

TOP 12 MUST KNOW INFLAMMATORY LAB MARKERS

AND THEIR OPTIMAL RANGES





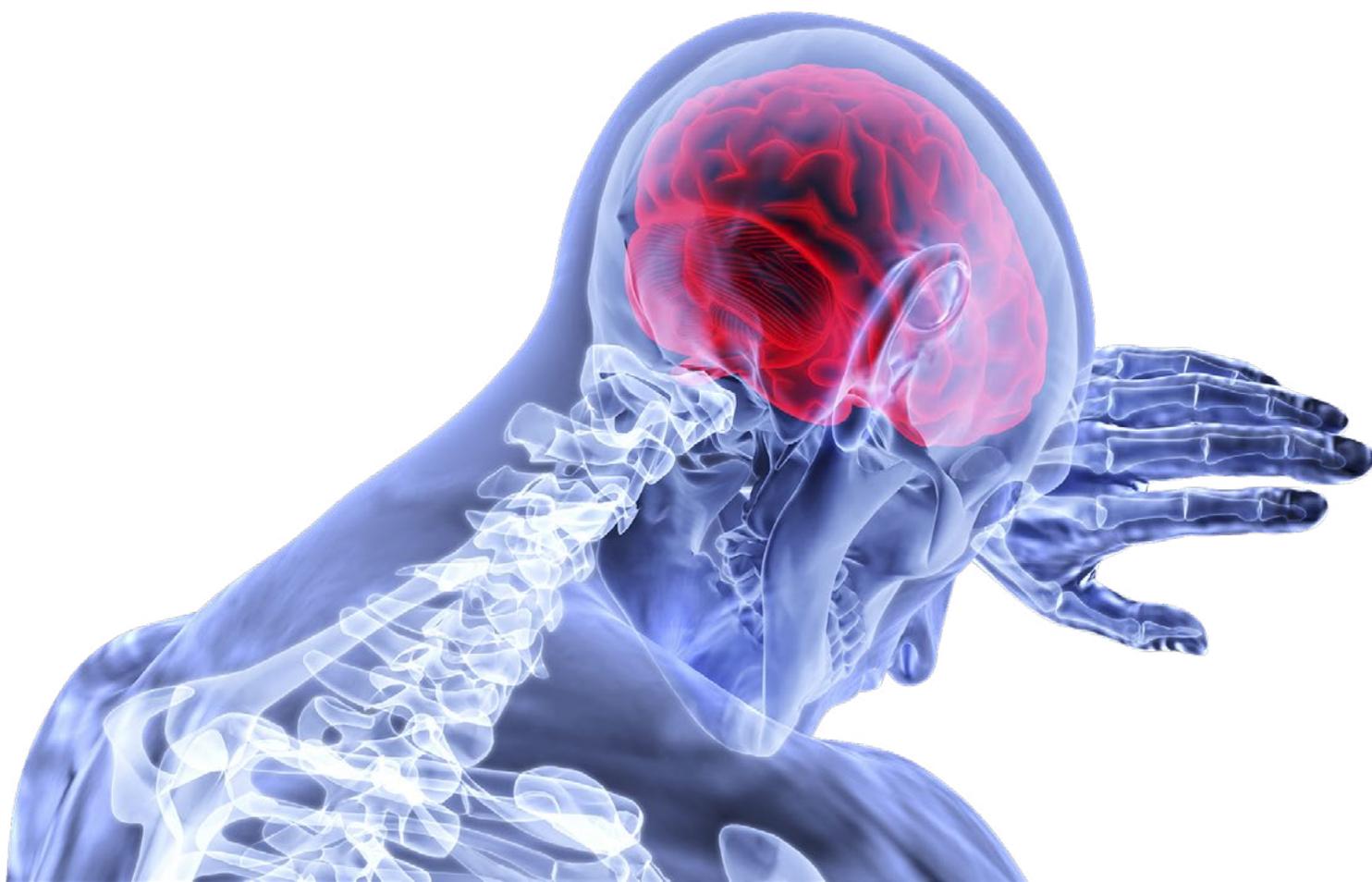
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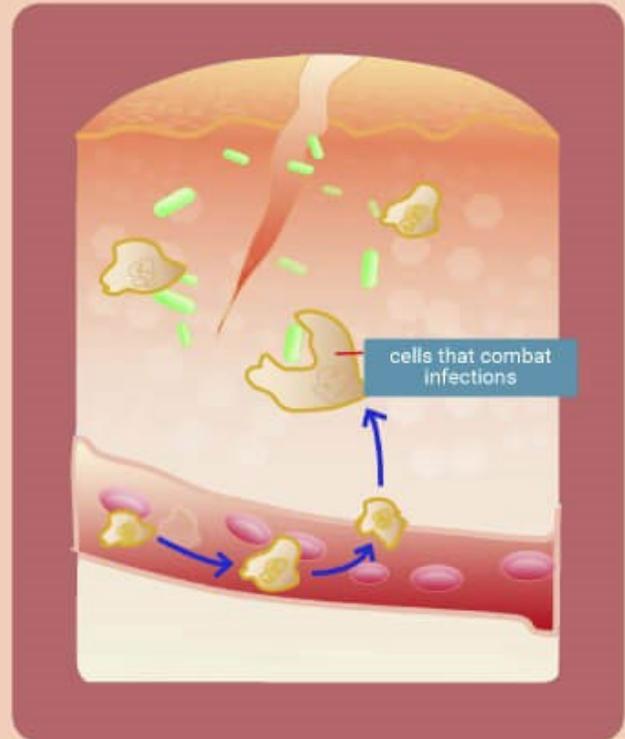
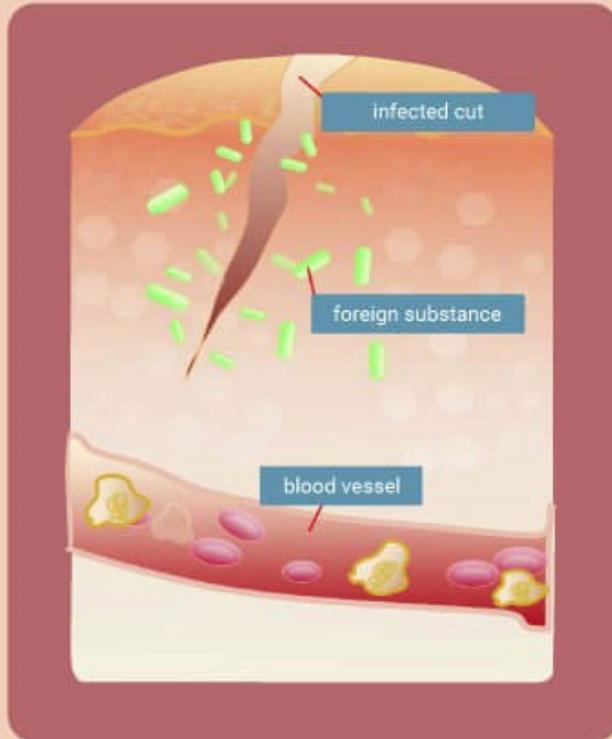
Are you experiencing fatigue, aches and pains, skin issues, digestive complaints, headaches, or other nagging, chronic symptoms? Chronic inflammation may be the cause. Chronic inflammation is the root cause of most chronic symptoms and diseases. Testing for inflammation markers can help to find underlying health issues, uncovering the root causes of your problems, creating an appropriate treatment plan, measuring your progress, and regaining your health and vitality.

In this article, you will learn about what inflammation is. You will understand the problems with chronic inflammation. I will share the top 12 inflammatory lab markers and optimal rangers that can support your progress and health.



INFLAMMATORY RESPONSE

The inflammatory process protects our body from damage and disease by releasing cells and mediators that combat foreign substances and help prevent infection. However, these same inflammatory elements can also be deadly to the body when "switched on" too long, a condition known as chronic inflammation.



What is inflammation

Inflammation is your body's natural defense mechanism against foreign pathogens, toxins, allergens, injuries, and other harm. Your immune system's response to any harm or cellular injury by increasing blood flow, capillary dilation, leukocyte infiltration, and the production of various chemical mediators. This complex process helps your body to produce antibodies and cytokines. This process helps to protect your body and fight hostile pathogens

from eliminating toxic agents and repairing tissue damage.

In case of an injury, inflammation also helps to protect the affected area and support recovery. Inflammation is clearly necessary and a friend to your body when it comes to acute infections or injuries. However, as a 2015 article published in the British Journal of Nutrition explains, chronic, low-grade, systemic inflammation can be problematic and harmful

ACUTE INFLAMMATION

innate Immunity

CHRONIC INFLAMMATION

Adaptive Immunity

Stimulus



Immune helper cells do their job of healing



End stimulus/Healing

Ongoing Stimulus



Immune helper cells try to do their job of healing but ongoing stimulus results in more cell recruitment, increased inflammation and changes to cells

Repetitive cycle
Increased disease



The Problems with Chronic Inflammation

Acute inflammation is essential for your health. It's a critical part of your body's survival response to injury, infection, or illness. It protects you from pathogens and supports the recovery and repair of damaged cells. Acute inflammation starts quickly, usually within minutes, upon infection. It may last for a few days or in some cases a few weeks, but decreases gradually and disappears upon recovery. Signs of acute inflammation may include pain, swelling, redness, heat, itching, or in case of respiratory issues or allergies, sneezing, coughing, congestion, and watery eyes.

Chronic inflammation is different. Low-grade, chronic inflammation is systemic. It can last for months, years, or for life if not addressed. While acute inflammation tends to have a specific cause, such as an injury, infection, allergen, or toxic

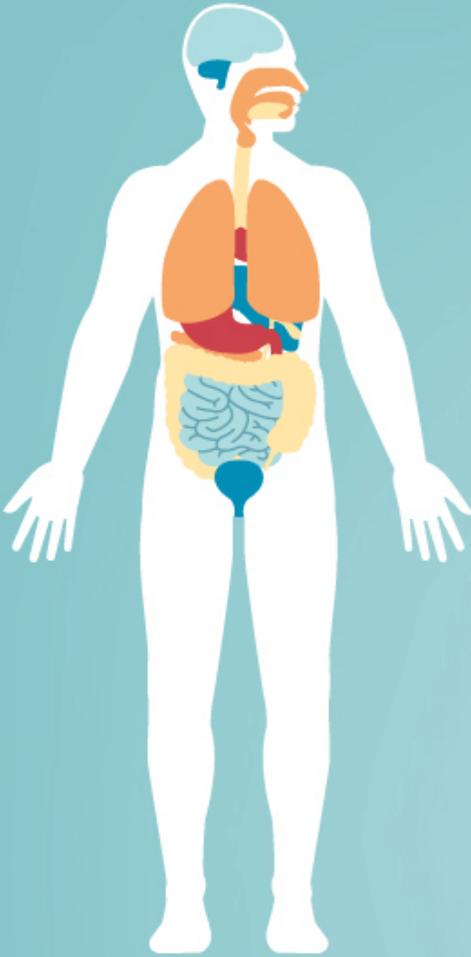
exposure, chronic inflammation doesn't have one specific cause.

Chronic inflammation tends to develop over time due to a combination of issues, including a poor diet, poor lifestyle choice, chronic stress, environmental toxin exposure, and other factors. These factors place an excessive stress load on the body. As a response, your body produces inflammatory modulators throughout your body, which can overwhelm your immune system and body overall.

Chronic and ongoing inflammatory stimulus can lead to white blood cell recruitment, cellular changes, and increased inflammation. Excess white blood cells may end up attacking your cells, tissues, or internal organs, which will lead to a continuous inflammatory response and on-going health issues.

How Inflammation Affects the Body?

"Inflammation is at the root of practically all known chronic health conditions"



BRAIN

Pro-inflammatory cytokines cause autoimmune reactions in the brain, which can lead to depression, autism, poor memory, Alzheimer's disease and MS.



CARDIOVASCULAR

Inflammation in the heart & arterial & venous walls contributes to heart disease, strokes, high blood sugar (diabetes) and anemia.



MUSCLE

Inflammatory cytokines can cause muscle pain and weakness. Can manifest as carpal tunnel syndrome, or polymyalgia rheumatica, to name a few.



BONES

Inflammation interferes with the body's natural ability to repair bone mass, increasing the number of fractures & leading to conditions like osteoporosis.



SKIN

Chronic inflammation compromises the liver & kidneys, resulting in rashes, dermatitis, eczema, acne, psoriasis, wrinkles & fine lines.



THYROID

Autoimmunity as a result of inflammation can reduce total thyroid receptor count and disrupts thyroid hormone function.



LUNGS

Inflammation induces autoimmune reactions against the linings of airways. Can result in allergies or asthma.



GI TRACT

Chronic inflammation damages our intestinal lining and can result in issues like GERD, Crohn's disease and Celiac disease.



KIDNEYS

Inflammatory cytokines restrict blood flow to the kidneys. Complications like edema, hypertension, nephritis & kidney failure can result.



LIVER

Build-up of inflammation leads to an enlarged liver or fatty liver disease. Increased toxic load build-up in the body.

Chronic Inflammation and Chronic Disease

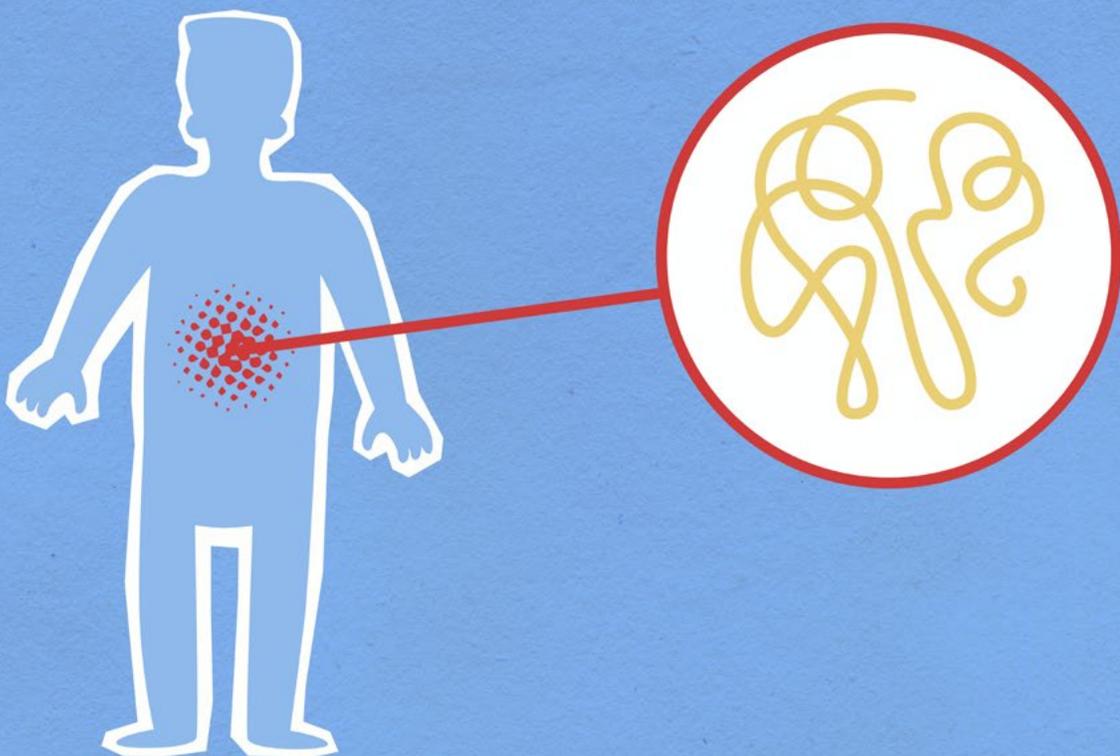
Chronic inflammation can be incredibly harmful to your body. Symptoms of chronic inflammation can vary from person to person and may include fatigue, chronic pain, headaches, migraines, muscles aches, joint pain, skin issues, brain

fog, memory issues, insomnia, gastrointestinal issues, anxiety, depression, mood swings, weight gain, weight loss, obesity, hormonal issues, frequent infections, early signs of aging, and more.

Chronic inflammation can affect all areas of your body, including your digestive system, kidneys, liver, lungs, brain, endocrine system, hormonal health, heart, skin, muscles, and bones. According to a 2015 article published in the British Journal of Nutrition explains, chronic, low-grade, systemic inflammation is likely involved in the early stages of disease development. Scientific research, including a 2012 article published in EMBO Rep, has linked chronic inflammation to major degenerative diseases, including cancer, heart disease, diabetes, and amyotrophic lateral sclerosis (ALS).

According to a 2010 review published in Autoimmune Reviews, chronic inflammation is also linked to autoimmune diseases. A 2015 study published in JAMA Psychiatry has linked chronic inflammation to brain inflammation, mental health issues, and brain health problems. Chronic inflammation may be connected to depression, anxiety, addictions, other mental health issues, memory issues, and neurodegenerative diseases.

Mitochondria are tiny structures within just about every cell of your body. They are responsible for producing the energy your cells need to carry out their functions. What many people don't realize is that these tiny structures are also very vulnerable to chronic inflammation. What this means is that chronic inflammation damages mitochondria, lowers your body's overall ability to function and heal, and steals energy from just about every process in your body.



The Spinning Wheel of Mitochondrial Damage and Dysfunction

FACTORS LEADING TO DAMAGE

- Poor Diet
- Chronic Stress
- Infections
- Toxins
- Poor Sleep
- Aging



METABOLIC INSTABILITY

- Lowered Energy Production
- Increased Metabolic Waste
- Increased Oxidative Stress
- Lowered Anti-Oxidant Production



CHRONIC DISEASE DEVELOPMENT



DAMAGE AND DYSFUNCTION

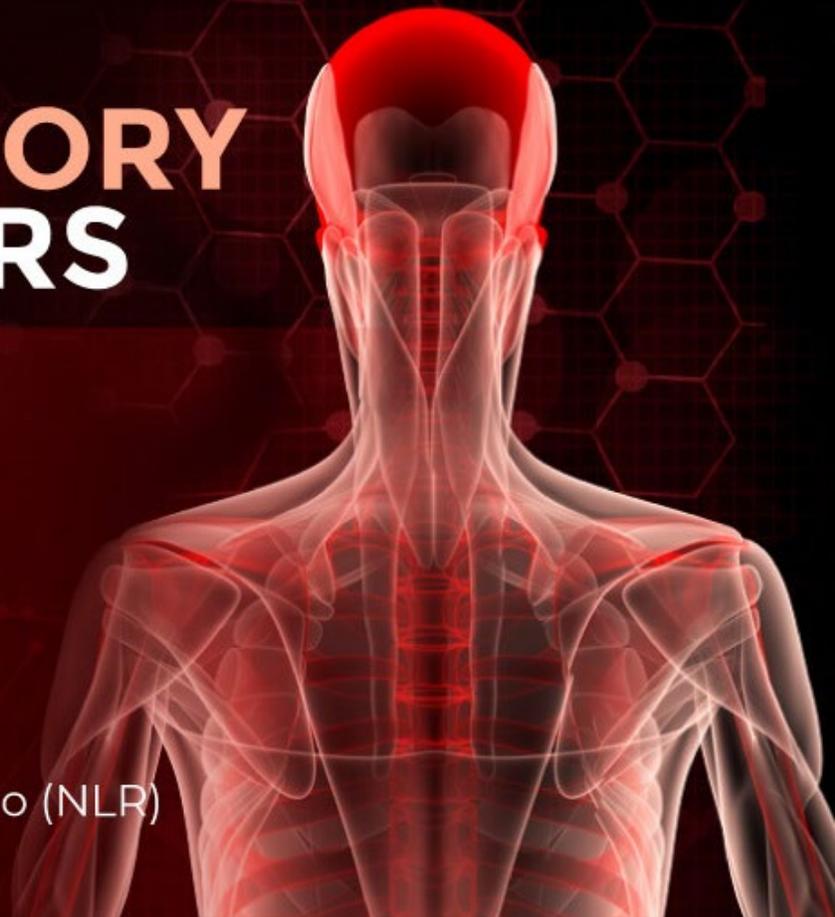
- Dyfunctional Energy Production
- Poor Fatty Acid Metabolism
- Metabolic Inflexibility
- Protein Damage
- Increased Oxidative Stress

MITOCHONDRIAL DYSFUNCTION HAS BEEN ASSOCIATED WITH:



TOP 12 INFLAMMATORY LAB MARKERS

- ▶ Hs-CRP
- ▶ HbA1C
- ▶ Fasting Insulin
- ▶ Serum Ferritin
- ▶ Red Blood Cell Width
- ▶ Homocysteine
- ▶ ESR and Platelets
- ▶ Lactate Dehydrogenase (LDH)
- ▶ Neutrophil to Lymphocyte Ratio (NLR)
- ▶ Liver Enzymes
- ▶ Lipid Panel
- ▶ Vitamin D3



Considering all the issues chronic inflammation can cause and all the symptoms, health issues, and diseases it's associated with, it's important that you get tested for inflammatory markers. Understanding inflammatory lab markers are critical for identifying underlying health issues and making appropriate changes to repair your body and regain your health and vitality.

It can help your functional health professional to create a personalized treatment plan, including dietary changes, lifestyle recommendations, and appropriate supplementation to improve your health. Here are the top 12 inflammatory lab markers you need to understand.

1. Hs-CRP

The C-Reactive Protein or CRP test is a key test I recommend. It measures a protein (CRP) produced in your liver that indicates inflammation levels in your body. A 2013 study published in Rheumatology has found that increased levels of CRP may be associated with muscle strength weakness in knee arthritis.

The clinical range is between 0 and 3 mg/L while the optimal range is 0 to 1 mg/L. When I see levels over 1 mg/L, I know the individual is having an inflammatory response that could be due to acute trauma or chronic conditions. Ideally, we want to see the CRP levels as low as possible, certainly under 1 mg/L and more like .01 mg/L.

Optimal Range 0 to 1

HS CRP

Reference Range
Optimal <1.0

3.8 H

mg/L

Jellinger PS et al. Endocr Pract.2017;23(Suppl 2):1-87.

A Simple BLOOD TEST that Can Save Your Life

*C-reactive protein (CRP) is a protein produced by the liver and found in the blood.
The level of CRP rises when the body suffers inflammation.*

The American Heart Association categorizes the levels of CRP as follows:

Low CRP – less than 1.0 mg/L

Moderate CRP – 1-2mg/L

High CRP – anything over 2.0mg/L



Diabetes



Cancer



Heart Disease,
Attacks & Strokes



Crohn's
Disease



Obstructive
Sleep Apnea



Rheumatoid
Arthritis

2. HbA1C

Blood sugar imbalances are one of the main causes of inflammation, so I recommend checking your hemoglobin A1C (HbA1C) levels. A 2005 study published in the Journal of Clinical Investigation, inflammation, stress, and diabetes are interlinked.

According to a study published in the Journal of Clinical Endocrine Metabolism, eating a Standard American Diet (SAD) increases the risk of obesity and metabolic diseases, which are both linked to

blood sugar imbalance, increased risk of inflammation, and age-related chronic diseases. Your HbA1C levels measure your average blood sugar over the past 2 to 3 months.

Hemoglobin A1C (HbA1c) gives the average amount of glucose in your blood or blood sugar over the past 3 months making it one of the top tests for inflammation and diabetes. The clinical range is between 4.8 and 5.6 while the optimal range is 4.5 – 5.2.

Optimal Range 4.5 to 5.2

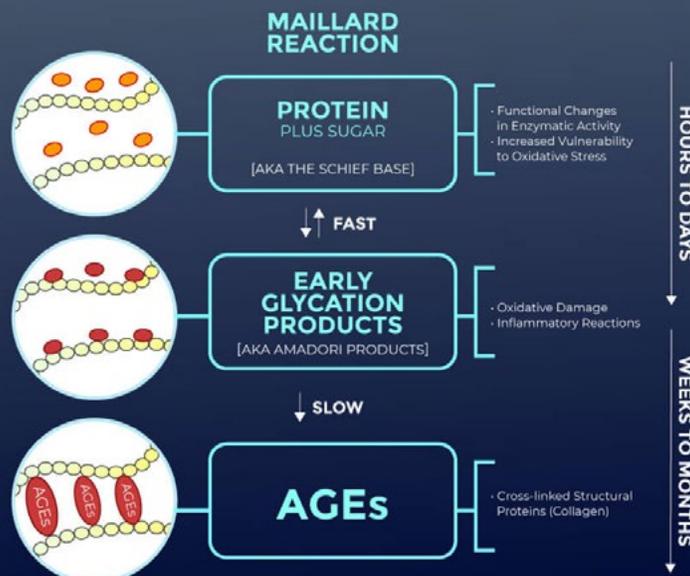
Hemoglobin A1c
Hemoglobin A1c

8.9 High

%

4.8-5.6

GLYCATION PROCESS AND FORMATION OF ADVANCED GLYCATION END-PRODUCTS



Prolonged bouts of hyperglycemia result in a large production of AGE's which damage the endothelial lining of the blood vessels, nerves, joints and major organs.

3. Fasting Insulin

Blood sugar imbalances may increase your risk of inflammation. A 2016 study published in the Journal of Biomedical Sciences has found that the development of insulin resistance and increased inflammatory responses in your body may be interlinked.

In addition to testing your HbA1C levels, I recommend checking

your fasting insulin levels. Testing your fasting insulin can recognize elevated blood sugar levels and can detect inflammation, insulin resistance, blood sugar issues, and diabetes.

The clinical range for fasting insulin is 2.6 – 24.9 uIU/ml and the optimal range is 1.0 – 5.0 uIU/ml.

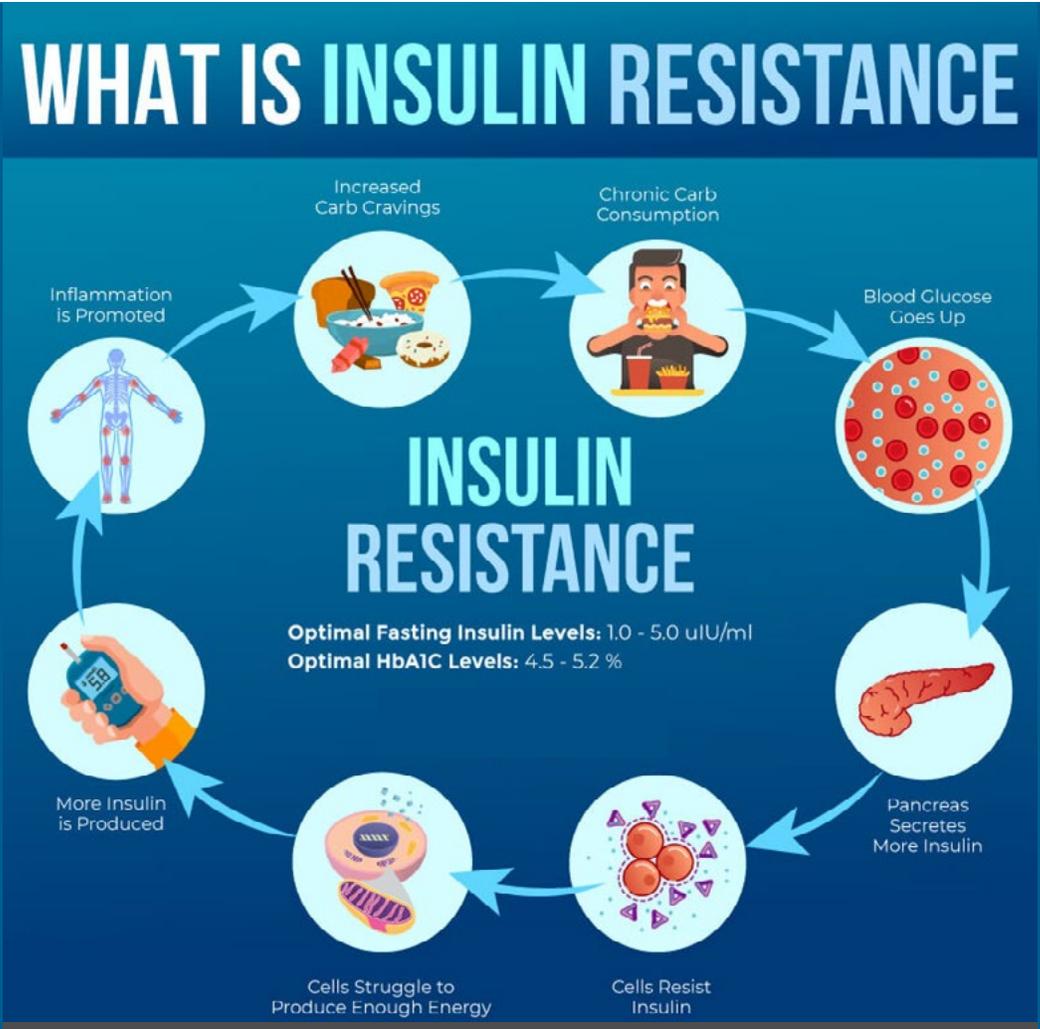
Optimal Range 1.0 to 5.0

Insulin

38.6 High

uIU/mL

2.6-24.9



4. Serum Ferritin

Serum ferritin measures the level of ferritin in your body to detect iron deficiency anemia and other health issues. A 2012 study published in the European Geriatric Medicine has found that increased ferritin levels may be associated with underlying

iron deficiency and age-related inflammation in older people.

Elevated serum ferritin levels may indicate inflammation, liver disease, autoimmune disease, or even cancer. The lab range is 30 to 400.

Optimal range is 40 to 90

Ferritin, Serum

704

High

ng/mL

30-400

Ferritin

Ferritin is an intracellular protein that stores iron and releases it in a controlled fashion. The protein is produced by almost all living organisms, including algae, bacteria, higher plants, and animals. In humans, it acts as a buffer against iron deficiency and iron overload.

Clinical Applications

High Serum Ferritin

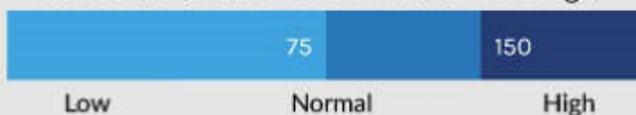
1. Iron overload
2. Acute inflammatory conditions
3. Liver disease
4. Alcohol excess



Optimal range for ferritin is

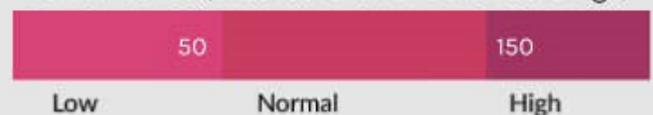
Male Ferritin Level ng/mL

Men: 75-150 (under 75 is low and over 150 is high)



Female Ferritin Level ng/mL

Women: 50-150 (under 50 is low and over 150 is high)



5. Red Blood Cell

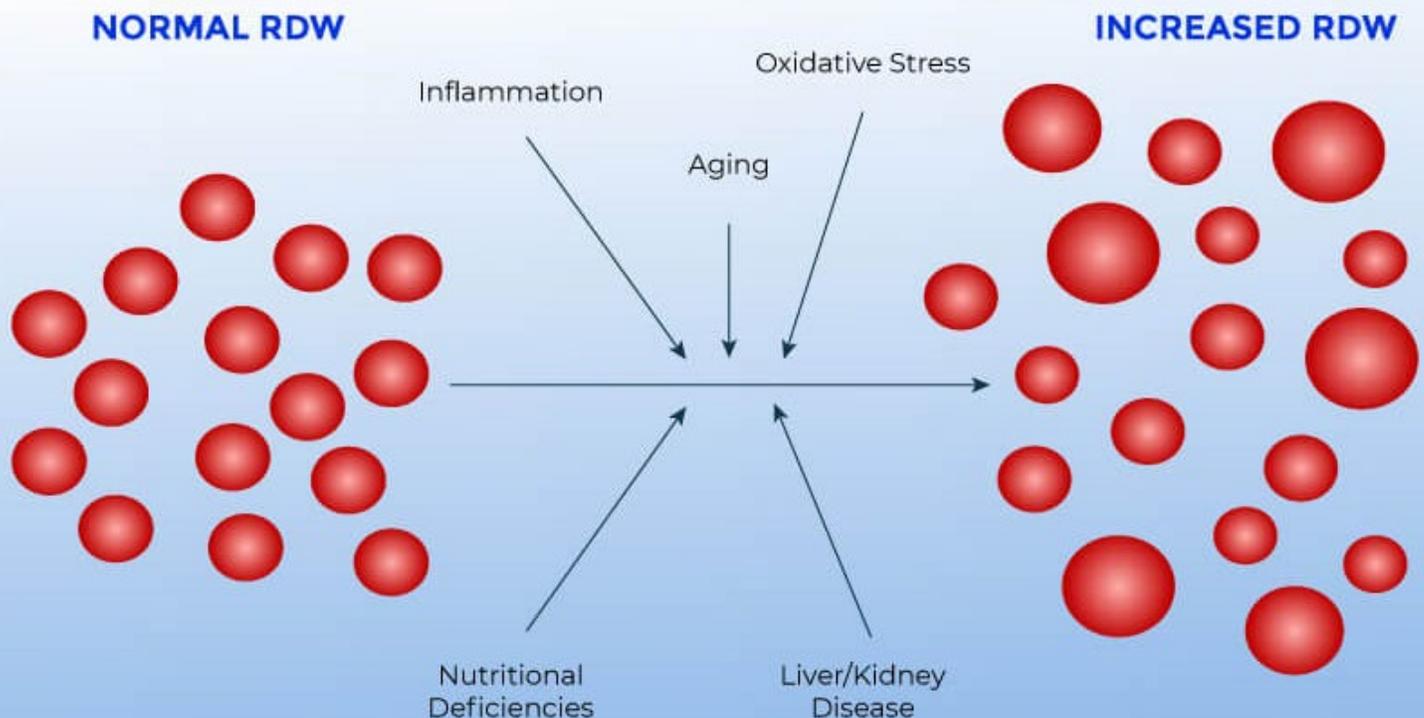
The size of your blood cells has to do with maturation and also depend on methylating agents, such as folate and vitamin B12. Red Blood Cell Distribution (RDW) markers are a great way to detect underlying inflammation in your body. A 2018 study published in Science Reports has found that RDW levels may be linked to sarcopenia,

an inflammation-related condition affecting older people.

The clinical range is between 12.3 and 15.4 percent while the optimal range is 11.5 and 13 percent. When this level is above 13% it may be a sign that inflammation has impacted the development of the red blood cell.

Optimal range is 11.5 to 13

RED BLOOD CELL WIDTH AS A MARKER FOR HEALTH



The ideal range for RBC Width is between 11.5-13%.

- ▶ High RBC Width can be due to inflammation, oxidative stress, vitamin B12 and/or folate deficiencies.
- ▶ Low RBC Width can be due to anemia, leukemia or vitamin B6 deficiencies.

6. Homocysteine

Homocysteine is a common amino acid in your blood that you mostly get from eating meat. Homocysteine is particularly a good marker for cardiovascular issues. According to a 2010 study published in Experimental & Clinical

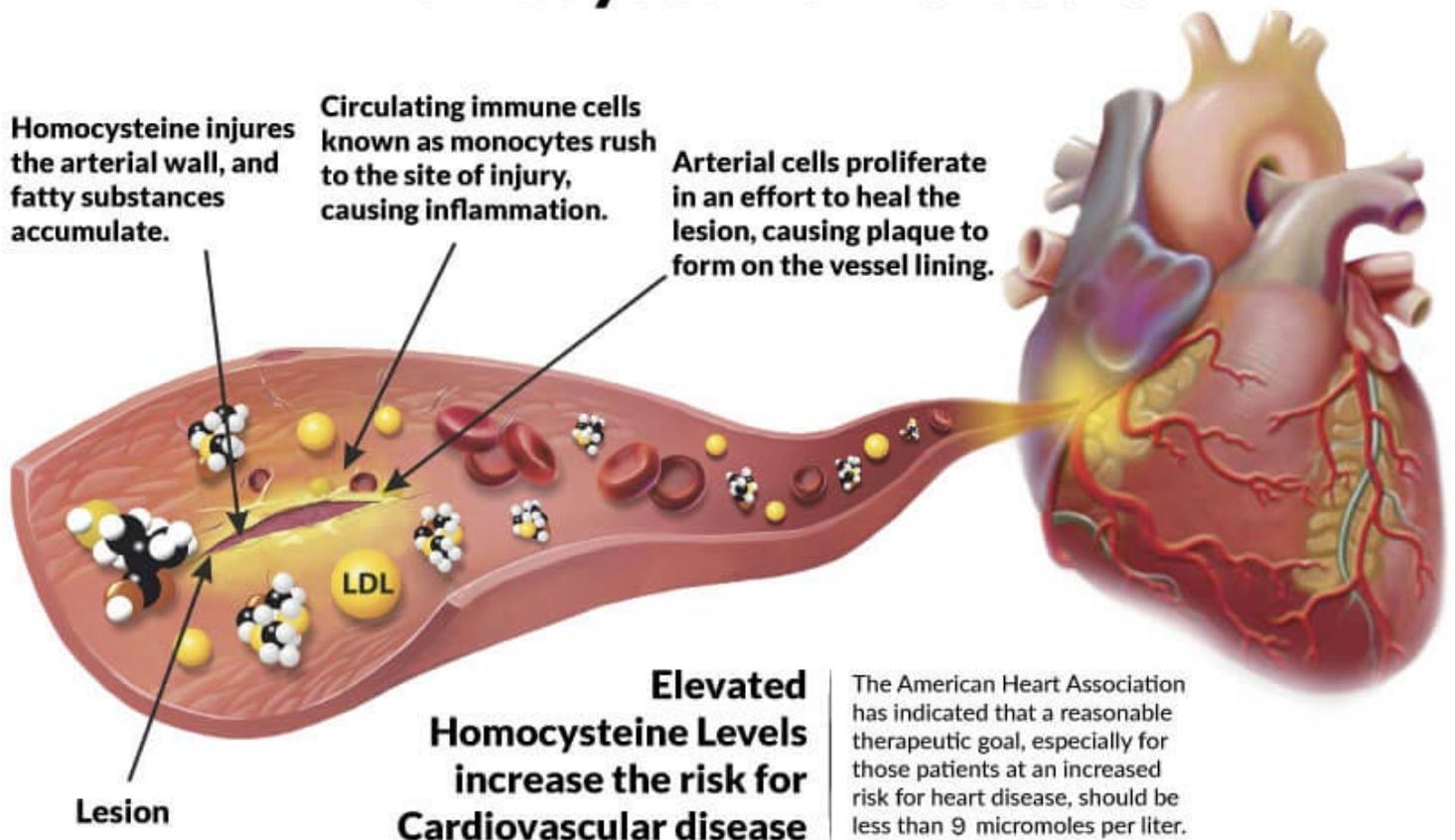
Cardiology, elevated homocysteine levels may indicate inflammation and acute coronary syndrome.

The optimal range for homocysteine is between 4 to 6 $\mu\text{mol/L}$.

Optimal range is 4 to 6

TESTS	RESULT	FLAG	UNITS	REFERENCE INTERVAL	LAB
Homocyst(e)ine	44.6	High	$\mu\text{mol/L}$	0.0 - 14.5	01
Please note reference interval change					

Homocysteine Molecule



7. ESR

The erythrocyte sedimentation rate (ESR) is a common hematology test to look for inflammation. It refers to the rate at which your red blood cells in anticoagulated whole blood go down in a standardized tube over a period of one hour. According to a 2014 study published in the *Journal of Clinical Lab Analysis*, ESR markers may be able to indicate inflammation in the body. Optimal range 11 or less.

You can also look at platelets as a measurement tool of inflammation and the stickiness of blood. Platelets elevated above 250 is a sign of inflammation. The sweet spot for platelets is between 175 and 250. Below 175, immune function and blood clotting are compromised; the same is true for levels above 250.

Optimal range 11 or less

Sedimentation Rate-Westergren

18

High

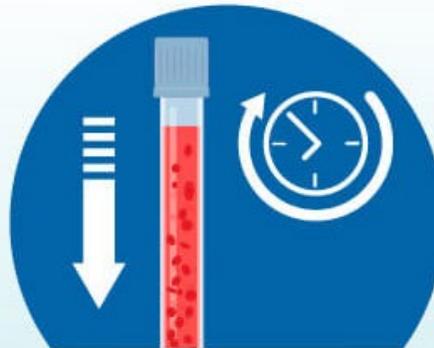
mm/hr

0-15

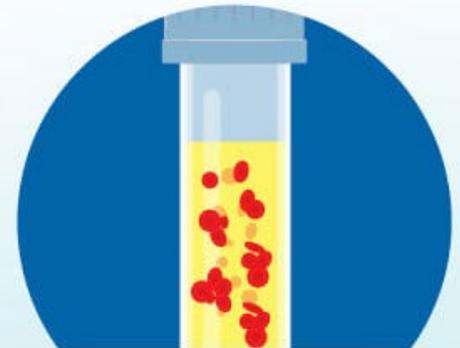
HOW THE SED RATE TEST WORKS



Phlebotomist draws blood into tube.



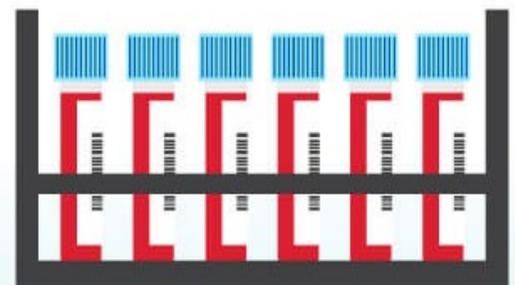
Test measures how fast red blood cells fall to bottom of tube in an hour.



Inflammation causes red blood cells to stick together and sink faster.

SEDIMENTATION RATE KEY FACTS

- ▶ A high sedimentation rate signals high levels of inflammation in the body.
- ▶ Most people with an autoimmune disease will have a high sed rate, but the test can't help diagnose a specific disease.
- ▶ The sed rate test can help evaluate how well your treatments are working.
- ▶ Optimal ESR is under 10 mm/hr.



8. LDH

Lactate Dehydrogenase (LDH) is an enzyme found in all living cells. It's job is to help support energy production in the lactate and pyruvate cycle of glycolysis.

Elevated levels may indicate inflammation. According to a 2020

retrospective and observational study published in Aging (Albany, NY), elevated LDH markers may be a risk factor for severe respiratory illness (14). Optimal levels are between 140-180. Levels over 180 indicate inflammation.

Optimal range 140 to 180

LACTATE DEHYDROGENASE (LDH)

LDH is a marker of glycolytic energy production. High levels are an indication of high levels of cellular oxidative stress and inflammation. Low levels indicate a state of hypoglycemia.

Optimal Range: 140-180



9. Neutrophil-Lymphocyte Ratio

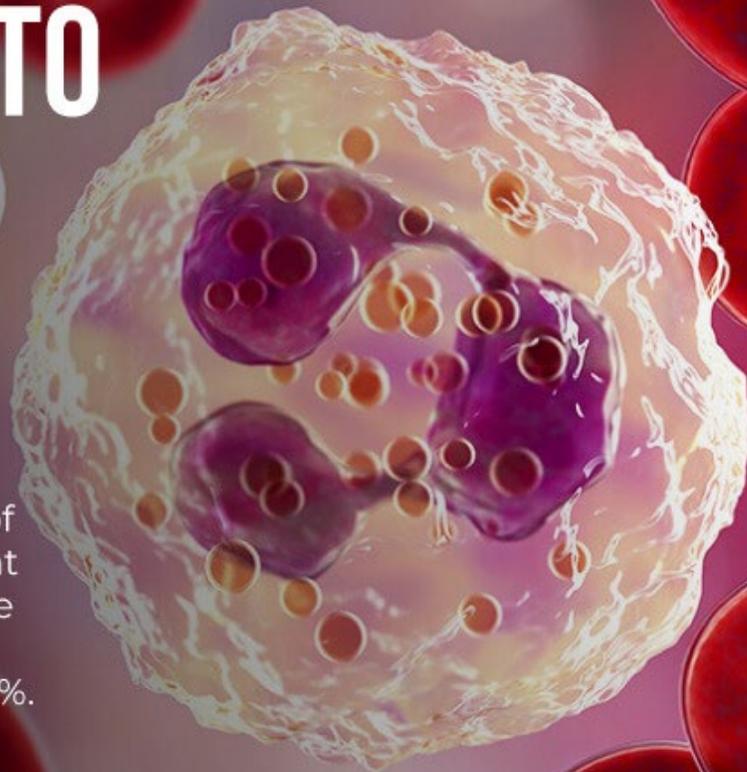
Neutrophil-Lymphocyte Ratio (NLR) is a measure of stress and inflammation that may affect your health. According to a 2012 study published in the International Archives of Medicine, NLR is a good measure of inflammation associated with prevalent chronic diseases.

When the body is dealing with chronic inflammation, over time, the lymphocyte levels will drop and the neutrophil levels will rise and cause an imbalance. NLR is usually measured with the absolute count and we want to see it at roughly 1.2-2.0. If you see that the number of neutrophils are more than twice the amount of lymphocytes it is a sign of chronic inflammation.

Optimal range 1.2 to 2.0

NEUTROPHIL TO LYMPHOCYTE RATIO (NLR)

The **NLR** is a measurement of immune activity. During periods of inflammation the neutrophil count increases and the lymphocytes are suppressed. The NLR is measured with absolute counts and not the %.



Optimal Levels: 1.2-2.0

10. Liver Enzymes

Liver enzyme levels may also indicate inflammation, as well as, liver, gallbladder, bile, or kidney issues. According to a 2019 study published in the Indian Journal of Clinical Biochemistry, there is an association between elevated liver enzyme levels, inflammation, and cardiometabolic problems.

Alkaline phosphatase is a liver enzyme that is made by the mucosal cells that line the bile system of the liver and helps normal bile flow. Elevated levels (over 95) may indicate inflammation and liver and gallbladder problems.

Alanine aminotransferase (ALT) is a liver enzyme. Elevated levels may indicate inflammation. Normal levels are between 10 and 26 IU/L.

Aspartate transaminase (AST) is an enzyme present in the liver that spills out during times of increased liver stress. Elevated levels may indicate inflammation. Normal levels are between 10 and 26 IU/L.

Gamma-Glutamyl Transpeptidase (GGT) is an enzyme in the liver, pancreas, and kidneys. Elevated levels may indicate inflammation and liver disease, usually due to alcoholism and/or sluggish gallbladder or gallstone obstruction. Normal levels are between 10 and 26 IU/L. Levels lower than 10 IU/L can be an indication of a vitamin B6 deficiency.

TYPES OF LIVER ENZYMES

The following liver enzymes are most commonly evaluated through a blood test.

ALT

Alanine Aminotransferase

Optimal range is between 10-26 units per liter of blood.

High levels can be an indication of liver stress and/or glutathione deficiency. Low levels can be an indication of B6 deficiency.

AST

Aspartate Transaminase

Optimal range is between 10-26 units per liter of blood.

High levels can be an indication of liver stress and/or glutathione deficiency. Low levels can be an indication of B6 deficiency.

GGT

Gamma Glutamyl Transferase

Optimal range is between 10-26 units per liter of blood.

High levels can be an indication of liver and biliary stress and/or glutathione deficiency. Low levels can be an indication of B6 deficiency.

ALP

Alkaline Phosphatase

Optimal range is between 55-95 units per liter of blood.

High levels can be an indication of liver and biliary stress and/or bone growth in the body. Low levels can be an indication of a zinc deficiency.

ALT – Optimal range 10 to 26

AST – Optimal range 10 to 26

AST (SGOT)	41	High	IU/L	0-40
ALT (SGPT)	83	High	IU/L	0-44

GGT – Optimal range 10 to 26

GGT	143	High	IU/L	0 - 65	01
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11. Lipid Panel

Your lipid panel may be another indication of inflammation and related issues, such as clogged arteries and cardiovascular issues. According to a 2019 article in *The Effect of Inflammation and Infection on Lipids and Lipoproteins* published by Endotext, elevated lipid levels may indicate inflammation or infection.

Having a balanced ratio of LDL to HDL and triglycerides to HDL is essential for your health. Ideally, we are looking for an LDL:HDL ratio: 3:1 or less, 2:1 being optimal. As we analyze triglycerides, we want them

to be under 100 and we are looking for the Tri:HDL ratio to be 2:1 or less, 1:1 being optimal. Higher rates may indicate insulin resistance and inflammation. For more info on the lipid panel, read this article. Optimal levels:

VLDL cholesterol: The ideal range is 5 to 30 mg/dl.

HDL cholesterol: The ideal range is 55 to 80. Levels above 100 can indicate chronic inflammation or active infection in the body.

Triglycerides: The ideal range is 40 to 80.

What Is an Optimal Range For The Lipid Profile

Total Cholesterol

180 - 300

(the test will flag it as high if it is over 200 but we aren't concerned about it if the ratios below are in range).

LDL:HDL Ratio

**3:1 or less
(2:1 is great)**

Triglyceride:HDL Ratio

**2:1 or less
(1:1 is great)**

Triglycerides should be under 100 and ideally right around the same number as HDL or in the 40-80 range. If these ratios are in order, it is a sign that the LDL particles are the larger fluffy types that are less prone to oxidation

How an Anti-Inflammatory Lifestyle Impacts the Lipid Profile

- 1 Increases LDL particle size to the less oxidation prone state
- 2 Increases the amount of HDL available to recycle LDL from the blood before it has a chance to become oxidized
- 3 Improves the LDL to HDL ratio
- 4 Lowers triglycerides and improves triglyceride to HDL ratio

12. Vitamin D3

Vitamin D3 is an important vitamin that most of our population is deficient in. Poor levels may indicate inflammation. A 2014 study published in the Journal of Inflammation Research has connected low levels of vitamin D to inflammatory diseases, including atherosclerosis-

related cardiovascular disease, inflammatory bowel disease, chronic kidney disease, nonalcoholic fatty liver disease, and asthma.

Optimal healthy levels of vitamin D are between 50 ng/mL and 70 ng/mL, while therapeutic levels are over 70 ng/mL up to 100 ng/mL

Optimal range 70 to 100

Vitamin D, 25-Hydroxy 27.5 Low ng/mL 30.0-100.0

VITAMIN D LEVELS 25 HYDROXY D

DEFICIENT

OPTIMAL

THERAPEUTIC LEVEL
(DISEASE TREATMENT)

EXCESS

<50 ng/mL

50-70 ng/mL

70-100 ng/mL

>100 ng/mL

Multiply ng/mL by 2.5 to convert to nmol/litre

COMPREHENSIVE BLOOD ANALYSIS

What Does It Cover?

Our comprehensive blood analysis covers markers for the following:

- Immune System Function
- Blood Sugar and Insulin Levels
- Red Blood Cells and Iron Status
- Mineral and Electrolyte Balance
- Vitamin A & D Levels
- Cardiovascular Risk Factors
- Urinary Tract Health
- Liver and Kidney Health
- Inflammatory Markers
- Thyroid Hormone Levels
- Zinc/Copper Levels
- Folate and Vitamin B12 Levels
- Lipid Panel
- Parathyroid Status

Comprehensive Blood Analysis - Bonus Labs

To check for these health markers, I recommend a Comprehensive Blood Analysis (CBA). This is the most detailed blood test that looks at all of these markers of inflammation. This test is more sophisticated than most conventional doctors are able to order.

It examines all parameters for inflammation, blood sugar levels,

thyroid function, zinc and copper ratio, vitamin A and D levels, a complete metabolic panel, complete blood count, liver function, nutrient deficiencies, and more. I recommend getting the Comprehensive Blood Analysis done regularly both as a preventative measure and to monitor your inflammation levels and progress.

Final Thoughts

Chronic inflammation is the root cause of most chronic symptoms and diseases. Testing for inflammation markers can help to find underlying health issues, uncovering the root causes of your problems, creating an appropriate treatment plan, measuring your progress, and regaining your health and vitality. I recommend the Comprehensive Blood Analysis to test for the top 12 inflammatory lab markers to help your recovery.

If you want to work with a functional health coach, I recommend this article with tips on how to find a great coach. Our website offers long-distance functional health coaching programs with our world-class team of health coaches. For further support with your health and other goals, just reach out—our fantastic coaches are here to support your journey.



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