perform Personal Report

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Welcome to Your GxPerform Personal Report

GxPerform Personal Report
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Congratulations!

You are holding in your hands the codes to unlock insights about your body that, up until now, have never been available. The science of the human body only recently has evolved enough to allow scientists to identify and analyze a person's DNA. This program not only provides you with a roadmap of your specific genes, but also gives direction on how you can potentially optimize your fitness and performance with this knowledge.

As an active, athletic adult, you carve out the time (and often make sacrifices) to prioritize exercise in your life. Whether your main motivation is being strong and having enough endurance to enjoy an active life; you like to participate in recreational sports and hobbies like skiing, soccer, and hiking; and/or you have aspirations to qualify for the Boston marathon, compete in a CrossFit competition, or even cross the finish line of an Ironman triathlon, you do the hard work to train your body to perform.

The explosion of technology designed to monitor your activity and fitness has made it easier than ever to plan and track your workouts. The Internet is filled with training plans. There are literally dozens of apps you can download that tell you what to eat and how to train to achieve your goals. Heart rate monitors let you track your workout intensity, while GPS equipped motion sensors tell you how fast and far you've gone. You can even buy sensors that evaluate your resting heart rate and tell you when you need to rest and when you're ready to go hard. However, tracking alone doesn't help you choose the type of training that will unlock your highest personal potential or the food that fuels you best or if you're more likely to get injured following a certain regimen.

It's no secret that not every workout plan and nutritional approach will work for every person. What has been secret until now is how to figure out the ones that most closely match your personal make up and maximize your potential. Your report will help you to better understand the factors that can affect how your body works to get the most from your exercise and training time and efforts.

This report will provide you with results in 4 key areas that can affect the way your body responds to training. It includes in-depth analysis of your genotype for certain key genes that are related to what type of athlete you are; your predicted training response, optimum strategies for fueling for activity and fat burning; and your recovery and risk for injury.

What is Genetic Testing?

Genetic testing utilizes a physical specimen from the body (saliva, blood, or other tissues) to reveal information about a person's chromosomes or their genes. In addition to identifying key genes, information is evaluated about areas on each gene that may differ between people. These areas are known as single nucleotide polymorphisms (SNPs). We use the term genotype to describe the outcome of your individual genetic tests.

Which Traits Were Analyzed?

To produce your results, this program looks at genes that are related to 4 major categories: Mental & Physical Foundation; Training Response; Fuel Utilization, and Recovery & Risk for Injury. Some of the results are directly related to your cardiovascular and strength foundation and "trainability"—what types of exercise suit your genotype best. Some results are related to how to optimize your training by way of fueling, recovery, and risk management. Other results are relevant because they can affect your motivation and behaviors that support your workouts and training.

How Are Your Results Determined?

We provide a genetic analysis that indicates which gene combinations you have in each category. You will receive a rating based on our calculated score for each trait in a category. Some categories have only one gene associated with that trait; other categories have several genes associated with that trait. Our calculated score reflects the potential combined influences from one or more genes.

We also provide personalized training, fueling, and recovery tips based on the potential implications of these results. In most cases, the outcomes for a genotype are a response to a specific fueling strategy or exercise prescription.

For example, in the case of cardiovascular exercise response, we review the body of literature, pulling the most well-conducted, relevant studies. One large study may follow participants who performed 50 minutes of cardiovascular training 3 to 4 days per week for 5 to 6 months. Participants may have differed in their response to this regimen based on their genetics. Some may have experienced greater fitness gains, while others experienced smaller gains and showed a decreased ability to perform at higher effort levels. If your result suggests a more unfavorable response, this doesn't mean that you cannot improve your fitness performing cardiovascular exercise. You may simply need a slightly different approach to get more favorable results. That's where many exercisers get stuck, attempting to discern just what the ideal approach may be. But we have evaluated your potential genetic response and provided suggestions on how to enhance it based on evidence-grounded research recommendations, as well as the experience of our medical team.

This program uses the best available research on which to base your results. We have established stringent criteria for studies that we use to help us evaluate the potential impact of your genotype for each gene tested. There are many studies that include genetic analyses, but for a variety of reasons, not all of them are reliable or valid. In determining how to process your genetic analysis, we do not accept just any research that has been performed on a gene. We use the largest and most scientifically valid genome-wide association studies, in addition to other high quality research, to calculate a score for the different genes or gene combinations for all genes tested. There is still much to learn in the field of genetic analysis. We are choosing the best available research upon which to base our analysis and recommendations.

Why Is Your Genotype Important?

Your genotype reveals the blueprint for your body. The ratings we provide you with reflect your genotypes for each gene or set of genes. This shows you your potential response, based on your genetic analysis, to different aspects of performance and training response to exercise, nutrition, and lifestyle behaviors (e.g., how you might be affected by different exercise modalities and fueling strategies). Keep in mind that if your results show the presence of certain genotypes and your result suggests that you will exhibit either an “enhanced” or “below average” response, this does not mean that the outcome associated with that genotype is definitely how your body will or does react.

Your phenotype is the physical manifestation, or expression, of your genotype. But your phenotype may be different than your genotype—not all the genetic variations seen in an analysis are manifested. That’s because how the genes that you have are expressed is largely affected by your lifestyle and other environmental factors. While your analysis might show that you have an increased or decreased potential for a certain training or performance trait, it does not mean that you will, in fact, express that trait.

This is very important to keep in mind because there is a tendency to view genotype results as a definitive diagnosis and to assume that you absolutely have certain traits, when this is not what a genetic analysis measures. The analysis only measures your odds for different outcomes, or the likelihood that your phenotype will express what your genotype predicts. Your results only suggest that there is a greater or lesser chance that you may exhibit certain traits or responses. The fields of nutrigenomics and exercise genomics are new, but growing, areas of research. Much still needs to be known to understand about genes and their interactions with each other, and the role in which other influences such as diet, exercise and the environment play in whether you will express a trait associated with a certain genotype.

That said, results from a genetic analysis may provide insights into how your body might perform optimally. If you have a certain genotype for a specific trait, knowing how it might affect you and adjusting your training, nutrition, and behaviors to maximize this information could make a difference in getting better results from your training and fueling. We provide personalized suggestions that may help you achieve the best results from your fitness and training efforts. Our team considers the results of your genetic analysis, along with an analysis of personal factors that you report, which may also influence your training response and body composition, as well as evidence-based guidelines that suggest the most effective strategies for optimum performance. All of this information combined is used to determine which training and diet strategies and lifestyle behavioral changes may be most helpful to reach your goals.

What You’ll Learn About You

On the following pages, you will see a summary of your results. You’ll learn what your genotypes suggest about your ability to make muscle in response to strength training, to boost your VO2 Max (a gold standard measure of physical fitness) in response to cardiovascular workouts, to burn fat, and to use carbs and protein. You also will gain insights into your intrinsic motivation to exercise; your sensitivity to caffeine; your ability to recover and minimize inflammation; your injury risk, and more. Your analyzed genotype results are followed by a detailed explanation and success strategy. Our medical team has evaluated your potential response and taken into account what evidence-based research recommendations on nutrition, training, and lifestyle behaviors suggest are the best approach for optimum performance to provide you with concrete success strategies. This guidance may give you that extra edge in finding the right plan that helps you maximize the results you get from all your hard work. While we can’t change our genes, we can change our behaviors to take advantage of what our genes say about our bodies.

REPORT SUMMARY

MENTAL AND PHYSICAL FOUNDATION

Intrinsic Motivation To Exercise	LESS LIKELY	BDNF
Addictive Behavior And Stimulus Control	LESS LIKELY	DRD2
Power and Endurance Potential	HIGHER POWER	ACTN3, AGT, IL-6, NOS3, ACE, FTO, IGF1, GNB3, IL6-174
Grip Strength and Muscular Fitness	NORMAL	TGFA, POLD3, ERP27, HOXB3, GLIS1, PEX14, LRPPRC, MGMT, SYT1, HLA, GBF1, KANSL1, SLC8A1, ACTG1, DEC1, IGFS9B

TRAINING RESPONSE

VO2 Max	LOW	AMPD1, APOE
Exercise Heart Rate Response	SLIGHTLY ABOVE AVERAGE	CREB1
Exercise Stroke Volume	NORMAL	KIF5B
Body Composition Response To Strength Training	ENHANCED	NRXN3, GNPDA2, LRRN6C, PRKD1, GPRC5B, SLC39A8, FTO, FLJ35779, MAP2K5, QPCTL-GIPR, NEGR1, LRP1B, MTCH2, MTIF3, RPL27A, EC16B, FAIM2, FANCL, ETV5, TFAP2B

FUEL UTILIZATION

Protein Utilization	ENHANCED	FTO
Fat Utilization	NORMAL	PPARG, TCF7L2, APOA5, CRY2, MTNR1B, PPM1K
Carb Utilization	NORMAL	IRS1
Caffeine Metabolism	SLOW	AHR, RP11-10017.3-001, ARID3B, CYP1A1

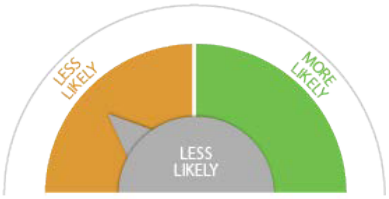
RECOVERY AND INJURY RISK

Systemic Inflammation	NORMAL	CRP, APOC1 (APOE-CI-CII), HNF1A
Injury Risk	WELL ABOVE AVERAGE	SPTBN1, MEPE, SLC25A13, MBL2/DKK1, LRP5, C18orf19

INTRINSIC MOTIVATION TO EXERCISE

WHAT YOUR GENES SAY ABOUT YOU:

Our analysis indicates that your genetic profile exhibits characteristics that make you LESS LIKELY to be intrinsically motivated to exercise. That means you are less likely to derive pleasure from training for training's sake, so you may feel less motivated to stay on track with your training when you get busy or you feel your performance is sub-par. The good news is that there are many sources of external motivation and plenty of people with DNA profiles like yours develop successful strategies to maintain their motivation and achieve their goals.



Your genetic profile indicates that you are LESS LIKELY to have intrinsic motivation to exercise.

You will be more inclined to maintain a consistent training schedule if you employ extrinsic motivation strategies that make the process itself feel more rewarding, regardless of the ultimate outcomes.

SUCCESS STRATEGIES

Being less inclined to be intrinsically motivated is very different from having no motivation. It just means you have to look for other sources of motivation that are linked to your training plan. Rewards such as winning and achieving personal records help, but you may struggle to stay on track during noncompetitive periods or when not achieving your desired outcomes. These strategies can help keep you consistently motivated to stick to your training schedule.

Buddy up. Accountability is key when your motivation wanes. Research shows that people are more likely to stick with a training plan when they have companionship—someone to workout with and who keeps them accountable. It's also more fun to train with a friend or two, which is rewarding in and of itself. Find a training partner who you can train with on a regular basis.

RELATED GENES / SNPs

BDNF

The gene and associated SNP included in this category has been shown to have significant associations with a person's intrinsic motivation to train.

Athletes participate and compete in their sports for a variety of reasons and each of us has our own personal motivations. Athletes who are intrinsically motivated are inclined to participate in a sport for internal reasons. They run marathons because they love to run. They push themselves because they are driven to see how good they can be. They enjoy the process of training with the outcome being secondary. Those who are not intrinsically motivated tend to be extrinsically motivated, or participate for external reasons, such as winning competitions, impressing peers, or in some cases material rewards like trophies, medals, and even cash and scholarships.

Intrinsic motivation may be embedded in your genes. In one study, researchers

INTRINSIC MOTIVATION TO EXERCISE

Sign up for a charity event. Sign up for a run, bike ride, or triathlon that benefits a charity of your choice. A concrete event like a 10K run and doing good for others are motivation to keep moving even when you're internal motivation is waning. There are also apps that will donate money to your favorite charity for every step you take.

Use technology to your advantage. Sign up for an active social network like Strava, Runkeeper or Endomondo, which let you set goals, connect with other athletes in your community and around the world, and track your training progress. These apps award you with PRs and trophies for hitting your goals or achieving personal best performances, which can provide the extrinsic motivation you need to keep moving.

Make some mantras. Sometimes you just need a self pep talk to stoke waning fire in your belly. When you're lying in bed listening to the rain when you should be out running, remind yourself how strong and resilient hard runs make you. Each time you overcome adversity makes the next time easier. Your affirmation can be as simple as "You got this." Then do it.

collected DNA samples from a group of healthy adult men and women then observed the group while they performed a 30-minute treadmill workout. After the half hour session was up, the exercisers were told that they had completed the session and they could either begin a cool down or could keep going if they wanted. Those with at least one copy of the met allele for the val66met polymorphism were more than 2 ½ times likely to keep going than their peers with a val/val genotype.

Our analysis investigated which genotype for this gene was present in your DNA. Your rating of either MORE LIKELY or LESS LIKELY reflects whether your genotypes included those that carried a risk for being low in intrinsic motivation or for being likely to be high in intrinsic motivation. Knowing that you're genetically more or less inclined to be intrinsically motivated can help you establish strategies that may help ensure your success.

ADDICTIVE BEHAVIOR / STIMULUS CONTROL

WHAT YOUR GENES SAY ABOUT YOU:

Our analysis indicates that your genetic profile exhibits characteristics that make you LESS LIKELY to be susceptible to addictive behaviors. You're less susceptible to overindulging in highly stimulating behaviors like excessive exercise, drinking too much, and binge eating—all behaviors to which everyone, including athletes, can succumb. That's good news as even healthy habits like exercise can be harmful and injurious when taken to extremes.

Your genetic profile indicates that you are LESS LIKELY to have an addictive behavior.

That means you are less likely to seek out high-reward system stimulating activities like excessive exercise that can lead to burn out, injury, and over-training.

SUCCESS STRATEGIES

Being less likely to be prone to addictive behavior can help protect you from succumbing to overtraining and will make it easier for you to follow a training plan that includes ample amounts of recovery and days off away from the rigors of exercise training. Just remember that it doesn't mean you're immune from the ill effects of overdoing it. Athletes often get drawn into over-training without realizing it.

Follow a plan. Whether or not you have an addictive personality, as an athlete there's always the temptation to do more, train harder, skip recovery days, and generally push yourself further than may be productive. This can lead to over-training and an unhealthy relationship with exercise. The best way to avoid it is by following a structured progressive plan that incorporates all the elements needed for optimum performance, which includes hard workouts, easier and moderate workouts, and days of complete rest and recovery.

RELATED GENES / SNPs

DRD2/ANNK1

The gene and its associated SNP that are included in this category have been shown to have significant associations with a person's likelihood to be susceptible to addictive behaviors.

The brain's reward pathways control an individual's response to natural rewards such as food, social interactions, sexual activity, and even exercise. It triggers the release of feel good chemicals to reward us for certain behaviors (many of which, like eating and sexual activity, keep us alive and reproducing) so we keep doing them. This system plays a crucial role in the susceptibility of addictive behaviors such as excess alcohol consumption, drug use, and overeating, and may explain why quitting these behaviors proves far more difficult for certain individuals than others.

Though it appears healthy on the outside, exercise also can become an addiction for certain people, and can manifest in unhealthy ways like increased risk for injury, over training, and social isolation.

ADDICTIVE BEHAVIOR / STIMULUS CONTROL

Keep a journal. Tracking your workouts either the old fashioned way in a journal or using one of the numerous online platforms or apps can help you maintain healthy levels of training without overdoing it. Be sure to track your mood, energy levels, and how you feel each day, too. If you're getting fatigued and irritable, that's a sign you're overreaching in your training and need more recovery.

Indulge occasionally and wisely. Moderation is key for indulgences whether or not you have an addictive personality. Though your personality may not be inclined to overdo alcohol consumption or sugary foods, it's still healthiest to limit indulgences to the occasional drink or an ounce or two of chocolate a day rather than partaking in excess.

It's also not uncommon for addictive personalities to display addictive behaviors in more than one area of their lives. So an obsessive distance runner may also have a binge/purge eating disorder like bulimia. Research finds that addictive personalities also trade addictions, such as exercising to quit drinking or smoking.

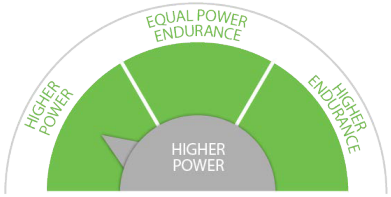
Researchers studying common addictions like cigarette smoking have found that variations of these genes are significantly associated with addictive personality behaviors. One meta-analysis of 22 studies including 11,075 men and women consistently showed that people carrying A2/ A2 genotype are more likely to quit smoking than those carrying A1/ A1 or A1/A2, who were less likely to quit. Taq1A genotypes were also more likely to quit smoking.

Our analysis investigated which genotype for this gene was present in your DNA. Your rating of either MORE LIKELY or LESS LIKELY reflects whether your genotypes included those that carried a risk for being more or less likely to have an "addictive personality" type.

POWER / ENDURANCE POTENTIAL

WHAT YOUR GENES SAY ABOUT YOU:

Our analysis indicates that your genetic profile exhibits characteristics that make you likely to have HIGHER POWER response to strength and power training.. You are likely to enjoy significant power gains in response to strength training. Your genes may help you exceed in sports where power plays a pivotal role, such as sprinting; ball sports such as baseball, football, tennis, and golf; track racing, competitive lifting, and CrossFit types of activities. You can capitalize on your genotype by prioritizing strength and power workouts in your exercise regimen.



Your genetic profile indicates that you are likely to have HIGHER POWER response to strength training than other genotypes

That means you are more likely to improve your power in response to strength training and excel in sports that are power based.

Power related sports involve faster, more forceful bursts of activity for a shorter time. Typical power sports are mixed martial arts, hockey, football, baseball, and CrossFit.

Whether you tend to be power or endurance oriented largely depends on your muscle fiber composition. Generally speaking, muscle fibers can be broken into two types: type I (slow twitch) and type II (fast twitch). Type I use oxygen for fuel, fire slowly, provide continuous energy, and have high endurance. Type II rely on anaerobic metabolism for fuel, fire rapidly, and are quicker to fatigue. Fast twitch fibers can further be broken down into type IIa, which are intermediate or hybrid fast twitch fibers in that they use both aerobic and anaerobic metabolism almost equally and type IIb, which are purely anaerobic and produce the highest rate of contraction for quick, powerful bursts of activity. They also fatigue very quickly.

RELATED GENES / SNPs

ACTN3, AGT, IL-6, NOS3, ACE, FTO, IGF1, GNB3, IL6-174

The genes and associated SNPs included in this category have been shown to have significant associations with a person's endurance and/or power potential, or how likely you are to have a positive response to aerobic endurance and/or power training, which in turn may help determine the activities at which you will be most successful.

A meta-analysis of 35 articles published between 2008 and 2016 that analyzed the DNA of 19,852 people identified nine genetic variations that have significant associations with being a power athlete. Other research has found that a specific allele of the ACE gene is heavily represented in endurance athletes like elite long distance cyclists and is beneficial for endurance, rather than power-related sports.

Knowledge of your genetic makeup can help you hone your training for the optimum

POWER / ENDURANCE POTENTIAL

Literature shows that healthy, sedentary people tend to have a 50/50 split of type I and type II fibers. Power athletes are estimated to have up to 80 percent type II fibers. Likewise, elite marathoners may have 80 percent type I fibers. Your DNA largely determines your personal combination. While you can train and make adaptations to muscle fiber size and shape and, to a small extent type, research shows genetic predisposition accounts for greater than 60 percent with only about a third being influenced by training and nutrition.

SUCCESS STRATEGIES

Your genetic inclination to be positively responsive to power training gives you an advantage for using training to get strong and fast for power-oriented sports and activities. That also means, of course, that you're less likely to excel in endurance-based sports like distance running, long distance cycling, and 70.3 or Ironman level triathlon. Which isn't to say you won't be successful in those endeavors, but may be less likely than other endurance-oriented genotypes to compete at an elite level.

outcome. In a study published in Biology of Sport, researchers tested the power and endurance levels of 28 athletes from different sports and 39 soccer players. All the athletes underwent genetic testing and then were assigned to a training protocol that either matched their DNA analysis or did not match their DNA analysis. After 8 weeks, they retested the athletes' aerobic fitness and explosive power. Those who were in the DNAmatched training group performed significantly better than those who were not.

Our analysis investigated which genotype for these genes was present in your DNA. Your rating of HIGHER ENDURANCE, EQUAL ENDURANCE/POWER, or HIGHER POWER, reflects whether your genotypes included those that carried the likelihood of being more responsive to endurance training; equally responsive to endurance and power training, or more responsive to power training.

Do some heavy lifting. Research indicates that athletes with your genotype see optimal gains in response to high intensity, low repetition type strength training. Try performing multiple sets of low weight such as 5 sets of 3 to 4 reps of close to your max weight with generous amounts of recovery (about 4 minutes) between sets. When you're comfortable with that, shake it up and lift closer to your max by performing 10 sets of 2 repetitions. This type of lifting stimulates your neural drive, improves your intramuscular coordination (so the fibers in any given muscle work better in concert to generate force), stimulates growth hormone production, and generates myofibrillar hypertrophy, which means your muscle fibers become denser and stronger—all of which plays to the strengths of your genotype and will help you excel in power-based athletic endeavors.

Be explosive. The definition of power is work divided by time. The more work you can do in a short amount of time, the more powerful you are. You can think of it as taking your strength and applying speed, such as what you do when you sprint, swing a bat to knock a ball out of the park, and clean and jerk a heavy bar. To maximize your genetic tendency to build power, include explosive types of training like Olympic style lifts and CrossFit into your training. Explosive workouts train your fast-twitch muscles to fire powerfully and quickly.

HIIT it. It may be tempting to forgo cardiovascular exercise completely, and if you're training for power-based sports, you don't need much. (Obviously if you're looking to do a mud run or Spartan challenge type of event, you'll need to increase your cardio training to build endurance to complete the distance of the event). By practicing high intensity interval training (HIIT), you can take advantage

POWER / ENDURANCE POTENTIAL

of your genotype and get the best of both worlds. Intense intervals tap into and condition your type II, turbo fibers, which you have in abundance. Because your heart rate stays elevated you get cardiovascular fitness benefits.

In one head-to-head comparison, Canadian researchers found that cyclists who performed 30-minute sprint sessions three days a week that included six 30-second max efforts with 4 minutes rest reaped nearly identical fitness gains to a group who pedaled moderately 90 minutes to two hours three days a week. In a similar study, the same research team found that high-intensity sprint training also doubled time to exhaustion during a threshold test. Since your genotype is one that is more responsive to power-based exercise, HIIT is an efficient way to improve your cardiovascular fitness.

A good example of HIIT is tabatas. They're super short, but very demanding. You can do them while running, cycling, or on exercise equipment like an elliptical. To do them, warm up for 5 to 10 minutes. Then go as hard as possible (you're going for maximum power output) for 20 seconds. Recover at an easy pace for 10 seconds. Repeat 6 to 8 times. Rest 4 to 5 minutes. If you are accustomed to interval training repeat for another set or two. If you're new to intervals, stick to one set. Cool down for 5 to 10 minutes.

Rest and recover. Because your genotype rewards high intensity training it can be tempting to hit it hard every time you hit the gym or perform your activity of choice. Resist the urge. Remember that your body repairs and makes its metabolic adaptations when you rest and recover. Take a couple of days off from hard training each week. Support your training and recovery with a healthful diet, good lifestyle habits, and quality sleep. Consider incorporating yoga into your routine for cross training and recovery. It will help you maintain muscle and joint mobility, which improves performance and helps prevent injury.

GRIP STRENGTH / MUSCULAR FITNESS

WHAT YOUR GENES SAY ABOUT YOU:

Our analysis indicates that your genetic profile exhibits characteristics that make you likely to have NORMAL hand grip/intrinsic muscular strength. You are genetically predisposed to perform in the average range on tests of grip strength as well as tests of general muscular strength and endurance. Though grip strength is not likely to be a limiter for you, you may still want to work on maximizing your grip strength, especially if you participate in racquet and ball sports and/or strength training, where grip strength is often people's weakest link. Because grip strength is indicative of intrinsic muscular strength and muscular endurance, total body strength training will also be helpful to maximize your overall strength.

Your genetic profile indicates that you are likely to have NORMAL hand grip/intrinsic muscular strength.

That means you are genetically likely to perform in the average range in tests of hand grip strength, as well as tests of general muscular strength and endurance, such as sit ups, push ups and lower body exercises like squats and leg presses.

SUCCESS STRATEGIES

Being genetically inclined to have average grip and intrinsic muscular strength may put you at a slight disadvantage in sports where grip strength is a priority. It may also limit your ability to maximize your muscular gains in the gym, since hand grip is often the first thing to give out when lifting heavy.

It's also important to note that everyone, regardless of genetic make up, has weaker hand grip strength than they used to. Your grip strength is partly determined by activity and lifestyle. People performing lots of manual labor will have stronger hands. Grip strength—along with the rise in technology and decline in manual labor—has also been in decline among younger Americans, according to research. One 2016 study of 237 men and women ages 20 to 34 published in the Journal of Hand Therapy found that men 25 to 29 years of age had grip strengths of 101 and 99 pounds of force (right and left hands strength and performance in tests of muscular strength and

RELATED GENES / SNPs

TGFA, POLD3, ERP27, HOXB3, GLIS1, PEX14, LRPPRC, MGMT, SYT1, HLA, GBF1, KANSL1, SLC8A1, ACTG1, DEC1, IGFS9B

The genes and associated SNPs included in this category have been shown to have significant associations with a person's grip strength, which in turn may help determine how successful you will be in activities requiring muscular strength and muscular endurance.

Hand-grip strength is not just about a firm handshake. It reveals a lot about your intrinsic muscular strength and fitness and may, when weak, also indicate an increased risk in fractures. So it's important not only for successful performance in many activities such as racquet and ball sports, resistance training, and off-road cycling, but also for general vitality and health.

Research has found that hand-grip strength is strongly correlated to muscular strength and endurance. In one study, significant correlations were found between grip

GRIP STRENGTH / MUSCULAR FITNESS

endurance respectively) today, a loss of 26 and 19 pounds from 30 years ago. Young women lost roughly 10 pounds of force over the same time period.

Grip strength naturally declines as we get older, especially after age 55, so exercising to maintain it can help make resistance training and tasks of daily living easier. You can improve your grip strength while you watch TV by simply squeezing a tennis ball. Squeeze in as hard as you can for 15 to 20 seconds. Rest for 10 seconds. Repeat 8 to 10 times. In the gym, incorporate the farmer's carry move into your routine. Grab a pair of heavy kettlebells (or dumbbells if there are no kettlebells available) and grasp them firmly as you walk for 30 feet, taking short quick strides. Put them down and rest. Repeat 3 times. Use the heaviest weight you can carry.

Other grip strengthening moves include deadlifts, rows, pull ups, Olympic style lifts like cleans and snatches, and front squats—all of which not only improve your grip strength, but also are excellent for maximizing total body strength, which is also helpful for your particular genotype.

strength and performance in tests of muscular strength and endurance including sit ups, push ups, leg extension, and leg press.

Grip strength is also highly heritable. A large-scale genome-wide association study including a combined sample of 195,180 men and women identified 16 SNPs associated with grip strength. A number of these are also associated with genes that are implicated in the structure and function of muscle fibers, which helps explain why grip strength is a good indicator of intrinsic overall muscular strength. The study also confirmed that these genetic determinants of muscle strength were linked to fracture risk, likely because low muscle strength increases risk of falling.

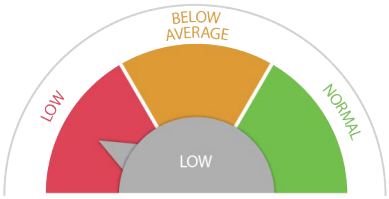
Our analysis investigated which genotype for these genes was present in your DNA. Your rating of BELOW AVERAGE, NORMAL, or ABOVE AVERAGE reflects whether your genotypes included those that carried the likelihood of having below average grip/intrinsic muscular strength, average intrinsic grip/muscular strength, or below average intrinsic grip/muscular strength.

TRAINING RESPONSE

VO2 MAX

WHAT YOUR GENES SAY ABOUT YOU:

Our analysis indicates that your genetic profile exhibits a LOW fitness response to moderate to high-intensity exercise. That means your genotype is among those that may respond sub-optimally to longer, harder bouts of exercise, so you may not see as great of an increase in oxygen capacity as someone with a more favorable genotype. That does not mean you should throw in the towel. You may still be able to make gains through lower-intensity and strength training.



Your genetic profile indicates that your fitness response to moderate-to-high-intensity cardio is LOW.

To increase VO2 Max, you may need to focus your training on lower, endurance-building intensities, as well as resistance training to improve your muscular strength, economy, and endurance, which can improve your performance, regardless of VO2 Max.

Your muscles need oxygenated blood to generate fuel. The more work you ask them to do, the more fuel—and oxygen-rich blood—they need. As you start to exercise, your heart rate and your breathing increases and keeps increasing as the intensity rises, so you can send more and more oxygenated blood to your working muscles. Keep pushing and you'll reach a point where your body can't use any more—your system is tapped out. Your heart is pumping all it can and your muscles are using all they can. That is your VO2 Max, the scientific name for the measure of your oxygen capacity— how much oxygen-rich blood your heart can pump and how much your muscles can use per minute, which is expressed in ml/kg/min.

VO2 Max is influenced by your genes, but also by your size, gender and, because it naturally diminishes overtime, age. For example, a sedentary woman in her 30s or 40s may have a VO2 Max of about 26 ml/kg/min while an athletic woman of the same age will have VO2 Max closer to 56 ml/kg/min. A 50-year-old man in fair condition may have a VO2 Max of 30, while his cross country ski-racing friend has one of 55 ml/kg/min.

RELATED GENES / SNPs

AMPD1, APOE

The genes and associated SNPs included in this category have been shown to have significant associations with a person's cardiovascular fitness response to moderate-to-high intensity exercise.

VO2 Max is generally considered the best indicator of aerobic fitness and endurance potential. Factors that impact it are how strong and efficient your heart is, how well developed your capillary system is to deliver blood into your muscles, and the size and number of the energy-producing furnaces known as mitochondria in your muscle cells. All of these factors—and in turn your VO2 Max—improve with moderate to high intensity training. People who are active will have a higher VO2 Max than their sedentary peers. It is also influenced by your size, gender and, because it naturally diminishes overtime, age.

How much you can improve your VO2 Max depends upon myriad factors, including

TRAINING RESPONSE

VO2 MAX

Some people appear more inclined to respond to higher intensity efforts while others respond to lower intensity efforts. In one study, researchers from Queen's University in Kingston, Ontario, and the University of Ottawa measured VO2 Max in a group of "non-responders." They then split the group in half and had one group perform classic endurance style moderate-intensity training for three weeks, while the other half performed Tabata style, very high intensity interval training (HIIT) style workouts over the same period. After three weeks, they measured their VO2 Max levels, waited several months, and then brought the volunteers back to do another three week training block, this time doing the opposite style training as before. In the end, about a third of the group had little response to endurance style training; a third had little response to HIIT training, but no one failed to respond at all and generally if they didn't respond to one type of training, they had a good response to the other style of training.

In a similar study, researchers had sedentary men and women begin a cardiovascular training routine that included up to 50 minutes of cardio machines, like spin bikes and treadmills, 3 to 4 days a week for 5 to 6 months. Those with an "unfavorable" fitness response to cardio genotype experienced smaller gains in their cardiovascular fitness from the training. However, they also were less able to perform high intensity efforts, suggesting that their optimal fitness response may be better achieved at a lower intensity of exercise.

your current fitness level and the intensity of your training. Research finds that sedentary people who start training at about 75 percent of their max for at least 30 minutes 3 times a week can increase their VO2 Max an average of 15 to 20 percent over six months, but the range of response is large. Some people make enormous gains, while others make very few. The reason, we now know, is in your genes. We've also learned that, contrary to what was thought previously, there are very few actual exercise "nonresponders." It's more a matter of to what type of cardiovascular intensity your body best responds.

Our analysis investigated which genotype for these genes was present in your DNA. Your rating of NORMAL, BELOW AVERAGE or LOW reflects whether your genotypes included those that carried a risk of reduced cardiovascular fitness response from moderate-to-higher intensity exercise.

You'll generally hit your VO2 Max upper limit within a year of consistent training. It's important to note that even among elite athletes, there is a wide variation in VO2 Max values and that just because you've hit your VO2 Max ceiling doesn't mean that you can't continue to improve your athletic performance. Raising your lactate threshold—being able to perform at a higher percentage of your VO2 Max before fatiguing—and improving your efficiency and economy (which allows you to save energy while cranking out a high pace) can help you make measurable gains regardless of absolute VO2 Max.

SUCCESS STRATEGIES

Depending upon your athletic goals, building your VO2 Max may or may not be a top priority. Though someone with your genotype may never reach elite levels in activities like 5K runs where being able to use the maximal amount of oxygen is key for success, you may still perform well in longer duration activities, where you're working at sub-maximal levels and sports that require other skills and traits beyond having a high aerobic fitness potential.

TRAINING RESPONSE

VO2 MAX

Though your genotype is not highly responsive to high-intensity exercise, you may be able to build your VO2 Max through more frequent sessions of moderate-intensity training. Aim to perform these endurance-building efforts at least 5 days a week if cardiovascular gains are a priority for you. You may be well suited for longer endurance events that don't require a high VO2 Max.

Also consider including resistance training to improve your muscular strength and economy, which can give you a large performance boost regardless of your VO2 Max. Research has found that endurance athletes like runners, cyclists, and triathletes who swap some cardiovascular training time for resistance training like CrossFit and plyometrics improve their performance in time trials and other cycling, running, and multisport events, despite having slightly lower total training hours.

TRAINING RESPONSE

EXERCISE HEART RATE RESPONSE

WHAT YOUR GENES SAY ABOUT YOU:

Our analysis indicates that your genetic profile exhibits characteristics that give you a likely SLIGHTLY ABOVE AVERAGE heart rate response to exercise. That means you are likely to experience a small to moderate decrease in your exercise heart rate with training. That does not limit your ability to make measurable fitness gains or mean that you will experience sub-par performance with training. Even small heart rate improvements are meaningful and heart rate is only one factor in exercise performance and success.

Your genetic profile indicates that you are likely to experience a SLIGHTLY ABOVE AVERAGE heart rate response to exercise.

You are likely to experience a small to moderate decrease in exercise heart rate with training. Though larger decreases may be advantageous, heart rate is only one measurement of fitness and performance potential.

SUCCESS STRATEGIES

Athletes often prize a low resting, and subsequent lower exercising, heart rate as a sign of superior fitness. Though a decrease in beats per minute (bpm) is a sign of improved cardiovascular conditioning and a lower resting heart rate can be an indicator of good fitness, it is only part of a larger picture when it comes to performance. These strategies can help maximize your training with regards to your genetic inclination for a more moderate heart rate training response.

Know your numbers. Healthy adults have an average resting heart rate (RHR) of 60 to 80 bpm; RHR may be 100 bpm in sedentary adults and lower than 60 bpm for active adults. Because women are smaller, their average heart rate is up to 10 bpm higher.

RELATED GENES / SNPs

CREB1

The gene and associated SNP included in this category have been shown to have significant associations with a person's exercise heart rate response. Your heart's primary job is to keep your blood circulating, sending blood into the lungs to pick up fresh oxygen and then pumping out that oxygenated blood into the rest of the body so your cells can function. When you exercise, your heart pumps faster to keep your working muscles fueled.

As you become more fit, your body becomes more efficient at using oxygen so your heart rate doesn't have to rise as dramatically when you exercise. It also becomes lower when you are at rest. Having a lower resting heart rate doesn't only indicate better heart health, but also, because your heart can pump more oxygenated blood with fewer beats per minute, you have greater endurance and exercise capacity. Your genetics have a considerable influence over how dramatically your exercise heart rate responds to endurance training.

EXERCISE HEART RATE RESPONSE

The first step is determining your current resting heart rate, because if you don't know where you're starting, you can't measure your progress. If you've been training for more than a few weeks, you may have already achieved a lower resting and exercising heart rate and will not see further declines. Keep in mind that research shows that if you naturally have a lower heart rate, you will not see as dramatic a decrease as someone who has a naturally higher heart rate might.

It's best to measure your resting heart rate first thing in the morning. You should be fully recovered from any recent hard training or racing, as that can elevate your morning heart rate. If you need to use the bathroom, do that first, so you're fully relaxed. Put on your heart rate monitor and measure for about a minute, noting your lowest heart rate number. If you don't have a heart rate monitor you can simply use a timer and place your fingertips on your pulse and count beats for a minute.

If you've just started training, check again in three to four weeks (again being sure you're fully recovered) to note any changes.

Consider your exercise intensities. Lower intensity exercise doesn't have as much of an impact on your resting and exercise heart rate as high intensity exercise. Research shows that one hour a week of high intensity aerobic training lowered resting heart rate more effectively than lower intensity bouts.

The HERITAGE Family Study of 472 men and women from 99 nuclear families found that after 20 weeks of endurance training, the average decrease in heart rate during steady state aerobic exercise (60% of VO2 Max) was 11.3 beats per minute (bpm), but there was a large range among individuals, from a decrease of 42 bpm to an increase of 12 bpm. Variations in the CREB1 SNP were strongly associated with heart rate response to exercise, explaining about 20 percent of the variance in heart rate response.

Our analysis investigated which genotype for this gene was present in your DNA. Your rating of NORMAL, SLIGHTLY ABOVE AVERAGE, or ABOVE AVERAGE reflects whether your genotypes included those that make you more likely to have a small, small to moderate, or moderate decrease in exercise heart rate with training.

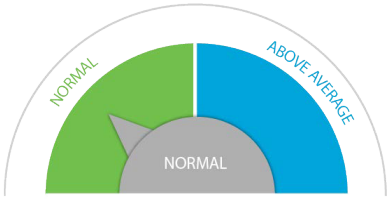
Practice other heart healthy behaviors. Exercise isn't the only thing that impacts your resting and exercising heart rate. Dehydration thickens your blood and raises your heart rate, so staying hydrated is key. Caffeine can make it higher, so sensible caffeine use will help keep a too high heart rate in check. Exercising in extreme temperatures will raise it. Your heart rate will be higher at high altitudes, especially if you're not acclimated.

Make it part of the larger picture. Resting heart rate is only one piece of your athletic portrait. Your training partner with a resting heart rate of 32 bpm may win a fitness contest on paper, but in the real world, you could still be stronger and faster and get to the finish line first. Training your strengths can help minimize any limitations.

EXERCISE STROKE VOLUME

WHAT YOUR GENES SAY ABOUT YOU:

Our analysis indicates that your genetic profile exhibits characteristics that make you likely to have a NORMAL stroke volume response to exercise. That means you are likely to experience a typical increase in stroke volume in response to exercise training.



Your genetic profile indicates that you are likely to experience a NORMAL stroke volume response to exercise training.

A greater stroke volume response is advantageous as you can pump out more blood at a lower heart rate. However, stroke volume response is only one factor in exercise performance and success.

Untrained people have a stroke volume of about 50 to 70 ml/beat at rest, which increases to 110 to 130 ml/beat during high intensity efforts. Exercise makes your heart muscle bigger and stronger, so you have a greater stroke volume. The resting stroke volume in elite athletes averages 90 to 110 ml/beat (which is why their resting heart rate is also so low), which increases to as much as 150 to 220 ml/ beat during high intensity exercise, according to research.

Your stroke volume response is also sport dependent. Swimmers generally see a smaller increase in stroke volume response than runners or cyclists; exercising heart rate is typically lower during swimming as well, because the supine position prevents blood from pooling in the lower extremities and there's less need for increased heart rate and stroke volume to meet the body's needs.

RELATED GENES / SNPs

KIF5B

The gene and associated SNP included in this category have been shown to have significant associations with a person's exercise stroke volume response.

There are two ways for your heart to get more oxygen-rich blood to your exercising muscles: pump faster (heart rate response) and pump out a greater volume of blood with every beat. The latter is your stroke volume response, the amount of blood ejected per beat from your left ventricle, as measured in ml/beat.

Stroke volume increases as your exercise intensity rises. How much your stroke volume improves with exercise is also largely hereditary. The HERITAGE Family Study of 483 men and women from 99 nuclear families found that after 20 weeks of endurance training, the average increase in stroke volume during steady state aerobic exercise (60% of VO2 Max) was 3.9 ml/beat.

EXERCISE STROKE VOLUME

Increasing stroke volume is believed to be more efficient than increasing heart rate during exercise, as you can do more work at a lower heart rate with a higher stroke volume. That said, once you reach a certain intensity, your stroke volume plateaus and your heart rate increases to meet your increasing exercise demands.

Your genetic tendency to have an average stroke volume response to exercise training does not mean you cannot perform at a high level or successfully compete against someone with a larger stroke volume response, though you may need to work harder at a given heart rate.

You can minimize any disadvantages by training your sport-specific skills; developing muscular power and efficiency and other fitness elements not solely dependent on cardiovascular efficiency. It's also important that you maintain optimum hydration status, as dehydration diminishes blood volume, which can exacerbate the impact of a genetically lower stroke volume.

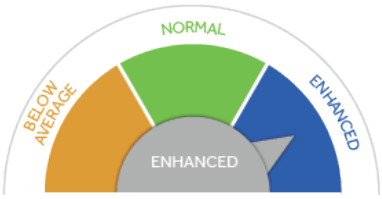
But there was a large range of stroke volume response among individuals, ranging from a decrease of 41 ml/beat to an increase of 45 ml/beat. Variations in the KIF5B SNP were strongly associated with stroke volume response to exercise, explaining nearly 30 percent of the variance.

Our analysis investigated which genotype for this gene was present in your DNA. Your rating of NORMAL or ABOVE AVERAGE reflects whether your genotype included those that make you likely to have an average or above average stroke volume response to regular exercise training.

BODY COMPOSITION RESPONSE TO STRENGTH TRAINING

WHAT YOUR GENES SAY ABOUT YOU:

Our analysis indicates that your genetic profile exhibits an ENHANCED body composition response to resistance training exercise. That means that along with improving strength and building lean muscle tissue, you are likely to lose weight and lower your body fat when you engage in a regular strength training routine. That's good news because many sports favor high power to weight ratios—having more lean muscle and less fat generally raises that ratio and may give you an advantage. A healthy body composition also lowers your risk for chronic disease like heart disease and diabetes.



Your genetic profile indicates that your body composition response to strength training is ENHANCED.

That means you are more likely to both make muscle and lose fat when you strength training regularly. You can maximize the benefits of your favorable genotype by resistance training at least two to three times a week.

As the term suggests, body composition is what your body is made from, including bone, water, fat mass, and lean tissue. For purposes of training and athletic performance, we tend to focus on the amount of body fat you have in relation to muscle. For good health, men should strive for a body composition that is less than 25 percent fat and women should aim for less than 32 percent fat. Generally speaking, athletic men and women have lower body fat percentages with elite athletic males averaging 6 to 13 percent and women averaging 15 to 20 percent.

Different sports have widely different requirements in terms of ideal body composition. A football lineman who needs a lot of absolute mass will have a higher percentage of body fat (though still a huge quantity of muscle) than an elite level male triathlete, who will be slowed down by any extra weight that is not helping to generate power. Regardless of sport, maintaining a healthy body composition is advantageous as it can help lower your chances of developing cardiovascular disease as well as diabetes and certain cancers.

RELATED GENES / SNPs

XN3, GNPDA2, LRRN6C, PRKD1, GPRC5B, SLC39A8, FTO, FLJ35779, MAP2K5, QPCTL-GIPR, NEGR1, LRP1B, MTCH2, MTIF3, RPL27A, SEC16B, FAIM2, FANCL, ETV5, TFAP2B

The genes and their associated SNPs are included in this category have been shown to have significant associations with a person's ability to improve their body composition in response to strength training.

As you know, resistance training helps you build and maintain lean muscle tissue. It may also help reduce the percentage and sometimes amount of body fat you have. That overall improvement in body composition makes you stronger and quicker in most sports. A higher percent of muscle and lower percent of fat tissue also contributes to a leaner appearance and, potentially, to a higher metabolism, or greater number of calories burned each day.

BODY COMPOSITION RESPONSE TO STRENGTH TRAINING

This genotype is particularly favorable for body builders and power-based athletes, but all athletes and active people benefit from a healthy body composition.

SUCCESS STRATEGIES

Strength training works best when you lift weight that is heavy enough to fully stimulate lean muscle tissue growth—something many people, including athletes—neglect to do.

Your genotype may assist in great body composition improvements by participating in a focused strength-based program like CrossFit or similar conditioning class. Otherwise, aim to perform full body strength training two to three days a week.

For the best results, continually challenge your muscles in novel ways, mixing up your sets and reps from session to session, so sometimes you're lifting heavy (3 to 4 sets of 3 to 6 reps, 3 to 5 minutes rest between sets); sometimes light (2 to 3 sets of 10 to 15 reps, 1 to 2 minutes rest between sets), and sometimes moderate (2 to3 sets of 8 to 10 reps, 1 to 2 minutes rest between sets). The weight you choose should be heavy enough so the last reps in a set are very challenging (but you can still maintain good form). When the exercises become easy, add more weight to continue to obtain the benefits.

Numerous factors, including your predominant muscle fiber type (which you discovered in the first section), your hormones (including testosterone, also from the previous section in this report), and the type of strength training you do influence how your body composition will respond to a resistance training program. Your genotype also plays a significant role.

In one large study, researchers had 148 volunteers participate in an intense resistance-training program for one year. They found that those who carried the most "favorable" gene variations enjoyed a full gamut of body composition benefits and not only improved their strength and muscle mass, but also experienced significant weight loss and body fat reduction. Those with less favorable genotypes still got stronger, but showed a decreased ability to lose weight and reduce body fat percentage by resistance training.

Our analysis investigated which genotype for these genes was present in your DNA. Your rating of either ENHANCED, NORMAL or BELOW AVERAGE reflects whether your genotypes included those that carried a risk of an enhanced or reduced body composition response to resistance training exercise.

FUEL UTILIZATION

PROTEIN UTILIZATION

WHAT YOUR GENES SAY ABOUT YOU:

Our analysis indicates that your genetic profile exhibits an ENHANCED utilization of protein. Your score reflects the fact that your genotype does include the allele combination that resulted in greater weight loss when a higher percentage of protein was eaten. Studies that investigated this genotype found that a diet consisting of a higher percentage of protein resulted in optimal weight loss. This suggests that the amount of weight or body fat you lose when trying to get lean is very likely to be affected by the percentage of protein you eat.

Your genetic profile indicates that your response is ENHANCED.

You may be more likely to meet your weight loss and/or maintenance goals by eating a moderate-to-high percentage of protein in your daily diet. Aim for 25% to 30% of your total calories to come from plant and/or lean animal-based protein.

The good news is that people with this genotype lost weight on a moderate protein diet. However, people with this allele also lost more lean body mass compared to those without this genotype. This suggests that if you want to drop weight and body fat, you are more likely to be successful by eating a moderate, instead of low percentage of protein in your daily diet, but that you may lose more muscle mass along with it, which is concerning for active individuals for whom muscle maintenance is essential for performance.

Since this genotype also suggests that you may lose more muscle mass when you are trying to lose fat and get lean compared to others with a different genotype, it is recommended that you be sure to include weight lifting in your training regimen if you do not already so you can prevent or minimize muscle loss that may come with weight loss.

SUCCESS STRATEGIES

To lose and/or maintain weight, consume a diet that is moderate to high in protein and be sure to include strength training in your regimen to minimize

RELATED GENES / SNPs

FTO

The gene and associated SNP included in this category has consistently been shown to be associated with body fat mass and BMI. As an athlete, you need more protein than the average person, as protein is required for muscle growth and repair after training, workouts, and competing. Many active people also rely on a heavy protein intake to shed and maintain weight, with a large contingency adopting protein-centric eating plans like the Paleo diet in hopes to maximize lean body tissue and minimize fat. How well that approach works may be largely dependent on your DNA.

One large study found that people with a specific FTO variant had more successful weight loss and shed more body fat, particularly high-risk abdominal fat, if they ate a moderate-to-high protein diet (25-30% of total daily calories) compared to a lower protein diet (15-20% of total daily calories), regardless of the percentage of their that

PROTEIN UTILIZATION

the loss of lean tissue. Here's how to optimize your protein intake.

Skew higher if you're actively trying to lose weight. The body must get a certain minimum amount of protein for normal functioning, and that is considered to be around 10% of total daily calories when you are eating enough food to meet your daily energy needs. This minimum amount of protein must be eaten to support processes such as enzyme and hormone production, cell repair and synthesis of skin and hair cells. If you start reducing your food intake to drop weight, you need to eat a slightly higher percentage of protein because you are eating less food overall. Your genotype suggests that, while losing weight, you may benefit from a higher percentage of protein – from 25% to 30%.

Maximize your essential amino acids. Protein in your foods should contain all of the essential amino acids, since your body requires these to produce proteins, as well as the other amino acids it uses to make compounds such as enzymes, hormones, and tissues in your body. Animal foods contain all of the essential amino acids in one food item, such as meat, poultry, fish or dairy products. But if your genetic analysis for the other macronutrients suggests that you should reduce your intake of total fat or saturated fat, choose leaner versions of animal foods or, better, opt for plant-based protein foods.

came from fat and carbohydrates. However, they also lost more non-fat mass — which includes muscle — with the weight loss, even though they were eating a higher protein diet and exercising.

Our analysis of your genes investigated which genotype for this SNP was present in your DNA. Your rating of either NORMAL or ENHANCED reflects whether your genotype included those alleles that exhibited protein sensitivity, because their presence suggests that you will be more successful in your weight loss and maintenance attempts by following a moderate to high protein diet.

You can obtain all of the essential amino acids in many single plant foods, including grains such as quinoa, seeds, such as shelled hemp hearts (hemp seeds), and beans such as edamame or tofu. Or you can consume several complementary plant foods in the same day and obtain the essential amino acids your body needs (brown rice and black beans; nuts, grains and beans; veggies, beans and grains, etc.)

Adjust Your Intake to Match Your Activity. For average people, the recommendation is to obtain between 0.8 and 1 gram of protein per 1 kilogram of body weight. So if you weigh 150 lbs., or 68 kg, it is recommended that you get between 54 and 68 grams of protein per day. You need more as an active person.

The Academy of Nutrition and Dietetics recommends that athletes who participate in light to moderate endurance training take in 1.2 to 1.7 grams of protein per kilogram, or about 0.55 to 0.8 grams of protein per pound of body weight each day. So that same 150-pound person would need 82 to 120 grams of protein a day.

PROTEIN UTILIZATION

Power and sprint athletes looking to gain muscle mass also need more than average amounts of protein. If you're one, the Academy recommends you take in 1.4 to 1.8 grams of protein per kilogram or about 0.64 to 0.82 grams of protein per pound of body weight daily to build muscle mass. That same 150-pound athlete who wants to build muscle should eat 96 to 123 grams of protein every day.

Finally, serious endurance athletes who perform high volume training that includes high intensity intervals require the most protein because of the rate they break down their muscle tissue. The Academy recommends that high intensity endurance athletes take in 1.4 to 2.0 grams of protein per kilogram, or about 0.7 to 0.9 grams of protein per pound of body weight every day. So that 150-pound, high-intensity endurance athlete may need to consume up to 135 grams of protein every day.

Spread it out. Eat a variety of high protein foods, including eggs, dairy products, poultry, meat, fish and seafood, legumes, soy products, nuts and seeds, and spread it out throughout the day. By eating protein with every meal, you ensure that your muscles always have what they need for repair and maintenance. Protein also improves satiety, so you're less likely to over eat.

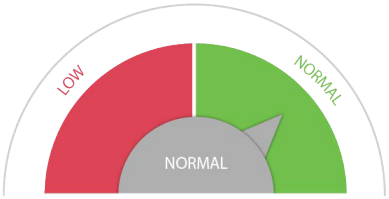
It's a good idea to get a sense of how much protein you are getting by recording your food intake for at least a week and entering it into a diet app or online nutrition log that can calculate the percentage of each of the macronutrients that you eat. Then you can tweak your menu as needed to obtain your recommended percentage of protein.

Add heavy resistance training. Since this SNP is also associated with reduced lean body mass, such as muscle tissue, with weight loss, it is recommended that you include heavier weight training as part of your plan if weight loss is one of your goals. This may help minimize or prevent the loss of lean body mass that can occur with weight loss. Study your results for your genetic analysis for exercise-related genes for a more specific exercise prescription. But for optimal muscle strengthening, you should do exercises with weights targeting your major muscle groups. On 2 to 3, non-consecutive days per week, do 3 sets of 12 reps with weight heavy enough to feel "hard" or "very hard" by the end of each set.

FAT UTILIZATION

WHAT YOUR GENES SAY ABOUT YOU:

Our analysis indicates that your genetic profile exhibits a NORMAL utilization of fat. Your score reflects the fact that for the genes investigated, your genotype showed few, if any, of the unfavorable allele combinations. This means that you appear to have a normal ability to lose weight by following an eating plan that is low, moderate, or high in fat, so long as you're not taking in more energy than you're expending. This result also suggests that you have a normal level of fat oxidation, or fat-burning ability in response to different levels of fat in your diet. That's good news, especially for endurance athletes, who rely on fat oxidation for optimum performance.



Your genetic profile indicates that your utilization of fat is NORMAL.

If you are reducing your food intake to try to lose weight, you can expect to lose similar amounts of weight on either a low or a moderate fat diet.

SUCCESS STRATEGIES

You may experience similar results in terms of weight loss from following a reduced-calorie diet, no matter if it is low, moderate, or high in fat. That's good news for athletes, especially those who participate in endurance activities, who rely on fat to fuel their long-distance efforts.

Athletes also need more fat than sedentary people not only to fuel activity, but also to assist in the production of essential steroid hormones, which control how your body responds to strenuous activity. Too little fat can cause hormone imbalances and hinder your athletic performance and recovery.

While your genetic profile suggests that you may be better able at handling higher levels of fat when you diet, for optimum health and performance, prioritize healthy, inflammation-reducing fats like omega-3 fatty acids found in fish, nuts and seeds, avocados, and olive oil over less healthful food sources like fried foods.

RELATED GENES / SNPs

PPARG, TCF7L2, APOA5, CRY2, MTNR1B, PPM1K

The genes and their associated SNPs that are included in this category all have been shown in scientifically sound studies to have statistically significant associations with how sensitive people are to eating a diet high in fat.

Like most active people, you may be trying to optimize your body composition by losing body fat and increasing lean muscle. Some athletes, concerned about carbohydrate-related weight gain, will prioritize fat in their diets, sometimes opting for a diet that gets a high percentage of calories from fat. Studies show that genotype plays a large role in how the amount of fat in your diet affects weight loss.

One study found that those people with an unfavorable genotype were more likely to have more body fat, a larger waist size, and a higher BMI the more fat they ate, compared to others without the same genotypes.

FAT UTILIZATION

Another study found that people with a protective genotype appeared to be able to consume greater amounts of fat, but without exhibiting higher BMIs. Another study found that people who went on a higher fat, reduced calorie diet lost weight, but they lost less weight if they had an unfavorable genotype compared to those with a more favorable genotype.

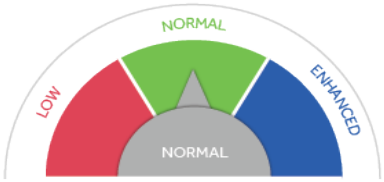
Our analysis of your genes investigated which genotype for each of these 6 genes was present in your DNA. Your rating of either NORMAL or LOW reflects whether your genotypes included some or all of those that carried a risk of reduced weight loss ability from a diet that was high in fat.

FUEL UTILIZATION

CARB UTILIZATION

WHAT YOUR GENES SAY ABOUT YOU:

Our analysis indicates that your genetic profile exhibits a NORMAL utilization of complex carbohydrates. Your score reflects the fact that your genotype does not appear to produce greater weight loss with a higher complex carbohydrate diet, and you can expect to lose around the same amount of weight with either a low, moderate or higher complex carb diet. Weight maintenance and loss aside, you still need adequate carbohydrate intake to fuel the sports and activities you perform. Complex carbs provide the most nutrients, fiber and, long-lasting energy during exercise.



Your genetic profile indicates that your utilization of carbohydrates is NORMAL

A high carbohydrate diet may not be beneficial if your goal is to lose and/or maintain weight. You still need adequate carbohydrate intake to fuel your activities, however. Prioritize complex carbohydrates, which provide the most nutrients, fiber, and lasting energy.

As an athlete, you use stored glucose—glycogen—to fuel your activity, particularly high intensity activity. Your body relies on glucose for daily living, as well, and this is why blood sugar levels are maintained within a consistent range. In fact, brain cells and red blood cells use glucose as their primary source of energy. Cells also use fat as a fuel source, but to metabolize fat, there must be some glucose present to complete the process.

Glucose is a very important nutrient. But sometimes cells do not respond to the insulin being released, a condition known as insulin resistance. The result is the bloodstream can be overloaded with glucose. Chronic high blood glucose levels can lead to pre-diabetes and, if unchecked, eventually diabetes, or uncontrolled high blood sugar. People who are overweight and/or physically inactive are at higher risk of insulin resistance. Athletes, however, are not immune to insulin resistance: one study on amateur athletes found that 3 out of 10 had fasting blood glucose in the pre-diabetes range.

RELATED GENES / SNPs

IRS1, FGF21

The genes and associated SNPs included in this category has been shown to be associated with a person's insulin sensitivity and the potential effects of the amount of carbohydrates and fat in the diet. Insulin is a hormone released by the body that helps cells take in glucose, or sugar, for energy. Glucose is present in the blood after the digestion of carbohydrates from foods like fruits, vegetables, legumes and grains. Insulin is also released in response to eating protein as it helps to shuttle amino acids into cells.

The gene in this category seems to influence insulin resistance and the body's response to carbs in the diet. One long-term study found that people with a variant of the IRS1 gene who ate a high carbohydrate, lower fat diet that consisted of high fiber, whole plant foods, as opposed to processed, lower fiber carbs, had greater insulin sensitivity—and lower levels of insulin and insulin resistance—and experienced greater

CARB UTILIZATION

Since carbohydrate intake triggers insulin release, many people, including athletes and recreationally active men and women, assume that eating more carbs is not healthy and can lead to body fat and weight gain, as well as diabetes. Athletes in sports like CrossFit include a large low-carb diet (such as Paleo) contingency. But the relationship is not that simple: many people who eat a high carbohydrate diet perform well, are not overweight, and do not have diabetes, and, in fact, may have much lower levels of blood glucose. Several large epidemiological studies have shown that increased carb intake actually leads to a lower risk of diabetes and that, surprisingly, increased protein intake, increases the diabetes risk.

The types of carbs you eat play a role: Complex carbohydrates or starches are those that are made up of sugar molecules that are strung together in long, complex chains, as opposed to simple carbs, which are simple sugars like fructose and glucose. Complex carbs take longer for your body to digest, so have less of a "spike" effect on blood glucose levels. Sources include: whole grains like brown rice, quinoa, oatmeal, barley, bulgur, and buckwheat, vegetables, fruits, and legumes. If you eat mostly processed carbs (as opposed to fiber-rich complex carbs), you are likely to release greater amounts of insulin and this could affect your insulin resistance.

SUCCESS STRATEGIES

For weight loss, your genotype suggests that a high carbohydrate diet is not necessarily beneficial. Though there are no universally accepted definitions, high carb diets generally include greater than 60 percent of total calories from carbohydrates, and low carb diets generally include less than 30 percent of total calories from carbohydrates. Review your results from the other macronutrient genetic traits for more guidance on the weight/fat loss diet composition that might work best for you.

weight loss compared to eating a lower carb, higher fat diet. This is especially important as an active person, as maintaining healthy insulin sensitivity allows you to store the carbohydrates you eat for energy as well as to promote recovery after exercise and training.

But not all genotypes respond equally to high-carb diets. A two-year weight loss / genotype study published in Diabetes Care revealed that carriers of a specific variant of the FGF21 gene, which helps regulate glucose and fat metabolism and weight loss, lost more total body and abdominal fat over the study period when they followed a low-carb diet than their peers who had genotypes more positively responsive to carbohydrate intake.

Our analysis of your genes investigated which variants were present in your DNA. Your rating of LOW, NORMAL or ENHANCED reflects whether your genotype included those genes that improved insulin sensitivity and weight loss from a higher carb and slightly lower fat diet.

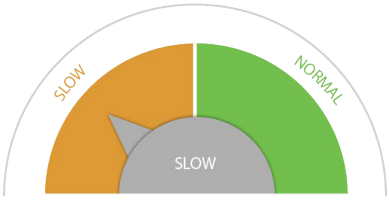
Performance-wise, your genotype does not suggest improved insulin sensitivity with high-carb intake. That does not mean you should eschew carbohydrates all together, however. But rather follow the carbohydrate intake recommendations found in current American College of Sports Medicine position statement on nutrition and athletic performance: reserve your higher carbohydrate intake for hard training days, races, and competitions. On easy or rest days, lean toward low carbohydrate intake.

Eat the majority of your carbohydrates from complex carbohydrate sources, which are highest in fiber, nutrients, and are best for your general health. Save simple carbohydrates like refined bread, pasta, sweets, and gels for when you need quick bursts of energy, such as right before a race or during prolonged activity, when you need fuel that is quickly absorbed. During such activity, you can aim for about 30 to 60 grams (120 to 240 calories) of carbohydrates per hour after the first hour to 90 minutes of activity.

CAFFEINE METABOLISM

WHAT YOUR GENES SAY ABOUT YOU:

Our analysis indicates that your genetic profile exhibits a SLOW rate of caffeine metabolism. That means you do not have the liver enzymes to breakdown and metabolize caffeine at a normal rate, but rather it stays in your system for a prolonged period of time. Using caffeine before training or sporting events may not be beneficial for you, and caffeine may have detrimental effects on your health. It also puts you at risk for more serious side effects from the stimulant, including elevated blood pressure and heart attack risk.



Your genetic profile indicates that you are likely to have a SLOW rate of caffeine metabolism.

This means you are not likely to benefit from the stimulant's ergogenic benefits as much as someone with a normal rate of caffeine metabolism and caffeine use may actually be detrimental to your health.

Research dating back to the '70s has consistently shown that caffeine can improve sports performance, particularly endurance performance, where the average improvement in exercise trials is about 24 percent in time to exhaustion and 3.1 percent in time to completion. It may also improve muscle power and endurance for power and sprint-based sports.

Caffeine primarily interacts with adenosine, a chemical in your central nervous system that regulates sleeping and waking. As adenosine accumulates, it inhibits nerve activity and causes drowsiness. Caffeine essentially blocks adenosine, preventing your nerve activity from slowing down, which increases alertness and brain activity and reduces tiredness, which benefits all sports performance. It also increases circulating epinephrine, the hormone responsible for your fight or flight response, which helps you feel physically and mentally keyed up to perform.

Caffeine use, however, does not benefit everyone equally. In one study of 35 trained male cyclists, caffeine decreased time on a 40 km time trial by nearly 4 minutes in those who had a favorable caffeine-metabolizing

RELATED GENES / SNPs

AHR, RP11-10017.3-001, ARID3B, CYP1A1

The genes and their associated SNPs that are included in this category have been shown to have significant associations with a person's ability to metabolize caffeine.

Caffeine is well known and widely used as a legal stimulant. On the endurance front, caffeine increases the body's ability to use stored fat as fuel, which spares limited muscle glycogen (stored carbohydrate) stores. It also increases beta-endorphins to enhance feelings of wellness while also lowering your perceived exertion, so hard efforts feel easier. However, not everyone responds equally...or favorably. Some people suffer from negative caffeine side effects after one ill-timed cup of coffee, while others can drink several cups a day and feel fine.

We now know this disparity is largely hereditary. Caffeine is rapidly absorbed into the bloodstream, with levels peaking after

CAFFEINE METABOLISM

genotype, while those who were slow metabolizers improved their time by 1.3 minutes. Other exercise trials have reported that slow metabolizers saw no improvements, or in some case, had poorer outcomes than those of the same slow-metabolizing genotypes who didn't take caffeine.

More concerning is that caffeine can raise blood pressure and heart attack risk in slow caffeine metabolizers. Research published in the Journal of the American Medical Association (JAMA) has reported that for slow caffeine metabolizers, those who drank 2 to 3 cups of coffee a day had a 36 percent increased risk of heart attack, while those who drank 4 or more cups daily had a 64 percent increased risk.

As a slow caffeine metabolizer, you likely are already aware that you are sensitive to caffeine and are less likely to consume moderate to high amounts. If you choose to use caffeine as an ergogenic aid, keep the dose low—100 to 150 mg in the hours before training or competing—and be sure to keep tabs on your blood pressure if you use caffeine regularly.

about 90 minutes and starting to drop off after about 3 to 4 hours. Caffeine eventually gets broken down in the liver by enzymes (Cytochrome P450 1A2, or CYP1A2) that metabolize the chemical. Depending on your genetic makeup, you will be able to metabolize caffeine at a normal rate, or your rate may be significantly slower. One study of 9,876 individuals found that variants in several genes were associated with slow caffeine metabolism (which was also associated with lower coffee consumption, indicating that people generally self regulate).

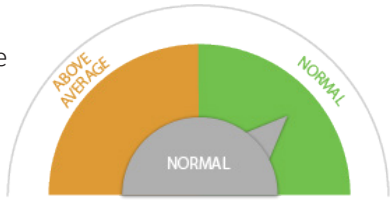
Being a slow caffeine metabolizer means the caffeine stays in your system longer, which can have adverse effects such as increasing blood pressure and may increase the risk of heart attack. Slow metabolizers also do not enjoy the same level of ergogenic improvement as people who metabolize the drug normally.

Our analysis investigated which genotype for these genes was present in your DNA. Your rating of NORMAL or SLOW reflects whether your genotype included those that carried a risk of adverse side effects in response to caffeine use or whether you are likely to benefit from using caffeine as an ergogenic aid.

SYSTEMIC INFLAMMATION

WHAT YOUR GENES SAY ABOUT YOU:

Our analysis indicates that your genetic profile exhibits characteristics that give you a likelihood of having NORMAL systemic inflammation levels. That means your CRP levels are likely to fall in a normal range. That's good news because chronically elevated inflammation levels take a toll on your organs and pave the way for diseases like diabetes and heart disease. Of course, genes are only one factor in systemic inflammation. You still need to follow a balanced diet, train intelligently, and maintain a healthy weight.



Your genetic profile indicates that you are inclined to have NORMAL systemic inflammation levels.

You can maximize the beneficial effects of your genes by eating an anti-inflammatory diet and training consistently, including rest and recovery days after strenuous workouts, competitions and races, and training blocks.

SUCCESS STRATEGIES

Normal CRP levels vary from laboratory to laboratory, but generally there are no or very low levels of CRP detectable in the blood. According to the American Heart Association, you are at a low risk for developing heart disease if your CRP levels are less than 1.0 mg/L; your risk is considered average if your levels are between 1.0 mg/L and 3.0 mg/L, and your risk is high if your levels are higher than 3.0mg/L. Simple, healthy lifestyle practices go a long way in keeping systemic inflammation levels in a low, healthy range. Maintaining a healthy weight is one of the best ways to keep systemic inflammation in check, since carrying excess fat, especially metabolically active abdominal fat, can induce chronic low-grade inflammation.

The good news for you as an active person is that regular physical activity, which can help you maintain a healthy weight, is one of the best "anti-inflammatories" there is. Regular exercise has been shown to reduce inflammation by up to 60 percent. In a 10-year study of nearly 4,300 men and women, British researchers found that those who got 2 ½

RELATED GENES / SNPs

CRP, APOC1 (APOE-CI-CII), HNF1A

The genes and their associated SNPs that are included in this category have been shown to have significant associations with a person's systemic inflammation levels. That's low-level inflammation we don't see, which left unchecked, can damage our blood vessels and lead to many serious chronic diseases like heart disease, diabetes, stroke, neurodegenerative diseases like Alzheimer's, and some cancers. Chronic inflammation also hinders recovery from exercise and training and harms performance.

Doctors use C-reactive protein (CRP) levels as a general marker of systemic inflammation. CRP is a protein found in your blood plasma that binds to the surface of dead or dying cells and certain bacteria to clear them from your body. When there's a lot of cellular damage to clean up, CRP levels rise. Unsurprisingly, high CRP levels have been linked to a higher risk of mortality.

SYSTEMIC INFLAMMATION

hours of moderate exercise a week had significantly lower CRP levels than those who were less physically active. Those who began exercising regularly during the study had lower inflammation levels by the end.

It's important to note that exercise often causes some degree of inflammation. A long, hard and/or intense training session is a form of stress that initiates an inflammatory response, which is part of the adaptation process that generates muscle and makes you stronger and fitter as your body rebuilds. If you constantly train hard without adequate rest, such as doing high intensity CrossFit workouts every single day or training for long endurance events like marathons, ultras, and long distance triathlons, you raise your risk for chronic inflammation. Also, research suggests that sporadic intense exercising, such as being a "weekend warrior," can increase inflammation and weaken immunity, rather than bolster it.

Your favorable genotype may help protect you from chronic inflammation that can result from too much intense exercise without adequate rest and inconsistent training, but you should still aim to follow healthy, consistent training practices that include a mix of high intensity training days interspersed with adequate recovery days. Avoid slogging through workouts when you're feeling fatigued.

Eating a Mediterranean-style diet that is rich in inflammation-lowering polyunsaturated omega-3 fatty acids also helps keep CRP levels low. Build your diet around plant foods and eat lots of vegetables and fruits with moderate amounts of lean protein and healthy fats. Avoid eating fried foods, fast foods, and foods that are high in sugar, as they can raise inflammation. If you drink, do so in moderation. Too much is bad for you, but research shows that moderate amounts, such as a drink a day, lowers your CRP levels more than totally abstaining. It's not a reason to start drinking, of course. But good news for those who enjoy alcohol in moderation.

There are many culprits behind systemic inflammation, including autoimmune diseases, being overweight (especially if you carry your excess fat in your abdomen, where it is most metabolically active), poor fitness, a diet that is high in sugar and other inflammatory foods, sleep deprivation, as well as exposure to secondhand smoke and other pollutants.

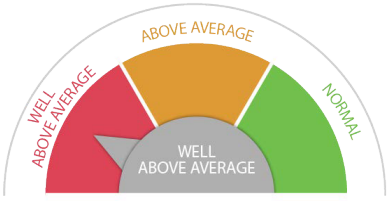
CRP is also significantly influenced by genetics. Researchers estimate that the heritability of CRP levels is up to 40 percent. In a recent genome wide association analysis of more than 82,700 men and women, scientists identified a half a dozen genetic variations that were significantly associated with CRP levels. When they ranked the study participants according to their at-risk CRP genetic makeup, those in the highest gene score group had an average CRP level that was more than double the average level of those in the lowest gene score group.

Our analysis investigated which genotype for this gene was present in your DNA. Your rating of NORMAL or, ABOVE AVERAGE reflect whether or not your genotype include those that increase your risk for elevated systemic inflammation levels.

INJURY RISK

WHAT YOUR GENES SAY ABOUT YOU:

Our analysis indicates that your genetic profile exhibits characteristics that give you a likelihood of having a WELL ABOVE AVERAGE fracture risk and a well below average bone mineral density. Because bone mineral density and fracture risk are highly heritable, it is important to pay attention to this potential risk. Weak bones leave you vulnerable to stress fractures and breaks and can be life-threatening later in life. As someone who is genetically inclined to have well below average bone density, it's important to practice bone-building nutrition, exercise, and lifestyle habits.



Your genetic profile indicates that you are inclined to have WELL ABOVE AVERAGE fracture risk

You can minimize the potentially detrimental effects of your genes by eating, exercising, and practicing lifestyle habits that contribute to strong, healthy bone density.

SUCCESS STRATEGIES

The good news is that as an active person, you're already doing one of the most important things you can do to build a strong skeleton— exercising. But it's essential that you eat a diet that supports your activity level and encourages bone development. Your lifestyle habits and even certain medications can contribute to bone loss. So it's important to practice bone-building behaviors and avoid those (like smoking, which you likely already avoid) that can diminish your bone density.

Eat adequate calcium and vitamin D. Inadequate calcium intake puts you at risk for low bone mineral density, as your bones are made from mostly from this essential mineral. Men 70 years old and younger and women 50 years old and younger need 1,000 milligrams a day; men 71 years old and older and women 51 years old and older need 1,200 milligrams a day of calcium. You can get adequate calcium from dairy products like yogurt and cheese, sardines and salmon with bones, dark leafy vegetables, and tofu. Vitamin D assists in calcium absorption and bone formation. You get vitamin D through exposure to the sun and you

RELATED GENES / SNPs

SPTBN1, MEPE, SLC25A13, MBL2/ DKK1, LRP5, C18orf19

The genes and their associated SNPs in this category have been shown to have significant associations with a person's bone mineral density and risk of fracture.

Strong bones are essential for good health and longevity as well as to support your active lifestyle and avoid injuries like stress fractures and breaks. Throughout your life, your body is constantly breaking down old bone (in a process called resorption) and laying down new bone. You reach peak bone density at about age 30, after which you may start breaking down bone faster than you make it. If this loss remains unchecked, you can end up with dangerously thin bones that increase your risk of fracture. Because of hormonal reasons and the fact that they have thinner bones to begin with, women are at particular risk for thinning bones and osteoporosis (a disease where bones are porous and

INJURY RISK

can get it from fortified dairy products, eggs (with the yolks), and saltwater fish. Men and women 50 years old and younger need 400 to 800 IUs a day; men and women 51 years old and older need 800 to 1,000 IUs a day.

Pump up your protein intake. Active adults need more protein, which not only helps you build and maintain skeletal muscle, but also helps build your skeleton, as well. It's especially important to take in enough protein to fuel your training recovery, which in turn helps you maintain bone mineral density and testosterone and for women can prevent menstrual cycle dysfunction, which can lead to significant bone loss. Aim for 30 to 40 grams per meal to help maintain muscle and bone integrity.

[IF FEMALE] *See your doctor if you stop menstruating and are not menopausal*. Irregular periods are a symptom of hormonal disruption that can cause bone loss. Amenorrheic athletes have up to a 30 percent lower bone mineral density as normally menstruating athletes. If your periods become irregular or you stop menstruating, see your doctor.

Bolster your core. Your spine is one of the most vulnerable spots for bone loss. Do core training, such as push-ups, pull ups, and planks year round.

Add impact and weight bearing exercise. Impact exercise like walking, running, racquet sports, and jumping drills put healthy stress on your bones and encourage bone development. If you primarily practice non-impact sports like cycling and swimming, incorporate some impact cross training into your schedule. If you already have weakened bones, however, high impact exercise can be harmful; these exercises are preventive.

prone to breaks), especially after menopause.

Twins and family research reveals that up to 85 percent of the variance in bone mineral density (BMD) is determined by genetics.

The largest meta-analysis of 17 genome-wide association studies found that certain genetic scores were highly associated with BMD and fracture risk. The only way to know for certain that you have healthy or low BMD is to have a bone density test, called a dual energy x-ray absorptiometry or DXA scan, which measures bone density in your hip and spine. Other screenings, such as the kinds that measure bone density in your lower arm wrist, finger, or heel, also can identify thinning bones.

Our analysis investigated which genotype was present in your DNA. Your rating of NORMAL, ABOVE AVERAGE, or WELL ABOVE AVERAGE reflects whether or not your genotype includes those that increase your risk for low bone mineral density and bone fracture.

Make muscle. Strong muscles and strong bones go hand in hand. Your muscles put healthy tension on your bones and encourage bone formation. Strength training is essential, especially once you hit your 40s, when muscle mass may naturally decline. It's also important to strength train those body parts that you don't use in your typical activity. Bone density is "site specific" meaning that you build more bone in the places that have the most muscle mass and that you work the hardest. Research has found that strength training can improve bone density by about 1 percent a year, according to the National Osteoporosis Foundation.

Be cautious about bone-robbing medications. Certain medications such as corticosteroids, aluminum containing antacids, antidepressants, and proton pump inhibitors can contribute to bone loss. Talk to your doctor if you need to be on them for any length of time.

INJURY RISK

Go easy on alcohol. Heavy drinking can compromise bone integrity and lead to bone loss. If you drink alcohol, keep your consumption moderate: one drink a day for women, two for men.

Consider getting a bone scan. If you're concerned about the status of your bone health, make an appointment to get a bone scan. It's quick and easy and will let you know what, if any, actions you should be taking.

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LINKS TO RELATED STUDIES

SYSTEMIC INFLAMMATION

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INJURY RISK

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