and active, a modest increase in starchy vegetables (sweet potatoes, squash, root vegetables) during cold months is physiologically reasonable. Your body

is burning more calories for thermoregulation.

Summer (longer days, more sunlight, heat):

- Hydration: Increases substantially. Add 16-32 oz of water per day beyond your baseline, more if training outdoors. Electrolyte intake becomes even more critical sodium, potassium, and magnesium losses in sweat are significant.

- Natural light: Take advantage. Get outside early and often. This is the easiest time of year to nail your circadian rhythm.

- Meal timing: Longer daylight hours naturally support a slightly wider eating window. Don't fight it. An 8 AM to 7 PM window in summer versus 9 AM to 6 PM in winter is a reasonable seasonal adjustment.

- Outdoor training: Move workouts outside when possible. Zone 2 cardio in nature hiking, cycling, swimming combines cardiovascular training with the cortisol-reducing benefits of nature exposure documented by Hunter and colleagues.

The meta-principle: your body evolved with seasons. Eating, moving, and sleeping in slight seasonal variation is not a failure of consistency it's a feature of human biology. Rigid year-round sameness is the anomaly, not the norm.

Your Metabolic Legacy: How Healing Yourself Heals Your Family

I saved this for last because it's the part that matters most, even though it's the part nobody talks about in nutrition books.

When you change how you eat, you change how your family eats.

When you stock the kitchen with real food, your children learn what real food looks like. When you sit down to a dinner of grilled salmon, roasted vegetables, and a salad dressed with olive oil, your kids learn without a single lecture that this is what dinner is. When they see you training three times a week, they learn that movement is a normal part of adult life. When they see you reading a book before bed instead of scrolling your phone, they learn that screens have an off switch.

The research on childhood metabolic health is alarming. Type 2 diabetes, once called "adult-onset diabetes," is now routinely diagnosed in teenagers. Non-alcoholic fatty liver disease is appearing in children as young as eight. The metabolic patterns that lead to adult disease are being established in childhood, and they are being established by the food environment, movement patterns, and lifestyle habits that parents create.

You are not just optimizing your own insulin sensitivity. You are modeling a metabolic future for the next generation.

And it goes even deeper than modeling. The emerging field of epigenetics the study of how environmental factors modify gene expression without changing DNA sequence suggests that metabolic health is, to some degree, heritable through mechanisms beyond genetics. Bikman discusses this in *Why We Get Sick*: parental metabolic health at the time of conception and during gestation influences the metabolic trajectory of offspring. A mother's insulin resistance during pregnancy increases the child's risk of metabolic disease. A father's metabolic health at conception may influence sperm quality and epigenetic markers passed to the child.

This is not about guilt. Many of us grew up in the metabolic environment we're now trying to escape the one built on seed oils, sugar, and the low-fat dietary guidelines that got everything backward. Our parents didn't know. We didn't know. Nobody told us, and the institutions that should have told us were too busy selling corn syrup.

But now you know. And what you do with that knowledge doesn't just affect you. It affects every person who eats at your table, lives under your roof, and looks to you consciously or not for a model of what a healthy adult life looks like.

This is your metabolic legacy. Not the lab numbers, though those matter. Not the waist measurement, though that matters too. The legacy is the pattern you establish, the rhythm you build, and the future you create not just for yourself, but for the people you love most.

#### The Long View

Let me close with a perspective that I think gets lost in the noise of biohacking and optimization and quarterly lab panels.

The goal of this book is not to make you obsess about your health. It is to give you such a solid metabolic foundation that you can stop thinking about your health and start living your life.

The metabolic day becomes automatic. The weekly rhythm runs itself. The quarterly labs are a quick check-in, not an anxiety spiral. The annual physical is a routine confirmation that the machine is running well.

The metabolic life plan is not a diet you're on. It's a way you live. And the way you live should not require constant effort, constant vigilance, or constant self-denial. It should require a good structure, a sustainable rhythm, and the patience to let compound interest do its work.

Here's the math. If you improve your metabolic health by just 1% per week a slightly better meal here, an extra walk there, one more hour of sleep that compounds to a 67% improvement over a year. And it keeps compounding. Year after year. Decade after decade.

That's not a 30-day transformation. That's a life. A longer one, a healthier one, a more independent one, and if you play it right a more joyful one.

Somewhere right now, a 56-year-old who followed this protocol is coaching Little League again. His grandson doesn't know what fasting insulin is. But he knows that Grandpa shows up every Saturday, that Grandpa can throw batting practice for an hour without sitting down, and that Grandpa brings a cooler to the game with hard-boiled eggs, beef jerky, and cut vegetables instead of Gatorade and Goldfish crackers.

The boy doesn't know he's learning metabolic health. But he is.

That's the legacy. That's the long game. And the data says you can play it too. I've spent my career working numbers, and the most important thing numbers have ever told me is this: your metabolic trajectory is not fixed. It is a variable you can change. Starting now.

This concludes Part VI: The Life Plan. What follows is two chapters on substances that affects more metabolic systems than almost any other intervention we have discussed, and then the Back Matter ? the reference appendices that will serve you for years to come.