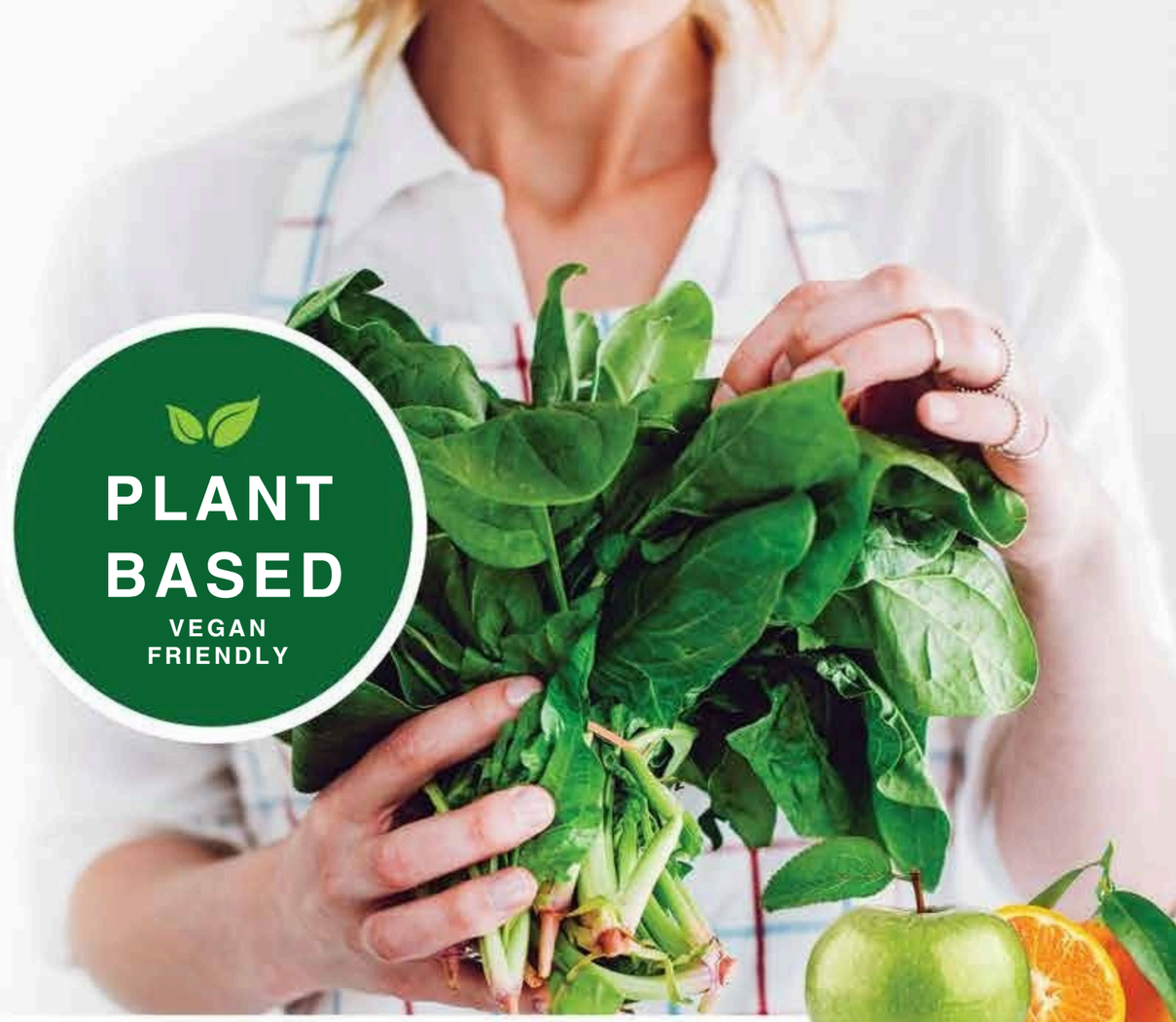

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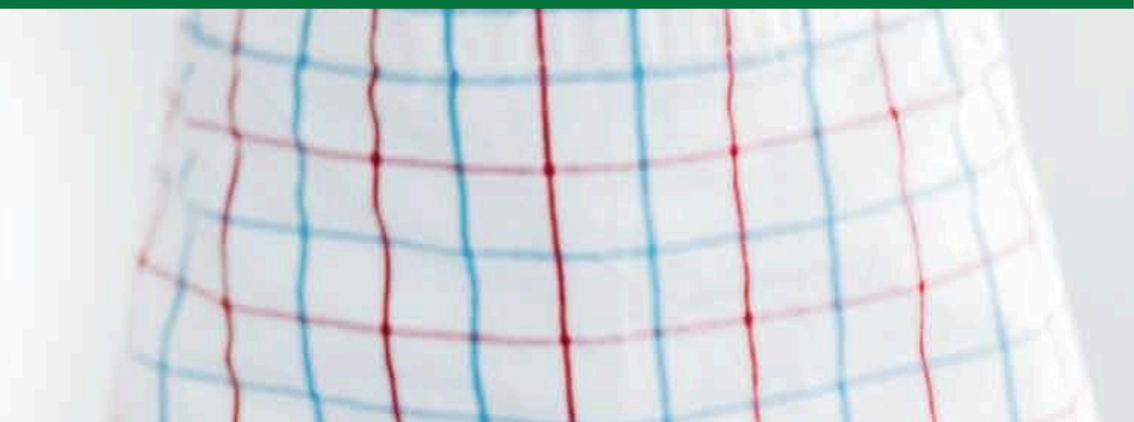
PLANT-BASED PERSONALIZED NUTRITION & FITNESS REPORT



Hello Caroline:

is pleased to provide you with your vegan friendly Plant-Based Personalized Nutrition and Fitness Report based on your individual genetic profile. Your recommendations are based on the most current evidence-based scientific research that has been published in peer-reviewed journals and reviewed by our team of world-renowned experts in the field of nutrigenomics.

Our laboratory has used state-of-the-art genetic testing procedures to analyze your DNA sample. We examined your genetic code to determine how your genes can influence recommendations related to weight management, body composition, cardiometabolic health, food intolerances, eating habits, fitness performance and injury risk. Based on these results, we developed a series of nutrition and fitness recommendations that are aligned with your genetic profile and plant-based lifestyle, and gathered additional genetic insights for you and your healthcare provider to consider.

You and your healthcare professional can now use the personalized recommendations contained in this report to help you achieve optimal nutritional status and fitness level. In this way, you can create a plan to maximize your genetic potential and overall health and start to eat according to your genes!

Ahmed El-Sohemy, PhD
Chief Scientific Officer

The Science Behind

Nutrition isoneof the most important lifestyle factors affecting your risk for developing certain diseases and has a significant impact on overall well-being. Over the past decade, there has been growing recognition of the importance of how genes influence our nutritional status, which directly impacts our health. The human genome consists of about 25,000 genes and virtually all can exist in different forms. The variations in our genes make us unique from one another. Genetic variation determines not only the color of our eyes and hair, but how we metabolize and utilize the foods, nutrients and supplements we ingest. Nutrigenomics is the science that applies genomic information and advanced technologies to uncover the relationship between genes, nutrition and human health. The term nutrigenomics refers to both the study of how the food, beverages and supplements we consume affects our genes and how our genes can influence our body's response to what we consume.

Different versions of a gene can make us respond differently to certain components in food such as the gluten in bread or the caffeine in coffee, along with carbohydrates, fats, proteins vitamins and minerals found in various foods. We are all familiar with people who cannot tolerate gluten. These differences between individuals can be explained by gene variations within the population. Through science and research we have learned that genetic variations in the population and between individuals affect a wide variety of responses to key components of the human diet. For instance, some individuals may benefit from limiting their consumption of caffeine or increasing their intake of omega-3 fat, while others can follow the general recommendation for either or both. Your best diet depends on the specific variants you have for these nutrient-related genes. Understanding your genetic profile and its implications on your unique response to the foods, supplements and beverages you consume will provide you with the tools needed to make the best dietary choices.

The science of how specific genes change how we respond to dietary components enables us to use nutrition to its fullest potential to prevent, manage or improve various health issues. These personalized diets can optimize an individual's nutritional status and empower them to focus on preventing diet-related diseases or conditions. A healthy, balanced diet should provide enough energy and nutrients to support optimal health, reduce the risk of disease and maintain a healthy body weight. While general dietary recommendations might be prudent to follow, the one-size- fits-all approach to nutritional advice could limit some individuals from reaching their full potential for health and wellness. By tailoring one's nutritional needs to their genetic profile, the benefits of nutrition on health status can be maximized.

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Summary of Results

Nutrien t Metabolism

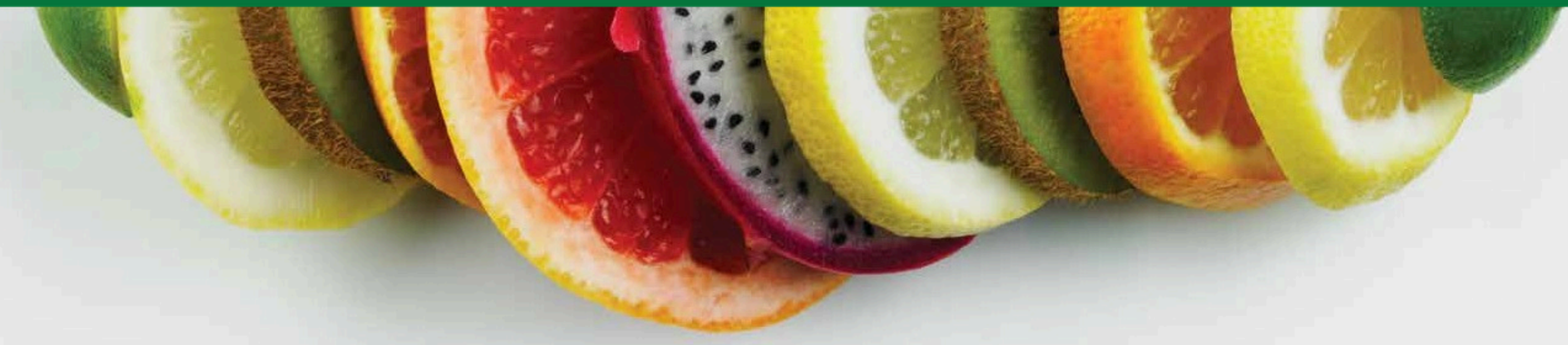
Dietary Component	Gene, rs Number	Risk Variant	Your Variant	Your Risk	Recommendations
Vitamin A	BCMO1, rs11645428	GG	GG	Elevated	Meet the RDA for vitamin A daily.
Vitamin B_{12}	FUT2, rs601338	GG or GA	GA	Elevated	Meet the RDA for vitamin B12 daily.
Vitamin C	GSTT1, rs2266633	Del	Ins	Typical	Meet the RDA for vitamin C daily.
Vitamin D	CYP2R1, rs10741657	Algorithm	GA	Elevated	Consume 1000 IU (25 mcg) vitamin D daily.
	GC, rs2282679		GG		
Vitamin E	COMT, rs4680	GG	GA	Typical	Meet the RDA for vitamin E daily from food sources rich in vitamin E.
Folate	MTHFR, rs1801133	CT or TT	TT	Elevated	Meet the RDA for folate daily.
Choline	MTHFD1, rs2236225	Algorithm	GG	Elevated	Meet the Adequate Intake (AI) level for choline daily.
	PEMT, rs12325817		CG		
Calcium	GC, rs7041	Algorithm	TG	Elevated	Consume 1200 mg of calcium daily.
	GC, rs4588		CA		
Iron Overload	SLC17A1, rs17342717	Algorithm	CC	Low	Follow the recommendations provided in the Low Iron Status section.
	HFE, rs1800562		GG		
	HFE, rs1799945		CC		
Low Iron Status	TMPRSS6, rs4820268	Algorithm	GA	Elevated	Meet the RDA for iron and consume sources of vitamin C with iron-rich foods.
	TFR2, rs7385804		CA		
	TF, rs3811647		AA		

Food Intolerances and Sensitivities

Dietary Component	Gene, rs Number	Risk Variant	Your Variant	Your Risk	Recommendations
Lactose	MCM6, rs4988235	CC or CT	CT	Slightly Elevated	You have a slightly elevated risk of experiencing lactose intolerance symptoms after consuming lactose.
Gluten	HLA, rs2395182	Algorithm	GT	Medium	Medium risk for gluten intolerance.
	HLA, rs7775228		TT		
	HLA, rs2187668		CT		
	HLA, rs4639334		GG		
	HLA, rs7454108		TT		
	HLA, rs4713586		AA		
Caffeine	ADORA2A, rs5751876	TT	CT	Typical	Follow the recommendations provided by the CYP1A2 gene section of this report.

Cardiometabolic Health

Dietary Component	Gene, rs Number	Risk/ Response Variant	Your Variant	Your Risk/ Response	Recommendations
Caffeine	CYP1A2, rs2472300	GA or AA	AA	Elevated	Limit caffeine intake to 200 mg/day.
Whole Grains	TCF7L2, rs12255372	TT or GT	GT	Elevated	Consume most grain products as whole grains.
Sodium	ACE, rs4343	GA or AA	AA	Elevated	Limit sodium intake to the Adequate Intake level.
Omega-6 and Omega-3 Fat	FADS1, rs174547	CC or CT	TT	Typical	Meet the RDA for omega-6 LA fat and omega-3 ALA fat.
Physical Activity	LIPC, rs1800588	TT or CT	CT	Enhanced	Aim for 150 to 300 min/week of cardio and at least 2 days/week of muscle-strengthening activities.



Weight Management and Body Composition

Dietary Component	Gene, rs Number	Response Variant	Your Variant	Your Response	Recommendations
Physical Activity	FTO, rs9939609	Algorithm	AA	Enhanced	Aim for at least 30-60 mins/day of cardio activity, 6 days/ week, and muscle-strengthening activities at least 2 days/ week.
	ADRB2, rs1042713		GG		
Energy Balance	UCP1, rs1800592	GG or GA	GA	Diminished	For weight loss, aim for a daily energy deficit of 10-20% from your current energy needs plus an additional 150 kcal.
Protein	FTO, rs9939609	AA	AA	Enhanced	Consume 25-35% of energy from protein.
Total Fat	TCF7L2, rs7903146	TT	CC	Typical	Consume 20-35% of energy from fat.
Saturated Fat	APOA2, rs5082	CC	TC	Typical	Limit intake of saturated fat to no more than 10% of energy.
Saturated and Unsaturated Fat	FTO, rs9939609	TA or AA	AA	Enhanced	Limit intake of saturated fat to no more than 10% of energy. Consume at least 5% of energy from polyunsaturated fat.
Monounsaturated Fat	PPARγ2, rs1801282	GG or GC	CC	Typical	Aim for a balance of saturated, monounsaturated and polyunsaturated fats to meet your total daily fat intake.

Eating Habits

Dietary Component	Gene, rs Number	Risk/ Response Variant	Your Variant	Your Risk/ Response	Recommendations
Fat Taste Perception	CD36, rs1761667	GG or GA	AA	Typical	Your ability to sense the fatty taste of foods is typical.
Sugar Preference	GLUT2, rs5400	CT or TT	CT	Elevated	You have a high preference for sugar.
Eating between Meals	MC4R, rs17782313	CC or CT	TT	Typical	Your tendency to eat between meals is typical.

Exercise Physiology, Fitness and Injury Risk

Dietary Component	Gene, rs Number	Risk/ Response Variant	Your Variant	Your Risk/ Response	Recommendations
Motivation to Exercise	BDNF, rs6265	AA or AG	AA	Enhanced	You have an enhanced innate motivation to exercise.
Exercise Behavior	CYP19A1, rs2470158	Algorithm	GG	Typical	You have a typical likelihood of engaging in physical activity.
	LEPR, rs12405556		GT		
Power and Strength	ACTN3, rs1815739	TC or CC	CC	Ultra	You have a genetic advantage to excel in power sports.
Endurance	NFIA-AS2, rs1572312	Algorithm	CC	Typical	Your endurance potential is typical.
	ADRB3, rs4994		TT		
	NRF2, rs12594956		CA		
	GSTP1, rs1695		AG		
	PGC1a, rs8192678		AA		
Muscle Damage	ACTN3, rs1815739	TC or TT	CC	Typical	Meet general guidelines for warming up and cooling down.
Pain	COMT, rs4680	GG or GA	GA	Enhanced	You have an enhanced pain tolerance and therefore tend to experience less pain.
Bone Mass	WNT16, rs2707466	TC or CC	TC	Elevated	You have an elevated risk for low bone mass.
Achilles Tendon Injury	COL5A1, rs12722	CT or TT	CC	Typical	You have a typical risk for Achilles tendon injury.

2in5

Your Results

Gene	Marker
BCMO1	rs11645428

Risk Variant	Your Variant
GG	GG

Your Risk

Elevated

only when vitamin A intake is low

Recommendation

Since you possess the GG variant of the BCMO1 gene, it is important for you to meet the RDA for vitamin A. Women should aim for 700mcg RAE/day and men should aim for 900 mcg RAE/day. Keep in mind that plant-based foods do not provide preformed sources of vitamin A. Therefore, a supplement may be warranted. Care should be taken to not exceed the tolerable upper intake level of 3000 mcg per day from dietary and/or supplement sources. Meeting your recommendations for vitamin A will help to support healthy immunity, vision, and reproductive health. It will also act as an antioxidant when consumed in the form of beta-carotene (plant-sources).

Meet the RDA for vitamin A daily.

Vitamin A (Beta-Carotene)

Vitamin A is a fat-solub levitamin that is important foreye health and vision, a strongimmune systemand healthy reproduction. Beta-carotene is a precursor of active vitamin A (retinol) and is an antioxidant found in certain fruits and vegetables that are orange-red in color. Beta-carotene can be converted to preformed vitamin A in the body to exert its biological functions. Research shows that individuals with the GG version of the BCMO1 gene are inefficient at converting beta-carotene to preformed active vitamin A.* These individuals are considered low responders to dietary beta-carotene, so consuming enough active vitamin A can help ensure circulating levels of active vitamin A are adequate to support vision, immunity and reproductive functions.

*LietzGet al.Single nucleotidepolymorphisms upstreamfromtheb-carotene15,15'-monoxygenasegene influence provitamin Aconversionefficiency in femalevolunteers.JournalofNutrition.2012;142:161S-5S.

BCMO1

Beta-carotene mono-oxygenase 1 (BCMO1) is an enzyme that plays akey role in the conversion of beta-carotene into the active form of vitamin A. Beta-carotene is the plant form of vitamin A. Individuals who possess the GG version of the BCMO1 gene are inefficient at converting beta-carotene into the active form of vitamin A. These individuals need to ensure they are consuming adequate amounts of vitamin A.

Sources of Vitamin A

	Amount(mcg RAE)
Pumpkin, canned (1/2 cup)	1010
Carrots, cooked (1/2 cup)	650
Sweet potato, boiled without skin (1/2 medium)	600
Spinach, boiled (1/2 cup)	500
Butternut squash (1/2 cup)	410
Dried apricots (1/4 cup)	190
Cantaloupe (1/2 cup)	140

Source: Health Canada's Nutrient Value of Some Common Foods and Dietitians of Canada Food Sources of Vitamin A

Vitamin B_{12}

Vitamin B_{12}(cobalamin) is important for normal brain and nervous systemfunctioning. It helps to keep blood cells healthy and prevent megaloblastic anemia, which can make you feel very weak and tired. Being deficient in vitamin B_{12} is also associated with pallor (pale skin) and irritability. Vegetarians and vegans must take particular care to consume enough vitamin B_{12}, as it is mainly found in meat, eggs, and dairy products. Therefore, it is more likely that a vegan or vegetarian will develop a vitamin B12 deficiency. In addition, research shows that some individuals are at a greater risk than others for vitamin B12 deficiency based on the FUT2 gene.* Since plant-based foods are not a reliable source of vitamin B_{12}, individuals with a genetic risk for vitamin B_{12} deficiency who also follow a vegan diet may be at an even greater risk for deficiency.

*HazraA etal.Commonvariantsof FUT2areassociatedwithplasmavitaminB12levels.NatureGenetics. 2008 Oct;40(10):1160-2.

FUT2

The fucosyltransferase 2 (FUT2) enzyme is encoded by the fucosyltransferase 2 gene and is involved in vitamin B_{12} absorption and transport between cells. Variants of this gene have been linked to low blood levels of vitamin B_{12} especially when consuming a plant-based diet. However, for individuals with the risk variant, consuming adequate vitamin B_{12} can help reduce the risk of vitamin B_{12} deficiency.

Sources of Vitamin B_{12}

	Amou n t (mcg
Fortified nutritionalyeast(1Tbsp)	
Fortified plant-based beverage (1 cup)	2.2
Soy 'burger' patty (1)	1.7

Source: Health Canada's Nutrient Value of Some Common Foods and http://nutritiondata.self.com

***Check your local health food or grocery store for fortified B12 products.**

4in5

Your Results

Gene	Marker
FUT2	rs602538

Risk Variant	Your Variant
GG or GA	GA

Your Risk

Elevated

onlywhenvitaminB12intakeislow

Recommendation

Sinceyou possess an elevated risk variant for vitamin B12 deficiency, you should aim to meet the RDA for vitamin B12 of 2.4 mcg daily. This will help you to maintain a healthy nervous system and red blood cells, and prevent low energy levels. Plant sources of vitamin B12 are not used by the body effectively, but plant-based milks, plant-based meats and breakfast cereals are fortified with vitamin B12 which can help you to meet your needs. You should consult with your healthcare practitioner to monitor your vitamin B12 blood levels. A supplement may be warranted.

Meet the RDA for vitamin B12 daily.

1in5

Your Results

Genes	Marker
GSTT1	Ins or Del

Risk Variant	Your Variant
Del	

Your Risk

Typical

Recommendation

Since you possessthe Ins variant of GSTT1, there isno increased risk of vitamin C deficiency. Therefore, following the RDA guidelines for vitamin C is sufficient for you. The RDA for vitamin C is 75 mg per day for women and 90 mg per day for men. Smokers require an additional 35 mg per day. Citrus fruits and juices, strawberries, tomatoes, red and green peppers, broccoli, potatoes, spinach, cauliflower and cabbage are examples of foods that are good sources of vitamin C.

Meet the RDA for vitamin C daily.

Vitamin C

VitaminC isan essential nutrient and powerful antioxidant. Vitamin C also aids in the absorption of non-heme (plant) iron, and supports immune function and the formation of collagen, a protein used to make skin, connective tissue, and blood vessels, along with supporting bone and tissue repair. Low blood levels of vitamin C have been associated with an elevated risk of cardiovascular disease, type 2 diabetes and cancer. Research has shown that the amount of vitamin C absorbed into the blood can differ between people even when the same amount is consumed. Some people do not process vitamin C from the diet as efficiently as others and are at a greater risk of vitamin C deficiency. Studies have shown that the ability to process vitamin C efficiently depends on a gene called GSTT1.*

*Cahill LE et al.Functionalgeneticvariantsofglutathione S-transferaseprotectagainstserumascorbicacid Horskaa et al.VitaminClevels inbloodareinfluencedbypolymorphismsinglutathione S-transferases. American Journal of ClinicalNutrition.2009;90:1411-7. European Journalof Nutrition. 2011;50:437-46.

GST T1

TheGSTT1 gene produces a protein for the glutathione S-transferase enzyme family. These enzymes play a key role in the utilization of vitamin C. The GSTT1 gene can exist in one of two forms. The insertion ("Ins") form is considered functional while the deletion ("Del") form is not functional. The different versions of this gene influence the way vitamin C is utilized in the body. A deletion version of the gene results in a reduced ability to process vitamin C. This means that people who possess the deletion version (Del) will have lower blood levels of vitamin C at a given level of vitamin C intake compared to people who possess the insertion version (Ins) of the gene.

Sources of Vitamin C

	Amount (mg)
Redpepper (1 pepper)	96
Strawberries (1 cup)	92
Pineapple (1 cup)	90
Brussels sprouts (1 cup)	86
Orange juice (1 cup)	82
Broccoli (1 cup)	78
Grapefruit (1 fruit)	75
Mango (1 fruit)	70
Kiwi (1 fruit)	

Source: TACO (UNICAMP), Canadian Nutrient File and USDA Nutrient Database

Vitamin D

Vitamin D is essential to calcium metabolism and promotes calcium absorption in the g ut.Low levels of vitamin D are associated with decreased bone mineral density and an increased risk of fractures. Vitamin D also contributes to normal functions of most cells in the body. Vitamin D can be synthesized by the skin from UV light or it can be obtained from the diet. Low blood levels of vitamin D can result in weak, brittle bones, poor muscle function, and decreased immunity. Life-long vitamin D insufficiency has also been linked to accelerated cognitive decline, autoimmune disorders, neuro-degenerative diseases and cardiovascular disease. Vitamin D deficiency is diagnosed by measuring the most common form of vitamin D in the blood, which is 25-hydroxyvitamin D. Research shows that variations in the CYP2R1 and GC genes can affect your risk for low circulating 25-hydroxyvitamin D levels.*

*Slater NA et al. Genetic VariationinCYP2R1 and GCGenesAssociated WithVitaminD DeficiencyStatus. Journal of Pharmacy Practice. 2015:1-6.
Wang TJ et al. Common genetic determinants of vitamin D insufficiency: a genome-wide association study. Lancet. 2010;376:180-88.

CYP2R1 & GC

Vitamin D 25-hydroxylase is the key enzyme that activates vitamin Dfrom its pre-formed type, which is obtained through sun exposure and the diet. This enzyme is encoded by the CYP2R1 gene and a variant of this gene has been associated with an increased risk of low circulating levels of vitamin D. The GC gene encodes the vitamin D-binding protein, which binds vitamin D and transports it to tissues. A variant in this gene has also been associated with an increased risk of low circulating levels of vitamin D.

Sources of Vitamin D

	Amount (IU)
Fortified soy beverage (1cup)	85
Fortified oat, rice, or almond beverage (1 cup)	50
Fortified orange juice (1/2 cup)	

Source: Health Canada's Nutrient Value of Some Common Foods and Canadian Nutrient File

6in7

Your Results

Genes	Markers
CYP2R1 GC	rs10741657 rs2282679

Risk Variant	Your Variants
Algorithm	GA GG

Your Risk

Elevated

onlywhen vitamin D intake islow

Recommendation

Since youpossess one or more elevated risk variants, you are at an increased risk for low circulating vitamin D levels, so getting enough vitamin D is important. Aim for 1000 IU (25 mcg) vitamin D per day. This can help to maintain and/or improve your bone health, muscle and brain function, immunity, and heart health. Since it may be challenging to get enough vitamin D in the diet, supplementation may be beneficial. Do not exceed 2000 IU (50 mcg) per day without first having your blood levels of vitamin D assessed and monitored by a healthcare professional.

Consume 1000 IU (25 mcg) vitamin D daily.

1in4

Vitamin E

Vitamin E is a fat-soluble antioxidant essential for building a strong immune system and supporting skin and eye health, andit may also help to reduce the risk of cardiovascular disease. Most vegetable oils, such as grapeseed, sunflower, canola and flaxseed oil, are excellent sources of vitamin E. Nuts and seeds are also great sources. Given its antioxidant properties, there has been much interest in the role for vitamin E supplementation in cancer prevention. While some studies have shown a protective effect of vitamin E supplementation on cancer risk, others have reported increased risk with higher vitamin E supplementation.* The discrepancy in findings across studies may be partly related to genetic variants that modify the risk associated with vitamin E supplementation. Scientists have reported a genetic variant in COMT may modify the risk associated with vitamin E supplementation.

*HallKTetal.COMT andAlpha-TocopherolEffectsin CancerPrevention:Gene-SupplementInteractions inTwoRandomized ClinicalTrials.JNatlCancer Inst.2019doi:10.1093/jnci/djy204

Your Results

C G O e M ne T	r M s a 4 r 6 k 6 er 0
Risk Variant GG	**Your Variant** GA

Your Risk

Typical

Recommendation

Since you possess the AA or GA variant of the COMT gene research shows that there is no elevated cancer Risk associated with vitamin E supplementation. In fact, those who possess the AA variant of the COMT gene have a slightly lower cancer risk when taking vitamin E supplements. However, since an effective and safe dose of vitamin E in the form of supplements has not yet been established for cancer protection, increasing intakes of vitamin E rich foods is recommended. Therefore, aim to meet the vitamin E RDA of 15 mg per day (21 IU/day) through food sources only. Good food sources of vitamin E include almonds, sunflower seeds, sunflower oil, hazelnuts, and grapeseed oil. Consult your healthcare provider before taking vitamin E-containing supplements.

Meet the RDA for vitamin E daily from food sources rich in vitamin E.

COMT

The COMT catechol-O- gene produces an enzyme called methyltransferase, which helps detoxify both substances produced by the body and environmental compounds such as drugs and harmful toxins. Variations in the COMT gene impact the enzyme activity of COMT, and research shows that this genetic variation may modify the way individuals respond to vitamin E supplementation as it relates to risk of cancer. Among individuals with the GG variant, a slightly increased cancer risk was observed with vitamin E supplementation compared to placebo.
By contrast, those with the GA variant experienced no risk or benefit, and individuals with the AA variant had a slightly reduced cfoalnlocwerin r gisvki tamin E supplementation.

Sources of Vitamin E

	Amount (mg)
Almonds (1/4 cup)	
Sunflower seeds, roasted (1/4 cup)	8.5
Sunflower oil (1 Tbsp)	5.7
Hazelnuts, dry roasted (1/4 cup)	5.2
Avocado (1/2 fruit)	4.0
Peanut butter (2 Tbsp)	2.9
Peanuts, dry roasted (1/4 cup)	2.6
Flaxseed oil (1Tbsp)	2.4
Canola oil (1 Tbsp)	2.4

Source: Health Canada's Nutrient Value of Some Common Foods

Folate

Folateis awater-soluble B vitamin that is naturally present insome foods,added to others, and available as a dietary supplement. Folate is necessary for cell growth and development. Folate is naturally present in a wide variety of plant-based foods, including dark green leafy vegetables, fruits and fruit juices, nuts, beans, peas and grains. Low blood levels of folate have been associated with increased risk of heart disease and stroke. Research has shown that the amount of folate absorbed into the blood can differ between individuals even when the same amount of folate is consumed. Some people do not utilize dietary folate as efficiently as others and consequently may be at a greater risk for folate deficiency. Studies have shown that an individual's ability to process dietary folate efficiently depends on a gene called MTHFR.*

*SolisC et al. FolateIntake atRDALevelsIsInadequateforMexican American Men withthe Methylenetetrahydrofolate Reductase 677TT Genotype. Journal of Nutrition. 2008 ;138 :67-72.
Guinotte CL et al. Methylenetetrahydrofolate Reductase 677C T Variant Modulates Folate Status Response to Controlled Folate Intakes in Young Women. Journal of Nutrition. 2003;133 :1272-1280.

MTHFR

TheMTHFRgene produces methylenetetrahydrofolate reductase (MTHFR), which is a vital enzyme for folate usage in the body. MTHFR converts folate obtained from the diet to an active form of the nutrient that can be used by the body at the cellular level. Variations in the MTHFR gene determine the way individuals can utilize dietary folate. Those people who have the CT or TT variant of the gene have reduced MTHFR enzyme activity and are at greater risk of folate deficiency when folate intake is low, compared to those with the CC variant.

Sources of Folate

	Amount (mcg)
Lentils, cooked (3/4 cup)	265
Edamame (soybeans) (1/2 cup)	190
Spinach, cooked (1/2 cup)	130
Asparagus (6 spears)	128
Chickpeas (3/4 cup)	119
Black beans (3/4 cup)	108
Artichoke, boiled (1/2 cup)	106
Kale, raw (1 cup)	100
Avocado (1/2 fruit)	81

Source: Canadian Nutrient File and USDA Nutrient Database

3in5

Your Results

M G T e H n F e R r s 1 8 a 0 r k 1 e r	
Risk Variant T T	**Your Variant** T T

Your Risk

Elevated
onlywhen folate intake islow

Recommendation

Since you possess the TT or CT variant of theMTHFR gene, there is a greater risk of folate deficiency if the RDA is not met on a daily basis. Ensure that folate intake is at least 400 mcg per day in order to reduce the risk of deficiency. Foods that are naturally high in folate include lentils, romano beans, black beans, white beans, okra, asparagus, spinach, and other leafy greens. Enriched ready-to-eat cereals, bread, and bread products are also good sources of folate. A folate supplement may be warranted if adequate intakes through dietary sources cannot be achieved.

Meet the RDA for folate daily.

3in5

Your Results

Gene	Markers
MTHFD1 PEMT	rs2236225 rs12325817

Risk Variant	Your Variants
Algorithm	GG CG

Your Risk

Elevated

only when choline intake is low

Recommendation

Sinceyoupossess one or more of the risk variantsyou have a greater risk of choline deficiency if your choline intake is low. Therefore, it is important to meet the Adequate Intake (AI) level of 425 mg/day for women or 550 mg/day for men. Do not exceed the tolerable upper limit (UL) of 3.5 g/day. Foods rich in choline include legumes, broccoli, brussels sprouts and quinoa. In addition, ensuring your level of dietary folate recommendations are met also helps lower your risk of choline deficiency (refer to the Folate section for your specific recommendations).

Meet the Adequate Intake (AI) level for choline daily.

Choline

Choline plays numerous roles in the body. This essential nutrient is involvedin multiple metabolic pathways, and is needed for the production of acetylcholine, a neurotransmitter implicated in memory, mood, and muscle control. Choline is found in all cells of the body, providing a vital structural component to cell membranes. Choline can also impact early brain development and regulate the function of genes or how they are "expressed". Although some choline is produced by the body, dietary sources of choline are necessary to meet daily needs. A number of factors contribute to individual choline needs, such as estrogen levels, pregnancy and lactation, age, athletic activity, as well as dietary methionine, betaine and folate. Research also shows that variation in the MTHFD1 and PEMT genes also impact dietary choline needs.*

*Ganz AB, Shields K, Fomin VG, Lopez YS, Mohan S, LoveskyJ, et al.Genetic impairments in folateenzymes increase dependence on dietary choline for phosphatidylcholine production at the expense of betaine synthesis. FASEB Journal: Official Publication of the Federation of American Societies for Experimental Biology. 2016;30(10):3321-33.
Kohlmeier M, da Costa K, Fischer LM, Zeisel SH. Genetic variation of folate-mediated one-carbon transfer pathway predicts susceptibility to choline deficiency in humans. Proc Natl Acad Sci U S A. 2005 Nov 1;102(44):16025-30.
da Costa K, Kozyreva OG, Song J, Galanko JA, Fischer LM, Zeisel SH. Common genetic polymorphisms affect the human requirement for the nutrient choline. FASEB J. 2006 Jul;20(9):1336-44.

MTHFD1 & PEMT

Methylene tetrahydrofolate dehydrogenase (MTHFD1) encodes an enzyme responsible for folate (also known as vitamin B9) metabolism. Choline's function is tightly linked to the metabolism of folate, as both share overlapping roles in the same metabolic pathways. Individuals who carry the A allele of the MTHFD1 gene are at higher risk of developing clinical signs of choline deficiency when choline intakes are very low in comparison to those who have the GG genotype. In addition, the phosphatidylethanolamine N-methyltransferase (PEMT) gene encodes a protein that allows the liver to produce choline. Individuals with the CG or CC variants of the PEMT gene are at a higher risk of experiencing clinical signs of choline deficiency compared to those with the GG variant if choline intake is low. Meeting the Adequate Intake (AI) for choline is

especially importa ntfor individuals withthe risk variants of these genes.

Sources of Choline

	Amount (mg)
Soybeans (1/2 cup)	107
Shiitake mushrooms, cooked (1/2 cup)	58
Baked potato (1 large)	57
Wheat germ (2 Tbsp)	51
Kidney beans (1/2 cup)	45
Quinoa, cooked (1 cup)	43
Brussels sprouts (1/2 cup)	32

Source: National Institutes of Health

Calcium

Dietary calcium is important for growth, maintenance and repairofbone tissue. It is also involved in maintenance of blood calcium levels, regulation of muscle contraction, nerve conduction, and normal blood clotting. In order to absorb calcium, we need adequate vitamin D intake (refer to the vitamin D section for your specific recommendations). Inadequate dietary calcium and vitamin D increase the risk of low bone mineral density and stress fractures. Although dairy foods have been a traditional source of calcium, vegans must rely on non-dairy sources found in vegetables, such as Chinese cabbage, kale, and broccoli as well as foods fortified with calcium including many fruit juices and drinks, plant-based milks, tofu, and cereals. Meeting dietary calcium needs through plant-based sources may be difficult, especially for those individuals who also have limited intakes of fortified foods. Due to these factors, individuals may have an increased risk of calcium deficiency. In addition, research shows that some people do not utilize dietary calcium as efficiently as others and this may depend on variations in the GC gene.*

*FangY etal.VitaminD bindingproteingenotypeandosteoporosis.CalcifTissueInt.2009;85:85-93.

GC

TheGC gene encodes the vitamin D-binding protein, which binds vitamin D and then transports it to various tissues. Since vitamin D is needed for the absorption of calcium, this binding protein can impact calcium levels in the body and, therefore, bone fracture risk. Research shows that two variations in the GC gene are associated with an increased risk of bone fractures when calcium intake is low.

Sources of Calcium

	Amount (mg)
Fortified plant-basedbeverage(1cup)	
Tofu, firm (150g)	235
Collards, cooked (1/2 cup)	190
Fortified orange juice (1/2 cup)	155
White beans, canned (3/4 cup)	141
Edamame (soybeans), boiled (1/2 cup)	130
Spinach, steamed or boiled (1/2 cup)	129
Kale, cooked (1/2 cup)	100
Almonds (1/4 cup)	100

Source: Health Canada's Nutrient Value of Some Common Foods

4in5

Your Results

Gene	Markers
GC	rs7041 rs4588

Risk Variant	Your Variants
Algorithm	TG CA

Your Risk

Elevated

onlywhencalciumintakeislow

Recommendation

Basedon your GC gene, you have an increased risk for bone fractures if your calcium intake is below 1200 mg per day. Meeting intakes of 1200 mg per day will bring your elevated risk down to typical. Adults 19-50 years old should not exceed 2500 mg calcium per day and adults over 50 should not exceed 2000 mg per day. Aim to meet your recommended daily intake of calcium through dietary sources. Calcium supplementation should not exceed 250 mg per day unless otherwise advised by your healthcare provider.

Consume 1200 mg of calcium daily.

1in150

Risk Variant(s)

Your Results

Genes	Markers
SLC17A1	rs17342717
HFE	rs1800562
HFE	rs1799945

Risk Variants	Your Variants
Algorithm	CC GG CC

Your Risk

Low

Recommendation

Sinceyou do not possessanyriskvariants for ironoverload, you have alowriskforiron overload. Follow the recommendations given in the next section for Low Iron Status.

Follow the recommendations provided in the Low Iron Status section.

Iron Overload

Hemochromatosis is a condition where the body absorbs too much iron (i.e. iron "overload") and can resultin liver disease, arthritis and heart conditions. If you have a high risk for iron overload it is important to monitor your iron intake and blood markers of iron status such as ferritin, hepcidin or transferrin saturation. There are two main types of dietary iron: heme and non-heme iron. Non-heme iron is the only type found in certain plant products and is not absorbed as effectively as heme iron, but vitamin C can substantially increase the absorption of non-heme iron.

The bioavailability of some food sources of non-heme iron, such as cooked spinach, is increased when cooked.

Hereditary hemochromatosis is an iron overload condition that is linked to variations in the HFE or SLC17A1 genes.*

*Allen KJ et al. Iron-overload-relateddiseaseinHFE hereditaryhemochromatosis. NewEnglandJournal of Medicine. 2008;358:221-30.
Pichler I et al. Identification of a common variant in the TFR2 gene implicated in the physiological regulation of serum iron levels. Human Molecular Genetics. 2011;15:1232-40.

HFE & SLC17A1

The humanhemochromatosis protein is encoded by the HFE gene and variations in the gene sequence have been linked to iron overload. The SLC17A1 gene is located near the HFE gene and variations in SLC17A1 have also been linked to iron overload. The HFE protein functions to regulate iron uptake in the small intestine. Those with elevated risk variants need to be careful not to consume too much iron and should have their blood markers of iron monitored. This test detects approximately 95% of cases of iron overload.

Low Iron Status

Ironisanessential mineral and important componentof hemoglobin, the substance in red blood cells that carries oxygen from your lungs to transport it throughout your body. Iron supports a strong immune system and is also necessary to maintain healthy cells, skin, hair, and nails. Low iron status is more common in vegans and is determined by measuring certain blood markers such as ferritin, hepcidin or transferrin. Iron is found in food in two forms; heme and non-heme iron. Heme-iron, derived from animal products is well absorbed. Non-heme iron, which is the iron in plants, is less well absorbed. Because vegan diets only contain non-heme iron, vegans should be particularly aware of foods that are high in iron and ways to promote iron absorption, such as using cast iron pans, and adding a vitamin C source to meals. Recommendations for iron for vegans and vegetarians may be as much as 1.8 times higher than for non-vegetarians. Low iron stores can lead to anemia, which is associated with fatigue, pale skin, weakness, shortness of breath and dizziness. Several genes can impact the risk of having low iron status including TMPRSS6, TFR2, and TF.*

*Pichler I et al. Identification of a common variant intheTFR2gene implicatedin thephysiologicalregulation ofserum iron levels.Human MolecularGenetics. 2011;15:1232-40.
Benyamin B et al. Variants in TF and HFE explain approximately 40% of genetic variation in serum-transferrin levels. Am J Hum Gen. 2009;84:60–65.

TMPRSS6, TFR2 & TF

TheTMPRSS6 gene codes for the protein matriptase-2,which affects hepcidin levels that help to regulate iron balance. The transferrin receptor 2 (TFR2) gene codes for the TFR2 protein, which helps iron to enter into cells. The transferrin (TF) gene codes for the protein transferrin, which is mainly responsible for transferring iron in the body. Together, variations inthese genescan impact the risk of low iron status.

Sources of Iron

	Amount (mg)
beans, cooked (3/4 cup)	6.5
pkin seeds (2 Tbsp)	5.2
ls, cooked (3/4 cup)	4.1
ach, boiled (1/2 cup)	3.4
peh, cooked (3/4 cup)	3.2
firm (1/2 cup)	3.0
ni (2 Tbsp)	2.7
kpeas (3/4 cup)	2.4
nds (1/4 cup)	1.5

Source: Health Canada's Nutrient Value of Some Common Foods

2in5

Risk Variant(s)

Your Results

Genes	Markers
TMPRSS6	rs4820268
TFR2	rs7385804
TF	rs3811647

Risk Variants	Your Variants
Algorithm	GA CA AA

Your Risk

Elevated
onlywhen iron intake islow

Recommendation

You are at an increased risk for low ironstatus. To minimize your risk for low iron, meet theRDA for iron and consume food sources of vitamin C with non-heme iron-containing foods to increase iron absorption. Combinations, such as beans and toma sauce or stir-fried tofu and broccoli, result in gener levels of iron absorption. Keep in mind that some fo sources of non-heme iron, like spinach, are better t consume in cooked form to improve the bioavailabi of iron. Both calcium in foods and supplements and tannins (found in tea and coffee) reduce iron absorption, and should therefore be consumed sev hours before a meal that is high in iron. Men aged 1 years and older and women over 50 should aim for 8 mg/day. Women 19-50 years old should aim for 18 mg/day.

Meet the RDA for iron and consume sources of vitamin C with iron-rich foods.

Your Results

MCM6	rs4988235

Risk Variant	Your Variant
CT	

Your Risk

Slightly Elevated

Lactose

Many individuals who follow a vegetarian or mostly plant-based diet may choos eto consume milk, cheese, yogurt or other dairy products. Lactose is a naturally occurring sugar found in dairy foods. When lactose is properly digested, it is broken down into two different sugar molecules: glucose and galactose. Lactase is the enzyme needed to break down lactose. Some people do not produce any, or enough lactase. Because of this, lactose passes through the intestines undigested. When this occurs, gut bacteria in the intestines ferment the lactose, which produces gas that leads to bloating and cramps, and causes water to enter the intestine quickly leading to diarrhea. These are the uncomfortable symptoms associated with lactose intolerance. Some people who do not digest lactose cannot tolerate any dairy products, while others can tolerate small amounts of lactose. When dairy is consumed with a meal there can be minor symptoms or no symptoms at all, but consuming dairy on its own (especially fluid milk) can result in more severe symptoms. Recommendations provided in this section are intended for those who follow a plant-based diet that includes milk or other dairy products.

Lactose Intolerance

Individuals whoare lactose intolerant cannot digest lactose. When lactoseisnot digested, it can cause uncomfortable symptoms such as stomach upset, gas, bloating, and/or loose stools. These symptoms can develop as early as one hour after you consume lactose-containing products. Typically, individuals with lactose intolerance may have to consume a lactose-free or lactose-reduced diet for life or consume dairy products with a meal to reduce the impact of lactose on the gastrointestinal system. Sometimes you can train your body to produce more lactase enzyme by gradually introducing lactose into your diet. Some lactose intolerant individuals can tolerate up to 12 g of lactose per day, which is equivalent to 1 cup of milk. Spreading out your intake over the course of a day and/or consuming lactose-containing foods with meals can help improve tolerance. Your risk for lactose intolerance depends in part on the MCM6 gene. Sometimes you can develop short-term lactose intolerance when you are sick.

MCM6

MCM6 ispart ofthe MCM complex that helps to regulate the expression of the LCT gene, which encodes lactase, the enzyme that plays a role in breaking down lactose. Variations in this gene can impact your ability to break down lactose, impacting your risk for lactose intolerance. Individuals who possess the CC or CT variant may produce some lactase, but in limited amounts. Individuals with the CC or CT variant have been shown to be at an increased risk for low calcium intake and blood calcium levels.* This particular variant in MCM6 may not predict lactose intolerance risk for individuals who are not of European descent.

*Enattah NS et al. Identification of a variant associated with adult-type hypolactasia. Nature Genetics. 2002;30:233-7.
Koek et al. The T-13910C polymorphism in the lactase phlorizin hydrolase gene is associated with differences in serum calcium levels and calcium intake. Journal of Bone and Mineral Research. 2010;25(9):1980-7.
Dzialanski et al. Lactase persistence versus lactose intolerance: Is there an intermediate phenotype? Clinical Biochemistry. 2015. doi: 10.1016/j.clinbiochem.2015.11.001.

9in10 People with Risk Variant

9in10 Variant

7in10 People with Risk Variant

Nutrition Considerations with a Lactose-Free Diet

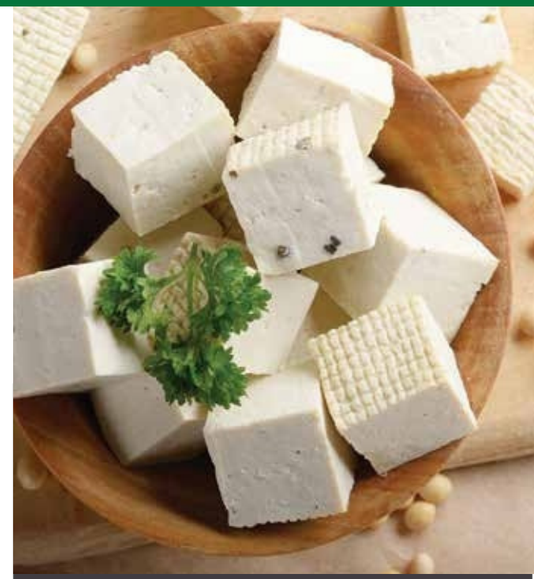
Research shows that individuals who cannot tolerate lactosemay be at agreater riskof inadequate calcium and vitamin D intake if they do not find appropriate alternatives, compared to individuals who can tolerate lactose.* Calcium and vitamin D are important for building and maintaining strong bones and teeth. If you have lactose intolerance or choose not to incorporate dairy into your plant-based diet, you can still get enough calcium and vitamin D in the diet through foods such as lactose-free milk, other dairy products, or fortified plant-based dairy alternatives such as soy, oat and almond beverages, yogurts and cheeses. Calcium and vitamin D are not added to all plant-based beverages and products, so be sure to read the label to check that the products you are choosing have been "fortified with calcium and vitamin D."

*Koek etal.TheT-13910Cpolymorphism inthe lactase phlorizinhydrolasegeneisassociatedwithdifferencesin serum calciumlevelsandcalciumintake. Journal ofBone andMineralResearch.2010;25(9):1980-7.

Sources of Lactose

	Amount (g)
Cow's milk (1 cup)	12
Goat's milk (1 cup)	11
Flavoured milk (1 cup)	10
Buttermilk (1 cup)	9
Yogurt (3/4 cup)	7
Frozen yogurt (1/2 cup)	5
Ice cream (1/2 cup)	5
Cottage cheese (1/2 cup)	3
Sour cream (1/4 cup)	2
Hard cheese, example: Parmesan (50g)	<1

Source: Dietitians of Canada, Food Sources of Lactose
Plant-based dairy alternatives contain 0g lactose.



Recommendation

Since youpossess the CT variant of the MCM6 gene, you have a slightly elevated risk of experiencing lactose intolerance symptoms after consuming lactose. If you experience gastrointestinal symptoms after consuming lactose-containing foods, try avoiding lactose and monitor your symptoms. Some lactose intolerant individuals can tolerate up to 12 g of lactose per day, which is equivalent to 1 cup of milk. If you choose to consume dairy, spreading out your intake over the day and/or consuming lactose-containing foods with meals can help improve tolerance. To help meet your calcium and vitamin D needs, aim to include 1 serving of dairy, if tolerated, and/or 1-2 servings of calcium- and vitamin D-fortified lactose-free milk or plant-based dairy alternatives such as soy, oat and almond beverages, yogurts and cheeses daily.

You have a slightly elevated risk of experiencing lactose intolerance symptoms after consuming lactose

Your Results

Gene	Markers
HLA	rs2395182 r s7 7 752 28 rs2187668 rs4639334 rs7454108 rs4713586
Risk Variants	**Your Variants**
Algorithm	GT TT CT GG TT AA

Your Risk

Medium

Gluten

Gluten isa protein found in wheat, barley, rye and products made from these grains. Some oats also contain gluten. Many foods that contain gluten provide fibre from whole grains and can be an excellent source of vitamins and minerals. However, for some people, gluten can cause severe digestive problems leading to nutrient malabsorption, anemia and many serious health problems.

Celiac Disease & Gluten Sensitivity

Celiac diseaserepresents themostsevere form of gluten intolerance and affects about 1% of the population. People with celiac disease require a gluten-free diet for life.* Non-celiac gluten sensitivity (NCGS) is a milder form of gluten intolerance that may affect 5% of the population. Individuals with NCGS often experience diarrhea, abdominal pain, fatigue and headaches when they consume gluten-containing foods. However, these adverse effects of gluten in individuals who do not have celiac disease are poorly understood and NCGS remains controversial.*

*Tonutti E andBizzaroN.Diagnosisandclassificationofceliacdiseaseandglutensensitivity.Autoimmunity Reviews. 2014;13:472-6.

Nutrition Considerations when Following a Gluten-Free Diet

Gluten-free plant-base dfoods include all unprocessed vegetables, fruits, nuts, legumes, seeds, fats and oils. Gluten-free grains include rice, quinoa, corn, buckwheat, amaranth, and millet. For individuals who need to follow a gluten-free diet, foods to avoid include any products that are made with wheat, rye, barley or triticale. Pure oats should be consumed in moderation if tolerated, while regular oats (which contain wheat) should be avoided. For the vast majority of the population, consuming a gluten-free diet is unnecessary. Processed gluten-free products often have more calories, sodium, added sugar and fat and fewer nutrients compared to their gluten-containing counterparts.

Recommendation

You have a medium risk for developing celiac disease; however, this does not mean you have celiac disease. Speak to a healthcare professional if you experience diarrhea, steatorrhea, cramps, flatulence, fatigue or joint pain while consuming gluten-containing foods, or if you have a family member with celiac disease. Major dietary sources of gluten include bread, pasta, cereal and any baked good made with wheat, barley or rye. It is not recommended that you immediately attempt to remove gluten from your diet, as eliminating gluten may interfere with the accuracy of celiac disease diagnostic tests.

Medium risk for gluten intolerance.

HLA

TheHLA genes produce a group of proteins called the human leukocyteantigen (HLA) complex, which are responsible for how the immune system distinguishes between the body's own proteins and foreign, potentially harmful proteins. Research has shown that the HLA genes are the most important genetic predictor of gluten intolerance. Approximately 99% of people with celiac disease and 60% of those with non-celiac gluten sensitivity* have the DQ2 or DQ8 risk version of HLA, compared to only 30% of the general population. Six variations in the HLA genes can be used to classify individuals into predefined risk groups for gluten intolerance. Risk prediction is based upon a scale of low, medium or high risk.

*MarkWolters VM andWijmenga C.Geneticbackground of celiacdisease anditsclinical implications. American Journal ofGastroenterology.2008;103:190-5.
Sapone A et al. Divergence of gut permeability and mucosal immune gene expression in two gluten-associated conditions: celiac disease and gluten sensitivity. BMC Medicine. 2011;9:23.
Monsuur AJ et al. Effective detection of human leukocyte antigen risk alleles in celiac disease using tag single nucleotide polymorphisms. PLoS ONE. 2008;3:e2270.

Sources of Gluten

Major Sources of Gluten	HiddenSources of Gluten
Bread	
Pasta	Vegan pudding
Cereal	Flavoured coffee/tea
Crackers and chips	Marinades
Oats*	Potato chips
Vegan baked goods	French fries
Malt	Soup stock cubes
Soy sauce	Vegan chocolate and candy
Vegan gravy	Plant-based meat substitutes
Barley or wheat based-beer	Canned soup
Vinegars	Instant rice
Wheat - incl rye, spelt and barley	Vegan ice cream

***Pure oats do not contain gluten; however, oats are often cross-contaminated with gluten-containing grains**

1in5

Your Results

ADORA2A rs5751876	
Risk Variant	Your Variant
TT	CT

Your Risk

Typical

Recommendation

Since you possessthe CTor CC variantof the ADORA2A gene, you have a typical risk for an increase in feelings of anxiety after caffeine consumption. Aim to follow your DNA-based caffeine intake recommendations for the CYP1A2 gene included in your report.

Follow the recommendations provided by the CYP1A2 gene section of this report.

Caf feine

Anxiety

Manycommonly consumed foods and beverages, such ascoffee, tea, softdrinks and vegan chocolate, as well as functional beverages such as energy drinks, contain caffeine. There are also hidden sources of caffeine found in pain medications, weight loss supplements, as well as chocolate or coffee-flavored beverages and food products. Caffeine is widely used to promote wakefulness and vigilance, reduce sleepiness and mitigate fatigue related to various shift-work occupations or travel across time zones. In the brain, the effects of caffeine are primarily due to its blocking action of adenosine, a neuromodulator that increases drowsiness and builds up over the day as bedtime approaches. Despite its widespread use, caffeine may cause anxiety in some people. A common variation in the ADORA2A gene contributes to the differences in subjective feelings of anxiety after caffeine ingestion,* especially in those who are habitually low caffeine consumers.**

*Childs E eta al. Association between ADORA2A and DRD2polymorphisms andcaffeine-inducedanxiety. Neuropsychopharmacology. 2008 Nov;33(12):2791-800
Alsene K et al. Association between A2a receptor gene polymorphisms and caffeine-induced anxiety. Neuropsychopharmacology. 2003 Sep;28(9):1694-702.
**Rogers PJ, et al. Association of the anxiogenic and alerting effects of caffeine with ADORA2A and ADORA1 polymorphisms and habitual level of caffeine consumption. Neuropsychopharmacology. 2010. (9):1973–1983.

ADOR A 2A

TheADORA2A(adenosine A2A receptor) gene encodes one of the main receptors foradenosine. Adenosine has many functions in the body, including promoting sleep and calmness and suppressing arousal. Caffeine blocks adenosine receptors, resulting in the stimulating effects of coffee, tea, chocolate and other caffeinated food products and supplements. Individuals who possess the TT variant of the ADORA2A gene are more sensitive to the stimulating effects of caffeine and experience greater increases in feelings of anxiety after caffeine intake than do individuals with either the CT or CC variant.

Cardiometabolic Health

Caffeine is the most widely consumed stimulant in the world and coffee is the most significant source of caffeine, with tea, soda and vegan chocolate also contributing to intakes. Research has shown that caffeine can influence cardiovascular health. However, the reported effects of coffee on the cardiovascular system have been inconsistent and at times have appeared contradictory. Some studies reported a link between high coffee consumption and an elevated risk of high blood pressure and heart disease, while other studies have shown no effect or even a protective effect with moderate intake. Two landmark studies* have now shown that the effect of coffee on cardiovascular disease depends on a variation in a gene called CYP1A2.

*Cornelis et al. Coffee,CYP1A2genotype, and riskofmyocardialinfarction.Journalof the AmericanMedical Association. 2006;295:1135-41.
Palatini P et al. CYP1A2 genotype modifies the association between coffee intake and the risk of hypertension. Journal of Hypertension. 2009;27:1594-1601.

CYP1A2

TheCYP1A2 gene produces an enzyme called cytochrome P450 1A2 (CYP1A2), which is themain enzyme responsible for breaking down caffeine in the body. Variations in the CYP1A2 gene affect the rate at which caffeine is broken down, which determines the impact of caffeine on heart health. Individuals who possess the GA or AA variant of CYP1A2 break down caffeine more slowly and are at greater risk of high blood pressure and heart attack when caffeine intake is high. Those who have the GG variant actually have a lower risk of heart disease with moderate coffee consumption than those who consume no coffee at all.

Sources of Caffeine

	Amount (mg)
Coffee (1 cup)	100
Energy drinks (1 cup)	80
Espresso (1 shot)	85
Black tea (1 cup)	50
Green tea (1 cup)	45
Cola (1 can)	26
Vegan chocolate, dark (40g)	27
Decaf coffee, espresso, tea (1 cup)	0-15
Herbal tea (1 cup)	0

Source: Canadian Nutrient File and USDA Nutrient Database

1in2

Your Results

CYP1A2 rs2472297	
Risk Variant	Your Variant
GG	AA

Your Risk

Elevated

onlywhen caffeineintake ishigh

Recommendation

Since you possess the AA or GA variant of the CYP1A2 gene, there is an increased risk of high blood pressure and heart attack if consuming more than 200 mg of caffeine daily, which is approximately 2 small cups of coffee. Limit caffeine consumption to no more than 200 mg per day in order to reduce this risk. Caffeine occurs naturally in coffee, tea, cocoa, kola and guarana. It is also manufactured synthetically and added to cola, energy drinks, and certain over the counter cold remedies.

Limit caffeine intake to 200 mg/day.

1in2

Whole Grains

Whole grains are a low glycemic index carbohydrate that contain more fibre than refined grains. T heyalso contain more essential micronutrients such as folic acid, magnesium and vitamin E. Years of research have demonstrated that whole grains may help reduce the risk of several diseases, particularly type 2 diabetes. Scientists have more recently shown that the benefits of consuming whole grains may be particularly important among individuals who have a variant in the TCF7L2 gene.*

*Cornelis MCetal.TCF7L2,dietarycarbohydrate,andriskoftype2diabetesinUSwomen.AmericanJournal ofClinical Nutrition.2009;89:1256-62.

Your Results

T C[G] F[e] n[e]7L 2 rs1[M]22[ar]5[k]5[er]3	
Bis T[k] o[V]r[a] r[T]T[ia]r[nt]	Your Variant
	GT

Your Risk

Elevated

only when whole grain intake is low

Recommendation

Sinceyoupossess the TT or GT variant of the TCF7L2 gene, there is an increased risk of developing type 2 diabetes if your whole grain consumption is low. Aim to consume most grain products as whole grains. One way to increase whole grain consumption is to replace high glycemic index carbohydrates with low glycemic index carbohydrates. The food replacement table provides you with some ideas for replacing non-whole grain carbohydrates with whole grain options. Reduce consumption of carbohydrates such as white bread, bagels, potatoes, and short-grain white rice. Choose instead whole grains, which have a low glycemic index. Cereal grains that can be found whole include wheat, rice, oats, barley, corn, wild rice, rye, quinoa and buckwheat.

Consume most grain products as whole grains.

TCF7L2

The TCF7L2 gene produces a protein called transcription factor-7 like 2 (TCF7L2). This protein, in turn, affects how the body turns on or off a number of other genes. The interaction of these proteins and genes is complex, and not yet fully understood. However, the TCF7L2 gene is one of the most consistent predictors of the likelihood of developing type 2 diabetes. People who possess the high risk GT or TT variant of the gene are at greater risk of developing type 2 diabetes. Yet, recent studies have shown that consuming whole grain foods can reduce the risk of type 2 diabetes in individuals who carry the GT or TT variant of the TCF7L2 gene.

Replace these foods...	with t hese f oods. .
White bread, bagels, pitas	and pitas
White rice	Brown or wild rice, quinoa
White pasta	100% whole wheat pasta or brown rice pasta
High sugar cold cereals	Oatmeal or 100% whole grain cold cereal
White flour baked goods	100% whole wheat flour baked goods

Sodium

Sodium is an essential micronutrient that regulates blood pressure and blood volum e.Most people consume more sodium than the body requires. The major adverse effect of excess sodium intake is elevated blood pressure, which predisposes to hypertension and heart disease. However, some individuals do not experience as great an increase in blood pressure in response to excess sodium intake as others. Research shows that the effect of sodium intake on blood pressure is influenced by variations in a gene called ACE.*

*PochEetal. Molecularbasisofsaltsensitivityinhumanhypertension:Evaluationofrenin-angiotensin-aldosterone systemgenepolymorphisms.Hypertension.2001;38:1204-9.

7in10

Risk Variant

Your Results

A[Ge]C[n]E[e]	r[M]s[a]4[r]3[k]4[er]3
Bis A[k] o[Va]r[r] i[A]an[A]t	Your Variant
	AA

Your Risk

Elevated

onlywhensodiumintakeishigh

Recommendation

Since you possess the AA or GA variant of th ACE gene, there is an increased risk of elevate blood pressure when sodium intake is hig Limiting sodium consumption to the Adequat Intake (AI) level should help to reduce the ris However, if you frequently sweat heavily durin exercise, causing sodium losses, your sodiu requirements may be higher. The AI is 1500 m per day in adults 19-50 years of age, 1300 m per day in adults 51-70 and 1200 mg per day in adults 71 years of age and older. The AI 1500 mg per day is equivalent to ¾ teaspoon of salt per day, which includes sodium that is found naturally in foods as well as salt that added during processing and preparatio Foods that can be high in sodium includ canned soups and canned vegetables, potat chips, vegan dairy-free cheese, plant protei meat substitutes, soy sauce, and ketchup.

Limit sodium intake to the Adequate Intake level.

ACE

TheACE genedirects the body to produce the angiotensin-converting enzyme (ACE), which is known to play a role in regulating the response of blood pressure to sodium intake. Studies have shown that a person's blood pressure response to excess sodium intake is dependent on which variant of the ACE gene they possess. Those who have the GA or AA variant of the ACE gene are at a greater risk of experiencing elevated blood pressure when higher amounts of sodium are consumed than those possessing the GG variant of the gene.

Sources of Sodium

	Amount (mg)
Ramen noodles, with flavour (1 package)	1760
Canned soup (1 cup)	1130
Soy sauce (1 Tbsp)	900
Pickle (1 medium)	830
Tomato sauce, canned (1/2 cup)	650
Olives, canned (4 olives)	460
Chips (1 small bag)	390
Cold cereal (1 cup)	350
Bread (1 slice)	230
Plant-based processed meats (100g)	350-660

Source: Canadian Nutrient File and USDA Nutrient Database

1in2

Your Results

FADS1	rs174547

Biochemical Variant	Your Variant
	TT

Your Risk

Typical

Recommendation

Since you possess the TT variant of the FADS1 gene, your HDL cholesterol levels are likely not impacted by the level of dietary omega-6 LA or your balance of omega-6 LA to omega-3 ALA intake. Meet the guidelines for healthy adults. Individuals should aim to consume between 5-10% of energy from omega-6 LA and between 0.6-1.2% of energy from omega-3 ALA. Limit intakes of omega-6 LA coming from baked goods, fried foods and other processed foods. For cooking, baking and salad dressings choose canola oil, which is an excellent source of omega-3 ALA. Other foods rich in omega-3 ALA include flax and chia seeds.

Meet the RDA for omega-6 LA fat and omega-3 ALA fat.

Omega-6 and Omega-3 Fat

Higher consumption of polyunsaturated fats (PUFAs) is associatedwith reduced risk ofcardiovascular disease. PUFAs include both omega-6 fat, such as linoleic acid (LA), and omega-3 fat, such as alpha-linolenic acid (ALA). Since our bodies cannot make omega-6 LA and omega-3 ALA, these essential fats must be obtained from our diets. However, consuming too much omega-6 LA and too little omega-3 ALA may have adverse health effects. Studies have shown that a gene involved in the metabolism of these PUFAs can adversely impact levels of HDL cholesterol ("good cholesterol") when dietary omega-6 LA intake is high,* or when the ratio of omega-6 LA to omega-3 ALA is too high.**

*LuY et al. Dietaryn-3andn-6polyunsaturatedfatty acidintakeinteractswithFADS1geneticvariation to affect total and HDL-cholesterol concentrationsin theDoetinchem CohortStudy.AmericanJournal of Clinical Nutrition. 2010; 92:258–65.
Dumont J et al. Dietary linoleic acid interacts with FADS1 genetic variability to modulate HDL-cholesterol and obesity-related traits. Clinical Nutrition. 2018;37:1683-1689.

**Hellstrand S et al. Intake levelsofdietary long-chain PUFAs modify the association between genetic variation inFADSand LDL-C. Journal ofLipidResearch. 2012; 53: 1183–1189.

FADS1

The FADS1 gene directs the production of an enzyme called fatty acid desaturase 1.Thisenzyme converts omega-6 LA and omega-3 ALA to longer-chain PUFAs that participate in inflammatory and immune responses. Compared to those with the TT variant, individuals who have the CC or CT variant of the gene have lower levels of HDL cholesterol when consumption of omega-6 LA is high. Among those with the CC or CT variant, increasing the proportion of dietary omega-3 ALA to omega-6 LA promotes higher levels of HDL cholesterol.

Sources of Omega-6 and Omega-3 Fats

	Omega-3 ALA (g)	Omega-6 LA (g)
Chia seeds (1 Tbsp)*	1.9	0.6
Flaxseeds (1 Tbsp)*	1.6	0.4
Canola oil (1 Tbsp)*	1.3	2.7
Walnuts (1/4 cup)	0.9	11
Edamame (1/2 cup)*	0.3	1.5
Corn oil (1 Tbsp)	0.2	7.3
Wheat germ cereal, toasted (1 Tbsp)*	0.1	0.4
Tahini (1 Tbsp)	0.1	3.5
Safflower Oil (1 Tbsp)	0.01	1.8
Sunflower Seeds (1/4 cup)	0.01	2.7
Sunflower Oil (1 Tbsp)	0.01	4

***Helps achieve a higher balance of omega-3 ALA to omega-6 LA Source: Canadian Nutrient File**

Physical Activity

for Cardiometabolic Health

Physical activity hasimportant benefitsfor mentalhealth, physical fitness, weight maintenance and the prevention of many chronic diseases. Indeed, exercise improves the function of your heart, lungs and blood vessels, and it also has beneficial effects on blood lipids. Scientists have demonstrated that the LIPC gene influences blood levels of HDL cholesterol (the "good" cholesterol). Research also shows that physical activity raises HDL cholesterol to a greater degree among individuals who have a particular variant of the LIPC gene, compared to those who do not.*

*Grarup et al.The -250G>A promotervariant in hepatic lipase associateswith elevatedfastingserumhigh-density lipoprotein cholesterol modulated by interaction with physical activity inastudyof 16,156Danish subjects. Journal of Clinical Endocrinology and Metabolism. 2008;93:2294-2299.
Ahmad et al. Physical Activity Modifies the Effect of LPL, LIPC, and CETP Polymorphisms on HDL-C Levels and the Risk of Myocardial Infarction in Women of European Ancestry. Circulation: Cardiovascular Genetics. 2011;4:74-80.

LIPC

Thehepatic lipase gene, also known as LIPC, encodes an enzyme that playsa key rol ein blood lipid metabolism. LIPC helps transport HDL cholesterol to the liver, where further lipid processing takes place. Large studies conducted in both men and women show that a genetic variant in LIPC impacts the way HDL cholesterol levels increase in response to physical activity. Generally, individuals who are physically active tend to have higher HDL cholesterol concentrations than those who are sedentary. However, even among those who are physically active, individuals who carry the TT or CT variant in the LIPC gene display an enhanced HDL-raising response when engaging in physical activity, resulting in higher HDL cholesterol than individuals without this variant.

Types of Cardiovascular Activities

Moderate-Vigorous Intensity	
Briskly walking (5 km/hour or faster)	Race walking, jogging, running
Biking	Tennis
	Water Aerobics

Types of Muscle-Strengthening Activities

Lifting weights	Working with resistance bands
Heavy gardening (digging, shovelling)	Push-ups
Certain types of yoga	Sit-ups

1in3

People with Response Variant

Your Results

LIPC	rs1800588

Response Variant	Your Variant
TT or CT	CT

Your Response

Enhanced

when physical activityishigh

Recommendation

Sinceyou possess theCT or TT variant of the LIPC gene, you have an enhanced HDL cholesterol-raising response from physical activity. Engage in 150 to 300 minutes of moderate-to-vigorous intensity exercise per week. This can be met through 30 to 60 minutes of moderate-to-vigorous intensity aerobic exercise five days per week in bouts of 10 minutes or more. This will ensure that you reap the benefits of physical activity not only for your cholesterol levels, but also body composition, weight management, mental health, blood pressure, bone health, blood sugar, and many other health-related factors. You should also include muscle strengthening activities at least 2 days per week.

Aim for 150 to 300 min/week of cardio and at least 2 days/week of muscle-strengthening activities.

3in10

People with Response Variant

Your Results

Genes	Markers
FTO ADRB2	rs9939609 rs1042713

Response Variant	Your Variants
Algorithm	AA GG

Your Response

Enhanced

when physical activity is high

Recommendation

Since you possess the enhanced response variants of the FTO and/or ADRB2 gene, you have an enhanced weight loss response from participation in higher levels of physical activity. Your physical activity recommendations, therefore, are to include at least 30-60 minutes/day of moderate-vigorous cardiovascular activity in bouts of 10 minutes or more, over at least 6 days of the week. You should also include muscle strengthening activities at least 2 days per week. These activities should involve major muscle groups. By meeting these physical activity recommendations, you are more likely to increase your lean mass, decrease your fat mass and decrease your body weight.

Aim for at least 30-60 mins/day of cardio activity, 6 days/week, and muscle-strengthening activities at least 2 days/week.

Physical Activity

for Weight Loss

Physical activity has important benefits for mental health, physical fitness, weight maintenance and the prevention of many chronic diseases. Cardiovascular or aerobic conditioning exercises include those that elevate your heart rate for a sustained period of time, such as brisk walking, running, swimming and cycling. These aerobic exercises improve the function of your heart, lungs and blood vessels. Muscle conditioning exercises improve muscle strength and power as well as bone health and include activities such as weight-lifting or higher intensity yoga and Pilates. Most forms of physical activity are beneficial; however, some individuals can achieve greater weight loss than others based on the amount and type of physical activity they perform. Research shows that variants in the FTO gene can impact an individual's metabolic response to physical activity.* Indeed, physical activity can reduce the effects of the FTO gene on risk of overweight and obesity by as much as 75%.** In addition, a variant in the ADRB2 gene influences how much body fat you lose in response to cardiovascular exercise.***

*Andreasen et al. Lowphysical activityaccentuatestheeffect oftheFTO rs9939609 polymorphism onbody fat accumulation. Diabetes. 2008;57:95-101.
**Reddon et al. Physical activity and genetic predisposition to obesity in a multiethnic longitudinal study. Scientific Reports. 2016;6:1-10.
***Garenc et al. Effects of 2-Adrenergic Receptor Gene Variants on Adiposity: The HERITAGE Family Study. Obesity Research. 2003;11:612-618.

FTO & ADRB2

The FTO gene is also known as the'fat mass and obesity-associated gene',and has been consistently shown to impact weight management and body composition. The FTO gene's role in the body is related to metabolic rate, energy expenditure and energy balance. It is also expressed in regions of the brain that are involved in the regulation of energy intake. Current research shows that specific physical activity recommendations can substantially help with weight loss and weight maintenance in individuals with certain variants of the FTO gene.* The ADRB2 gene encodes the Beta-2-Adrenergic Receptor, which belongs to a family of molecules that are involved in the fight-or-flight response to stress and response to substances like adrenaline. ADRB2 contributes to the breakdown and mobilization of fat cells, and its activity increases during exercise. A large study of obese, sedentary individuals found that variation in the ADRB2 gene predicted fat loss in response to cardiovascular exercise. Women who carried two copies of a specific ADRB2 variant had an enhanced response to a cardiovascular exercise program, losing over three times more body fat than women who had a typical response.** , ***

*Rodrigues et al. A single FTO gene variant rs9939609 is associated with body weight evolution in a multiethnic extremely obese population that underwent bariatric surgery. Nutrition. 2015;31:1344-50.
**Garenc et al. Effects of Beta-2-Adrenergic Receptor Gene Variants on Adiposity: The HERITAGE Family Study. Obesity Research. 2003;11:612-618.
*** Lagou et al. Lifestyle and Socioeconomic-Status Modify the Effects of ADRB2 and NOS3 on Adiposity in European-American and African-American Adolescents. Obesity. 2011;19:595-603.

Energy Balance

Energy isused to fuel all function s inthe body. A calorie is acommonly used unit of measurement to quantify energy, which comes from the foods and beverages consumed. The body uses this energy to complete essential processes such as digestion, breathing, brain function and maintaining a normal body temperature. The energy expended during these essential processes is referred to as the Resting Metabolic Rate (RMR). Total energy output, on the other hand, is the sum of the RMR plus energy burned during physical activity. Consuming less energy and/or expending more energy can lead to weight loss. RMR can vary substantially between individuals, and can result from differences in muscle mass, weight, age and genetics. Research shows that variation in the UCP1 gene affects RMR.*

*NagaiNetal.UCP1geneticpolymorphism(-3826A/G) diminishesresting energyexpenditureand thermoregulatory sympathetic nervous system activity in young females. Int J Obesity. 2011;35:1050-5.

UCP1

Uncoupling protein 1 (UCP1) is found in fat tissue and is involved in metabolicprocesses that create energy and then release it in the form of heat. The UCP1 gene is important for regulating normal body temperature and can impact RMR. Research shows that individuals with the GG or GA variants tend to have lower RMRs compared to individuals with the AA variant. As such, they need to consume less energy to maintain regular bodily functions.

Sources of High Energy Foods

	Amount (calories)
Mixednuts, roasted (1/2cup)	410
Plant-based muffin (1 medium)	340
Avocado (1 fruit)	320
Plant-based donut (1)	270
French fries (20-25)	240
Plant-based croissant (1)	230

Source: Health Canada's Nutrient Value of Some Common Foods

2in5

People with Response Variant

Your Results

UCP1	rs1800700

Response Variant	Your Variant
GG or GA	GA

Your Response

Diminished

Recommendation

Since you possess the GG or GA variant of the UCP1 gene, your daily RMR may be about 10% (or 150 kcal) lower compared to those who have the AA variant of the UCP1 gene. This 10% decrease is based on an average RMR of 1500 kcal per day, which may be higher or lower than your RMR. Therefore, to lose fat mass it may be helpful to reduce daily energy intake or increase energy expenditure through additional exercise, by an amount equal to 10-20% of your estimated energy needs plus an additional 150 kcal. For example, an individual consuming 2000 kcal per day for weight maintenance may choose an energy deficit of 200 kcal, plus an additional 150 kcal deficit per day, which totals a 350-kcal deficit for weight loss. These values will depend on several factors including physical activity levels, and time needed to reach your goal.

For weight loss, aim for a daily energ deficit of 10-20% from your current energy needs plus an additional 150 kcal.

1in5

People with Response Variant

Your Results

GeTnOe	rs9939609 Marker
Response Variant	**Your Variant**
AA	AA

Your Response

Enhanced

whenproteinintakeishigh

Recommendation

Since you have the AAvariant ofthe FTO gene, you have an en hanced weight loss response when consuming a moderate-to- high protein diet. A moderate-to-high protein diet can be beneficial since it can help you lose fat mass, enhance weight loss and improve your body composition. It can also help with long-term improvements to body fat distribution and increase your chances of long-term weight loss success.

to consume 25-35% of energy from protein as part of an energy-restricted diet.

Consume 25-35% of energy from protein.

Protein

Protein is anessentialnutrient for muscle building, wound healing, healthy hair,skinand nails and proper immune function. Protein isbest known for supporting the building and repairing of muscle tissue, which helps to build and maintain strength. Protein has also been shown to regulate appetite by filling you up and allowing you to feel more satisfied with fewer calories. For individuals at risk for overweight and obesity based on the FTO gene, a high protein diet can help with weight loss and weight maintenance over both the short-term and long-term.

FTO

The FTOgene is also known as the 'fat mass and obesity-associated gene' since it can impact weight management and body composition. This gene's role in the body is related to your metabolism, energy expenditure and energy balance. It is also expressed in regions of the brain that are involved in the regulation of energy or food intake. In individuals who have undergone bariatric surgery for weight loss, variation in the FTO gene can help predict their long-term weight loss success, which can have significant implications for nutrition care plans.* Research shows that in comparison to individuals with the TA or TT variant, those with the AA variant lose more body weight, including fat mass, when consuming a moderate-to-high protein diet, but not when consuming a lower proteindiet.**

*Rodrigues GK et al. A single FTO gene variant rs9939609 is associated with body weight evolution in a multiethnic extremely obese population that underwent bariatric surgery. Nutrition. 2015;31(11-12):1344-50.
**Zhang X et al. FTO genotype and 2-year change in body composition and fat distribution in response to weight-loss diets: The POUNDS LOST trial. Diabetes. 2012;61(11):3005-11.

Sources of Protein

	Amount (g)
, regular, extra firm (150g)	
bean curd cheese (1/4 cup)	15
ils (3/4 cup)	14
t protein meat substitute (1 slice)	12
k beans (3/4 cup)	11
kpeas (3/4 cup)	9
mame (1/2 cup)	9
nds (1/4 cup)	8
oa (1/2 cup)	4
pkin and squash seeds, dried (1/4 cup)	3

Source: Health Canada's Nutrient Value of Some Common Foods

Total Fat

Fat is an essential part of a healthy diet, and is needed for the absorption of the fat-soluble vitamins including vitamins A, D, E, and K. Each gram of fat provides more than double the amount of calories as carbohydrates or protein on a gram per gram basis. This makes fat the most energy- dense nutrient. The total amount and types of fats that you consume can affect heart health and body composition. In general, unsaturated fats are heart-healthier than saturated or trans fats. The TCF7L2 gene is involved in body weight regulation and body composition. Research shows that individuals who possess the TT variant of TCF7L2 experience greater weight loss when they consume lower- to-moderate fat diets, in comparison to when they consume higher fat diets. For those with the CC or TC variant, there is no difference in weight loss based on the amount of fat consumed, although lower total energy intakes are needed to create a calorie deficit for weight los s.*

TCF7L2

The TCF7L2 gene produces a protein called transcription factor-7 like 2. This protein affects how the body turns on or off a number of other genes. Research shows that for individuals who possess the TT variant of the TCF7L2 gene, the amount of fat in the diet can significantly impact body composition (lean/muscle mass vs. fat mass) as well as the risk for being overweight or obese. Furthermore, possessing the TT variant puts you at an increased risk for insulin resistance (reduced ability to control blood sugars) when your total fat intake is high. Consuming a low-to-moderate fat intake can help facilitate weight loss in individuals with the TT variant, which can in turn help with reducing insulin resistance.

Sources of Fat

	Amount (g)
Macadamia nuts (1/4 cup)	26
Peanuts, dry roasted (1/4 cup)	18
Almond butter, plain (2 Tbsp)	18
Avocado (1/2 fruit)	15
Veggie burger (1 patty)	15
Olive oil (1 Tbsp)	14
Coconut oil (1 Tbsp)	14
Pistachios (1/4 cup)	14

Source: Health Canada's Nutrient Value of Some Common Foods

1in10

People with Response Variant

Your Results

TCF7L2 rs7903146 Marker
Response Variant	**Your Variant**
TT	CC

Your Response

Typical

Recommendation

Since youpossess the CCor TC variant ofthe TCF7L2 gene, you have a typical weight loss response based on your fat intake. However, to help ensure that you are consuming a healthy, well-balanced diet, consume 20-35% of your total daily energy needs from fat as part of an energy-restricted diet.

Consume 20-35% of energy from fat.

1in7

Peoplewith Response Variant

Your Results

APOA2	rs5068
CC	TC
Response Variant	Your Variant

Your Response

Typical

Recommendation

Since you possess the TT or TC variant of the APOA2 gene, there is no increased risk of high BMI and obesity with a diet high in saturated fat. However, you should still limit saturated fat intake to less than 10% of total energy intake, as recommended, in order to reduce the general risk of other associated health conditions such as cardiovascular disease. Foods typically high in saturated fat include coconut and palm oils, vegan dairy- free cheese, fried foods and baked goods. Suitable alternatives with lower saturated fat include olive and vegetable oils, beans, lentils, nuts/seeds and soy-based proteins such as soy beverages and tofu.

Limit intake of saturated fat to no more than 10% of energy.

Saturated Fat

Saturated fatsare mainly inanimal products such as red meat, processed meats, butter and cheeses, but also in palm oil and coconut products. Palm oil is used extensively in the production of cookies, pastries, chocolate, and instant noodles, and may be a major source of saturated fats for those following vegan or vegetarian diets. Although there are many health claims for coconut oil, this is partly due to their medium-chain triglyceride content, which is isolated from coconut oil and used in research studies. However, the regular coconut oil available in stores may have adverse cardiovascular effects. Saturated fats have long been associated with health conditions such as diabetes, cardiovascular disease and obesity. However, the connection between saturated fats and obesity, has been poorly understood. A number of studies have now shown that the effect of saturated fat on obesity can be influenced by variations in a gene called APOA2.*

*CorellaDetal. APOA2,dietaryfat,and bodymassindex:replicationofagene-dietinteractionin 3independent populations.Archives ofInternalMedicine.2009;169:1897-906.

APOA2

TheAPOA2gene directs the body to produce a specific protein called apolipoprotein A-II, which plays an important role in the body's ability to utilize different kinds of fat. There are different variations in the APOA2 gene present in the human population and these different versions of the gene interact with saturated fat in unique ways to influence energy balance and ultimately the risk of obesity. Those people who have the CC variant of the gene are at a higher risk of developing obesity when consuming a diet high in
osar tTuCr avtaerdia fnatt so ft hthaen gtheonsee. possessing the TT

Sources of Saturated Fat

	Amount (g)
Coconutoil (1 Tbsp)	12
Palm kernel oil (1 Tbsp)	11
Plant-based meat patty (100g)	6
Plant-based muffin (1 small)	5
French fries (20-25)	5
Vegan cheese (28g)	2

Source: Canadian Nutrient File and USDA Nutrient Database

Saturated and Unsaturated Fats

There aretwo maintypesof dietary fats: saturated and unsaturated. Saturated fats can be found in plant-based foods such as coconut oil, palm kernel oils, vegan cheese, and fried or baked goods. A diet high in saturated fat has long been associated with health conditions such as diabetes, cardiovascular disease and obesity. Unsaturated fats, including monounsaturated and polyunsaturated fats, such as those found in olive oil, almonds and grape seed oil, may help to decrease the risk of diabetes, cardiovascular disease and obesity. Research shows that variation in the FTO gene can impact the body's response to saturated and unsaturated fat.*

*PhillipsCMetal.Highdietary saturated fatintake accentuatesobesityriskassociatedwiththefatmass andobesity-associatedgene inadults. Journal ofNutrition.2012;142:824-31.

FTO

The FTOgene is also known as the 'fat mass and obesity-associated gene' since it can impact weight management and body composition. This gene's role in the body is related to metabolic rate, energy expenditure and energy balance. It is also expressed in regions of the brain that are involved in the regulation of energy intake. In individuals who have undergone bariatric surgery for weight loss, variation in the FTO gene can help predict their long-term weight loss success, which can have significant implications for nutrition care plans.* Research shows that for individuals with the AA or TA variant, a high intake of unsaturated fat, and low intake of saturated fat in the diet can help facilitate weight loss, decrease fat stores around the abdomen and decrease the risk for obesity.*

*Rodrigues et al. A single FTO gene variant rs9939609 is associated with body weight evolution in a multiethnic extremely obese population that underwent bariatric surgery. Nutrition. 2015;31:1344-50.

Sources of Mono and Polyunsaturated Fat

Monounsaturated Fat	Amo u nt (g)
Macadamianuts (1/4cup)	
Almond butter (2 Tbsp)	12
Olive oil (1 Tbsp)	10
Canola oil (1 Tbsp)	8
Peanut butter (2 Tbsp)	8
Polyunsaturated Fat	**Amount (g)**
Walnuts (7 nuts)	
Grape seed oil (1 Tbsp)	10
Sunflower oil (1 Tbsp)	9
Soybean oil (1 Tbsp)	8
Brazil nuts (1/4 cup)	7

Source: Health Canada's Nutrient Value of Some Common Foods

3in5

People with Response Variant

Your Results

GeTnOe	rs 9939 3r k9e r
TA or AA	AA
Response Variant	Your Variant

Yo u rR e sp onse

whensaturatedfatintakeislowand

polyunsaturated fatintake ishigh

Recommendation

Since you have the TA orAA variantof the FTO gene, you can enhance your weight loss by limiting saturated fat intake to less than 10% of total energy intake and consuming the rest of your recommended daily fat intake from unsaturated fats. Your intake of polyunsaturated fats should be at least 5% of your total energy intake, and the rest should come from monounsaturated fats. This can further help to decrease your risk of overweight, weight gain, and fat around your middle.

Limit intake of saturated fat to no mo than 10% of energy. Consume at leas 5% of energy from polyunsaturated fa

1in4

People with Response Variant

Your Results

PPARγ2	rs1800172
GG or GC	CC
Response Variant	Your Variant

Your Response

Typical

Recommendation

Since you possess the CC variant of the PPARγ2 gene, consuming more monounsaturated fats will not necessarily help to facilitate weight loss and lower your body fat percentage. However, for heart health, you should aim for a balance of saturated, monounsaturated and polyunsaturated fats to meet your total daily fat intake recommendation.

Aim for a balance of saturated, monounsaturated and polyunsaturated fats to meet your total daily fat intake.

Monounsaturated Fat

dfats suchas thosefoundin oliveoil,

Monounsaturate

almonds and avocados have beenassociated withreduced riskfor heart disease. Monounsaturatedfats canhelp reduce “bad” (LDL) cholesterol levels and may also help increase “good” (HDL) cholesterol. Research shows that these fats can help facilitate weight loss and lower body fat composition in some individuals based on their PPARγ2 gene.*

*Garaulet Metal. PPARγ Pro12Alainteracts withfatintakeforobesityandweightlossinabehavioural treatment based onthe Mediterraneandiet. MolecularNutritionandFoodResearch.2011;55:1771-9.

PPARγ2

The PPARγ2 gene is involved in the formation of fat cells. This gene is mainly found in fat tissue. Because of its involvement in the formation of fat, PPARγ2 can impact weight management and body composition. Specifically, individuals who have the GG or GC variant of the gene tend to experience greater weight loss and lose more body fat, compared to those with the CC variant, when they consume a diet high in monounsaturated fats.

Sources of Monounsaturated Fat

	Amount (g)
Macadamia nuts (1/4cup)	
Almond butter (2 Tbsp)	12
Olive oil (1 Tbsp)	10
Canola oil (1 Tbsp)	8
Peanut butter (2 Tbsp)	8
Sesame oil (1 Tbsp)	6
Pumpkin and squash seeds, dried (1/4 cup)	5
Soybeans, boiled (3/4 cup)	3
Hummus (1/4 cup)	2

Source: Health Canada’s Nutrient Value of Some Common Foods

Fat Taste Perception

Food intake i slargely determined by our taste perceptions and preferencesfor certainfoods and beverages. The way that we perceive thetaste of fatty foods is particularly important because our intake of fats can affect heart health and body composition. Fat is needed to absorb certain vitamins including vitamins A, D, E, and K. It provides 9 calories per gram, which is more than double the calories in a gram of protein or carbohydrate. Research shows that our preference for fatty foods can vary depending on which version of the CD36 gene we have.*

*Melis M, SollaiG, Muroni P, Crnjar R,BarbarossaIT. Associationsbetweenorosensoryperceptionof oleic acid, the common single nucleotide polymorphisms (rs1761667and rs1527483)in the CD36gene, and 6-n-propylthiouracil (PROP) tasting. Nutrients 2015; 7(3): 2068-84.
Pepino MY et al. The fatty acid translocase gene CD36 and lingual lipase influence oral sensitivity to fat in obese subjects. Journal of Lipid Research. 2012;53:561-6.

CD36

The cluster of differentiation 36 (CD36) gene is also known as fatty acid translocase. It is found on the surfaces of many cells, including taste bud cells in the tongue, and is involved in the transport of fat from the blood. Several studies have now linked variations in the CD36 gene to differences in the perception of the taste and texture of fats and oils. ‘Super tasters’ tend to be able to detect the taste of fats and oils at lower levels than ‘low tasters.’

Sources of High Fat Foods

	HighinHealthy (Unsaturated)Fat	Amount (g)
Macadamia nuts (1/4 cup)	P	26
Peanuts, dry roasted (1/4 cup)	P	18
Almond butter, plain (2 Tbsp)	P	18
Oil & vinegar salad dressing (2 Tbsp)	P	16
Avocado (1/2 fruit)	P	15
Olive oil (1 Tbsp)	P	14
Coconul oil (1 Tbsp)		14
Pistachios (1/4 cup)	P	14

Source: Health Canada’s Nutrient Value of Some Common Foods

7in10

People with Response Variant

Your Results

CD36	rs1761667
GG or GA	AA
Response Variant	Your Variant

Your Response

Typical

Recommendation

Since you possess the AA variant of the CD36 gene, you are a ‘low taster’ of fats. This means that you require greater amounts of fat in your food to be able to detect the taste of fats. In comparison, those who are ‘super tasters’ are better able to detect the taste of fats at lower levels. Consuming too much fat, and the wrong types of fats (saturated vs. unsaturated) can increase the risk of obesity and cardiometabolic disease. Refer to the Total Fats section of your report for your recommended daily intake of fats.

Your ability to sense the fatty taste of foods is typical.

1in4

Your Results

GLUT2	MC4R
Risk	**Your Variant**
	CT

Your Risk

Elevated

Recommendation

Since you possess the CT or TT variantof the GLUT2 gene, you are at an increased risk of over-consuming sugar. Be mindful of this tendency to consume sweet foods and beverages and aim to keep your intake of added sugar below 5% of your total daily energy intake. A high intake of added sugar is linked to overweight & obesity, cardiometabolic disease and dental caries risk.

You have a high preference for sugar.

Sugar Preference

Sugar intakeis partly determined by oursweet taste preferenceand cravings forcertain foodsand beverages. There is considerable variability in individuals' preferences and cravings for sweet foods and beverages. There are many factors that may impact your preference for sugary foods including the age that you are first introduced to sweets, and psychological associations between consuming these foods and certain life experiences or emotions. In addition to 'pleasure-generating' signals in the brain given off in response to eating or drinking something sweet, there are specialized areas in the brain that regulate both food intake and glucose (sugar) levels in the body. Research has shown that your intake of sweet foods can be determined by a genetic variant that regulates blood glucose levels in your body. People who carry the variant associated with higher sugar intake are also at higher risk of dental caries (cavities).

GLUT2

Glucose transporter type 2 (GLUT2) is involved in regulating glucose (sugar) in the body. The expression of this gene has been found in areas of the brain that are involved in controlling food intake. Individuals who possess the TT or TC variant of this gene seem to have a greater preference for sweet foods and beverages and are more likely to over-consume sugar.* In addition, those who have the variant associated with higher sweet food intake, have also been shown to have a higher risk of dental carries.**

*Eny KM et al. Genetic variant in the glucose transporter type 2 is associated with higher intakes of sugars in two distinct populations. Physiol Genomics. 2008;33(3):355-60.
**Kulkarni GV et al. Association of GLUT2 and TAS1R2 genotypes with risk for dental caries. Caries Research. 2013; 47:219-25

Sources of High Sugar Foods

	Amount (g)
Cola (1 can)	36
Citrus juice, frozen, diluted (1 cup)	32
Vegan caramels (40g)	26
Vegan chocolate (50g)	26
Maple syrup (2 Tbsp)	24
Vegan caramel-coated popcorn (1 cup)	20
Red licorice (3 pieces)	15
Popsicle (75g)	10
Jam (1 Tbsp)	10

Source: Health Canada's Nutrient Value of Some Common Foods

Eating between Meals

Eating between meals (i.e. snacking) can be beneficial ifsnacks are healthful and the extra calories are not in excess of those needed to maintain a healthy weight. Healthy snacks can assist with regulating blood sugar levels and weight control, curb food cravings and boost energy levels. However, for many people snacking is often an unhealthy habit due to snack-food choices and/or excessive calorie intake beyond one's needs. For your overall health and wellness, it is important to manage emotional eating (psychological reasons for snacking), and focus on more healthful snacking when you feel hungry. Some reasons for emotional eating may include boredom, habit (i.e. eating in front of the television, or at certain times), stress, frustration, anxiety or loneliness. Scientists have also discovered that variations in the MC4R gene are associated with the likelihood of eating between meals, driven by the

*StutzmannF etal.Common geneticvariationnearMC4Risassociatedwitheatingbehaviourpatternsin
dueropseainr peoputlaotio nse. Inat Jt Obmes. o20r09e;3 3:o373r- 37l8e.ss frequently, depending on
your genotype.*

MC4R

TheMC4Rgene codes for the melanocortin 4 receptor, which is found in thehypothalamus region of the brain. This is an area of the brain that controls hunger and appetite. The MC4R gene plays an important role in appetite regulation and hunger cues. Research shows that individuals with the CC or CT version of the MC4R gene are more likely to eat between meals often and have a heightened appetite.

Replace these foods...	with these foods ..
Potatochips and a plant-based dip	or other plant-based dip
Muffin	Whole wheat English muffin with peanut butter
Dairy-free ice cream with toppings	Soy/plant-based yogurt with fresh berries
Trail mix with added oils or sweets	Fibre-rich cereal with plant-based milk alternative
'Veggie' chips	Fresh vegetables with with plant-based dip
Pasta salad	Mixed salad topped with chickpeas
Potato chips	Natural popcorn
Vegan pizza slice	Half a veggie sandwich with hummus

2in5

Your Results

MC4R	rs1777892
Risk	**Your Variant**
	TT

Your Risk

Typical

Recommendation

Since you possessthe TTvariant of the MC4R gene,you have a typical risk for eating between meals. To maintain a healthy metabolism, avoid going longer than six hours without eating during the day. Monitor and respond to hunger cues, which may include a lack of energy, mood changes, stomach growling, weakness, dizziness, or having a headache. Choose healthy snacks that are not excessive in calories.

Your tendency to eat between meals is typical.

1in3

Peoplewith
Response
Variant

Your Results

B^G D^e ^nN^e F	r^Ms^a6^r2^k6^er5
Response Variant	**Your Variant**
AA or AG	AA

Your Response

Enhanced

Implications

Since you possess the AA or AG variant of the BDNF gene, you are more likely to experience greater enjoyment and positive mood changes from exercise. You also tend to perceive your exertion level during exercise to be lower than individuals with the GG variant. These responses to exercise result in a heightened motivation to exercise and greater likelihood that you will continue to exercise regularly. Therefore, you are at a genetic advantage when it comes to motivation to begin or continue regular exercise.

You have an enhanced innate motivation to exercise.

Motivation to Exercise

Yourattitude toward exercise and the effect it has on your moodcangreatly impact your likelihood of starting or maintaining a physically active lifestyle. Research shows that individuals who possess the AA or AG variant of the BDNF gene are more likely to experience positive mood changes and exercise for enjoyment. They also perceive their effort and exertion level as lower during exercise compared to individuals who possess the GG variant.* All of these factors impact motivation to exercise. Being physically active has a multitude of benefits including improved cognitive function, and a lowered risk of many diseases, through improvements in body fat levels, blood sugars, blood pressure, blood lipid profiles, and mental health.

*BryanA et al.A transdisciplinarymodelintegratinggenetic,physiological,andpsychologicalcorrelates ofvoluntary exercise. Health Psychol. 2007;26:30-39.
Caldwell Hooper A et al. What keeps a body moving? The brain-derived neurotrophic factor val66met polymorphism and intrinsic motivation to exercise in humans. J Behav Med. 2014;37(6):1180-92.

BDNF

The brain-derivedneurotrophic factor is a protein that is encoded by the BDNF gene.This protein works in regions of the brain to influence the nervous system, musculature, and blood vessels, all of which are important to exercise. Because of the complexity of mental stamina and the psychological response to exercise, the BDNF gene is only one of many possible genetic factors that may influence responses to exercise and future exercise behavior. Nevertheless, research shows that those with the AA or AG variant of the BDNF gene derive greater enjoyment or pleasure and improvements in mood from exercise and a lower perception of effort during exercise compared to those without this variant.

Exercise Behavior

Participating in physicalactivity can lower blood pressure, lowerblood sugars, improve cholesterol levels, decrease depression and improve mood, among many other positive outcomes. Research shows that genetic differences influence the likelihood of engaging in physical activity. The CYP19A1 and LEPR genes have been identified as being key contributors to one's probability of participating in physical activity.*

*De Moor MHet al.Genome-wideassociationstudyofexercisebehaviorinDutchandAmericanadults. Med Sci Sports Exerc.2009;41:1887-95.

CYP19A1 & LEPR

The CYP19A1 gene helps to makethe enzyme aromatase, which is involvedin hormone conversion. The exact physiological pathway by which this gene impacts exercise behavior is unknown. However, current research shows that those who have the AA or GA variant of the CYP19A1 gene are more likely to exercise compared to those with the GG variant. The LEPR gene helps to make the leptin receptor protein, which helps to regulate body weight. The precise relationship between variations in the LEPR gene and exercise behavior may stem from this gene's involvement in regulating energy balance. Those who have the TT or GT variant of the LEPR gene are more likely to participate in physical activity compared to those who have the GG variant.

1in12

People with
Response
Variant

Your Results

Genes	Markers
CYP19A1 LEPR	rs2470158 rs12405556
Response Variant	**Your Variants**
Algorithm	GG GT

Your Response

Typical

Implications

Basedon yourLEPR andCYP19A1variants, you have a typical likelihood of engaging in physical activity. Set monthly SMART (specific, measurable, attainable, realistic, timely) goals and consider using mental imagery; these can further enhance your motivation. Having an exercise partner can also enhance your likelihood of participating in physical activity.

You have a typical likelihood of engaging in physical activity.

Your Results

Gene	Marker
ACTN3	rs1815739

Response Variant	Your Variant
CC or TC	CC

Your Response

Ultra

Implications

Since you possess the CC variant ofthe ACTN3 gene,you have a genetic advantage to excel in strength and power-based activities. These activities are important for building and maintaining muscle mass. Aim to participate in strengthening activities at least two days per week.

You have a genetic advantage to excel in power sports.

Power and Strength

Strengtheningactivities,asthe name implies, are activities that strengthenyour muscles and bones. Research shows that muscle-building exercises can also benefit your brain, help with regulating blood sugars, improve posture and help achieve and maintain a healthy body weight. Examples of these activities include body weight exercises such as push-ups, sit-ups, and lunges as well as lifting weights, using gym machines and working with resistance bands. Some activities of daily living or household chores are also considered strengthening activities such as strenuous gardening, carrying heavy groceries or running up stairs. Research shows that the ACTN3 gene plays a major role in your genetic predisposition to excelling in strength and power-based activities.*

*MaFetal.Theassociationofsportperformance withACEandACTN3geneticpolymorphisms: asystematicreviewandmeta-analysis.PLoS One.2013;8:e54685.

1in2 Enhanced

1in3 Ultra

ACTN3

There are two types of muscle fibres: slow twitch and fast twitch. Fast twitch muscle fibres contract with greater speed and force, which are needed for short bursts of intense activities including sprinting or lifting heavy objects. Slow twitch fibres contract for longer periods and at lower intensities and are used in activities such as walking, slow running or easy cycling. The ACTN3 gene encodes the alpha-actinin-3 protein, which is only expressed in fast twitch muscle fibres. Therefore, certain variations in this gene can be beneficial for exercises or activities requiring strength and power. In particular, individuals with the CC variant of ACTN3 are more likely to excel at strength-based activities. Those with the TC variant have a slightly enhanced power and strength potential.*

*Garton and North. The effect of heterozygosity for the ACTN3 null allele on human muscle performance. Med Sci Sports Exerc. 2015 [Epub ahead of print].

Endurance

Endurance activities refer to aerobic, or “cardio” exercises that cause your heart rate to increase, such as brisk walking, jogging, biking, swimming, or dancing. Your VO2 max, or maximal aerobic capacity, measures the maximum amount of oxygen that your body can process during 1 minute of exercise, and it is a marker of physical fitness. A higher VO2 max generally results in a performance advantage when it comes to endurance activities, although many factors play a role. Research shows that multiple genes impact your genetic predisposition to excelling in endurance activities.* In some of these genes, certain versions of the gene have also been shown to improve your endurance capacity in response to endurance training more effectively.**

*Ahmetov I et al. Genome-widea sociation studyidentifies threenovel geneticmarkersassociatedwithelite endurance performance. Biol Sport. 2015;32(1):3-9. doi:10.5604/20831862.1124568.
Santiago C et al. Trp64Arg polymorphism in ADRB3 gene is associated with elite endurance performance. British Journal of Sports Medicine. 2011;45:147-9.
**Zarebska A et al. The GSTP1 c.313A>G polymorphism modulates the cardiorespiratory response to aerobic training. Biol Sport. 2014;31:261-266.
He et al. NRF2 genotype improves endurance capacity in response to training. Int J Sport Med. 2007; 28:717-721.
Stefan et al. Genetic Variations in PPARD and PPARGC1A Determine Mitochondrial Function and Change in Aerobic Lifestyle Intervention. J Clin Endocrinol Metab. 2007; 92: 1827-1833.

3in10 Enhanced

1in10 Ultra

NFIA-AS2, ADRB3, NRF2, GSTP1 & PGC1a

NFIA-AS2, ADRB3, NRF2, GSTP 1andPGC1a are all involved in physiological processes that impact your endurance abilities. Individuals with the CC variant in the NFIA-AS2 gene tend to have greater VO2 max, which is advantageous for endurance exercise. Variations in the ADRB3 gene are more common among world-class endurance athletes compared to non-athlete controls. The NRF2 gene plays an important role in the production of mitochondria, the power houses of the cell, and those with the AA variant improve their endurance in response to exercise training. Variation in the GSTP1 gene is also associated with differences in VO2 max responses to aerobic training and individuals with the GG and GA variants have greater improvements. Finally, the GG variant of the PGC1a gene is associated with improved aerobic fitness in response to endurance training. Together, these genes can predict your genetic advantage for excelling in endurance activities and sports.

Your Results

Genes	Markers
NFIA-AS2 ADRB3 NRF2 GSTP1 PGC1a	rs1572312 rs4994 rs12594956 rs1695 rs8192678

Response Variants	Your Variants
Algorithm	CC TT CA AG AA

Your Response

Typical

Implications

Based on your DNA,your end urancepotential is typi
You may need to increase your training to a greater
than an individual with a genetic advantage to achie
the same level of cardiovascular fitness. Aim to get
least 150 to 300 minutes of moderate-intensity exerc
per week. This can be met through 30 to 60 minutes
moderate-intensity aerobic exercise five days per we
such as brisk walking or moderate intensity cycling.

Your endurance potential is t ypical.

7in10

Risk Variant

Your Results

AGene	rs1815739
Risk Variant	Your Variant
	CC

Your Risk

Typical

Implications

Since you possess the CC variant of the ACTN3 gene, you have a typical susceptibility to muscle damage after strenuous or unaccustomed exercise. When starting a new exercise program ensure you take necessary precautions like warming up and cooling down, and gradually increase exercise intensity over time. Rest and recovery are also important – if you experience extreme soreness after a workout, take a break from working that muscle group until it is no longer sore. It is also important to ensure adequate intakes of protein throughout the day for muscle repair and consume plenty of antioxidant-rich plant foods such as fruits, vegetables, nuts and seeds.

Meet general guidelines for warming up and cooling down.

Muscle Damage

Delayedonset musclesoreness (DOMS) is commonly experienced in the days following unaccustomed or strenuous exercise, and it is characterized by tender, stiff muscles which also cause a temporary reduction in strength and range of motion. DOMS is a result of exercise-induced muscle damage, which at low levels is a positive stimulus for muscle growth and increased strength. However, excessive damage or inadequate recovery may cause persistent and unnecessary soreness which can impede strength gains and increase the risk of developing over-use injuries. DOMS is caused by oxidative stress, inflammation, and muscle protein degradation. There is considerable variability in an individual's response to muscle-damaging exercise, due to factors such as age, exercise history and genetics. Research shows that variation in the ACTN3 gene influences one's susceptibility to muscle damage after prolonged, strenuous or unaccustomed exercise.* The type of activity inducing the greatest muscle damage is most often high-intensity resistance or power-type exercise.

ACTN3

The ACTN3 gene encodes the alpha-actinin-3 protein, which plays akey rolein the contraction of fast-twitch or power-type muscle fibres during short bursts of intense activities, such as sprinting or lifting heavy objects. Genetic variation in ACTN3 affects the expression of the resulting protein in fast-twitch fibres, and individuals who carry at least one copy of the T variant produce a lower functioning ACTN3 protein that has been linked to increased risk of muscle damage. For example, a recent study showed that experienced endurance athletes with the TC or TT variant had higher levels of markers of muscle damage after a competitive marathon than individuals with the CC variant, and a similar trend was observed in a study where healthy young men performed knee extension exercises, working the quadriceps, in a laboratory setting.**

*DelCoso et al. ACTN3genotype influencesexercise-inducedmuscle damageduring amarathoncompetition. European Journalof Applied Physiology.2017;117:409–416.
**Vincent et al. Protective role of alpha-actinin-3 in the response to an acute eccentric exercise bout. Journal of Applied Physiology (1985). 2010;109:564-573.

Pain

Pain is an unpleasant feeling triggered by the nervous system that can be mild to severe. Pain threshold is a term that refers to the point where you begin to feel pain that causes discomfort to the extent that it becomes difficult for you to withstand. It is a threshold at which you cannot continue to exercise at a certain intensity level due to an intolerable level of discomfort. Pain tolerance refers to the maximum amount of pain that someone can withstand. There are substantial differences in the way, or the degree to which people feel pain. Overall, men tend to have higher pain tolerances than women. Research shows that variations in the COMT gene impact how we feel and perceive pain.*

*Zubieta et al. COMTv al[sup158]metgenotypeaffectsμ-Opioid NeurotransmitterResponses toaPain Stressor. Sci. 2003;299:1240-1243.
Tammimäki A, Männistö PT. Catechol-O-methyltransferase gene polymorphism and chronic human pain: a systematic review and meta-analysis. Pharmacogenet Genomics. 2012;22(9):673-91.

COMT

TheCatechol-O-methyltransferase (COMT) gene is involved in pathways inthebodythatprocess pain signals. Because of this, researchers have studied how variations in this gene can impact our perception of pain. Studies show that the COMT gene is a significant predictor of pain tolerance. Specifically, individuals with the GG or GA variant tend to experience less pain compared to those with the AA variant.

3in4

Response Variant

Your Results

CGOMT	rs4680
Response Variant	Your Variant
GG or GA	GA

Your Response

Enhanced

Implications

Since youpossess the GG or GA variant of the COMT gene, you have enhanced pain tolerance, meaning that you tend to experience less pain. To increase your pain tolerance even further, there are several strategies that you can use such as practicing deep breathing and changing negative thoughts to positive thoughts when you are undergoing pain. For example, if you are out running, try to shift your focus away from the discomfort you may be feeling in your muscles, and focus on how the running is positively impacting your health. Exercising more often to build tolerance to discomfort can also help to decrease pain perception during physical activity. Be sure not to exercise through pain as this may cause injur y.

You have an enhanced pain tolerance and therefore tend to experience less pain.

4in5

Your Results

WNT16 rs2707466	
Risk Variant	Your Variant
T	TC

Your Risk

Elevated

Implications

Since you possess the CC orTC variant of the WNT16 gene, you have an elevatedrisk for low BMD and bone fracture. Exercise protocols that produce high mechanical forces in the skeleton can increase bone density and strength. For example, sports such as basketball and volleyball, or fitness classes that include running or jumping can all help to improve bone density. In addition, resistance exercise using your own body weight, free weights or machines has been shown to strengthen bones. Daily activities such as running up stairs, carrying heavy groceries or gardening also help to maintain bone strength. Aim to engage in both weight-bearing and resistance exercises most days of the week. Be sure to seek expert guidance before trying new or more challenging exercises. It is also important to ensure adequate intakes of protein, calcium, vitamin D and antioxidants for optimal bone health.

You have an elevated risk for low bone mass.

Bone Mass

Osteoporosis and osteopenia are common bone diseases that occur more often in older adults but can develop at any age. Both involve a deterioration of tissue, resulting in low bone mineral density (BMD) and compromised bone strength. Osteoporosis can develop without any signs or symptoms and is characterized by low BMD and a high risk of bone fracture. Osteopenia is also characterized by reduced BMD and can predict later development of osteoporosis and fracture risk. Fractures are associated with hospitalization, as well as reduced mobility and independence. Our bones support us, protect our organs, and enable us to move. We also store minerals such as calcium and phosphorous in our bones, which keep them strong, and we release them into the circulation when they are needed by other tissues. Peak bone mass is reached by early adulthood, and gradually declines with age. The rate of bone loss is influenced by factors such as nutrition and exercise, with some forms of exercise slowing the rate of loss and even increasing BMD and bone strength. Genetic variation also contributes to differences in BMD levels across individuals. Research shows that a genetic variant in the WNT16 gene is associated with a greater risk of low BMD and increased risk of fracture.*

*Zheng etal. WNT16 influencesbone mineraldensity,corticalbonethickness,bonestrength,andosteoporotic fracture risk. PLOS Genetics.2012:8; e1002745.

WNT16

WNT16 encodes a protein belonging to the WNT family of genes, which is involved in the regulation of bone formation. WNT16 has been associated with bone mass and structure across all life stages, and it is an important determinant of BMD, bone strength, and risk of fracture. Individuals who possess the CC or TC version of the WNT16 gene are predisposed to having a lower BMD and higher risk of bone fracture, compared to those with the TT variant. It is particularly important for individuals with the CC or TC variant to engage in weight-bearing exercises and to ensure they consume adequate amounts of protein, vitamin D and calcium, which are essential nutrients for bone health.

Types of Weight Bearing Activities

Walking	Running
Hiking/trekking	Tennis
Jogging	Team Sports

Types of Resistance Activities

Lifting weights	Working with resistance bands
Using weight machines	Push-ups
Squats	Lunges

Achilles Tendon Injury

YourAchilles tendon is one of thelargestandstrongest tendonsin the human body. It starts at the bones in your heels and continues up to your calf muscles. This tendon gives you the ability to point your toes and extend your foot. Unfortunately, injuries to the Achilles tendon are common. They typically arise from doing exercises that require a sudden surge of energy. Symptoms of an Achilles tendon injury include extreme pain, tenderness, swelling, or stiffness along the back of your foot and above your heel. Your risk of developing an Achilles tendon injury depends in part on the COL5A1 gene.*

*September AV et al.V ariants withintheCOL5A1geneareassociatedwithAchillestendinopathyintwo populations. Brit J Sport Med. 2009;43:357–365.

COL5A1

TheCOL5A1 gene directs the body to produce a protein called collagen alpha-1(V) chain, which plays an important role in the creation of collagen. Collagen is the protein that is used to make connective tissues in the body. Given the role of the COL5A1 gene in the creation of connective tissue, scientists have studied the link between this gene and Achilles tendon injury risk. Research has shown that individuals with the CT or TT variant of COL5A1 gene have a higher risk for developing an Achilles tendon injury.

Dynamic Stretching Warm-up

Side lunges	Warrior pose
Heel raises	Tip-toe walking
Walking lunges with rear leg extension	Mountain climbers

Lower Leg Strengthening Exercises

Seated calf raises	Weighted toe raises
Standing calf raises	Anterior tibialis isometrics

Higher Risk Exercises for Achilles Tendon

Box jumping	Hill sprints
Plyometrics	Sled pushes

4in5

Your Results

COL5A1 rs12722486	
Risk Variant	Your Variant
CT	CC

Your Risk

Typical

Implications

Sinceyou possess the CC variant of the COL5A1 gene, you have a typical risk of developing an Achilles tendon injury. To decrease your risk, be mindful of exercises requiring a surge of energy or overextension of this tendon through certain exercises such as plyometrics and uphill running. Preventive measures also include additional stretching of your calf muscles and increasing the duration of your warm up and cool down during exercise sessions.

You have a typical risk for Achilles tendon injury.

Additional Genetic Insights for Health and Wellness

Thetablebelow includes genetic markersthat provide additional insights forhealth and wellness. These insights come from researchstudies on genetic variation and its associationwith health-related outcomes, such as the association for a genetic marker with having a higher level of a nutrient circulating in the blood. This section differs from the previous sections in the report, which focus on genetic markers that modify the way we respond to diet or exercise to impact health outcomes. Therefore, currently, no personalized diet or fitness recommendations are given for the markers in the following table. Talk to your healthcare provider about general strategies you can implement to optimize your health given these additional health-related insights.

	Gene, rs Number	Gene Function	Risk/ Response Variant	Your Variant	Your Risk/ Response	Implications
Nutrients						
Magnesium	**TRPM6, r s1114 413 4**	**TRPM6 is a magnesium transporter**	**TT or CT**	**CT**	Elevated	**You have an elevated risk of low levels of magnesium.**
Zinc	**SLC30A3, rs11126936**	**SLC30A3 is a zinc transporter**	**CC**	**CC**	Elevated	**You have an elevated risk of low levels of zinc.**
Starch	**AMY1, r s 424 4 372**	**AMY1 is a salivary starch enzyme**	**AA**	**AT**	Typical	**Your ability to metabolize starch is typical.**
Vitamin E	**Intergenic – rs12272004**	**APOA5 is a component of HDL**	**CC or CA**	**CA**	Elevated	**You have an elevated risk of low vitamin E levels.**
Inflammation and Antioxidant Capacity						
Adiponectin	**ADIPOQ, rs17366568**	**Adiponectin is an anti-inflammatory hormone**	**GA or AA**	**GA**	Diminished	**Your levels of adiponectin are likely to be diminished.**
Interleukin 6	**IL6, r s18 0 079 5**	**IL6 is an inflammation biomarker**	**GG or GC**	**GG**	Elevated	**Your levels of interleukin 6 are likely to be higher than normal.**
Superoxide Dismutase 2	**SOD2, rs4880**	**SOD2 is an antioxidant**	**TT or CT**	**CT**	Diminished	**Your SOD2 enzymatic activity, which affects antioxidant capacity, is diminished.**
Nitric Oxide	**NOS3, rs1799983**	**NOS3 is involved in producing antioxidants**	**GT or TT**	**GG**	Typical	**Your plasma nitric oxide levels are likely to be typical.**
Eating Habits						
Hunger	**NMB, r s10 5116 8**	**NMB regulates eating behaviour**	**TT**	**GT**	Typical	**You have a typical susceptibility to hunger.**

	Gene, rs Number	Gene Function	Risk/ Response Variant	Your Variant	Your Risk/ Response	Implications
Weight Management						
Maintenance of Long-Term Weight Loss	**ADIPOQ, rs17300539**	**Adiponectin regulates fat metabolism and insulin sensitivity**	**AA or AG**	**GG**	Typical	**You have a typical ability to maintain weight loss in the long term.**
Sleep and Lifestyle						
Short Sleep Duration	**CLOCK, rs1801260**	**CLOCK regulates the circadian rhythm**	**CC or TC**	**TT**	Typical	**You have a typical risk of short sleep duration.**
Alcohol Sensitivity	**ALDH2, r s 671**	**ALDH2 is involved in alcohol metabolism**	**AA or AG**	**GG**	Typical	**You have a typical sensitivity to the effects of drinking alcohol.**
Cardiometabolic Health						
Total Cholesterol	**APOA5, rs662799**	**APOA5 is a component of HDL**	**CC or TC**	**TT**	Typical	**You have a typical risk of high total cholesterol.**
LDL Cholesterol	**ABCG8, rs6544713**	**ABCG8 is involved in cholesterol transport**	**TT or CT**	**CC**	Typical	**You have a typical risk of high LDL cholesterol.**
HDL Cholesterol	**ABCA1, rs1883025**	**ABCA1 is involved in cholesterol transport**	**TT or TC**	**CC**	Typical	**You have a typical risk of low HDL cholesterol.**
Triglycerides	**ANGPTL3, rs10889353**	**ANGPTL3 is involved in regulating lipid metabolism**	**AA or CA**	**AA**	Elevated	**You have an increased risk of high triglycerides.**
Fasting Glucose	**ADCY5, rs11708067**	**ADCY5 is involved in insulin secretion**	**AA or GA**	**AA**	Elevated	**You have an increased risk for high fasting glucose.**
Insulin	**IRS1, rs2943641**	**IRS1 is involved in insulin signaling**	**CT or CC**	**CT**	Elevated	**You have an increased risk for high insulin concentrations.**
Injury						
Rotator Cuff Injury	**MMP1, rs1799750** **MMP3, r s 3 0250 58**	**MMP1 and MMP3 are involved in tissue remodeling**	**Algorithm**	**GG** **DelA**	Elevated	**You have an elevated risk of having a rotator cuff injury.**