

# Comprehensive Blood Panel Guide



The recommended **Comprehensive Blood Panel** provides an in-depth picture into your overall health, including your metabolic resiliency, nutrient status, systemic inflammation, and hormone balance.

This guide provides an overall explanation of the key lab markers included in your panel and what they indicate about your health. You may be familiar with some of these tests already and their standard lab ranges. **Standard lab ranges** are typically wide ranges designed to detect disease at the most extreme ends of the spectrum. In Functional Medicine, we believe in narrowing the standard ranges to **optimal ranges** that reflect the ideal for ideal health and help identify imbalances before they become disease. Because Conventional and Functional Medicine lab ranges do not always align, some information and interpretation may slightly differ.

Your **individual lab results and summary** will be provided separately, most often during an appointment. Your results will include any additional tests your practitioner has ordered in addition to the Comprehensive Blood Panel, which will not be discussed in this guide. Markers notated with an asterisk (\*) may or may not be drawn based on your individual needs.



## General Health

### Complete Blood Count (CBC)

Measures red and white blood cells, hemoglobin, hematocrit, and RBC indices to assess the size and color of red blood cells. A CBC indicates how well oxygen is delivered to cells, whether nutrient deficiencies may be impacting red blood cells and causing anemia, the status of immune function, and whether there are platelet irregularities.

#### Key Markers Included in a CBC

- **Red blood cells (RBC):** A measure of how many red blood cells you have. Red blood cells are responsible for delivering oxygen to other cells in the blood.
- **White blood cells (WBC):** A measure of how many white blood cells you have. White blood cells protect the body against infection.

- **Hemoglobin:** A blood protein that carries oxygen to tissue and is responsible for giving red blood cells their color.
- **Hematocrit:** A measure of the percentage of red blood cells in the blood.
- **MCV (Mean Corpuscular Volume):** A measure of the average size of your red blood cells.

| Marker            | High Value                                                                           | Low Value                                                                       | Optimal Range      |
|-------------------|--------------------------------------------------------------------------------------|---------------------------------------------------------------------------------|--------------------|
| <b>RBC</b>        | Dehydration, iron excess, bone marrow disorders, heart/lung issues                   | Anemia, blood loss, medication side effects, liver disease, nutrient deficiency | 4.4 – 4.9 x10E6/uL |
| <b>WBC</b>        | Acute or chronic infection, immune disorders, physical injury                        | Chronic infection, nutrient deficiency, bone marrow issues                      | 5 – 8 x10E3/uL     |
| <b>Hemoglobin</b> | Dehydration, bone marrow disease, hypoxia, hemachromatosis, certain heart conditions | Anemia, chronic illness, kidney disease, medication side effects                | 14 – 15 g/dl       |
| <b>Hematocrit</b> | Dehydration, heart disease, smoking, sleep apnea, medication side effects            | Anemia, blood loss, over hydration                                              | 40 – 48%           |
| <b>MCV</b>        | Vitamin B12/folate deficiency, chemotherapy                                          | Iron deficiency                                                                 | 85 – 92 fL         |

## Comprehensive Metabolic Panel (CMP)

An assessment of the body's chemical balance and metabolism based on the measurements of 14 different blood substances. These markers include glucose, calcium, sodium, potassium, carbon dioxide, chloride, albumin, bilirubin, BUN, ALP, and AST. A CMP ultimately reveals how the liver, the kidneys, electrolytes, blood sugar, and protein balance are affecting the body.

### Key Markers Included in a CMP

- **Blood Urea Nitrogen (BUN) & Creatinine:** Markers used to assess kidney, and secondarily liver, function.

- **Electrolytes (sodium, potassium, chloride, carbon dioxide):** Electrically charged minerals that help control fluids and balance acids and bases in the body.
- **Liver Enzymes (ALP, ALT, AST):** Enzymes produced by the liver.

| Marker                      | High Value                                                                                              | Low Value                                                                                               | Optimal Range                                                                                                                                                               |
|-----------------------------|---------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>BUN &amp; Creatinine</b> | Low kidney or liver function due to protein intake, medication use, hydration status, pregnancy, or age | Liver disease or malnutrition                                                                           | 13 – 18 mg/dL                                                                                                                                                               |
| <b>Electrolytes</b>         | A variety of conditions, including endocrine disorders, dehydration, and heart disease                  | A variety of conditions, including endocrine disorders, dehydration, and heart disease                  | <b>Sodium:</b><br>135 – 140 mmol/L<br><br><b>Potassium:</b><br>4.0 – 4.5 mmol/L<br><br><b>Carbon dioxide:</b><br>25 – 30 mmol/L<br><br><b>Chloride:</b><br>100 - 106 mmol/L |
| <b>Liver Enzymes</b>        | Liver stress, damage, or disease                                                                        | Certain ratios of AST to ALT can provide additional information into the causes of certain liver issues | <b>ALP:</b> 42 – 107 IU/L<br><br><b>ALT:</b> 0 – 26 IU/L<br><br><b>AST:</b> 0 – 25 IU/L                                                                                     |



## Cholesterol & Heart Health

The Comprehensive Blood Panel includes both a **Lipid Panel** and a measure of **advanced lipid markers**. In general, lipids are fats and fat-like substances that make up cell structures and serve as sources of energy. These markers are important for assessing cardiovascular disease (CVD) risk.

# Lipid Panel

The Lipid Panel includes measures of cholesterol and triglycerides. These lipids are transported in the blood by lipoproteins, which each contain a combination of cholesterol, triglyceride, protein, and phospholipid molecules. We measure these particles by their density into high-density lipoproteins (HDL), low-density lipoproteins (LDL), and very-low-density lipoproteins (VLDL)

## Key Markers Included in a Lipid Panel

- **Total cholesterol:** A measure of the amount of total cholesterol in the blood, including HDL, LDL, VLDL, and lipoproteins.
- **High-density Lipoproteins (HDL):** Commonly referred to as “good cholesterol”, HDL is protective for heart health. In the context of the lipid panel, it is not as significant as the level of triglycerides and non-HDL results.
- **Low-density Lipoproteins (LDL):** Commonly referred to as “bad cholesterol,” LDL in higher levels may increase cardiovascular risk.
- **Triglycerides:** Closely linked to insulin resistance and metabolic health.

| Marker            | Optimal Range   |
|-------------------|-----------------|
| Total Cholesterol | 150 – 220 mg/dL |
| HDL               | 55 – 85 mg/dL   |
| LDL               | 0 – 140 mg/dL   |
| Triglycerides     | 50 – 100 mg/dL  |

## Advanced Lipid Markers

- **Apolipoprotein B (Apo B)\*:** Better predictor of heart risk than total cholesterol.
- **Lipoprotein(a) [Lp(a)]\*:** A genetically determined lipoprotein involved in vessel wall repair and a marker of cardiovascular risk.
  - **High Lp(a)** amplifies plaque buildup and clotting risk. Rather than focusing on lowering Lp(a) directly, it is best viewed as a risk amplifier, prompting more aggressive management of other modifiable factors like

LDL, apoB, blood pressure, and lifestyle.

| Marker | Optimal Range                       |
|--------|-------------------------------------|
| Apo B* | < 90 mg/dL                          |
| Lp(a)* | < 50 mg/dL<br>< 50 nmol/L preferred |



## Blood Sugar

- **Fasting Glucose & Insulin:** Measures how your body regulates blood sugar. A variety of factors can affect fasting blood sugar, so a single value is not the most reliable measure. For that reason, multiple fasting glucose tests are recommended to verify abnormalities.
  - **Multiple high fasting glucose and insulin levels** may indicate blood sugar dysregulation.
- **Hemoglobin A1c:** Measures the percentage of red blood cells with sugar-coated hemoglobin. Reflects average blood sugar over 2–3 months and is a good indicator of diabetes risk.
- **HDL & Triglycerides:** High triglycerides and low HDL are often indirect markers of insulin resistance and blood sugar dysregulation.

| Marker                    | Optimal Range                                                   |
|---------------------------|-----------------------------------------------------------------|
| Fasting Glucose & Insulin | Fasting glucose: 75 – 85 mg/dL<br>Fasting insulin: 3 – 7 uIU/mL |
| Hemoglobin A1c            | 4.6 – 5.3%                                                      |



## Inflammation

- **High-sensitivity C-reactive Protein (hs-CRP):** An acute phase reactant that becomes elevated in acute inflammatory reactions, including infection, autoimmune disease, and inflammatory-driven illness.
- **Ferritin:** A type of iron in the body.
- **Homocysteine:** An amino acid present in the body produced during the methylation process.

| Marker       | High Value                                                                            | Low Value                                     | Optimal Range                                              |
|--------------|---------------------------------------------------------------------------------------|-----------------------------------------------|------------------------------------------------------------|
| hs-CRP       | Acute inflammation, linked to chronic conditions including chronic disease and cancer | —                                             | < 1.0 mg/dL                                                |
| Ferritin     | Excess iron storage or acute inflammation                                             | Iron deficiency or poor iron storage capacity | <b>Women:</b> 30 – 100 ng/mL<br><b>Men:</b> 30 – 200 ng/mL |
| Homocysteine | Irritate blood vessels and increase cardiovascular risk, linked to low B vitamins     | —                                             | < 7 – 8 umol/L                                             |



## Nutrient Status

- **Vitamin D:** A fat-soluble vitamin obtained from the sun, food, and supplements that works with parathyroid hormone to regulate bone and immune health. Most people are deficient in vitamin D.
- **Parathyroid Hormone (PTH):** Released by the parathyroid glands to moderate blood calcium levels. Works with vitamin D to regulate bone and immune health.
  - **High PTH (above 60 pg/mL)** may indicate hyperparathyroidism
- **Vitamin B12:** A water-soluble vitamin obtained from food and supplements which is essential for energy, nerves, and DNA repair.

- **MMA:** A coenzyme that requires vitamin B12.
  - **High MMA (> 300 nmol/L)** may indicate a B12 deficiency
- **Folate:** An essential water-soluble vitamin obtained from food and supplements and is the natural form of B9. Required to make DNA and RNA
- **Zinc & Copper:** Essential nutrients that play a role in skin and immune health, inflammation, thyroid function, metabolism, neurohormone homeostasis, and gene regulation.
  - **Low serum zinc/copper ratio** may indicate either zinc deficiency or copper excess
- **Iron Studies (Iron, Saturation, Ferritin):** A mineral that helps transport oxygen to tissues

| Marker          | Optimal Range                                                                               |
|-----------------|---------------------------------------------------------------------------------------------|
| Vitamin D       | 40 – 60 ng/mL                                                                               |
| PTH             | 15 – 30 pg/mL                                                                               |
| Vitamin B12     | 450 – 2000 pg/mL                                                                            |
| MMA             | < 300 nmol/L                                                                                |
| Folate          | > 8 ng/mL                                                                                   |
| Zinc & Copper   | <b>Zinc:</b> 90 – 120 ug/dL<br><b>Copper:</b> 83 – 141 ug/dL<br><b>Zinc/copper ratio:</b> 1 |
| Iron            | 40 – 135 ug/dL                                                                              |
| Iron Saturation | 17 – 45%                                                                                    |



# Thyroid Health

- **Thyroid Stimulating Hormone (TSH):** A signaling hormone which tells the thyroid gland to produce hormones, including T4 and T3.
  - **High TSH** may indicate a hypoactive thyroid or hypothyroidism
  - **Low TSH** may indicate a hyperactive thyroid or hyperthyroidism
- **Thyroxine (T4) & Triiodothyronine (T3) (total and free):** The primary thyroid hormones, which play a role in regulating weight, body temperature, muscle strength, and mood. Total T4 and Total T3 measure levels of the hormone attached to proteins and free floating. Free T4 and T3 measure levels of the hormone free in the blood and available to interact with tissues.
- **Antithyroid Antibodies (TPO, TGA):** Measured to detect autoimmune thyroid disease (Hashimoto's or Graves').

| Marker   | Optimal Range   |
|----------|-----------------|
| TSH      | 0.5 – 2 uIU/mL  |
| Free T4  | 1.0 – 1.5 ng/dL |
| Free T3  | 2.4 – 4.0 pg/mL |
| Total T4 | 6.0 – 12 ug/dL  |
| Total T3 | 100 – 180 ng/dL |
| TPO      | < 9 IU/mL       |
| TGA      | < 1 IU/mL       |



# Autoimmunity

- **Antinuclear Antibody (ANA)\*:** A measure of antinuclear antibodies in the blood, which can indicate autoimmune activity. This is a general marker for autoimmunity. Additional testing and investigation is required when ANA is positive or elevated.

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## Next Steps Using a Functional Medicine Approach

While individual markers are useful, patterns often reveal the bigger picture. Your practitioner will use your lab results in conjunction with your health history to assess your health and create a personalized plan.

Review your results with your practitioner to understand how these markers apply to you and what lifestyle, nutrition, or treatment strategies may best support your optimum health.