

## The Metabolic Equation - Chapter 22

### Chapter 22: Know Your Numbers

#### The Labs, Metrics, and Milestones That Prove You're Healing

I am going to tell you something that will sound controversial, but every physician who treats metabolic disease already knows it: the standard annual physical is almost useless for detecting the condition that will most likely kill you.

Your doctor checks your fasting glucose. Normal. Your doctor checks your total cholesterol. A little high, but "nothing to worry about." Your doctor checks your blood pressure. Fine. Your doctor says, "Everything looks good! See you next year." You walk out feeling reassured. Meanwhile, your fasting insulin the single most important metabolic marker, the earliest warning signal, the canary in the coal mine was never tested. It is not part of the standard panel. It is not in the annual wellness check. It is not covered by most "routine" blood work. And by the time your fasting glucose and hemoglobin A1C finally trip the alarm into "prediabetes" territory, you have been insulin resistant for 10 to 15 years, and significant metabolic damage has already accumulated.

This is not negligence on your doctor's part. It is a systemic failure. The standard of care simply has not caught up to the science. Dr. Joseph Kraft, who performed over 14,000 oral glucose tolerance tests with simultaneous insulin measurements, demonstrated decades ago that insulin rises long before glucose becomes abnormal. Ben Bikman has built his entire research career on this foundation. Dr. Peter Attia calls fasting insulin "arguably the most important blood test that most people never get." And yet here we are.

This chapter exists to fix that. By the end of these pages, you will know exactly which labs to order, what the numbers mean (the real optimal ranges, not the absurdly wide "normal" ranges printed on your lab report), how to talk to your doctor about getting them, and how to track your progress over time so you have objective, undeniable proof that what you are doing is working.

Numbers do not lie. And when you see your numbers change, the motivation to continue becomes self-sustaining.

#### The Metabolic Blood Panel: What to Test and Why

I am going to organize these markers into tiers. Tier 1 is the core panel that every single reader of this book should get tested. Tier 2 is the advanced panel for deeper insight. Tier 3 is for specific situations and annual monitoring.

##### Tier 1: The Core Metabolic Markers

These are the tests that, taken together, give you a comprehensive picture of your metabolic health. Get these at baseline (before or during Week 1 of the 30-Day Reset), again at 90 days, and every 3-6 months thereafter.

##### 1. Fasting Insulin THE Most Important Test

This is number one for a reason. If you get only one test from this entire chapter, make it this one.

Fasting insulin tells you how hard your pancreas is working to keep your blood sugar in the normal range. A "normal" fasting glucose of 92 milligrams per deciliter looks perfectly healthy on paper. But if your fasting insulin is 18 micro-international units per milliliter to achieve that glucose level, your pancreas is screaming. It is pouring out insulin at three times the optimal rate just to maintain the appearance of normality. That is like a duck gliding calmly

across a pond while paddling frantically underneath ? serene on the surface, exhausting underneath, and unsustainable.

Ben Bikman's framework is clear: hyperinsulinemia is the earliest detectable sign of metabolic disease. It precedes glucose abnormalities by years to decades. By the time glucose rises into the prediabetic range, you have been insulin resistant for a very long time.

- Standard lab "normal" range: 2-25 micro-international units per milliliter (this range is almost criminally wide it includes values that represent frank insulin resistance)

- Optimal: 2-6 micro-international units per milliliter

- Concerning: Greater than 8 micro-international units per milliliter

- Alarming: Greater than 12 micro-international units per milliliter

A fasting insulin of 15 with a "normal" fasting glucose is not fine. It is insulin resistance that has not yet broken through to hyperglycemia. And every year it goes undetected is a year of damage to your blood vessels, your liver, your brain, and your pancreatic beta cells.

The catch: Most standard physicals do NOT include fasting insulin. You must specifically request it. This is arguably the single biggest gap in preventive medicine today. More on how to request it later in this chapter.

## 2. Fasting Glucose

The standard metabolic marker that everyone already gets. Useful, but incomplete without fasting insulin.

- Standard "normal": Less than 100 milligrams per deciliter

- Optimal: 72-85 milligrams per deciliter

- Prediabetic: 100-125 milligrams per deciliter

- Diabetic: Greater than 126 milligrams per deciliter

Context matters enormously here. A fasting glucose of 95 looks "normal" on the standard report. But paired with a fasting insulin of 15, that 95 reveals profound insulin resistance your pancreas is working overtime to hold glucose at that level. Without the insulin measurement, you would have walked out of the lab thinking everything was fine. This is why you request both tests.

## 3. HOMA-IR score (Calculated)

This is not a separate blood draw it is calculated from your fasting insulin and fasting glucose using a simple formula:

$$\text{HOMA-IR score} = (\text{Fasting Insulin} \times \text{Fasting Glucose}) / 405$$

This index provides a more robust estimate of insulin resistance than either marker alone.

- Optimal: Less than 1.0

- Normal: Less than 1.5

- Early insulin resistance: 1.5-2.5

- Significant insulin resistance: Greater than 2.5

Example: Fasting insulin of 5 and fasting glucose of 82 gives a HOMA-IR score of 1.01 excellent. Fasting insulin of 14 and fasting glucose of 96 gives a HOMA-IR score of 3.32 significant insulin resistance, despite both individual values falling within the standard "normal" range.

Your doctor may not automatically calculate this for you. No matter you can do it yourself with the formula above, a calculator, and 10 seconds. Or just type "HOMA-IR score calculator" into your phone. The internet will do the math for you. We live in amazing times.

## 4. Hemoglobin A1c (hemoglobin A1C)

hemoglobin A1C reflects your average blood glucose over the preceding 90 days. It measures the percentage of hemoglobin (the protein in red blood cells that carries oxygen) that has been glycated essentially sugar-coated. Higher average blood glucose means more glycated hemoglobin.

- Standard "normal": Less than 5.7%

- Optimal: 4.8-5.2%

- Prediabetic: 5.7-6.4%

- Diabetic: Greater than 6.5%

An hemoglobin A1C of 5.5% is "normal" by standard criteria but already edging toward metabolic dysfunction. Optimal is below 5.2%.

Important caveats: hemoglobin A1C can be falsely low in conditions that increase red blood cell turnover (iron deficiency, hemolytic conditions, significant blood loss). It can be falsely high with low iron or vitamin B12 deficiency. This is another reason to interpret hemoglobin A1C in context with fasting insulin and glucose, not in isolation.

## 5. Triglycerides

Triglycerides are fat molecules circulating in your bloodstream. Elevated triglycerides are a direct reflection of de novo lipogenesis your liver converting excess carbohydrates (particularly fructose) into fat. This is one of the most responsive markers to dietary change and one of the most gratifying to track, because the improvements can be dramatic and fast.

- Optimal: Less than 100 milligrams per deciliter (ideally less than 80)

- Concerning: Greater than 150 milligrams per deciliter

Individuals who eliminate refined sugar and processed carbohydrates routinely see triglycerides drop 30-50%. Some individuals go from 280 to 110 in six weeks. When your liver stops being flooded with fructose and excess glucose, it stops manufacturing triglycerides. It really is that straightforward.

## 6. The Triglyceride-to-HDL Ratio

This is Ben Bikman's favorite cardiovascular risk marker, and I have come to share his enthusiasm. It is the single best lipid-based predictor of both cardiovascular risk and insulin resistance, as demonstrated in research by Dr. Pedro da Luz published in Clinics in 2008 and by Dr. J. Michael Gaziano published in Circulation in 1997.

Calculate it yourself: divide your triglycerides by your HDL cholesterol.

- Optimal: Less than 1.0

- Acceptable: Less than 2.0

- Concerning: Greater than 2.0

- High risk: Greater than 3.5

This ratio predicts small, dense LDL particle pattern better than your LDL cholesterol number alone. A TG: HDL ratio of 1.0 or below strongly suggests a Pattern A (large, buoyant) LDL profile the kind that is largely benign. A ratio above 3.5 strongly suggests Pattern B (small, dense) LDL the atherogenic type driven by insulin resistance.

The best part? This ratio responds beautifully to the interventions in this book. Eliminating seed oils and sugar drops triglycerides. Eating adequate fat (especially omega-3s) raises HDL.

The ratio improves from both directions simultaneously.

Almost nobody's doctor routinely calculates or discusses this ratio. Now you can calculate it yourself, and you will understand your cardiovascular risk better than most standard lipid panels communicate.

## 7. HDL Cholesterol

HDL (high-density lipoprotein) is the "good cholesterol" and for once, the conventional wisdom is actually right. Higher HDL is genuinely associated with lower cardiovascular risk. HDL particles function as reverse cholesterol transporters, carrying cholesterol away from arterial walls and back to the liver for disposal.

- Optimal: Greater than 60 milligrams per deciliter (men), Greater than 70 milligrams per deciliter (women)

- Concerning: Less than 40 milligrams per deciliter (men), Less than 50 milligrams per deciliter (women)

What raises HDL? Exercise. Dietary fat (especially saturated and monounsaturated fat). Omega-3 fatty acids. Weight loss. Moderate alcohol consumption (though the metabolic costs of alcohol generally outweigh this single benefit). What lowers HDL? A low-fat diet. Seed oils. Smoking. Sedentary lifestyle. Trans fats.

It is a beautiful irony that the dietary advice given for decades eat low-fat, use vegetable oils, avoid saturated fat is precisely the prescription for lowering HDL.

Tier 2: Advanced Lipid and Inflammatory Markers

Test these at baseline and every 6-12 months. Complete optimal ranges for every marker below are listed in Appendix A.

#### 8. ApoB (Apolipoprotein B)

If you want one single number that captures your atherogenic particle burden, ApoB is it. Every atherogenic lipoprotein particle (LDL, VLDL, IDL, Lp(a)) carries exactly one ApoB molecule, so the ApoB count is literally a count of all the particles that can contribute to atherosclerosis. Dr. Allan Sniderman's 2019 review in JAMA Cardiology makes the case that ApoB is the single best lipid marker for cardiovascular risk, period. If your ApoB is low, your cardiovascular risk from lipids is low, regardless of what your LDL-C number says.

#### 9. Advanced Lipid Panel (NMR LipoProfile or Ion Mobility)

Standard LDL-C is a deeply flawed metric. It tells you the total cholesterol mass carried by LDL particles but nothing about the number or size of those particles which is what actually determines atherogenic risk. An NMR LipoProfile breaks down LDL particle number, small dense LDL subtypes, and Lp(a). As Dr. William Cromwell's 2007 study demonstrated, LDL particle number is a better predictor of cardiovascular events than LDL-C. Two people with identical LDL-C of 130 can have vastly different risk profiles. Standard testing cannot distinguish between them. Also test Lp(a) once. It is genetically determined and does not change much with lifestyle. If elevated, it significantly changes your risk calculation and warrants cardiology follow-up.

#### 10. hs-CRP (High-Sensitivity C-Reactive Protein)

A general marker of systemic inflammation. Test when healthy, not during acute illness or after intense exercise. A persistently elevated hs-CRP suggests chronic low-grade inflammation the smoldering fire that drives atherosclerosis, insulin resistance, and neurodegeneration. The interventions in this book should lower it over time.

Tier 3: Micronutrient, Hormonal, and Organ-Specific Markers

Test at baseline and annually, or as specific symptoms warrant. Complete optimal ranges for all Tier 3 markers are in Appendix A.

#### 11. Liver Enzymes (ALT, AST, GGT)

Your liver is ground zero for metabolic disease. NAFLD affects 25-30% of American adults and is driven by hyperinsulinemia and excess fructose consumption. GGT is a particularly sensitive early marker of liver stress that is massively underutilized. Elevated liver enzymes in the

absence of alcohol abuse or viral hepatitis signal metabolic liver disease and typically improve significantly with dietary changes.

#### 12. Uric Acid

More than just a gout marker, uric acid is a byproduct of fructose metabolism and an independent driver of hypertension, kidney disease, and insulin resistance (Johnson et al., 2007). When you eliminate added sugars and refined fructose, uric acid often drops meaningfully within weeks.

#### 13. 25-Hydroxy Vitamin D

Technically a hormone, not a vitamin, involved in immune function, bone health, insulin sensitivity, and mood. Approximately 42% of American adults are deficient (Forrest, 2011). Test your level, supplement D3 accordingly, and retest in 3 months to calibrate your dose.

#### 14. Omega-3 Index

Measures EPA plus DHA as a percentage of red blood cell membrane fatty acids. The average American is at 4-5%, severely insufficient. It takes 3-4 months of consistent supplementation to shift the index meaningfully. You can order this directly through OmegaQuant (finger-prick, mail-in, approximately \$50) or through your physician.

#### 15. Complete Thyroid Panel

If you have symptoms of thyroid dysfunction, request a full thyroid panel not just TSH. The standard TSH range of 0.4-4.5 is so broad it hides a massive amount of dysfunction. Subclinical hypothyroidism is remarkably common, especially in women, and directly impairs metabolic rate, energy, and body composition.

#### Beyond Blood Work: The Metrics You Can Measure at Home

Not everything that matters shows up on a lab report. These measurements provide crucial metabolic information without a blood draw.

#### Waist Circumference

Your waist circumference is a better predictor of cardiometabolic risk than BMI, as demonstrated by Dr. Ian Janssen's 2004 research in the Canadian Medical Association Journal. It is a proxy for visceral fat the metabolically dangerous fat that surrounds your organs and drives inflammation.

How to measure: Standing, after exhaling, at the level of your navel. Same time of day each time (morning, before eating is most consistent). Use a flexible tape measure. Do not suck in.

- Metabolic syndrome threshold: Greater than 40 inches (men), Greater than 35 inches (women)

- Better target: Waist-to-height ratio below 0.5 (your waist in inches should be less than half your height in inches)

Track weekly. A reduction of 0.5 to 1 inch per month is excellent progress and represents meaningful visceral fat reduction.

#### Body Composition

The scale measures gravitational pull on your total body mass. It does not distinguish between fat, muscle, water, glycogen, or the dinner still in your digestive tract. It is the least useful metric for metabolic health yet the one most people obsess over.

Body composition the ratio of lean mass to fat mass is what actually matters.

DEXA scan: The gold standard. Measures body fat percentage, lean mass, visceral fat, and bone density. Costs \$50-150. Available at many radiology centers, health clinics, and some gyms. Get one at baseline and every 6-12 months.

Healthy body fat ranges:

- Men: 10-20% (athletic: 8-15%)
- Women: 18-28% (athletic: 15-22%)

InBody or similar bioimpedance devices: Less accurate than DEXA for absolute numbers but useful for tracking trends over time. Available at many gyms and wellness clinics.

What matters more than the absolute number: the direction of change. Gaining lean mass while losing fat mass simultaneously body recomposition may show zero change on the scale while representing profound metabolic improvement.

### Blood Pressure

Hypertension is one of the earliest clinical signs of insulin resistance. Insulin promotes sodium retention by the kidneys and shifts endothelial function from nitric oxide (vasodilation) toward endothelin-1 (vasoconstriction), as Bikman describes in his framework.

- Optimal: Less than 120/80 millimeters of mercury
- Elevated: 120-129 / less than 80
- Hypertension Stage 1: 130-139 / 80-89
- Hypertension Stage 2: 140+ / 90+

Buy a home blood pressure cuff (a good one costs \$30-60). Take readings in the morning before coffee, after sitting quietly for 5 minutes. Average three readings. Track weekly.

Dietary changes particularly sodium optimization with adequate potassium (not sodium restriction, which is counterproductive for many people) and the elimination of processed food frequently normalize blood pressure within 2-4 weeks.

### Heart Rate Variability (HRV)

HRV measures the variation in time between consecutive heartbeats. Higher variability indicates a healthy, adaptable autonomic nervous system with strong parasympathetic (rest-and-digest) tone. Lower variability indicates sympathetic dominance (chronic stress) and reduced adaptability.

If you wear an Oura Ring, Whoop, Apple Watch, or similar device, you already have HRV data. Track the trend, not the daily number. A rising HRV trend over weeks and months indicates improving recovery capacity, reduced chronic stress, and better autonomic balance.

Factors that improve HRV: sleep quality, exercise (especially Zone 2), stress management (breathwork, meditation, cold exposure), omega-3 supplementation, and reduced alcohol intake. Factors that tank HRV: poor sleep, overtraining, chronic stress, alcohol (even one drink), and illness.

### Resting Heart Rate

Measure first thing in the morning, before getting out of bed. A declining resting heart rate trend indicates improving cardiovascular fitness.

- Average: 60-80 bpm
- Good: 50-60 bpm
- Excellent: 40-50 bpm (common in trained athletes)

### How to Talk to Your Doctor: Scripts for Requesting Labs

This is the section I wish I did not have to write. In an ideal world, your physician would proactively order fasting insulin, calculate your HOMA-IR score, discuss your TG: HDL ratio, and suggest a continuous glucose monitor for two weeks of personalized data. In the real world, you may encounter resistance.

Here is why: the standard of care in primary medicine is built around population-level screening guidelines, insurance-driven test panels, and time-constrained appointments. Your

doctor may have 15 minutes with you. They are following protocols designed for the average patient, not for someone who has read this book and wants proactive metabolic optimization. This is not an adversarial situation. Your doctor is almost certainly a good person who wants you to be healthy. They may simply not be familiar with the metabolic framework we have been discussing, or they may be concerned about ordering "unnecessary" tests that insurance will not cover. Here is how to navigate this:

#### Script 1: Requesting Fasting Insulin

"Doctor, I have been reading about metabolic health, and I understand that fasting insulin can detect insulin resistance years before fasting glucose becomes abnormal. I would like to add fasting insulin to my next blood draw so we can calculate my HOMA-IR score. Is that something you can order?"

If they push back: "I understand this is not part of the standard panel. I am willing to pay out of pocket if insurance does not cover it. Fasting insulin is typically \$15-30 through standard lab companies. I am committed to being proactive about my metabolic health."

#### Script 2: Requesting an Advanced Lipid Panel

"I would like to get a more detailed picture of my lipid health beyond standard LDL and total cholesterol. Can we order an NMR LipoProfile or Ion Mobility panel that includes LDL particle number, particle size, and Lp(a)? I am also interested in my ApoB level."

If they push back: "I understand that standard lipid panels are the norm, and I appreciate that. My concern is that LDL-C alone may not accurately reflect my atherogenic risk, especially since I eat a diet higher in healthy fats. The research by Cromwell in the Journal of Clinical Lipidology and Sniderman in JAMA Cardiology suggests particle number and ApoB are more predictive. I would feel more confident with the additional data."

#### Script 3: Requesting a Comprehensive Panel

"I am starting a metabolic health program and would like to establish baseline labs. In addition to the standard metabolic panel and lipid panel, I would like to add: fasting insulin, hs-CRP, vitamin D, hemoglobin A1C, liver enzymes including GGT, uric acid, and a thyroid panel. Can we run these together?"

#### If Your Doctor Will Not Order the Tests

You have options:

- Direct-to-consumer lab services: Ulta Lab Tests, Life Extension Blood Tests, Walk-In Lab, and similar services allow you to order your own blood work without a physician's order in most US states. You pay out of pocket (\$100-300 for a comprehensive panel) and go to a local lab (Quest, LabCorp) for the blood draw.
- Omega-3 Index: Order directly from OmegaQuant.com. Finger-prick kit, mailed to you, results in about two weeks. Approximately \$50.
- Find a new doctor. I say this with respect: if your physician actively discourages you from getting more data about your health, and will not engage in a productive conversation about it, you may need a practitioner who is more aligned with a proactive, root-cause approach. Functional medicine physicians, integrative medicine doctors, and progressive primary care providers are increasingly embracing this metabolic framework.

#### The Tracking Framework: When to Test What

The complete testing schedule with every marker at every timepoint is in Appendix A. Here is the narrative version of what to expect at each milestone.

Baseline (Day 0): Get the full panel everything in Tiers 1 through 3 that applies to you, plus

at-home metrics (weight, waist circumference, blood pressure, resting heart rate, progress photos, and subjective scores for energy, mood, cravings, and sleep quality on a 1-10 scale). This is your personal starting line.

30 Days: Run an abbreviated "quick wins" panel fasting glucose, fasting triglycerides, and full lipid panel to calculate your TG: HDL ratio. Remeasure waist circumference, blood pressure, and subjective scores. This is where you see the early movers. Triglycerides often plummet. Blood pressure starts to normalize. These early wins provide powerful motivational fuel.

90 Days: Repeat the full baseline panel. This is the true inflection point. Hemoglobin A1C has fully cycled and reflects three months of metabolic improvement. Fasting insulin should be trending toward optimal. Compare your numbers side by side and see the transformation in black and white.

6 Months: Full Tier 1 and Tier 2 retest. Add Omega-3 Index (should be improving after 3-4 months of supplementation) and body composition via DEXA if available.

12 Months and Annually: Full comprehensive panel, all tiers. Compare to your original Day 0 baseline. Patients who see their fasting insulin drop from 18 to 5, their TG: HDL ratio go from 4.2 to 1.1, their hemoglobin A1C drop from 5.8% to 5.0%, and their waist shrink by 4 inches those patients do not go back. The numbers become their own motivation.

Continuous Glucose Monitors: The Game-Changer

I want to close this chapter with a tool that is not a lab test but may be the single most educational device you can use on your metabolic journey: the continuous glucose monitor (CGM). A CGM is a small sensor (about the size of two stacked quarters) that attaches to your arm and measures your interstitial glucose every 1-5 minutes, 24 hours a day, for 10-14 days per sensor. You can see your glucose in real time on your phone.

Dr. Peter Attia has called CGMs "the most important thing I have learned about my own health" and recommends that every adult wear one for at least two weeks to understand their personal glycemic response to food, exercise, sleep, and stress.

Here is why CGMs are transformative:

1. They reveal your personal response. The same food can spike one person's glucose by 80 milligrams per deciliter and another person's by 20 milligrams per deciliter. Genetics, microbiome composition, insulin sensitivity, and meal context all influence the response. A CGM shows you how your body responds to your food not population averages.
2. They make invisible consequences visible. That "healthy" bowl of oatmeal that spikes your glucose to 180? You would never know without the CGM. That post-meal walk that cuts the spike by 40%? You can see it in real time. That terrible night of sleep that elevated your fasting glucose by 15 milligrams per deciliter the next morning? Visible. That stressful meeting that spiked your glucose without eating anything? Visible. The CGM turns metabolic biology from an abstract concept into a real-time feedback loop.
3. They validate your dietary choices. When you see that your steak-and-vegetable dinner barely moves the glucose needle while your colleague's pasta dinner sends theirs to 200, the motivation to continue eating well becomes visceral, not intellectual.
4. They teach you about meal timing, food order, and exercise. You will discover that eating protein and fat before carbohydrates (Jessie Inchauspe's "glucose hack") genuinely blunts the spike. You will see that walking after eating is not a theoretical recommendation it visibly and dramatically reduces your glucose excursion. These are lessons you learn once and apply forever.

How to get one:

- Through a CGM coaching program: Levels Health, Nutrisense, and similar companies provide CGM sensors with app-based tracking and optional coaching for \$150-300 per month.
- Through your physician: If you have a diagnosis of prediabetes or diabetes, insurance often covers CGMs (Dexcom, Libre). If you are metabolically healthy and want one for education, your doctor can write a prescription, but you may pay out of pocket (\$75-150 per sensor, each lasting 10-14 days).
- Over-the-counter: In some countries, the Libre CGM is available without a prescription. US availability is expanding.

My recommendation: Wear a CGM for two to four weeks during your 30-Day Reset. The data it provides will teach you more about your personal metabolism than any textbook, including this one. Then put it away and use what you learned. You do not need to wear one forever you just need to learn what your body does in response to different inputs, and then make informed choices going forward.

The Numbers Do Not Lie

The 90-day lab results tell a consistent, unmistakable story the kind of data pattern that makes a statistician emotional, because you can see the inflection point where the body starts healing.

A fasting insulin that dropped from 22 to 7. A TG: HDL ratio that went from 4.5 to 1.2. An hemoglobin A1C that fell from the prediabetic range back to optimal. A waist that lost 3 inches. A blood pressure that no longer requires medication.

These numbers are not hypothetical. They are the documented outcomes of the metabolic framework you have been learning throughout this book a framework grounded in the research of Ben Bikman, Peter Attia, Jason Fung, Matthew Walker, Satchin Panda, and dozens of other scientists whose work we have cited.

Your numbers are your proof. They are objective, they are undeniable, and they are yours. Get them tested. Track them. Watch them change. And when they do, know that what changed them was not a pill, not a procedure, and not luck.

It was you. Making better decisions, one meal, one walk, one night of sleep at a time. For 30 days, then 90, then a year, then the rest of your life.

That is the Metabolic Equation. And now you have the numbers to prove it is working.

"In God we trust. All others must bring data." W. Edwards Deming, who never tested his fasting insulin but would have been absolutely insufferable about it if he had.