# Results Overview

### Vitamin K breakdown

You do not carry gene variants that reduce the inactivation of vitamin K and likely have average vitamin K levels.

Lower Risk

### Vitamin E breakdown

Your gene variants are associated with an average vitamin E requirement due to normal levels of breakdown.

Normal Turnover

### Vitamin B2 requirement

Your genetic and lifestyle data suggest you may require additional vitamin B2 in your diet.

Average Risk

### Vitamin B12 requirement

Your genetic and lifestyle data suggest you do not require additional vitamin B12 in your diet.

Normal Requirement

### Vitamin A requirement (BCMO1)

You have an increased vitamin A requirement due to reduced conversion of provitamin A carotenoids.

High Need

### Vitamin C level (SLC23A1)

Your gene variants are associated with a slightly increased vitamin C requirement due to reduced SVCT1 function.

Moderate Need

**Vitamin B6 level**
Your gene variants are associated with a slightly increased vitamin B6 requirement.

Moderate Requirement

**Vitamin D conversion (CYP2R1)**
You have a slightly increased vitamin D requirement due to mildly impaired activation of vitamin D2 and D3.

Moderately Higher Risk

**Vitamin D levels (GC)**
Your gene variants are associated with normal blood levels of vitamin D and therefore do not increase your vitamin D requirement.

Normal Requirement

**Magnesium levels (MUC1)**
You carry MUC1 gene variants linked to lower blood magnesium levels.

Moderately Higher Risk

**Betaine requirement**
You do not carry gene variants that increase your betaine requirement.

Normal Requirement

**Choline metabolism**
Your gene variants are associated with an increased choline requirement, as your body produces choline less effectively.

Increased Need

**Blood calcium level**
You carry some gene variants linked to higher blood calcium levels.

Average Risk

## Zinc requirement

Your gene variants are associated with a normal zinc requirement due to average blood and tissue fluid levels.

Normal Requirement

## Magnesium requirement

Your genetic and lifestyle factors suggest you have a higher magnesium requirement.

Increased Requirement

# Vitamin K breakdown

Vitamin Requirements

Vitamin K is a fat-soluble vitamin important for blood clotting and maintaining healthy bones. Most of us get enough vitamin K from the foods we eat, as well as from vitamin K produced by bacteria in our colon. We convert this dietary vitamin K into active vitamin K, which can then be used to produce clotting factors and drive other metabolic reactions in the body.Depending on our genetics, however, we metabolise active vitamin K differently. One variant of your CYP4F2 gene causes you to produce less of an enzyme that inactivates active vitamin K. This leads to slightly higher vitamin K levels and the need for higher drug dosages when taking warfarin, an anticoagulant drug that blocks your liver from using vitamin K to make clotting factors.

## Your result

Higher Risk

Moderately Higher Risk

**Lower Risk**

No Data

**You do not carry gene variants that reduce the inactivation of vitamin K and likely have average vitamin K levels.**

Your CYP4F2 gene encodes a liver enzyme that inactivates Vitamin K. Certain variants of this gene are associated with reduced inactivation, leading to higher levels of Vitamin K.

Your CYP4F2 genotype is: CC

Your genotype is associated with lower blood and tissue levels of active Vitamin K compared to other genotypes.

You do not carry the 'T' allele.

The 'T' allele is associated with lower CYP4F2 enzyme levels and, due to reduced vitamin inactivation, increased blood and tissue levels of active Vitamin K.

You are less likely to require a higher warfarin dose if starting anticoagulation treatment. People with the T allele (TT and CT

genotypes) have been shown to require an 8.3% higher dose of warfarin compared to those with your genotype (CC).

Unlike those with other genotypes, you are not at a reduced risk of bleeding with long term warfarin use.

Vitamin K helps to maintain bone mineral density. Some evidence suggests that supplementation with 45 mg/day of MK-4 (a form of vitamin K) reduces the risk of osteoporosis and rates of bone fractures.

Blood tests are required to assess your Vitamin K status more accurately. This may include: serum Vitamin K1 levels, serum PIVKA-II levels, and a blood coagulation screen (including prothrombin time/INR, APTT).

## Recommended Actions

**Add a handful of kale to a few meals a week.** Leafy green vegetables are great sources of vitamin K with one cup (67 g) of raw kale providing 684% of the recommended daily amount!

**If taking high dose vitamin D, look to make sure you are consuming plenty of leafy greens like spinach and kale each day.** These vegetables are high in vitamin K which helps reduce calcium build up from high vitamin D doses.

**Eat raw spinach.** Spinach is very high in vitamin K, so by adding raw spinach to your diet, it will help to keep your vitamin K levels healthy.

**Cook broccoli and kale in a microwave.** This form of cooking has been shown to increase the absorption rate of vitamin K from these food sources as the heat breaks down the cell walls to release vitamin K.

**Add good sources of fats to your meals such as 112 g (4 oz) of salmon or 2-3 eggs.** Fats are important for maintaining good vitamin K levels as they aid with its absorption. The addition of fat to cooked spinach can increase K1 availability from 5-13%.

**Give natto a try.** Natto is a traditional Japanese fermented food that is very rich in vitamin K (especially vitamin K2). It is traditionally eaten at breakfast and may contribute to a reduced risk of poor cardiovascular health.

**If older and/or concerned about bone health, you could consider supplementing vitamin K2.** Vitamin K2 is more effective at improving bone mineral density compared to K1 sources (vegetables).

**If on blood thinning medication, consult your doctor before adjusting your vitamin K intake.** Warfarin has been shown to work against the actions of vitamin K so you do not want to be altering your daily intake of vitamin K as it can interfer with this medication.

# Vitamin E breakdown

Vitamin Requirements

Vitamin E (α-tocopherol) is an important antioxidant - it protects cells against damage caused by highly reactive substances generated in the body called free radicals. Our blood and tissue levels of vitamin E not only depend on how much we consume in our diet, but also on how our body metabolises and breaks down vitamin E.This trait analyses a SNP (rs2108622) of your CYP4F2 gene that affects the rate at which you break down α-tocopherol, the main form of vitamin E used by the body. This, in turn, influences your vitamin E levels. Your personalised actions focus on how to optimise your vitamin E levels in line with your CYP4F2 genotype.

## Your result

Moderate Turnover

Low Turnover

**Normal Turnover**

No Data

**Your gene variants are associated with an average vitamin E requirement due to normal levels of breakdown.**

The main enzyme in the liver that breaks down Vitamin E (α-tocopherol) is called cytochrome P450 F2. This enzyme is encoded by your CYP4F2 gene.

Your CYPF42 genotype is CC.

You do not carry the 'T' allele.

The 'T' allele is associated with lower enzyme levels and, due to reduced vitamin breakdown (catabolism), increased blood levels of Vitamin E (α-tocopherol).

Your genotype is associated with normal cytochrome P450 F2 enzyme activity.

Your genotype is associated with lower blood serum levels of Vitamin E (α-tocopherol) compared to other genotypes. In

studies, all participants still had a healthy serum Vitamin E level.

This trait is based on CYPF42 gene variants only. Diet, other genetic traits, and the presence of other medical conditions can significantly affect Vitamin E levels.

Fat is required for the absorption of Vitamin E in the digestive system. People with fat-malabsorption disorders (e.g. Crohn's disease) and those on very low fat diets may be at greater risk of developing low Vitamin E levels.

A fasting serum α-tocopherol level is required to assess Vitamin E levels more accurately. A healthy serum α-tocopherol level is considered to be between 5.5 and 17 mg/L.

## Recommended Actions

**Add good sources of fats to your meals such as 112 g (4 oz) of salmon or 2-3 eggs.** Fats are important for maintaining good vitamin E levels as they aid with its absorption.

**Eat raw almonds.** Almonds contain plenty of vitamin E with 28 g (1 oz) providing 6.8 mg - almost half your recommended daily amount.

**Add 28 g (1 oz) of sesame seeds to some meals.** Sesame provides plenty of a-tocopherol which can help reduce breakdown of a-tocopherol, along with having sesamin which improves retention of vitamin E through inhibiting CYP4F2 enzyme activity.

**Eat avocados.** Avocados are a great source of vitamin E as well as containing plenty of healthy fats to aid absorption.

**Snack on 28 g (1 oz) of sunflower seeds.** Sunflower seeds are one of the best sources of vitamin E, providing plenty of antioxidants to keep inflammation low.

# Vitamin B2 requirement

Vitamin Requirements

Vitamin B2, also known as riboflavin, is a micronutrient that plays an important role in energy production, cell growth and the metabolism of other vitamins. An adequate of intake of vitamin B2 is also needed to maintain an efficient folate cycle: an important biochemical process required for making DNA and maintaining a healthy cardiovascular system. Your folate cycle efficiency, based on folate conversion, methionine production and homocysteine regulation; influence your vitamin B2 requirements.

## Your result

High Need

**Average Risk**

**Your genetic and lifestyle data suggest you may require additional vitamin B2 in your diet.**

Our analysis shows that your folate cycle is efficient. You do not require supplements and should focus on getting enough vitamin B2 from foods.

To ensure you are getting a regular source of vitamin B2, include at least one B2-rich ingredient daily.

Based on your MTHFR gene, your folate cycle is functioning well. Adequate B2 intake will help you to maintain healthy levels of folate and homocysteine. Homocysteine is a molecule linked to cardiovascular disease.

As our analysis shows that your folate cycle is efficient, you have a good level of active folate to maintain healthy blood flow.

Adequate vitamin B2 intake from your diet helps with the efficient breakdown of macronutrients, providing your body with plenty of energy for daily activities and exercise.

Steaming and microwaving loses half the vitamin B2 that boiling does. Sauteing and stir-frying for a short amount of time are also useful cooking methods for conserving B2 in food.

## Recommended Actions

**Exercise increases your body's requirement for B2, so consume more when exercising.** Fill your post-workout meal with plenty of foods high in vitamin B2.

**Eat enough B2 to maintain healthy iron levels and reduce fatigue.** If you begin to feel more fatigued during your workouts, try adding some more foods rich in vitamin B2 to your diet.

**Increase your B2 intake if you regularly drink large amounts of alcohol, as alcohol reduces B2 absorption in the gut.**

**Vitamin B2 can help if you suffer from migraines.** Studies have shown that B2 supplements can reduce episode frequency in migraine sufferers. You may need a higher daily dose to get these benefits.

**Consume 1.1-1.3 mg of vitamin B2 (riboflavin) each day from food.** If you don't consume many animal products also consider taking a B-complex supplement with at least 2 mg of vitamin B2 (can be taken with or without food).

**Eat foods rich in vitamin B2.** Examples of good sources of vitamin B2: 170 g beef skirt steak, 1.5 mg B2; 170 g tofu, 1 mg; 108 g oyster mushrooms, 0.4 mg; 1 large egg, 0.3 mg.

# Vitamin B12 requirement

Vitamin Requirements

Vitamin B12 (also known as cobalamin) is a extremely important water-soluble B-vitamin. It plays some role in the metabolism of every cell in our bodies. It is particularly important for making DNA, producing red blood cells and supporting the nervous system.

## Your result

High Need

Normal Requirem

Average Risk

**Your genetic and lifestyle data suggest you do not require additional vitamin B12 in your diet.**

Based on your MTR and MTRR results, you convert active folate to methionine efficiently. Meeting your recommended intake of vitamin B12 should be sufficient for you.

Our analysis shows that you are not at risk of vitamin B12 deficiency, as long as you get enough from your diet.

As you do not follow a vegan diet, you can get sufficient vitamin B12 from foods such as meat, fish, eggs and/or dairy.

Getting enough vitamin B12 from foods will prevent you from feeling tired, facilitating muscle building and fat loss.

If you're looking to increase your exercise volume or intensity, ensure you consume adequate B12. This will provide your body with more energy and allow you to work harder for longer.

If you are over 60 and don't consume at least one portion of meat or eggs daily, you may want to supplement with vitamin B12 to ensure you are not deficient.

# Recommended Actions

**You do not need vitamin B12 supplements if you regularly eat foods high in vitamin B12.**

**Increase your dietary vitamin B12 intake if your activity level increases to improve your blood flow and keep your working muscles well supplied with oxygen.**

**Nutritional yeast is also a source of vitamin B12, with 1 tbsp containing 6 mcg of B12.** This could be an easy addition to meals to boost B12 intake.

**Foods rich in vitamin B12 include: 100 g cooked fresh tuna, 9.** 4 mcg vitamin B12; 100 g cooked fresh salmon, 2.8 mcg; 100 g cooked ground beef, 2.7 mcg; 240 ml fortified soy milk, 2.6 mcg; 2 large boiled eggs, 1.2 mcg.

**Eat foods fortified with vitamin B12, such as cereals or grains, at least twice a week to help you reach your recommended intake.**

**If you don't eat much animal products, it can be difficult to get enough vitamin B12 and other B vitamins.** Take a vitamin B-complex with at least 1 mg of vitamin B12 each day, in the morning with food.

# Vitamin A requirement (BCMO1)

Vitamin Requirements

Vitamin A is a key micronutrient needed for healthy eyes, skin and immune function. Fruits and vegetables are rich sources of vitamin A, but this is mainly in the form of provitamin A carotenoids e.g. beta-carotene, which must be converted into active forms of vitamin A before they can be used by the body.This trait looks at variants of your BCMO1 gene, which affect how effectively you make active vitamin A from provitamin A carotenoids. Your result will influence how much vitamin A you require from your diet.

## Your result

- High Need
- Moderate Need
- Average Requirement
- No Data

**You have an increased vitamin A requirement due to reduced conversion of provitamin A carotenoids.**

Vitamin A is important for immune function, healthy eyesight, red blood cell production and skin health.

Sources of Vitamin A include preformed Vitamin A (e.g. retinol, retinyl palmitate, retinyl acetate) in animal products and provitamin A carotenoids (e.g. β-carotene) in fruits and vegetables.

Provitamin A carotenoids (e.g. β-carotene) in fruit and vegetables must be converted into active forms of Vitamin A (e.g. retinol, retinal, retinoic acid) before they can be used by the body.

BCMO1 is an enzyme that converts provitamin A carotenoids into active forms of Vitamin A. The activity of this enzyme affects how well your body makes Vitamin A.

This trait analyses several variants of your BCMO1 gene (including rs11645428 and rs6564851), which change the activity of the BCMO1 enzyme.

You carry gene variants associated with low BCMO1 enzyme activity.

Your body is less effective at making Vitamin A from provitamin A carotenoids (e.g. β-carotene) in fruit and vegetables.

You have an increased requirement for Vitamin A.

You are at a greater risk of Vitamin A deficiency if you exclusively rely upon plant-based sources of Vitamin A (i.e. provitamin A carotenoids in fruits and vegetables).

This trait focusses on BCMO1 gene variants only. Other factors such as your intake of other micronutrients (including zinc and iron) and the presence of inflammatory bowel disorders (e.g. Crohn's, celiac disease), which impair absorption of Vitamin A, can affect your Vitamin A requirement.

## Recommended Actions

**Moderate your alcohol intake.** Alcohol depletes your vitamin A levels further enhancing the risk of deficiency and associated conditions.

**If supplementing with vitamin A, do not exceed 1.5mg a day.** Overconsumption of vitamin A can lead to some negative impacts on your bone health.

**Optimise your vitamin D levels.** Vitamin A can compete with vitamin D so you want to make sure your levels of vitamin D stay optimal.

**Eat dairy, fish and organ meat to increase vitamin A levels.** These foods are sources of preformed vitamin A (e.g. retinol) which are not converted by BCMO1 in order to form vitamin A.

**If vegetarian or vegan, consider supplementing vitamin A.** You are a low responder to ß-carotene (found in fruit and vegetables) so need to get preformed vitamin A from supplements containing retinyl palmitate or acetate as you do not consume food sources of this.

# Vitamin C level (SLC23A1)

Vitamin Requirements

Vitamin C (ascorbic acid) is an essential micronutrient that helps to maintain healthy skin, bones and blood vessels; support fat burning; and protect cells from oxidative stress. In order to maintain healthy levels of vitamin C in the body, our kidneys reabsorb vitamin C into the bloodstream using a specialized transport protein known as SVCT1. Variants of the SLC23A1 gene, which codes for the SVCT1 protein, can impair this reabsorption process, thereby reducing blood and tissue levels of vitamin C.This trait studies which of these gene variants you carry and examines their potential effect on your vitamin C levels.

## Your result

- High Need
- Moderate Need
- Normal Requirement
- No Data

**Your gene variants are associated with a slightly increased vitamin C requirement due to reduced SVCT1 function.**

SVCT1 (sodium-dependent Vitamin C transporter 1) is a protein that is responsible for reabsorption of Vitamin C. The function of this protein affects levels of Vitamin C in your blood and tissues.

SVCT1 is coded for by your SLC23A1 gene. Certain variants of this gene impair the function of the SVCT1 protein and are linked to lower Vitamin C levels.

This trait analyzes both rare (e.g. rs33972313, rs6886922) and common (e.g. rs4257763) SLC23A1 gene variants associated with lower blood Vitamin C levels.

You do not carry rare SLC23A1 gene variants, but carry common gene variants (rs4257763, rs6596473) that are

typically present in more than 20% of Caucasian and African-American populations.

You carry one copy of common SLC23A1 gene variants (rs4257763 - G and/or rs6596473 - C) associated with reduced SVCT1 function and mildly reduced blood plasma Vitamin C levels.

Low Vitamin C levels are associated with an increased risk of oxidative stress and cardiovascular disease.

This trait focusses on gene variants only. A blood test is required to more accurately assess plasma Vitamin C levels.

## Recommended Actions

**If not getting enough in your diet, supplement.** Supplementing with vitamin C will help to keep your levels healthy, and minimise any negative health effects.

**Ensure that you are always adequately hydrated.** Vitamin C is a water-soluble vitamin so insufficient water levels in the body can reduce circulating vitamin C.

**Freeze your green vegetables.** Preserving foods like spinach, peas and beans in the freezer helps reduce the loss of vitamin C content.

**Eat tomatoes, broccoli, peppers and kale.** These are great food sources of vitamin C helping to keep your levels elevated and keep inflammation reduced.

**Look to stop smoking if currently doing so.** Smoking has been shown to reduce vitamin C levels by up to 50% compared to those who have never smoked.

**Eat your fruits and vegetables raw whenever possible.** Cooking, especially boiling, strips the food of much of its water-soluble vitamins, such as vitamin C.

# Vitamin B6 level

Vitamin Requirements

Vitamin B6 is an important micronutrient needed for over 100 different enzyme reactions in the body. It helps us maintain healthy nervous, immune, and cardiovascular systems, and is important for lowering levels of homocysteine - an amino acid linked to cardiovascular disease.This trait analyses gene variants associated with differences in blood levels of PLP, the active form of vitamin B6. This can tell you whether you are likely to have normal, slightly reduced, or reduced vitamin B6 levels based on your genetics.

## Your result

High Need

Normal Requirement

Moderate Requirem

**Your gene variants are associated with a slightly increased vitamin B6 requirement.**

Vitamin B6 is important for several metabolic reactions in the body, including those involved in making neurotransmitters (e.g. serotonin), producing haemoglobin (the oxygen carrying pigment in red blood cells), and maintaining immune function.

Vitamin B6 is an essential micronutrient: it cannot be made by the body and must be obtained from the diet (i.e. from food and/or supplements).

There are six different forms of Vitamin B6. PLP (pyridoxal 5' phosphate) and PMP (pyridoxamine 5' phosphate) are the active forms and are involved in over 100 different enzyme reactions in the body.

Levels of PLP in the bloodstream are a measure of your overall Vitamin B6 status.

Studies have linked low blood levels of Vitamin B6 (PLP) to an increased risk of chronic inflammation, cardiovascular

disease, and poorer cognitive function.

This trait looks at variants of your NBPF3 and ALPL genes, which are associated with differences in blood levels of Vitamin B6 (PLP).

You carry gene variants associated with slightly reduced plasma Vitamin B6 (PLP) levels.

Lifestyle factors (including diet, alcohol consumption, medication use) also affect your Vitamin B6 levels.

You may be at greater risk of low Vitamin B6 levels if you follow a restricted vegetarian or vegan diet. This is because the form of Vitamin B6 in many plants, pyridoxine glucoside, is less well absorbed.

Individuals with alcohol dependence, certain autoimmune conditions (e.g. rheumatoid arthritis), and impaired renal function are at greater risk of low Vitamin B6 levels.

This trait focusses on gene variants only. A blood (e.g. plasma PLP level) or urine test is required to assess Vitamin B6 levels more accurately.

## Recommended Actions

**Make sure you are getting enough vitamin B12 (2.4 mcg) and folate (400 mcg DFE).** Low levels or deficiencies in these B-vitamins can lead to a reduction in vitamin B6 levels.

**Look to stop smoking if currently doing so.** Smoking can cause reductions in vitamin B6 levels, increasing the risk of deficiency.

**Moderate alcohol intake.** Consuming high amounts of alcohol regularly can cause vitamin B6 levels to become depleted.

**Add 170 g (6 oz) of salmon or 200 g (1 cup) of chickpeas to your evening meals.** These are some of the main sources of dietary vitamin B6 to help keep your levels healthy.

# Vitamin D conversion (CYP2R1)

Vitamin Requirements

Are your genes putting you at risk of low vitamin D levels?Vitamin D produced by our skin and obtained from our diet must be activated before it can have effects in our body. Our liver first converts vitamin D into calcidiol (25[OH]D), before our kidneys convert this into calcitriol (1,25[OH]2D) - the biologically active form of vitamin D. Due to differences in our genetic make-up, however, the efficiency of this activation process can vary from person to person, leading to differences in vitamin D levels.In this trait, we look at gene variants that may impair the first stage of vitamin D activation. Inheriting these variants can contribute to lower vitamin D levels, which, in turn, is linked to poorer bone health, immune function, cardiovascular health, and a greater risk of type II diabetes.

## Your result

Higher Risk

Moderate Higher Risk

Lower Risk

**You have a slightly increased vitamin D requirement due to mildly impaired activation of vitamin D2 and D3.**

CYP2R1 is one of the major liver enzymes responsible for the first step of Vitamin D activation.

CYP2R1 converts Vitamin D2 and D3 into 25(OH)D (calcidiol) - the main circulating form of Vitamin D.

Certain risk variants of the CYP2R1 gene (e.g. rs10741657) may impair this conversion process, increasing the risk of Vitamin D insufficiency.

Vitamin D insufficiency refers to a 25(OH)D level of 50 - 75 nmol/L (20 - 30 ng/ml). This level is considered inadequate for optimal bone and general health.

You have CYP2R1 risk variants linked to mildy impaired D2 and D3 conversion, slightly lower Vitamin D levels, and a

slightly greater risk of Vitamin D insufficiency.

In one large study, people with your CYP2R1 variants had 25(OH)D levels that were 1-4% lower than those without risk variants.

Your CYP2R1 variants have been associated with a moderately higher risk of Vitamin D insufficiency (compared to those without risk variants).

Your risk of Vitamin D insufficiency may be further increased if you solely consume Vitamin D2. This is because activation of D2 (but not D3) is wholly reliant on CYP2R1 activity.

A blood test (serum 25[OH]D level) is required to accurately assess Vitamin D levels and diagnose Vitamin D insufficiency.

## Recommended Actions

**Snack on a handful of pumpkin seeds.** Pumpkin seeds are high in magnesium and maintaining healthy magnesium levels has been shown to reduce the risk of vitamin D insufficiency.

**Eat wild salmon, particularly sockeye (570 IU per 85 g/3 oz).** Salmon is rich in vitamin D3 and sockeye has the highest amounts; so regular consumption helps maintain healthy vitamin D levels.

**Add canned sardines to your salads or pasta.** Sardines are great sources of vitamin D (178 IU per can), as well as heme (iron) which the enzyme CYP2R1 requires to function optimally.

**Supplement with at least 2000 IU of Vitamin D3 daily with breakfast.** This will ensure you have adequate levels of vitamin D, protecting against the negative effects associated with insufficiency.

**Use your lunch breaks to get outside.** Safe sun exposure for as little as 15 minutes can be an easy way to boost your vitamin D levels.

# Vitamin D levels (GC)

Vitamin Requirements

Vitamin D, commonly known as the 'sunshine vitamin' is important for bone health, immune function, glucose metabolism, and control of blood pressure. This trait looks at variants of your GC gene, which encodes Vitamin D binding protein (DBP) - a key molecule that transports vitamin D in the bloodstream. Studies suggest that, depending on which GC gene variants you inherit, you may have lower blood levels of vitamin D (25[OH]D) and be at greater risk of vitamin D insufficiency/deficiency.

## Your result

High Need

Normal Requirem

No Data

**Your gene variants are associated with normal blood levels of vitamin D and therefore do not increase your vitamin D requirement.**

Vitamin D helps to regulate levels of calcium and phosphate in the body and is important for bone health and immune function.

Vitamin D is transported in the bloodstream bound to a carrier protein called Vitamin D binding protein (DBP).

Vitamin D binding protein (DBP) is encoded by your GC gene. There are three common variants or 'alleles' of this gene: Gc1f, Gc1s, and Gc2.

The Gc1f, 1s and 2 variants code for DBP proteins with different abilities to bind Vitamin D and are also linked to different blood levels of DBP. This may lead to differences in levels of Vitamin D circulating in the bloodstream.

As we inherit pairs of genes, the three GC gene variants give rise to six different gene combinations or 'genotypes': 1f/1f, 1f/1s, 1f/2, 1s/1s, 1s/2, and 2/2.

Your GC genotype is: 1s/2

Your genotype is associated with normal blood (serum) levels of total 25-hydroxyvitamin D (25[OH]D) - a commonly used marker of Vitamin D status.

In one large study (the Tromso study), people with your genotype (1s/2) had an average serum total 25[OH]D level of 50.5 nmol/L.

A healthy serum total 25[OH]D level is typically between 50 nmol/L (20 ng/ml) and 125 nmol/L (50 ng/ml) and reflects adequate Vitamin D intake and production.

This trait is based on GC gene variants only. A blood test (namely serum 25(OH)D level) is required to directly assess your Vitamin D levels.

Several other genetic and lifestyle factors affect Vitamin D levels, including: exposure to sunlight, skin colour, age, body fat percentage, and presence of certain health conditions e.g. liver, kidney disease.

## Recommended Actions

**Eat more vitamin D rich foods such as salmon, eggs and portobello mushrooms.** Having a diet rich in these foods will help to keep your vitamin D levels optimal.

**Supplement with vitamin D3 during the autumn/winter months.** You are likely to get less sun exposure during these months. Take a supplement in the morning with a fat-containing meal.

**Try to spend 15-30 minutes a day in the sun with your arms and legs uncovered.** Safe sun exposure is an easy way to boost your vitamin D levels naturally.

# Magnesium levels (MUC1)

Mineral Requirements

Do you carry genes linked to lower magnesium levels?The What We Eat in America, National Health and Nutrition Examination Survey (WWEIA, NHANES 2013-2016) found that 48% of Americans are not meeting their recommended intakes of magnesium. With over 300 different enzymes in our body needing magnesium to function effectively, it is vital that we get enough of this essential mineral. Lots of processes in our body require magnesium, including energy production, regulation of blood pressure, and control of blood sugar levels. Suboptimal magnesium levels, however, has been linked to a higher risk of cardiovascular disease (e.g. heart attack and stroke) and type II diabetes. While symptomatic or overt magnesium deficiency is uncommon, suboptimal blood magnesium levels can arise from poor mineral absorption in our gut. This, in turn, is influenced by our genetic make-up.In this trait we look at variants of MUC1, a gene which helps form the mucus layer of your gut lining. One MUC1 variant is thought to impair mineral absorption and is linked to lower blood magnesium levels.

## Your result

Higher Risk

Moderate Higher Risk

Lower Risk

No Data

**You carry MUC1 gene variants linked to lower blood magnesium levels.**

Mucins are proteins that make up the layer of mucus that lines our gut.

Mucins play an important role in the gut absorption of mineral ions such as magnesium into our bloodstream.

The 'G' variant (rs4072037) of the MUC1 gene, which encodes mucin 1, is linked to lower blood magnesium levels.

Suboptimal magnesium levels can worsen control of blood sugar levels and increase the risk of cardiovascular disease.

A healthy blood magnesium level is considered to be 0.65 - 1.05 mmol/L.

You carry one copy of the 'G' variant linked to lower blood magnesium levels. Your MUC1 genotype is AG.

Large studies have found people with your genotype (AG) to have magnesium levels that are roughly 0.01 mmol/L lower than non-carriers.

One study also found your genotype to be roughly 1.3 times more likely to have low magnesium levels ('hypomagnesaemia' defined as <0.7 mmol/L).

Gastrointestinal diseases (e.g. Crohn's, coeliac disease), elevated blood sugar levels, and long-term alcohol use can all increase the risk of low magnesium levels.

## Recommended Actions

**As you are male, aim to consume at least 420 mg of magnesium a day.** 420 mg is the recommended daily allowance (RDA) which meets the nutrient needs of the majority, but as you may be at risk of slight reductions in magnesium levels, you may want to aim to eat slightly more than this.

**Moderate your alcohol intake, and opt for low alcohol alternatives.** Alcohol causes greater depletion of magnesium in the body, so moderating your intake is important in order to keep your magnesium levels healthy.

**Eat brazil nuts.** A 1 oz serving (approximately 8 medium sized Brazil nuts) provides 170 mg of magnesium - an easy way to help you reach the recommended daily amount of 420 mg.

**Add mackerel to your salads and pasta.** Mackerel is rich in magnesium with 1 fillet providing over 20% of your recommended daily amount.

**Serve up your meals with a side of scotch kale.** Scotch kale is the richest variety of kale for magnesium, and so consuming this will help to keep your magnesium levels higher.

**Try adding sea vegetables such as seaweed and kelp into your diet.** Sea water has high amounts of magnesium, therefore vegetables that grow in the sea are a rich source of this mineral.

**Add Epsom salt to your baths.** Epsom salt baths 2-3 times a week have been shown to increase levels of magnesium in the blood.

**Swap to low sugar versions of foods such as juices, sauces and dressings.** Foods with added sugar can cause micronutrient dilution which reduces magnesium absorption, so limiting your intake of foods with added sugar can help prevent low magnesium levels.

**Try to have 3 servings of dairy each day; a cup of milk or yoghurt equates to one serving.** Lactose, found in dairy products, helps to improve intestinal absorption of magnesium.

# Betaine requirement

Mineral Requirements

Betaine (also known as trimethylglycine [TMG]) is a nutrient that we need for healthy cardiovascular, liver and muscle function. It plays a key role in the methionine cycle, which has wider effects on several processes, including: making proteins, switching genes on and off, and producing phosphocreatine to fuel short bursts of exercise. Betaine also helps to maintain the water content, volume and structure of cells (osmoregulation). This trait analyzes how effectively you produce (or ‘synthesize’) and use ('metabolize') betaine based on your gene variants. Reduced production and/or increased usage of betaine may mean you need to get more betaine from your diet.

## Your result

Increased Need

High Need

**Normal Requiren**

**You do not carry gene variants that increase your betaine requirement.**

Trimethylglycine (TMG), or betaine, is a methylated form of the amino acid glycine. It is an active metabolite of choline. It has an important role in methylation and osmoregulation, and may mildly aid athletic performance.

Betaine deficiency can have a negative impact on the health of the liver and cardiovascular system, and broadly effect methylation in the body.

Genetic variants can reduce betaine synthesis, and increase the conversion of betaine to methionine, in your body. Carrying these can alter your betaine requirement

Using our analysis, we have not detected variants that would overtly increase your need for betaine.

# Recommended Actions

**When preparing food, microwaving vegetables results in the lowest losses of betaine content.** Boiling food products significantly reduces the levels of betaine.

**Ensure you are consuming choline-rich foods in your diet in order to be synthesized into betaine.** Good sources are eggs, liver, soy beans, mushrooms, quinoa, peanuts and milk.

**If supplementing with betaine (TMG) take it with its vitamin cofactors, vitamin B6 and B12, preferably in the morning and with a meal later in the day.**

**Ensure you are consuming betaine-rich foods in your diet.** Good sources are shrimp, wheat bran, amaranth, spinach, beets and quinoa.

**Aim to try and get 1,500 to 2,000 mg of betaine per day through food and or supplements.**

# Choline metabolism

Mineral Requirements

Choline is an essential micronutrient needed for making lipids and cell membranes, producing neurotransmitters (acetylcholine), and conducting a class of metabolic reaction called methylation. The amount of choline we need from our diet depends on how well we produce our own supply choline (choline synthesis) and how much choline we use for making lipids and methylation reactions (choline metabolism).This trait analyzes gene variants related to both these processes and advises you how to optimize your choline intake accordingly.

## Your result

- Increased Need
- High Need
- Normal Requirement

**Your gene variants are associated with an increased choline requirement, as your body produces choline less effectively.**

Choline is an essential vitamin-like nutrient. It is required for liver function, brain development, brain function, muscle movement, and metabolism.

Choline is important for the biosynthesis of cell membrane lipids, and betaine, which is a source of methyl groups required for methylation.

Choline deficiency leads to liver and muscle dysfunction, and can impair neuronal function.

We have detected variants that reduce your ability to synthesize choline. This will increase your need for a dietary source.

Your need for choline can be enhanced if you drink alcohol, are vegetarian or vegan, or if you are partaking in endurance activities or sport.

## Recommended Actions

**Make sure you are consuming enough vitamin E as this vitamin has a positive impact on one of the key enzymes of choline synthesis.**

**Add more choline-rich foods into your diet.** Good sources are eggs, liver, soy beans, mushrooms, quinoa, peanuts and milk.

**Consume probiotics to improve gut motility, function and choline absorption in the small intestine.** Probiotics are found in such foods sources as yogurt, kefir, sauerkraut and kimchi.

**Ensure you eat colourful fruits, such as berries, lychee, grapes, and vegetables, such as broccoli, carrots, bok choi.** This will increase the amount of antioxidants in your diet.

**As you have reduced synthesis, aim to try and get 550 mg of choline per day through food and supplements.**

**If involved in strenuous and prolonged endurance exercise, supplement with 250-500 mg of choline.** Choline levels decrease during this type of exercise, and as you have reduced baseline synthesis, supplementation will be important for maintaining health choline levels.

# Blood calcium level

Mineral Requirements

Calcium is an essential mineral needed for nerve signalling, muscle contraction, maintaining healthy bones and driving several key chemical reactions within cells. To ensure these processes occur efficiently, we need to regulate levels of calcium in the blood within a tight range. This trait analyzes your ability to maintain healthy levels of blood calcium, which is influenced by both your gene variants and lifestyle. We then provide actions for you to choose from, so you can make the changes you need.

## Your result

Higher Risk

Average Risk

Lower Risk

**You carry some gene variants linked to higher blood calcium levels.**

You have variants that lead to increased serum calcium.

The secretion of a parathyroid hormone (PTH) from the parathyroid gland increases calcium absorption in the gut, and release from bone tissue.

You have genetic variants that are linked to having a higher serum level of parathyroid hormone, and thus higher levels of calcium.

This means your baseline calcium serum level will be higher than average.

This can be further enhanced by taking a combination of calcium and vitamin D supplements. Be sure to check your vitamin D trait for recommendations about supplementation.

In addition to this, hyperparathyroidism can lead to very high levels of calcium. To detect this, a blood test, looking at

parathyroid hormone and calcium levels, is a good starting point.

## Recommended Actions

**Avoid regularly using antacids as these can contain high levels of calcium.** This could cause unwanted elevations of blood calcium levels beyond the healthy range.

**It will be important to monitor your vitamin D3 requirement, and you should preferably get your blood vitamin D level checked.** Look at your vitamin D trait for your detailed requirements.

**You should not avoid calcium.** However, you should ensure you are getting no more than 1000 mg of calcium per day in total.

**Take magnesium supplements (magnesium citrate or magnesium malate) at night to help with generalized muscle relaxation, and to reduce parathyroid hormone secretion.** Check out your magnesium trait for detailed magnesium recommendations.

**Monitor your hydration state by checking your urine colour, and rehydrate with isotonic solutions.** Staying hydrated is important for calcium regulation, as dehydration can lead to high blood clacium levels.

**Be aware that calcium is found in over-the-counter products and prescription medicines.** Look out for calcium carbonate, calcium citrate, calcium lactate, calcium phosphate on the packaging.

**Warm up working muscles effectively before any heavy lifting.**
This will prime your muscles to help optimise contractions.

**Make sure your calcium intake is spread throughout the day, with no more than 500mg at any one time, and if you supplement, take with food.**

# Zinc requirement

Mineral Requirements

Zinc is an essential mineral and co-factor for many enzymes and proteins. It is important for hormone balance, the immune system, the body's reaction to infection, and also its ability to repair. Zinc is a supplement that many people should consider taking.

## Your result

High Need

Moderate Requirement

Normal Requirem

**Your gene variants are associated with a normal zinc requirement due to average blood and tissue fluid levels.**

Your genetics suggest that you are not at risk of lower systemic (blood and tissue fluid) zinc levels.

You should supplement with zinc if you either regularly drink alcohol or occasionally heavily drink (i.e. binge drinking).

Consider zinc supplements if you have been taking, but did not respond to, antidepressants.

Although our analysis shows you are not at risk of low zinc levels, supplementation may be useful if you are looking to have children, or if you want to raise levels of sex hormones to promote muscle growth.

Although you are unlikely to be deficient in zinc, supplementation can help reduce the length of infections with the common cold.

During periods of heavy exercise, make sure to include foods rich in zinc.

# Recommended Actions

**Monitor your dietary intake of zinc using a diary or food tracking app.** Many modern, mass-production farming methods can deplete foods of zinc so if you monitor your intake, you can identify whether supplementation is required.

**If you are looking to improve muscle growth, take a zinc supplement to increase the production of muscle growth factors (for example, IGF-1 or testosterone).**

**Take a zinc supplement to enhance your ability to use and store fat and carbohydrate before and after training.** Zinc is also important when regularly doing exercise as it is lost through sweating.

**If you drink alcohol regularly, have been ill, are vegetarian, or otherwise have a low meat or fish intake, you may become transiently deficient in zinc.** Make sure you get 30 mg of zinc per day.

**If you are suffering from diarrhea or a cold, it is important that you take a 30 mg zinc supplement daily during your illness.**

**Zinc is a key co-factor for hormone production, which is important for fertility.** You should make sure you are getting enough zinc if you are looking to have children.

# Magnesium requirement

Mineral Requirements

Magnesium is an essential mineral required for several chemical reactions in the body. It plays a role in breaking down fats and carbohydrates to produce energy, making DNA, maintaining a healthy nervous system and recovery from exercise. Low levels of magnesium are linked to high blood pressure, poor blood glucose control, and increased risk of cardiovascular disease and diabetes.

## Your result

Increased Requirem

Normal Requiremen

**Your genetic and lifestyle factors suggest you have a higher magnesium requirement.**

Our analysis shows you have a high susceptibility to magnesium deficiency.

Low magnesium can cause muscle cramps and muscular weakness as it makes it difficult for the muscles to use oxygen.

Being very active can lower your magnesium level even further, increasing your daily intake need by 10-20%.

Magnesium deficiency impairs your exercise performance, as it is needed for muscles to take up oxygen.

Boosting your magnesium level can increase your rate of recovery from exercise, especially when increasing volume or intensity of your workouts.

Sleep is crucial for muscle building and physical performance. Increasing your magnesium intake can help to improve your sleep quality.

# Recommended Actions

**Examples of magnesium rich foods include: 100 g cooked spinach, 160 mg magnesium; 170 g tuna, 100 mg; 125 g firm tofu, 46.** 6 mg; 1 medium banana, 31.9 mg.

**Increase your magnesium intake to reduce the frequency of muscle cramps and improve your recovery rate.** This will allow you train harder and more frequently.

**Magnesium is a very common deficiency; aim to consume 3 servings of magnesium-rich food each day.**

**HIIT (High Intensity Interval Training), long distance running and cycling can all decrease magnesium levels.** As a rule of thumb; the more you sweat, the greater the loss of magnesium.

**If choosing to supplement magnesium, choose magnesium citrate as it has a good absorption rate and a high percentage of elemental magnesium.**

**If you choose to supplement magnesium, take 250-350 mg with food.** Taking it with your evening meal can help to improve sleep quality. Do not supplement more than 400 mg magnesium per day, as it may cause diarrhoea, nausea and other unpleasant symptoms.