

Pernicious Anemia

Disease Report

REPORT CATEGORY —



ENERGY & FATIGUE

Sample Client

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DISCLAIMER

This report does not diagnose this or any other health conditions. Please talk to a healthcare professional if this condition runs in your family, you think you might have this condition, or you have any concerns about your results.

Personal information

NAME

Sample Client

SEX AT BIRTH

Male

HEIGHT

5ft 5" 165cm

WEIGHT

137lb 62kg



How this works

Our Wellness Reports analyze how your DNA influences your health.
We then use this analysis to give you personalized risk estimates and recommendations.



Similarly, our Trait Reports look at how your DNA influences your traits.



Your DNA is like an instruction manual — it contains a lot of information.
You can think of it as a blueprint for your body.

Genetic variants are parts of DNA that differ from person to person. Some can make you more vulnerable to certain health issues, while others may influence traits such as eye color.



We use artificial intelligence and machine learning to analyze all this information.
We then summarize your results as a risk score or display it on a gauge.

In total, we analyze up to 83 million genetic variants.

When we give a risk score, the risk icon tells you if you are at a higher or lower risk compared to other people:



Genotype color info:

AA

You don't have any risk alleles

AA

You have 1 risk allele

AA

You have 2 risk alleles

Your risk is also displayed as a percentile. This will tell you how your risks compare to our sample population. The lower your percentile number, the lower your risk. The "50th percentile" would be an average risk.

Similarly, the gauge tells you your relative risk score compared to our sample population, or it indicates a specific trait or haplotype you are more likely to have based on your genetic variants.

When applicable, we also list top evidence-based recommendations that may help lower your risk. The focus is on recommendations that may be of benefit to you, based on your genetics.

Our recommendations come in four categories: lifestyle, diet, supplements and drugs.
The following icons tell you which category a recommendation falls into:



Our team of scientists also ranks each recommendation.
We rank based on impact and the strength of evidence in the medical literature.

Impact shows how strongly a recommendation will affect your health in a certain area.
Evidence is how much scientific support there is for the recommendation. Rankings are from 1 to 5 (low to high):



Impact

Impact scores range from 1-5. These scores reflect how much of an effect each recommendation can have. An impact score of 5 predicts the biggest effect.

When a recommendation affects something we can measure, we use those measurements to assign the impact score. For example, a recommendation that decreases cholesterol by 20% will have a higher impact score than one that decreases it by 5%.

Some recommendations affect things that we cannot directly measure, like stress or mood. For these, the impact score is based on how well they work relative to other recommendations and standard treatments. The best ones get the highest scores.

If there is a lot of research that shows a recommendation works especially well for your genotype, the impact score gets increased.

Recommendation Evidence

5 / 5

Recommendations that are considered effective and generally recommended by experts and medical bodies.

4 / 5

Recommendations that are considered likely effective and that have multiple independent meta-analyses and a great many studies supporting them.

3 / 5

Recommendations that are considered possibly effective and have many studies supporting them

2 / 5

Recommendations that have insufficient evidence, with two or several clinical trials supporting them, or many studies but with ambiguous results.

1 / 5

Recommendations that have insufficient evidence, with a single clinical trial, or with many studies most of which didn't find support for the recommendation.

0 / 5

No evidence in humans.

Genotype-specific Evidence

High-quality

Direct evidence that a recommendation helps more in people with your gene variant (many clinical trials, a few large clinical trials, or a meta-analysis).

Medium-quality

Direct evidence that a recommendation helps more in people with your gene variant (a few clinical trials or one large clinical trial).

Low-quality

Direct evidence that a recommendation helps more in people with your gene variant (a single clinical trial or more trials with inconsistent results).

Indirect

A recommendation may help more in people with your gene variant because it targets a specific gene or protein affected by your variant (e.g., MTHFR, dopamine).

In theory

A recommendation may help more in people with your gene variant because it targets a specific mechanism affected by your variant (e.g., inflammation, oxidative stress).

Some things to keep in mind:

- Genetics doesn’t play a considerable role in a condition or a trait.
- There is not enough research available to estimate a genetic predisposition.
- There are technical limitations to estimating or presenting a genetic predisposition.
- The topic is sensitive, and a genetic predisposition should only be estimated and presented by a healthcare professional.

Introduction

Vitamin deficiency anemia is a lack of healthy red blood cells caused by insufficient levels of the vitamins B12 and folate. As a result, the body produces red blood cells that are too large and have a reduced ability to carry oxygen [\[R\]](#).

In addition to an insufficient dietary intake of these vitamins, vitamin deficiency anemia can be caused by disorders that impair their absorption or metabolism. For instance, **pernicious anemia** is an autoimmune condition in which the body’s immune system attacks the stomach cells that produce a substance called intrinsic factor. Without sufficient intrinsic factor, vitamin B12 cannot be effectively absorbed, regardless of dietary intake. Less commonly, pernicious anemia can also arise from other conditions that affect the stomach or small intestine, such as Crohn's disease, certain surgeries, or genetic factors that affect intrinsic factor production.

Symptoms and Treatment

Pernicious anemia often develops slowly and can cause a variety of symptoms due to its effect on blood and nerve cells. These include [\[R\]](#):

- Fatigue and weakness
- Pale or jaundiced skin
- Heart palpitations
- Shortness of breath
- Nerve problems like numbness or tingling, muscle weakness, and problems walking
- Mental problems like memory loss, changes in mood, or behavioral changes
- Glossitis and mouth ulcers

Left untreated, it increases the risk of stomach cancer.

The primary treatment for pernicious anemia is the administration of regular injections of vitamin B12, initially given frequently (often weekly) and then monthly after vitamin levels stabilize. For some, high oral doses of vitamin B12 or nasal administration may also be effective, especially if their daily intake is not sufficient due to increased requirements or reduced dietary intake [\[R\]](#).

Regular monitoring of blood levels and maintenance of proper vitamin B12 levels can manage the symptoms effectively and help prevent complications. Lifestyle changes, such as dietary adjustments to increase vitamin B12 intake (through fortified foods or supplements), are also recommended, though they alone cannot completely address the issue if intrinsic factor is lacking.



LESS LIKELY

Less likely to have pernicious anemia based on 1,666 genetic variants we looked at

Your Recommendations

Your recommendations are prioritized according to the likelihood of it having an impact for you based on your genetics, along with the amount of scientific evidence supporting the recommendation.

You'll likely find common healthy recommendations at the top of the list because they are often the most impactful and most researched.

DOSAGE		DOSAGE			
1	Vitamin B12	100 mcg	2	Tuna	
3	Dietary Vitamin B12		4	B Vitamins	
5	Turkey giblets		6	Oysters	
7	Vitamin B12 And Folate		8	Salmon	
9	Beef liver		10	Clams	
11	Sardines				

1



Vitamin B12

IMPACT3 / 5

EVIDENCE3 / 5

How to implement

Take a 50 mcg vitamin B12 supplement daily, preferably with a meal to enhance absorption.

TYPICAL STARTING DOSE

100 mcg

Description

Vitamin B12 is a water-soluble vitamin primarily found in animal-based foods like meat, fish, and dairy products. It plays a crucial role in maintaining healthy nerve cells, DNA synthesis, and red blood cell formation. Vitamin B12 deficiency can lead to anemia, neurological issues, and fatigue.

[Vitamin B12](#) is important for [\[R\]](#), [\[R\]](#):

- Building DNA
- Nervous system function
- Energy production

You can get vitamin B12 from [\[R\]](#):

- Animal products (meat, fish, eggs, and dairy)
- Fortified foods
- Supplements

Adults should be getting **2.4 micrograms** of vitamin B12 every day [\[R\]](#).

How it helps

Pernicious anemia is caused by a deficiency of vitamin B12. Supplementation with vitamin B12 helps restore normal red blood cell production, reducing symptoms like fatigue and weakness [\[R\]](#).

2



Tuna

IMPACT

0 / 5

EVIDENCE

0 / 5

How to implement

Incorporate tuna into your meals 2-3 times per week, aiming for a serving size of about 3.5 ounces (100 grams) per meal. Choose fresh or water-packed tuna instead of oil-packed to reduce unnecessary calorie intake.

Description

Tuna is a type of saltwater fish commonly consumed worldwide, rich in lean protein, omega-3 fatty acids, and essential vitamins and minerals. Its health benefits include heart health support, improved brain function, and reduced inflammation. Tuna is often included in diets for conditions like cardiovascular disease prevention and cognitive enhancement.

Tuna is a source of niacin, vitamin D, as well as being a very good source of protein and omega-3 fatty acids. A 3-ounce serving has 8.6 mg of niacin or 54%DV.

How it helps

Tuna provides a high level of vitamin B12, helping to compensate for the deficiency causing pernicious anemia and improving energy levels.

3



Dietary Vitamin B12

IMPACT

0 / 5

EVIDENCE

0 / 5

How to implement

Incorporate foods rich in vitamin B12 into your daily diet, such as beef, chicken, fish, and dairy products. If you are vegetarian or vegan, consider fortified cereals or plant-based milks. Aim to meet the recommended dietary allowance (RDA) for adults of 2.4 micrograms of vitamin B12 per day.

Description

Vitamin B12 is important for nerve function, red blood cell production, and overall energy metabolism. It's crucial for preventing pernicious anemia and maintaining neurological health.

How it helps

Supplementing with dietary vitamin B12 directly addresses the deficiency causing pernicious anemia, supporting the formation of healthy red blood cells and improving overall energy levels.

4



B Vitamins

IMPACT

0 / 5

EVIDENCE

0 / 5

How to implement

Take a B vitamin complex supplement once daily, preferably with your morning meal to enhance absorption. The supplement should include a range of B vitamins such as B1 (thiamine), B2 (riboflavin), B3 (niacin), B5 (pantothenic acid), B6 (pyridoxine), B7 (biotin), B9 (folate), and B12 (cobalamin). Ensure consistency by taking it at the same time each day.

Description

B vitamins help the body function properly. Two examples are [vitamin B9 \(folate\)](#) and [vitamin B12](#). They play essential roles in [\[R, R, R, R\]](#):

- DNA formation
- Metabolism
- Energy production

You can get these vitamins from [\[R, R, R, R, R\]](#):

- Animal products
- Green leafy vegetables
- Citrus fruits
- Fortified foods
- Supplements

Adults should be getting **400 micrograms (mcg) of folate** and **2.4 mcg of vitamin B12** every day [\[R, R\]](#).

Folate deficiency is rare but can happen in people that don’t eat enough fruits and vegetables. Alcoholics and lactating mothers may also be at an increased risk [\[R\]](#).

Vitamin B12 deficiency often takes years to develop, as the body is able to store large amounts in the liver. Groups that may be at an increased risk include [\[R, R\]](#):

- Vegans
- Pregnant women
- Older people
- People with gut issues

How it helps

Pernicious anemia is often caused by a deficiency in Vitamin B12. B Vitamins, especially B12 (cobalamin), help in the production of healthy red blood cells and maintaining nerve function.

5



Turkey giblets

IMPACT

0 / 5

EVIDENCE

0 / 5

How to implement

Incorporate cooked turkey giblets into your diet a few times a week. You can add them to soups, stews, gravies, or finely chopped in stuffing, providing a source of protein, vitamins, and minerals. Ensure they are properly cooked to a safe internal temperature of 165°F to avoid foodborne illnesses.

Description

Turkey giblets refer to the edible organs of a turkey, typically the heart, liver, and gizzard. They are nutrient-dense and provide essential vitamins and minerals. These organ meats are used in various culinary dishes and can offer health benefits like iron and vitamin A intake.

Turkey giblets are a great source for copper, selenium, and zinc, vitamin A and B-vitamins, as well as protein and choline. A 3-ounce serving provides 588 mcg of copper or 65%DV.

How it helps

Turkey giblets are rich in vitamin B12, which is necessary for treating pernicious anemia by aiding in the production of red blood cells and reducing fatigue.

6



Oysters

IMPACT

0 / 5

EVIDENCE

0 / 5

How to implement

Consume 3-5 medium-sized oysters, which are about 50-100 grams, two to three times a week. This ensures an adequate intake of essential nutrients like zinc without excessive heavy metal consumption.

Description

Common to coastal areas around the world, oysters are a mullusk that has been harvested for thousands of years. Oysters are a rich source of protein, vitamins (especially B12), zinc, iron, copper, and omega-3 fatty acids.

Oysters are an excellent source of iodine, iron and are loaded with other vitamins and minerals, especially copper and vitamin B12. A 3-ounce serving provides 93 mcg of iodine or 62%DV.

How it helps

Oysters are rich in vitamin B12, which helps to alleviate the symptoms of pernicious anemia as this condition is caused by a deficiency in vitamin B12.

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Vitamin B12 And Folate

IMPACT

0 / 5

EVIDENCE

0 / 5

How to implement

Take a combined supplement of vitamin B12 and folate daily. For adults, the typical dose is 2.4 mcg of B12 and 400 mcg of folate. This supplement should be taken with water and a meal to enhance absorption.

Description

Vitamin B12 and folate (vitamin B9) work together to support DNA synthesis and red blood cell formation. Both are essential for preventing megaloblastic anemia and are commonly found in a variety of foods, including leafy greens, legumes, and fortified cereals.

How it helps

Vitamin B12 and folate work together to produce red blood cells and improve nerve function. Supplementing both can help alleviate the symptoms of pernicious anemia and improve overall health.

8



Salmon

IMPACT

0 / 5

EVIDENCE

0 / 5

How to implement

Incorporate at least two servings of salmon into your weekly diet, aiming for each serving to be about 3.5 ounces (100 grams), cooked. Choose wild-caught salmon when possible for higher omega-3 content.

Description

Salmon is a nutrient-rich fish known for its high content of omega-3 fatty acids, which can support heart health and reduce inflammation. It's also an excellent source of protein, vitamin D, and various minerals.

How it helps

Salmon is an excellent source of vitamin B12, which is crucial for the production of red blood cells and can help improve symptoms of pernicious anemia.

9



Beef liver

IMPACT

0 / 5

EVIDENCE

0 / 5

How to implement

Incorporate beef liver into your diet 1-2 times per week, aiming for a serving size of about 3-4 ounces (85-113 grams) each time. This can be pan-fried, baked, or incorporated into dishes like stews or pate to make it more palatable.

Description

Beef liver is a commonly recommended organ meat due to its rich content of protein, B-vitamins, and minerals.

Chickpeas are a good source of vitamin B6, iron, folate, fiber, and rich in minerals like copper, zinc, and phosphorus. A ½ cup serving provides 1.1 mg of vitamin B6 or 65%DV.

How it helps

Beef liver is rich in vitamin B12, which is essential for the production of red blood cells. Pernicious anemia is caused by a deficiency in B12, so consuming beef liver can help replenish this important nutrient.

10



Clams

IMPACT

0 / 5

EVIDENCE

0 / 5

How to implement

Incorporate cooked clams into your diet 2-3 times per week, either as part of main dishes, in soups, or salads. Each serving should be about 3-4 ounces (85-113 grams).

Description

Clams are a seafood source rich in essential nutrients like protein, vitamin B12, and minerals. Including clams in your diet can support healthy blood and nerve function, as well as overall nutritional well-being.

Clams provide manganese, vitamin B12, protein, and omega-3’s along with being a good source of riboflavin. A 3-ounce serving provides 0.9 mg of manganese or 39%D.

How it helps

Clams are an excellent source of vitamin B12. Including clams in your diet can help manage pernicious anemia by providing necessary B12 to improve red blood cell production.

11



Sardines

IMPACT

0 / 5

EVIDENCE

0 / 5

How to implement

Incorporate two to three servings of sardines into your diet each week. You can eat them grilled, steamed, or straight from the can as part of salads, sandwiches, or as a snack. Each serving should be about 3.5 ounces (100 grams), which is roughly one can of sardines.

Description

Sardines are small, oily fish known for their rich content of omega-3 fatty acids, calcium, B12, and vitamin D. Consuming sardines can support heart health, bone strength, and provide essential nutrients, and they are typically found in coastal waters.

Sardines are a good source of iron, omega-3 fatty acids, and a host of vitamins and minerals including calcium, iron, and vitamin D. A 2-sardine serving provides 2 mg of iron or 11%DV.

How it helps

Sardines are packed with vitamin B12, essential for individuals with pernicious anemia, as it helps with the production of red blood cells and dealing with fatigue.

Next Steps

Remember, your genes only tell one important part of your health story!

Now that you've seen your DNA-based results for this health topic, let's take a look at other contributing factors.

Your lab results

Your lab results are impacted by the combined effect of your genes, environment and lifestyle.

Lab tests will give you the best picture of your current health status, while your genes provide insight into your health predispositions and which recommendations are best for you.

	MCH	28.2 pg		9 Nov 2025
	MCV	85.6 fL		9 Nov 2025
	Vitamin B12	687 pg/mL		9 Nov 2025
	Hematocrit	51.8 %		9 Nov 2025
	Hemoglobin	17.1 g/dL		9 Nov 2025
	Homocysteine	12.84 umol/L		9 Nov 2025