

Statin-Induced Muscle Pain

DNA Health Report

REPORT CATEGORY —



HEART & BLOOD
VESSELS

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

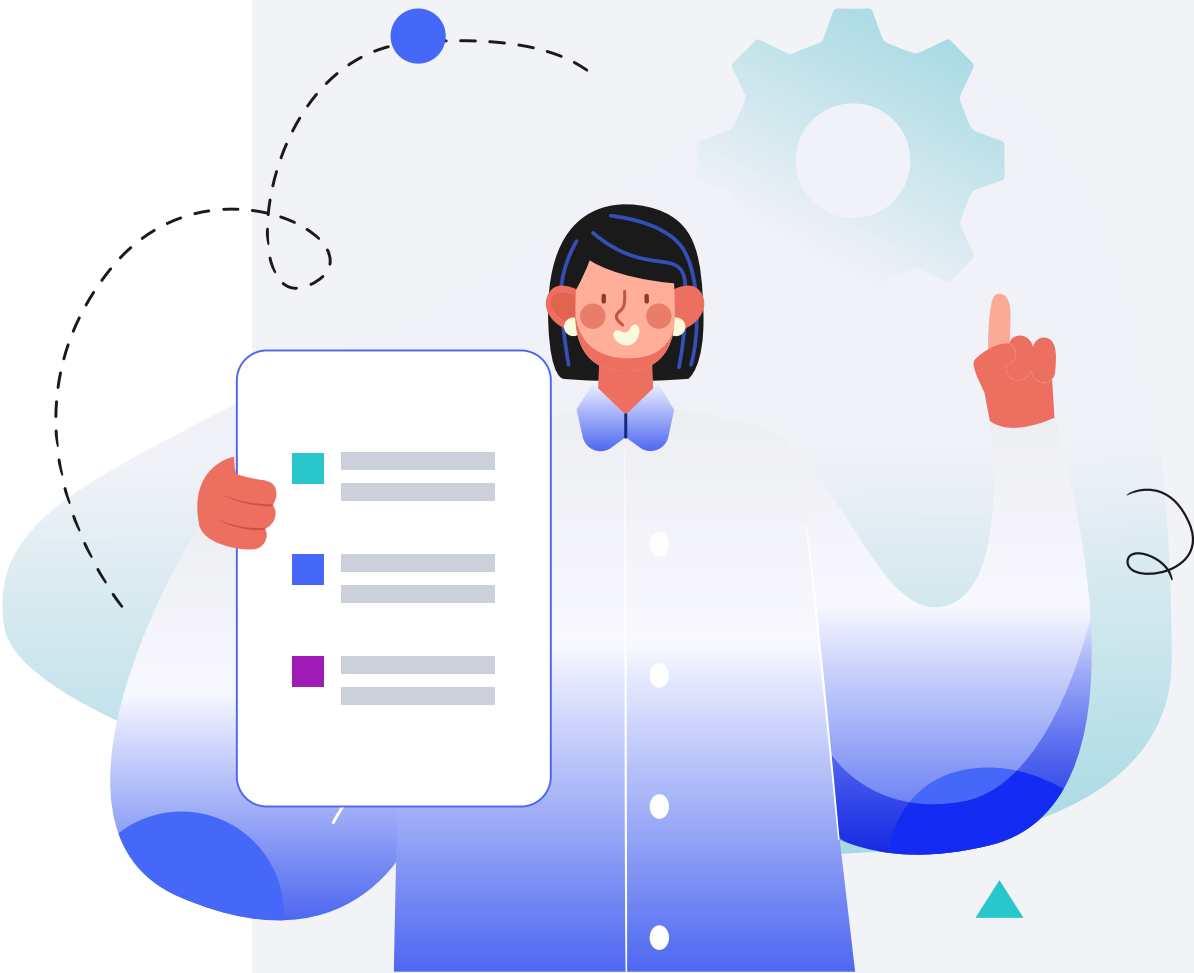
Male

HEIGHT

5ft 5" 165cm

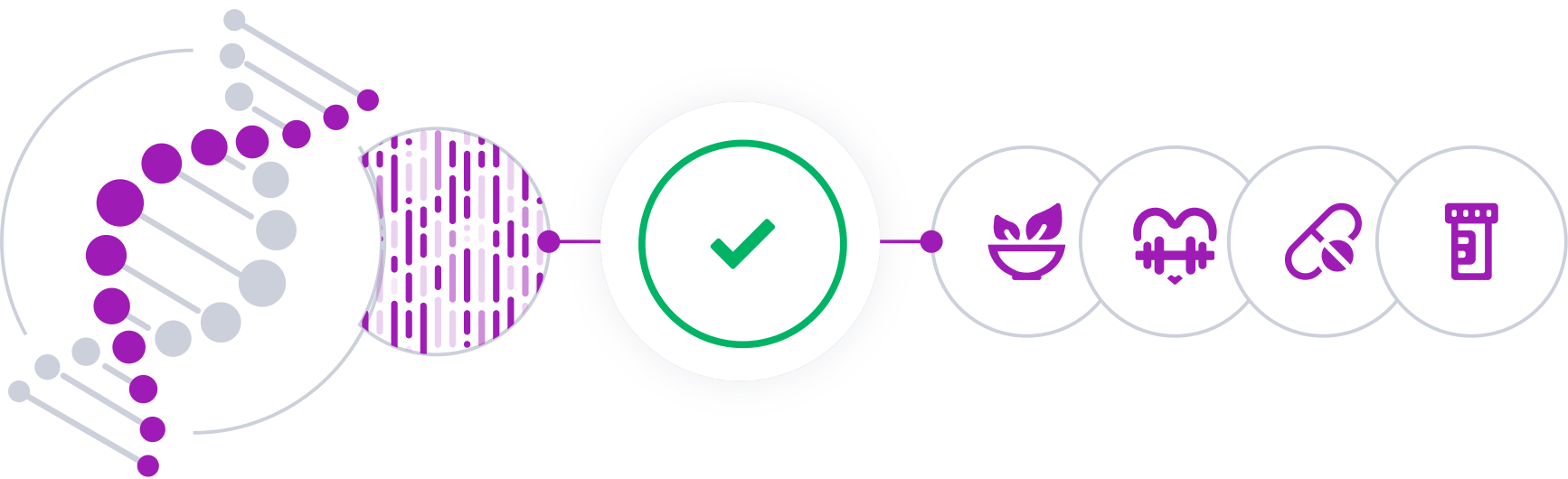
WEIGHT

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.

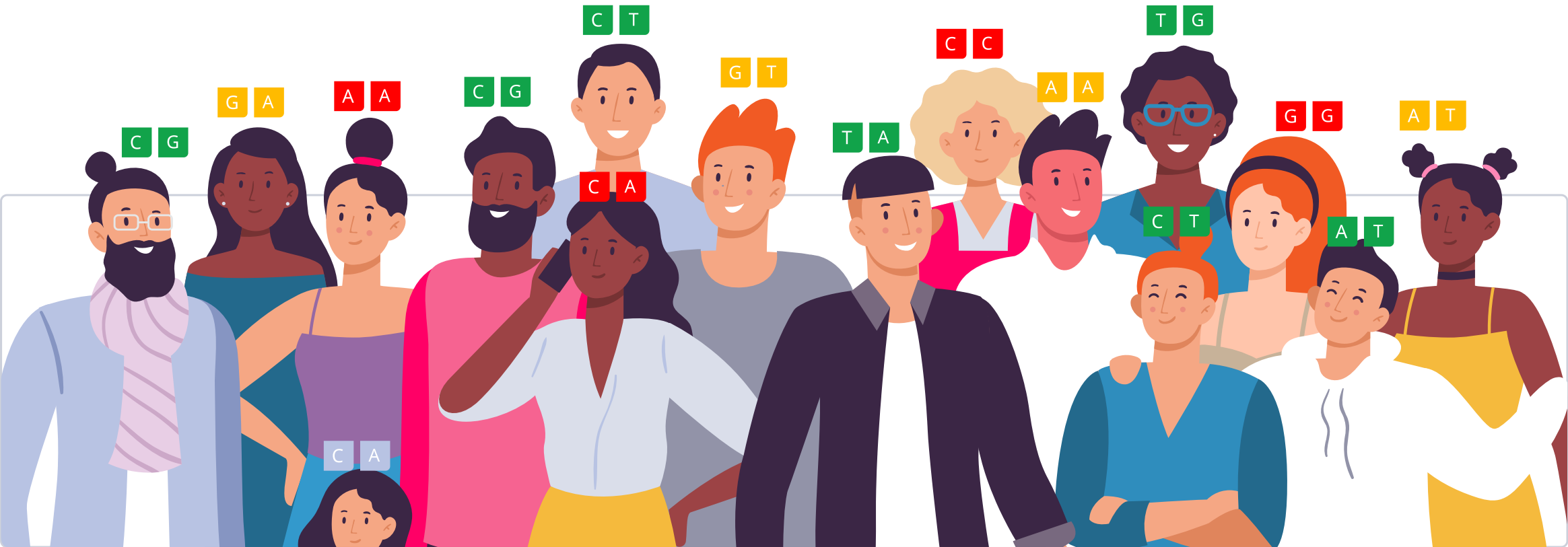


Similarly, our Trait Reports look at how your DNA influences your traits.



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

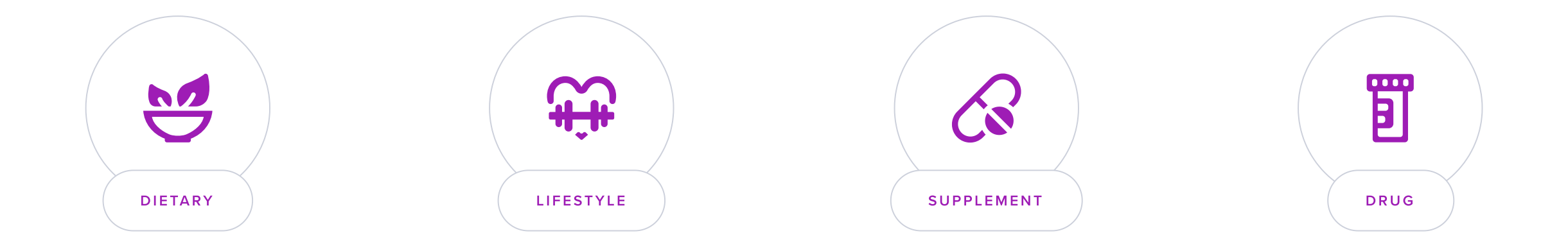
You have 2 risk alleles

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

Statin-induced myopathy is a condition in which individuals taking statin medications, which are commonly used to lower cholesterol levels, experience muscle pain, weakness, or tenderness. The condition ranges from mild discomfort to a severe form known as rhabdomyolysis, where there is significant muscle damage leading to pain, weakness, and elevated levels of muscle enzymes, such as creatine kinase, in the blood.

This issue may develop immediately after starting treatment or after years of statin use, with symptoms typically emerging within a few weeks to months of initiation.

Risk Factors and Treatment

The exact mechanism by which statins cause muscle injury is not completely understood, but it is believed to be related to the depletion of coenzyme Q10, a key component in muscle energy production, or effects on muscle cell membranes and protein synthesis. Risk factors for developing statin-induced myopathy include higher statin dosages, advanced age, female sex, smaller body frame, concurrent use of certain medications, and pre-existing conditions such as kidney disease.

Most patients see improvement in symptoms after discontinuation of the statin, but the condition necessitates careful balancing of the benefits of cholesterol lowering against the discomfort and potential harm of muscle symptoms.



MORE LIKELY

More likely to have statin-induced muscle pain based on 38 genetic variants we looked at



Your top variants that most likely impact your genetic predisposition:

GENE	SNP	GENOTYPE
ADCY2	rs4256319	CC
PPP1R14C	rs6925743	AA
ZNF536	rs33428	GG
SPNS2	rs333114	CC
SLCO1B1	rs4149056	TC
/	rs145427387	AA
ZNF208	rs28420503	GA
ZNF208	rs34312380	CT
SLCO1B1	rs4363657	TC
ALK	rs62131018	TT
CDC14C	rs7779564	AG
TBKBP1	rs72648866	AT
CBLN2	rs10871700	AG
TBKBP1	rs79980568	AG
SLCO1B1	rs11519272	CA
CAMK1D	rs10795948	GC
TMEM9	rs6667912	CG
KIAA1328	rs2861137	GG
EVC2	rs140854723	GG
/	rs150707400	CC
VPS45	rs77051277	AA
/	rs190206717	TT
ADAMTS18	rs149208014	TT
C16ORF78	rs190668351	CC

GENE	SNP	GENOTYPE
LCOR	rs184787123	AA
ZNF562	rs77180504	TT
/	rs149657468	TT
XKR6	rs117119573	CC
STX18	rs12508927	GG
/	rs9831928	TT
RALYL	rs11780883	GG
RNGTT	rs6454721	GG
ODF3L1	rs148352615	CC
MAN2C1	rs138591431	CC
ERCC1	rs41558212	GG
TBC1D21	rs56027559	CC
ADTRP	rs116168042	CC
COQ2	rs4693596	TT
CLVS2	rs10872257	CC
/	rs11155111	AA

The number of "risk" variants in this table doesn't necessarily reflect your overall result.

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	Aerobic Exercise (Cardio)	1 hour	
2	Maintain Optimal Vitamin D Levels	1000 iu	
3	Geranylgeraniol	150 mg	
4	Coenzyme Q10 (CoQ10)	100 mg	

1



Aerobic Exercise (Cardio)

IMPACT

3 / 5

EVIDENCE

2 / 5

How to implement

Engage in at least 150 minutes of moderate-intensity aerobic exercise or 75 minutes of vigorous-intensity activity each week. Distribute this time over at least 3 days per week, avoiding consecutive days of vigorous exercise to allow for recovery.

TYPICAL STARTING DOSE

1 hour

Description

Engaging in regular aerobic exercise, such as running, swimming, or cycling, offers numerous health benefits, including improved cardiovascular fitness, weight management, and mood enhancement. It supports overall physical and mental well-being while reducing the risk of chronic diseases.

Cardio, short for cardiovascular exercise, is any type of physical activity that temporarily increases your heart rate. Examples include **running, cycling, swimming, and brisk walking**.

Regular cardio exercise has many benefits for your overall health. It can help lower your risk of heart disease and diabetes, support weight loss, and improve your mood and energy levels. To get the most out of cardio, try to do it for at **least 30 minutes, 3-5 times a week**.

Interval training is a type of cardio that combines periods of high-intensity training with brief rest periods.

How it helps

A meta-analysis of 13 studies concluded that combining exercise and statin therapy may counteract statin-induced adverse effects in the skeletal muscles in people with dyslipidemia [R].

Aerobic exercises may help improve muscle function while reducing muscle weakness and pain associated with this condition.

2



Maintain Optimal Vitamin D Levels

IMPACT

1 / 5

EVIDENCE

1 / 5

How to implement

Check your vitamin D levels, they should ideally be in the 30-66 ng/mL range. If your levels are lower than that, take a vitamin D supplement, 1000-4000 IU daily, to reach an optimal range.

TYPICAL STARTING DOSE

1000 iu

Description

Vitamin D, often referred to as the "sunshine vitamin," can be synthesized by the skin when exposed to sunlight, as well as being found in fish, eggs, and fortified milk. It helps regulate calcium absorption, promoting strong bones and a healthy immune system. Vitamin D deficiency can lead to conditions like rickets in children and osteoporosis in adults.

Your body needs [vitamin D](#) for strong bones. Vitamin D also plays a role in [\[R\]](#):

- Mood
- Immunity
- Heart health
- Blood sugar control

[Sunlight](#) is our main source of vitamin D. Experts recommend getting at least **5-15 minutes of midday sun, 2-3 times per week**. People with darker skin and those living at high latitudes may need longer periods of sun exposure [\[R\]](#), [\[R\]](#).

Foods like fish, eggs, and fortified milk provide small amounts of vitamin D. **People lacking vitamin D should consider taking a supplement** [\[R\]](#).

How it helps

A clinical trial comparing oral and injectable forms of vitamin D3 in patients with statin-induced myopathy found that both forms significantly reduced pain and emotional perception associated with myopathy. Increased vitamin D levels correlated with reduced symptoms [\[R\]](#).

Another study in a veteran population showed that vitamin D replenishment allowed patients previously unable to tolerate statins due to myopathy to successfully restart and maintain statin therapy, improving their cholesterol management [\[R\]](#).

Research on patients intolerant to statins due to myopathy symptoms such as myalgia, myositis, and myonecrosis showed that vitamin D supplementation, aimed at normalizing vitamin D levels, enabled most patients to tolerate rechallenged statin therapy without recurrence of symptoms [\[R\]](#).

Supplementing with vitamin D can help alleviate muscle pain and weakness associated with statin therapy by improving vitamin D levels in the body, thus enhancing muscle strength and function.

3



Geranylgeraniol

IMPACT

0 / 5

EVIDENCE

0 / 5

How to implement

Geranylgeraniol can be taken as a dietary supplement, typically in the form of capsules or softgels. The recommended dosage varies depending on individual health needs and the specific product formulation. It is generally advised to start with a lower dose and gradually increase it, under the guidance of a healthcare professional. Taking it with a meal may enhance absorption and efficacy.

TYPICAL STARTING DOSE

150 mg

Description

Geranylgeraniol is a natural compound found in various plants and herbs, known for its potential health benefits. It plays a crucial role in the body's biosynthesis of essential molecules like CoQ10 and vitamin K2. This compound is noted for its anti-inflammatory, antioxidant, and anti-cancer properties, making it a promising supplement for enhancing overall well-being.

How it helps

A review explored the potential role of geranylgeraniol (GG) in managing statin-associated muscle symptoms (SAMS), which are common side effects of statins. Statins reduce the synthesis of CoQ10 and GG, essential for skeletal muscle health.

While CoQ10 supplementation has not effectively reversed SAMS, GG supplementation has shown promise. The paper suggests employing GG to prevent SAMS, especially in the context of COVID-19, as statins are increasingly used to manage cardiovascular risks associated with the virus. Further research is recommended to validate GG's efficacy in human studies [\[R, R\]](#).

4



Coenzyme Q10 (CoQ10)

IMPACT

0 / 5

EVIDENCE

0 / 5

How to implement

Take a 100 mg Coenzyme Q10 (CoQ10) supplement once daily with a meal that contains fat for better absorption.

TYPICAL STARTING DOSE

100 mg

Description

Coenzyme Q10 (CoQ10) is a naturally occurring antioxidant that plays a crucial role in cellular energy production. It is often taken as a supplement to support heart health, improve energy levels, and provide antioxidant protection, especially for individuals with certain medical conditions or as they age.

[Coenzyme Q10](#) (CoQ10) is a compound that helps enzymes work better. By doing so, CoQ10 helps improve [R](#), [R](#), [R](#), [R](#):

- Energy levels
- Antioxidant protection
- Heart health
- Muscle strength
- Blood sugar control

The amount of CoQ10 made by your body decreases as you get older. Luckily, you can also get it from food or supplements. Good sources of CoQ10 include [R](#), [R](#):

- Organ meats
- Fatty fish
- Whole grains

How it helps

CoQ10 helps counteract statin-induced myopathy by replenishing CoQ10 levels in the body. Statins lower CoQ10, a substance necessary for muscle health, hence supplementing with CoQ10 can alleviate muscle pain and weakness associated with statin use.

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.

