VITALS VAULT

A VITALS VAULT FIELD GUIDE

Read your vitamin and mineral blood tests in 15 minutes

For anyone wondering if they are low in a vitamin or mineral: learn which test fits and how far to trust it.

8

CHAPTERS

15 minutes

Every claim is tied to a named study. References are on the last page.

Educational only. Not medical advice.

THIS GUIDE IS FOR YOU IF

- You wonder if you are low in iron, B12, vitamin D or magnesium.
- You have a blood result and are not sure how much to trust it.
- You want to know what can distort a vitamin or mineral number.
- You want better questions to bring to a clinician.

HOW TO USE IT

Read the first chapter, then jump to the nutrient you care about. Each chapter opens with one thing to remember. Use the tables to compare tests, the question lists for your visit, and the results page at the end to track numbers over time.

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CHAPTER 1

A blood level is not the same as your stores

THE ONE THING TO REMEMBER

A blood test samples a small, moving slice of a nutrient, so the right test depends on where the body keeps it.

Think of a bank. Your checking account is the blood. Your savings are in bone, liver, muscle and cells. The checking balance can look fine while savings run low, or look odd for a day because a bill just cleared. Some tests read the checking account (serum, the liquid part of blood). Others read savings or a long average, such as ferritin (the iron storage protein) and red cell tests.

Nutrient	Common blood test	How well it tracks the body
Iron	Ferritin	Tracks stores, but infection and inflammation raise it
B12	Serum B12, active B12, MMA	Serum B12 alone can miss a shortfall in cells
Folate	Serum or red cell folate	Serum follows recent meals; red cell, about 120 days
Vitamin D	25-OH vitamin D	Standard marker, but not the active form
Magnesium	Serum magnesium	Blood holds about 1% of the body's magnesium
Zinc	Serum or red cell zinc	Serum dips with infection and stress
Omega-3	Omega-3 index (red cells)	Reflects about 3 to 4 months of intake

1%

About 1% of the body's magnesium is in blood serum. Roughly 60% is in bone, and most of the rest is inside cells.

WHAT A STUDY FOUND

27 people with cognitive impairment and 21 without. Plasma magnesium looked alike (2.2 vs 2.24 mg/dL), but red cell magnesium was lower in the impaired group (3.14 vs 3.7 mg/dL). Limit: a pilot of 48 people. It shows tests can disagree, not that low magnesium causes impairment.

Sitzia et al., pilot study, 2020

COMMON BELIEF

"A normal blood result means I have enough."

WHAT THE EVIDENCE SAYS

Not always. Magnesium and B12 can look normal while cells run short, and inflammation can push ferritin up even when iron is low. A result is a clue to read with symptoms, history and a second marker.

ASK YOUR CLINICIAN

- **Which test fits this nutrient best: stores or recent intake?**
- **Could inflammation, a medicine or a recent illness be changing this result?**
- **Is one marker enough here, or should two be read together?**

CHAPTER 2

Iron and ferritin: low stores before low hemoglobin

THE ONE THING TO REMEMBER

Ferritin shows iron stores, but inflammation can raise it, so read it with transferrin saturation.

Ferritin is the most useful single iron number. About 1 ng/mL in blood reflects roughly 8 mg of stored iron. Hemoglobin (the oxygen-carrying red cell protein) falls late. Fatigue, brain fog and breathlessness can appear while hemoglobin is still normal, so a basic blood count can miss low iron.

Who sets the line	Low ferritin cut-off	Note
Common lab cut-off	Below 12 ng/mL	Often quoted as the deficiency line
WHO	Below 15 ng/mL	A population-level definition
General adults, one review	Below 30 ug/L	Standard first marker (ug/L = ng/mL)
With inflammation	Below 100 ug/L	Plus transferrin saturation under 20%
One GI society	Wants above 45 ng/mL	A higher bar than most

WHAT A STUDY FOUND

In healthy students, ferritin below 30 ng/mL matched bone marrow iron deficiency with 100% sensitivity and 89% specificity. A cut-off of 26 ng/mL best predicted anemia that iron treatment cures. Limit: students are not every patient, and inflammation shifts the line.

Daru et al., 2017

Estimates of iron deficiency in women before menopause range from about 20% to 60% depending on the cut-off, and about 4% to 10% in men. Common routes are low intake (vegetarian and vegan diets), poor absorption (celiac disease, H. pylori, acid-reducing medicines, gut surgery) and blood loss (periods, donation, slow gut bleeding).

20%

About 20% of people worldwide have iron deficiency anemia, and deficiency without anemia is thought to be even more common (Balendran and Forsyth, 2021).

COMMON BELIEF

"A high ferritin means plenty of iron."

WHAT THE EVIDENCE SAYS

Ferritin is also an acute-phase protein (one that rises with inflammation). Infection, liver disease and cancer can raise it, so a high value can hide deficiency. Above about 300 ng/mL in men, or 150 in menstruating women, overload becomes a question.

ASK YOUR CLINICIAN

- **Was ferritin read with transferrin saturation, not on its own?**
- **Which ferritin cut-off does this lab use, and does inflammation matter here?**
- **If ferritin is low, what could be causing it, including hidden blood loss?**

CHAPTER 3

B12 and folate: when a normal level can miss a shortfall

THE ONE THING TO REMEMBER

Serum B12 can look normal while cells run short, so one number is not enough to rule it out.

B12 (cobalamin, the nerve and blood vitamin) travels in blood in two ways. Most is held on carrier proteins that cells cannot use. Only 20% to 25% sits on transcobalamin; this active B12, called holoTC, is the part cells can take up. Body stores are about 2 to 3 mg, so a shortfall builds slowly. A standard serum B12 reports one number for all of it.

Marker	What it shows	Limit
Serum B12	Total B12 in blood	May miss up to 45% of deficient people
Active B12 (holoTC)	B12 that cells can use	Less useful in kidney disease
MMA	Waste that builds up when B12 is short	Also rises with poor kidney function
Homocysteine	Amino acid that builds up	Also moved by folate, B6, smoking, alcohol
Serum folate	Recent folate intake	Can look high when cells are short
Red cell folate	Folate over about 120 days	Can reflect a B12 problem

WHAT A STUDY FOUND

In 9,645 US adults, MMA above 300 nmol/L appeared in 56% of people with serum B12 below about 190 pg/mL, but in 4.1% of those with adequate B12. Even so, 25% of people with serum B12 below about 135 pg/mL still had normal MMA. Limit: MMA also rises with age and kidney decline.

Wolffenbuttel et al., NHANES analysis, 2020

45%

Serum B12 alone may miss up to 45% of people who are deficient, which is why researchers suggest combining two to four markers (Fedosov et al., 2015).

COMMON BELIEF

"No anemia means no B12 problem."

WHAT THE EVIDENCE SAYS

Most people with B12 deficiency do not have anemia, and nerve problems can occur without the telltale blood changes. In one study of 217 people, average red cell size was raised in only 11.4% of those with serum B12 below 200 pg/mL.

Studies link low B12 to strict vegetarian diets, older age, low stomach acid, celiac and Crohn's disease, acid-reducing medicines and a common type 2 diabetes medicine. B12 and folate are tied together: when B12 is short, folate can get stuck in a form cells cannot use, and serum folate may look high.

ASK YOUR CLINICIAN

- **Besides serum B12, would active B12 or MMA help in my case?**
- **Do my medicines or diet raise my chance of a low B12?**
- **Could my kidneys be changing my MMA or homocysteine?**

CHAPTER 4

Vitamin D: what the number means and what trials showed

THE ONE THING TO REMEMBER

Guidelines agree on bone health, not on a higher target, and supplement trials for other outcomes were modest or mixed.

Vitamin D is made in skin from sunlight and comes from a few foods. Blood tests measure 25-OH vitamin D (the storage form). It is the standard marker, but it is not the active hormone, which the kidney makes. Both activation steps depend on magnesium. One unit note: 1 ng/mL equals 2.5 nmol/L.

Group	Called deficient	Called sufficient
Health and Medicine Division	Below 12 ng/mL	20 and above
Endocrine Society	20 ng/mL or below	30 and above
AACE (endocrinology society)	30 ng/mL or below	30 to 50

Lower levels are more likely with darker skin, little sun, winter at northern latitudes (above about 37 degrees N), older age, obesity, gut malabsorption and some medicines. Few foods contain vitamin D: fatty fish, egg yolks and liver, plus fortified foods.

WHAT A STUDY FOUND

34 healthy adults, 82% of them insufficient, took either vitamin D2 or D3 for 11 weeks. Both forms raised the blood level. Limit: a small, short study; it shows the test moves, and says nothing about health outcomes.

Biancuzzo et al., 2013

15–20%

Results for the same blood can differ by 15% to 20% between lab methods, so a borderline number may deserve a repeat.

COMMON BELIEF

"Fixing a low vitamin D number protects the heart."

WHAT THE EVIDENCE SAYS

A clinical review reports that supplement trials mostly showed no effect on heart attack, blood pressure or stroke. The best-supported benefits are for bone and a modest reduction in falls in older people. Many trials gave a fixed amount without checking blood levels.

ASK YOUR CLINICIAN

- **Which cut-off does this lab use, and what is my number in ng/mL or nmol/L?**
- **Do my skin tone, location, weight or medicines change how I read this?**
- **When should this be repeated, and should calcium be checked too?**

CHAPTER 5

Magnesium, zinc and minerals that are hard to measure

THE ONE THING TO REMEMBER

Blood is a poor window on magnesium and zinc: a tiny blood share, infection and stress can all distort the result.

Magnesium works in hundreds of enzyme reactions. About 60% sits in bone and about 39% inside cells, so serum holds roughly 1%. Cells can run short while serum looks normal. Red cell magnesium holds about three times as much as serum and may reflect stores better, but the evidence is thin and mostly from small studies.

WHAT A STUDY FOUND

In 12,040 adults, people in the lowest fifth of serum magnesium (1.4 mg/dL or less) had a 24% higher rate of later dementia than the highest fifth (1.8 or more). Limit: an association. Low magnesium may mark poorer health or diet, and serum is an imperfect measure.

Alam et al., ARIC cohort, 2020

Mineral	Test	Why it is hard to read
Magnesium	Serum	Only about 1% of the body's magnesium is in blood
Magnesium	Red cell	Closer to stores, but studied in small groups
Magnesium	24-hour urine	Low loss can mean the body is holding on to it
Zinc	Serum	Falls with infection, stress and steroids
Zinc	Red cell	Steadier over time, but less often ordered

Zinc runs more than 100 enzymes and supports taste, immunity and the gut lining. Serum zinc below about 70 ug/dL is often read as deficiency, but infection, stress, steroids, time of day and weight loss can lower it without a true shortage. In mild deficiency the body shifts zinc from tissues into blood to hold serum steady, so red cell zinc can tell a longer story.

75

Average serum zinc (ug/dL) in users of acid-reducing medicines, against 91 in controls, in one small study (Farrell et al., 2011).

COMMON BELIEF

"If my serum magnesium is normal, my intake must be enough."

WHAT THE EVIDENCE SAYS

A perspective paper argues a chronic shortfall can exist with a normal serum level, and notes that about half of US adults eat below the estimated average requirement (Costello et al., Advances in Nutrition, 2023). That is a reason to look at diet, not proof of deficiency.

ASK YOUR CLINICIAN

- **Do my medicines, alcohol use or gut health raise my chance of low magnesium or zinc?**
- **Is serum enough for this mineral, or would a different test help?**
- **Could a recent infection explain a low zinc result?**

CHAPTER 6

Omega-3 and iodine: tests with their own quirks

THE ONE THING TO REMEMBER

The omega-3 index tracks months of intake, while iodine risk is U-shaped, so both can be misread.

The omega-3 index is the share of EPA and DHA (two fish omega-3 fats) in red cell membranes. Red cells give a steadier long-term picture than plasma, and the index takes about 3 to 4 months to move. The average American is near 4% to 5%. One research group calls 8% or above low risk and 4% or below high risk. That is one group's view, not a guideline. Plasma-based labs use different numbers.

Fish (3 oz cooked)	DHA (g)	EPA (g)
Farmed Atlantic salmon	1.24	0.59
Wild salmon	1.22	0.35
Herring	0.94	0.77
Canned sardines	0.74	0.45
Mackerel	0.59	0.43
Cod	0.10	0.04
Chicken breast	0.02	0.01

WHAT A STUDY FOUND

About 25,000 healthy adults took fish oil or placebo. The main heart outcome showed no clear benefit; one component, heart attack, fell about 20%. Limits: the dose was modest, blood levels were not targeted, and people were not chosen for low levels.

Manson et al., N Engl J Med, 2019

COMMON BELIEF

"Flax and walnuts give the same omega-3 as fish."

WHAT THE EVIDENCE SAYS

Plant omega-3 (ALA) converts to EPA and DHA poorly; estimates run from 5% or less to 15% or less. Fish supplies EPA and DHA directly. In cohort data, vegetarians and vegans had lower red cell omega-3.

Iodine builds thyroid hormone. Main sources are seafood, dairy and iodized salt. Too little and too much can both disturb the thyroid. US intake has fallen as more salt comes from restaurants, processed food and sea salt, which is naturally low in iodine. Urinary iodine is the most sensitive marker of excess intake.

WHAT A STUDY FOUND

In 902 adults, serum iodine above 100 ug/L went with 1.95 times the risk of subclinical hypothyroidism (a mildly underactive thyroid), and above 130 ug/L with 4.26 times. Limit: a snapshot, so it cannot show which came first, and ranges differ by region.

Jin et al., 2017

ASK YOUR CLINICIAN

- **Does this lab report the omega-3 index in red cells or in plasma?**
- **If my thyroid tests are off, should iodine intake be part of the picture?**

CHAPTER 7

Food first: what common foods contribute

THE ONE THING TO REMEMBER

Foods differ widely in what they carry and how well it absorbs, so a table beats a guess.

These tables show what a serving contains, from nutrient reference tables. Amounts are not the same as what you absorb. Animal (heme) iron absorbs better than plant iron, tea and coffee reduce iron absorption, and phytates (binding compounds in grains and seeds) hold on to zinc. Folate is shown in DFE (folate adjusted for absorption).

Food (serving)	Iron (mg)	Type
Mussels, 3 oz	5.7	Heme
Oysters, steamed, 3 oz	5.3	Heme
Lentils, cooked, 1/2 cup	3.3	Non-heme
Spinach, cooked, 1/2 cup	3.2	Non-heme
Beef, 90% lean, 3 oz	2.5	Heme
Egg, one	0.9	Mixed
Chicken breast, 3 oz	0.4	Heme

Nutrient	Food (serving)	Amount (mcg)
B12	Clams, 3 oz	84
B12	Sockeye salmon, 3 oz	4.8
B12	Milk, 1 cup	1.2
B12	Egg, one	0.6
Folate	Lentils, cooked, 1/2 cup	180 DFE
Folate	Asparagus, 6 spears	134 DFE
Folate	Spinach, cooked, 1/2 cup	130 DFE

Nutrient	Food (serving)	Amount (mg)
Magnesium	Pumpkin seeds, roasted, 1/4 cup	162
Magnesium	Almonds, 1 oz	80
Magnesium	Spinach, boiled, 1/2 cup	78
Zinc	Oysters, steamed, 6 medium	45
Zinc	Ground beef, 3 oz	5.3
Zinc	Cheddar, 1 oz	1.5

Nutrient	Food (serving)	Amount
Vitamin D	Canned pink salmon, 3 oz	465 IU
Vitamin D	Fortified milk, 1 cup	124 IU
Vitamin D	Egg, one	41 IU
Iodine	Baked cod, 3 oz	158 mcg
Iodine	Milk, 1 cup	85 mcg
Iodine	Iodized salt, 1/4 tsp	76 mcg
Iodine	Dried seaweed, 1 g	16 to 2,984 mcg

WHAT A STUDY FOUND

In a survey of reported intake, people who ate no fish and took no supplements averaged an omega-3 index of 4.1%. People who ate fish three times a week and took some supplements averaged 8.1%. Limits: self-reported intake, and the groups differ in more than diet.

Jackson et al., 2019

18%

Heme iron absorbs at about 18% in omnivore diets, against about 10% on plant-based diets, so equal milligrams do not mean equal absorbed iron.

CHAPTER 8

Your results page and questions to bring

THE ONE THING TO REMEMBER

Write down the number, the lab's range, the date and what could distort it, so the next test can be compared.

A single result is a snapshot. Compare it with your past results, the lab's own range and the context: illness, blood loss, pregnancy, medicines, supplements and the time of day. For zinc, researchers advise comparing against past results and clinical context rather than trusting one value.

BEFORE YOU READ A RESULT

- [ ] I know which test measured this nutrient and what it reflects
- [ ] I noted whether I was sick or inflamed when I gave blood
- [ ] I listed every medicine and supplement I was taking
- [ ] I told the lab about any high-dose biotin product (it can skew assays)
- [ ] I kept the lab's range and units beside my number

MY RESULTS PAGE

Nutrient and test name _____

My result and units _____

This lab's range _____

Date and time of the blood draw _____

Illness, medicines or supplements at the time _____

Question to ask _____

WHAT A STUDY FOUND

A 2024 narrative review argues that supplement choices should follow measured need, not guesses. It lists harms from guessing, such as iron building up when stores are not low, and notes that most evidence links markers to intake or disease, with few trials of marker-guided choices. Limit: a narrative review; two authors have ties to an AI tool maker.

Pokushalov et al., Nutrients, 2024

ASK YOUR CLINICIAN

- What do my results suggest, and what could be normal variation?
- Which result should be repeated, and when?
- What else should we rule out before acting on any one number?
- Do my medicines or conditions change how to read these?

THE WHOLE GUIDE ON ONE PAGE

If you remember nothing else

1. A blood level is a sample, not your stores. Pick the test that fits where the nutrient is kept.
2. Ferritin tracks iron stores but rises with inflammation. Read it with transferrin saturation.
3. Serum B12 can miss a shortfall. MMA and active B12 add information.
4. Vitamin D guidelines agree on bone. Trials for other outcomes were modest or mixed.
5. Magnesium and zinc are hard to read in blood: a tiny blood share, infection and stress distort them.
6. The omega-3 index moves over 3 to 4 months. Iodine risk is U-shaped, so too much also matters.
7. Food tables show contents, not absorption. Absorption and needs differ by person.
8. Write the number, range, date and context each time, and bring questions.

WHAT THIS GUIDE CANNOT DO

This guide cannot tell you whether you are low in anything. That takes your own results, your history and a clinician. It cannot say what any number means for you, and a single result is a snapshot. Most findings here come from observational studies or small trials. It gives no advice on supplements and does not replace medical care.

A FREE NEXT STEP

Read the short free page on the site about which vitamin and mineral markers are worth checking in blood, so you can see which tests fit your questions before you talk with a clinician.

vitalsvault.com/lab-check

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This guide is educational. It is not medical advice and not a diagnosis, and it does not replace a clinician who knows your history. Study findings describe groups of people and may not apply to you.