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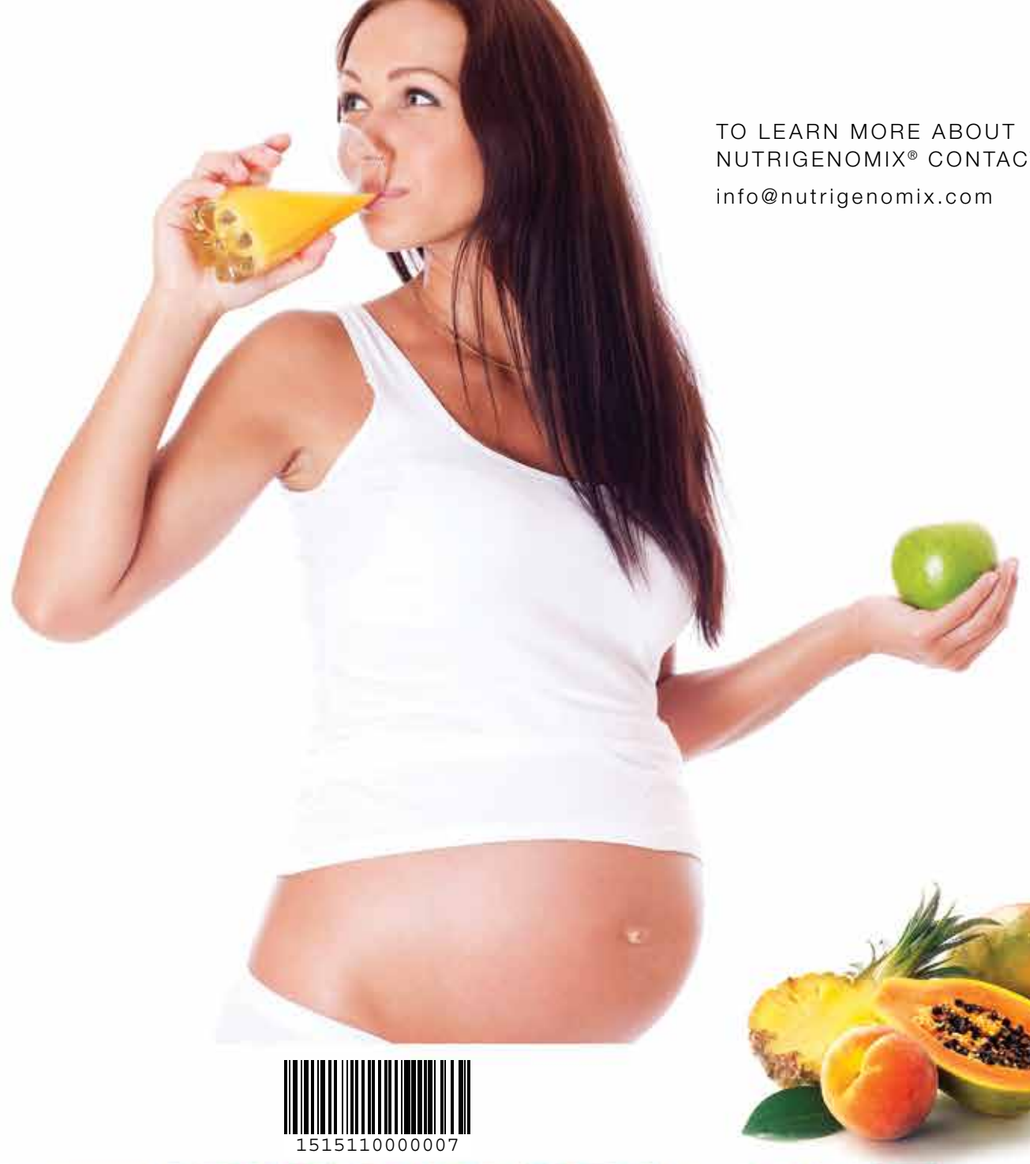

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NUTRIGENOMIX®

PERSONALIZED NUTRITION FOR FERTILITY REPORT

Hello Caroline:

Nutrigenomix is pleased to provide you with your Personalized Nutrition for Fertility Report, based on your individual genetic profile. Your recommendations are based on 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 nutrition recommendations related to fertility, through nutrient metabolism and requirements, cardiometabolic health, weight management, body composition, food intolerances, eating habits, and fitness performance. Based on these results, we have developed a series of nutrition and fitness recommendations that are aligned with your genetic profile and gathered additional genetic insights for you and your healthcare provider to consider. As new discoveries in the field of nutrigenomics are made, you will have the opportunity to access this information to further fine-tune your personalized nutrition and fitness plan.

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

Ahmed El-Sohemy, PhD
Chief Scientific Officer

The Science Behind Nutrigenomix

One man's food is another man's poison – Lucretius

Nearly 50 million couples worldwide experience infertility. Although the causes of infertility are often complicated and difficult to identify, health and lifestyle factors affect the ability of both men and women to reproduce. In women, older age, inability to produce ova (mature oocytes), and presence of endometriosis or polycystic ovarian syndrome (PCOS) can play a large role in infertility. Among men, sperm count and quality are variable and play an important role in successful fertilization. For both sexes, factors known to affect fertility include the viability of gametes (in women, oocytes, and in men, sperm), hormonal imbalances, presence of sexually transmitted infections (STI's), substance use, over- or under-weight, and past or present chronic disease. Clearly, many contributing factors must align for healthy fertilization and pregnancy to occur. One of these factors is nutrition. There is mounting evidence to support the relationship between various dietary components and fertility, but the effects of nutritional interventions on fertility remain unclear because of variations in response to those interventions across individuals.

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 each person unique. Genetic variation determines not only the color of our eyes and hair, but how we metabolize and utilize the foods, beverages and dietary supplements we consume. The science of nutrigenomics applies genomic information and advanced technologies to uncover the relationship between genes, nutrition and health. The term nutrigenomics refers to both the study of how the food, beverages and supplements we consume affect our genes, and how our genes can influence our body's response to what we ingest. This response can affect virtually all bodily functions, including reproduction.

Different versions of a gene can cause us to respond differently to certain components in foods such as the lactose in milk, the gluten in bread, the caffeine in coffee. We may also respond differently to carbohydrates, fats, proteins, vitamins and minerals as well as certain dietary patterns based on our genetic make-up. We may be familiar with people who are lactose intolerant or cannot eat gluten. These dietary sensitivities that differ between individuals can usually 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. The optimal diet for you 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 nutrigenomics enables us to use nutrition to its fullest potential to improve health and optimize fertility. 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 fertility potential. By tailoring one's nutritional needs to their genetic profile, the benefits of nutrition on reproductive outcomes can be maximized.

Table of Contents

Summary of Results

Nutrient Metabolism

Dietary Component	Gene, rs Number	Risk Variant	Your Variant	Your Risk	Recommendations
Vitamin A	BCMO1, rs11645428	GG	GG	Elevated	Focus on consuming preformed sources of vitamin A to meet the RDA. Do not exceed 3000 mcg RAE per day.
Vitamin B_{12}	FUT2, rs601338	GG or GA	GA	Elevated	Focus on consuming bioavailable sources of vitamin B12.
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. If you are pregnant, consume a 400 mcg folic acid supplement 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. If you are pregnant, consume a 16-20 mg iron supplement each day.
	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	Limit dairy intake if you experience gastrointestinal symptoms.
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 consumption to 100 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 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 150 min/week of cardio and at least 2 days/week of muscle-strengthening activities.
	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

People with Risk Variant

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. Consuming foods that are higher in preformed active vitamin A can help you to meet your needs more easily. These foods include fish, liver, eggs, and dairy products. Meeting your recommendations for vitamin A will help to support the production and health of oocytes and sperm. It will also act as an antioxidant when consumed in the form of beta-carotene (plant-sources). Women who are not pregnant should aim for 700 mcg RAE/day, pregnant women 770 mcg RAE/day, and men 900 mcg RAE/day. Both women and men should consume less than 3,000 mcg RAE/day.

Focus on consuming preformed sources of vitamin A to meet the RDA. Do not exceed 3000 mcg RAE per day.

Vitamin A (Beta-Carotene)

Vitamin A is a fat-soluble vitamin important for healthy reproduction and immune function. Beta-carotene is a precursor of active vitamin A (retinol) and is an antioxidant found in certain fruits and vegetables that are orange in color. Beta-carotene can be converted to preformed vitamin A (retinol) in the body to exert its biological functions. Preformed vitamin A, or retinol, can be found in animal sources such as fish, eggs and cheese. In men, vitamin A is essential for sperm development, or spermatogenesis, and due to its role in immune function, it preserves sperm quality. For women, sufficient consumption of vitamin A is important in egg (oocyte) maturation and embryonic development, and it may reduce time to conception.* However, once pregnant, high levels of vitamin A can be harmful to a developing fetus, especially during the time just after conception. It is especially important for pregnant women to ensure vitamin A intake does not exceed the tolerable upper intake level (UL) of 3,000 mcg RAE per day. 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 reproductive and immune functions.

*Ruder E, Hartman T, Reindollar R, Goldman M. Female dietary antioxidant intake and time to pregnancy among couples treated for unexplained infertility. Fertility and Sterility. 2014;101(3):759-766.
**Lietz G et al. Single nucleotide polymorphisms upstream from the b-carotene 15,15'-monoxygenase gene influence provitamin A conversion efficiency in female volunteers. Journal of Nutrition. 2012;142:161S-5S.

BCMO1

Beta-carotene mono-oxygenase 1 (BCMO1) is an enzyme that plays a key 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, particularly preformed vitamin A.

Sources of Vitamin A

	High in Preformed 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
Goat cheese, hard (50g)	✓	240
Eggs (2 large)	✓	220
Mackerel (75g)	✓	190

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 DNA and RNA synthesis, and works together with folate to reduce levels of homocysteine in the blood. High levels of circulating homocysteine have been linked to reduced sperm motility and abnormal sperm morphology in men, and endometriosis and reduced follicle quality in women.* Vitamin B_{12} also keeps red blood cells healthy and helps to prevent megaloblastic anemia, which can negatively affect pregnancy. Research shows that some individuals are at a greater risk than others for vitamin B_{12} deficiency, based on the FUT2 gene.** Since animal products are the only sources of vitamin B_{12}, individuals following a vegetarian or vegan diet are at an even greater risk of vitamin B_{12} deficiency.

*Ebisch IMW et al. Homocysteine, glutathione and related thiols affect fertility parameters in the (sub)fertile couple. Hum. Reprod. (2006) 21 (7): 1725-1733.
**Hazra A et al. Common variants of FUT2 are associated with plasma vitamin B12 levels. Nature Genetics. 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 vegetarian 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}

	Amount (mcg)
Clams, boiled or steamed (5 large)	59.0
Oysters, boiled or steamed (6 medium)	14.7
Atlantic herring (75g)	14.0
Fortified nutritional yeast (1 Tbsp)	3.9
Ground beef, lean (75g)	2.2
Fortified plant-based beverage (1 cup)	2.2
Atlantic salmon (75g)	2.1
Lamb (75g)	1.7
Soy 'burger' patty (1)	1.7
Eggs, hard boiled (2)	1.1

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

4in5

People with Risk Variant

Your Results

Gene	Marker
FUT2	rs601338

Risk Variant	Your Variant
GG or GA	GA

Your Risk

Elevated

only when vitamin B12 intake is low

Recommendation

Since you possess the GG or GA variant of the FUT2 gene, you have an elevated risk for vitamin B12 deficiency. It is important for you to meet the RDA for vitamin B12 of 2.4 mcg daily (for pregnant women, 2.6 mcg daily), to maintain healthy homocysteine levels and promote adequate gamete development and red blood cell production. You should focus on eating foods with a high bioavailability of vitamin B12 (foods with a form of vitamin B12 that your body uses more effectively). Meat and fish products have a higher bioavailability than eggs or foods fortified with vitamin B12. Foods fortified with B12 include soy products, vegetarian meat alternatives, or fortified plant-based milk alternatives, such as soy or almond. If you follow a vegetarian or vegan diet, you are at an even greater risk for vitamin B12 deficiency and, depending on your food choices, a supplement may be warranted.

Focus on consuming bioavailable sources of vitamin B12.

1in5

People with Risk Variant

Your Results

Gene	Marker
GSTT1	Ins or Del

Risk Variant	Your Variant
Del	Ins

Your Risk

Typical

Recommendation

Since you possess the Ins variant of GSTT1, there is no 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 who are not pregnant (85 mg per day for pregnant 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. Vitamin C can also be taken in supplement form and is found in most multivitamins and prenatal vitamins. However, consuming vitamin C from natural food sources is preferable.

Meet the RDA for vitamin C daily.

Vitamin C

Vitamin C is a powerful antioxidant. Antioxidants play a key role in reproduction. Both sperm and oocytes are vulnerable to oxidative stress. Therefore, gonads require antioxidants for optimal fertility. In fact, as much as 10 times the amount of vitamin C is present in semen and follicular fluid as in the remainder of the body.* In women, higher intake of vitamin C may reduce time to establish pregnancy.** Vitamin C also aids in the absorption of non-heme (plant) iron and supports immune function, both of which are required for healthy reproductive function. Research has shown that the amount of vitamin C absorbed into the blood can differ between people, even when the same quantity is consumed. Some people do not process vitamin C from the diet as efficiently as others, and they 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.***

* Agarwal A et al. The role of antioxidant therapy in the treatment of male infertility. Human Fertility. 2010;13(4):217-225.
**Ruder E, Hartman T, Reindollar R, Goldman M. Female dietary antioxidant intake and time to pregnancy among couples treated for unexplained infertility. Fertility and Sterility. 2014;101(3):759-766.
***Cahill LE et al. Functional genetic variants of glutathione S-transferase protect against serum ascorbic acid deficiency.
American Journal of Clinical Nutrition. 2009;90:1411-7.
Horska A et al. Vitamin C levels in blood are influenced by polymorphisms in glutathione S-transferases.
European Journal of Nutrition. 2011;50:437-46.

GSTT1

The GSTT1 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)
Red pepper (1 pepper)	216
Strawberries (1 cup)	96
Pineapple (1 cup)	92
Brussels sprouts (1 cup)	90
Orange juice (1 cup)	86
Broccoli (1 cup)	82
Grapefruit (1 fruit)	78
Mango (1 fruit)	75
Kiwi (1 fruit)	70

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

Vitamin D

Vitamin D can be synthesized by the skin from UV light or it can be obtained from the diet, and it plays an important role in fertility and reproduction. Vitamin D is essential for calcium metabolism and promotes calcium absorption in the gut, which is required for fertilization as described in the Calcium section of this report. Higher levels of vitamin D been linked to higher in vitro fertilization (IVF) success rates and contribute to a healthy immune system and reduced risk for endometriosis, both of which impact embryo implantation in the endometrium. Vitamin D deficiency has been linked to higher risk of spontaneous abortion during the first trimester.* In men, vitamin D promotes sperm motility and viability.** Low blood levels of vitamin D can negatively impact immune function and, in turn, fertility. 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 Variation in CYP2R1 and GC Genes Associated With Vitamin D Deficiency Status. Journal of Pharmacy Practice. 2015:1-6.
Hou W, Yan X, Bai C, Zhang X, Hui L, Yu X. Decreased serum vitamin D levels in early spontaneous pregnancy loss. European Journal of Clinical Nutrition. 2016;70(9):1004-1008.
**Blomberg Jensen M et al. Vitamin D is positively associated with sperm motility and increases intracellular calcium in human spermatozoa. Human Reproduction. 2011;26(6):1307-1317.
***Wang TJ et al. Common genetic determinants of vitamin D insufficiency: a genome-wide association study. Lancet. 2010;376(9736):180-88.

CYP2R1 & GC

Vitamin D 25-hydroxylase is the key enzyme that activates vitamin D from its preformed 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, including the endometrium and testes. 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)
Sockeye salmon (75g)	680
Whitefish (75g)	448
Sardines, canned in oil (1/2 can)	254
Rainbow trout (75g)	192
Smoked salmon (40g)	168
Halibut (75g)	144
Fortified plant-based beverage (1 cup)	124
Arctic char (75g)	112
Milk (1 cup)	104
Orange juice, fortified with vitamin D (1/2 cup)	50

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

6in7

People with Risk Variant(s)

Your Results

Genes	Markers
CYP2R1 GC	rs10741657 rs2282679

Risk Variant	Your Variants
Algorithm	GA GG

Your Risk

Elevated

only when vitamin D intake is low

Recommendation

Since you possess 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 likelihood of conceiving by enhancing calcium absorption and metabolism, immune function, and sperm or oocyte viability. 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

People with Risk Variant

Your Results

Gene	Marker
COMT	rs4680

Risk Variant	Your Variant
GG	GA

Your Risk

Typical

Recommendation

Since you possess the AA or GA variant of the COMT gene, current 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.

Vitamin E

Vitamin E is a fat-soluble antioxidant essential in protecting sperm and oocytes from oxidative stress. Antioxidant availability in gonads may predict the length of an individual's fertility span, the viability of sperm and oocytes, and the potential for healthy fertilization and embryo implantation to occur. Most vegetable oils, such as sunflower, canola and flaxseed oil, are good 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.*

*Hall KT et al. COMT and Alpha-Tocopherol Effects in Cancer Prevention: Gene-Supplement Interactions in Two Randomized Clinical Trials. J Natl Cancer Inst. 2019 doi: 10.1093/jnci/djy204

COMT

The COMT gene produces an enzyme called catechol-O-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 cancer risk following vitamin E supplementation.

Sources of Vitamin E

	Amount (mg)
Almonds (1/4 cup)	9.3
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
Halibut (75g)	2.2
Eggs (2 large)	1.0

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

Folate

Folate is a water-soluble B vitamin necessary for cell growth and development, which are essential for embryonic development. Although folate helps prevent neural tube defects (NTD) in the developing fetus, it is also needed for maintenance of healthy homocysteine levels. High homocysteine in both males and females is associated with reduced fertility. Adequate folate enhances sperm's fertilizing capability, and thus promotes the development of higher quality embryos.* The amount of folate absorbed into the blood can differ between individuals, even when the same quantity is consumed. Some people do not utilize dietary folate as efficiently as others, and they are consequently may be at a greater risk for folate deficiency. Research** shows that an individual's ability to process dietary folate efficiently depends on a gene called MTHFR. Health Canada recommends all women of child-bearing age take a daily multivitamin containing 400 mcg of folic acid. Consult with your healthcare practitioner to help you choose an appropriate multivitamin for you.

*Solis C et al. Folate Intake at RDA Levels Is Inadequate for Mexican American Men with the Methylenetetrahydrofolate Reductase 677TT Genotype. Journal of Nutrition. 2008;138(1):67-72.
Boxmeer JC et al. IVF outcomes are associated with biomarkers of the homocysteine pathway in monofollicular fluid. Hum Reprod. 2009 May; 24(5):1059-66.
**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(5):1272-80.

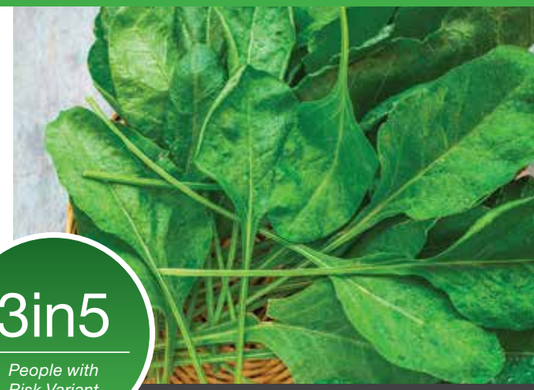
MTHFR

The MTHFR gene produces methylenetetrahydrofolate reductase (MTHFR), which is a vital enzyme for folate metabolism. 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, often to help metabolize and reduce levels of homocysteine. Variations in the MTHFR gene determine the way individuals can utilize dietary folate. Individuals with 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

People with Risk Variant

Your Results

Gene	Marker
MTHFR	rs1801133

Risk Variant	Your Variant
CT or TT	TT

Your Risk

Elevated

only when folate intake is low

Recommendation

Since you possess the TT or CT variant of the MTHFR gene, you have a greater risk of folate deficiency if you do not meet the RDA on a daily basis. Ensure that folate intake is at least 400 mcg per day (600 mcg per day for pregnant women) to reduce the risk of deficiency and neural tube defects in the developing fetus (for women). Health Canada also recommends all women of child-bearing age take a daily multivitamin containing 400 mcg of folic acid, which is the synthetic form of folate used in supplements. Foods rich in folate include lentils, romano beans, black beans, white beans, okra, asparagus, spinach, and other leafy greens. Enriched and fortified products, such as ready-to-eat cereals and bread products, are also good sources of folic acid.

Meet the RDA for folate daily. If you are pregnant, consume a 400 mcg folic acid supplement daily.

3in5

People with Risk Variant(s)

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

Since you possess one or more of the risk variants you 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. Pregnant women require 450 mg/day. Do not exceed the tolerable upper limit (UL) of 3.5 g/day. Foods rich in choline include meat, poultry, dairy products and eggs, as well as 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 involved in 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 throughout the body, providing a vital structural component to cell membranes as they grow and develop. Choline can also impact early brain development in the fetus and regulate gene expression (the process by which the sequence of DNA in a gene is synthesized into its protein form). Although some choline is produced by our own bodies, dietary sources of choline are necessary to meet our 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 shows that variation in the MTHFD1 and PEMT genes also impact dietary choline needs.*

*Ganz AB, Shields K, Fomin VG, Lopez YS, Mohan S, Lovesky J, et al. Genetic impairments in folate enzymes 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 important for embryonic development. Individuals who have the AA or AG version of the MTHFD1 gene are at higher risk of developing clinical signs of choline deficiency when choline intakes are 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 important for individuals with the risk variants of these genes, especially during pregnancy.

Sources of Choline

	Amount (mg)
Egg (1)	147
Soybeans (1/2 cup)	107
Chicken breast (85g)	72
Ground beef (85g)	72
Atlantic cod (85g)	71
Shiitake mushrooms, cooked (1/2 cup)	58
Baked potato (1 large)	57
Wheat germ (2 Tbsp)	51
Kidney beans (1/2 cup)	45

Source: National Institutes of Health

Calcium

Calcium plays a key role in bone metabolism, which is linked to reproductive physiology in men.* In women, calcium is crucial for the development of the fetal skeleton during pregnancy. In addition, calcium is involved in synthesizing estrogen, a key reproductive hormone in women, and maintaining adequate estrogen levels in the blood, which are associated with reduced risk for endometriosis. To absorb calcium, we need an adequate vitamin D status. Refer to the Vitamin D section for your specific recommendations. Research shows that some people do not utilize dietary calcium as efficiently as others, and this may depend on variations in the GC gene.**

*Karsenty, G. and Oury, F. Regulation of male fertility by the bone-derived hormone osteocalcin. Molecular and Cellular Endocrinology, 2014;382(1):521-526.
**Fang Y et al. Vitamin D binding protein genotype and osteoporosis. Calcif Tissue Int. 2009;85:85-93.

GC

The GC gene encodes the vitamin D-binding protein, which transports vitamin D throughout the body. Since vitamin D is needed for the absorption of calcium, this binding protein can impact calcium levels in the body and, therefore, may be linked to fertility. Research shows that two variations in the GC gene are associated with increased risk of poor bone health, which can impact reproductive potential, when calcium intake is low.

Sources of Calcium

	Amount (mg)
Low-fat cheddar cheese (50g)	450
Yogurt, plain (3/4 cup)	330
Skim milk (1 cup)	325
Fortified soy or rice beverage (1 cup)	320
Tofu, firm (150g)	235
Canned salmon, with bones (75g)	210
Sardines, canned in oil (1/2 can)	200
Kefir, plain (3/4 cup)	185
Edamame (soybeans) (1/2 cup)	130
Spinach, boiled (1/2 cup)	130

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

4in5

People with Risk Variant(s)

Your Results

Gene	Markers
GC	rs7041 rs4588

Risk Variant	Your Variants
Algorithm	TG CA

Your Risk

Elevated

only when calcium intake is low

Recommendation

Based on your GC gene variant, you have an increased risk for poor bone health if your intake is below 1200 mg per day. Meeting these recommendations will bring your elevated risk down to typical, and help support fertility. Adults 19-50 years old should not exceed 2500 mg calcium per day. Aim to meet your recommended daily intake of calcium through dietary sources.

Consume 1200 mg of calcium daily.

1in150

People with Risk Variant(s)

Your Results

Genes	Markers
SLC17A1 HFE HFE	rs17342717 rs1800562 rs1799945

Risk Variants	Your Variants
Algorithm	CC GG CC

Your Risk

Low

Recommendation

Since you do not possess any risk variants for iron overload, you have a low risk for iron overload. Follow the recommendations given in the next section for Low Iron Status. Aim to consume the RDA for iron, which is 8 mg/day for men and 18 mg/day for non-pregnant women who are 19-50 years old. Pregnant women are advised to consume an iron supplement containing 16-20 mg each day in addition to iron-rich foods to achieve an RDA of 27 mg/day, either alone or as part of a prenatal (multi) vitamin.

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 result in iron toxicity to the anterior pituitary. This condition is associated with decreased production of key reproductive hormones, which can impair sperm and oocyte generation. Iron overload can also damage reproductive tissues directly and affect their normal function. High circulating iron can also contribute to oxidative stress in the body, which damages sperm in men and promotes follicular aging in women.*
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 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. Hereditary hemochromatosis is an iron overload condition linked to variations in the HFE or SLC17A1 genes.** It is important for both women and men to follow the appropriate RDA for iron, but consume less than the tolerable upper intake level (UL), which is 45 mg/day.*

*Singer S et al. Reproductive capacity in iron overloaded women with thalassemia major. Blood. 2011;118(10):2878-2881.
**Allen KJ et al. Iron-overload-related disease in HFE hereditary hemochromatosis. New England Journal 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 human hemochromatosis 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.

Sources of Iron

Sources of Heme Iron	Sources of Non-Heme Iron
Beef	Almonds
Chicken	Chickpeas
Fish	Parsley
Organ meats	Spinach
Shrimp	Tofu
Veal	White beans

Low Iron Status

Iron is an essential mineral and required for embryonic development. Low iron stores in women are associated with a reduced ability to conceive. In men, iron is an important component of semen that supports healthy sperm function. During pregnancy, iron is essential to support placental and fetal brain development, as well as establish iron stores for the baby’s first six months of life. Low iron stores can lead to anemia, which is associated with fatigue, pale skin, weakness, shortness of breath and dizziness. During pregnancy, low iron stores can lead to increased risk of complications. 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 in the TFR2 gene implicated in the physiological regulation of serum iron levels. Human Molecular Genetics. 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

The TMPRSS6 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 in these genes can impact the risk of low iron status.

Sources of Iron

	Amount (mg)
White beans, canned (1 cup)	8.0
Pumpkin seeds (2 Tbsp)	5.2
Lentils, cooked (3/4 cup)	4.1
Spinach, boiled (1/2 cup)	3.4
Tofu, firm (1/2 cup)	3.0
Tahini (2 Tbsp)	2.7
Ground beef, extra lean (100g)	2.7
Chickpeas (3/4 cup)	2.4
Almonds (1/4 cup)	1.5
Lean ground chicken (75g)	1.2

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

2in5

People with Risk Variant(s)

Your Results

Genes	Markers
TMPRSS6 TFR2 TF	rs4820268 rs7385804 rs3811647

Risk Variants	Your Variants
Algorithm	GA CA AA

Your Risk

Elevated

only when iron intake is low

Recommendation

You are at an increased risk for low iron status. To minimize your risk for low iron, meet the RDA for iron and consume food sources of vitamin C with non-heme iron-containing foods to increase iron absorption. Keep in mind that some food sources of non-heme iron, like spinach, are better consumed in cooked form to improve the bioavailability of iron. Focus on foods with a high iron bioavailability in the form of heme iron from animal products. Men aged 19 years and older should aim for 8 mg/day. Women 19-50 years old who are not pregnant should aim for 18 mg/day. Pregnant women are advised to consume an iron supplement containing 16-20 mg/day, either alone or as part of a prenatal (multi) vitamin, in addition to iron-rich foods to achieve an RDA of 27 mg/day.

Meet the RDA for iron and consume sources of vitamin C with iron-rich foods. If you are pregnant, consume a 16-20 mg iron supplement each day.

Your Results

Gene	Marker
MCM6	rs4988235

Risk Variant	Your Variant
CC or CT	CT

Your Risk

Slightly Elevated

Lactose

Lactose is a naturally occurring sugar found in dairy products. 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.

Lactose Intolerance

Individuals who are lactose intolerant cannot digest lactose. When lactose is not 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 is part of the 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 East Asians *People with Risk Variant*

9in10 African Americans *People with Risk Variant*

7in10 Caucasians *People with Risk Variant*

Nutrition Considerations with a Lactose-Free Diet

Research shows that individuals who consume a lactose-free diet are at a greater risk of inadequate calcium and vitamin D intake 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, you can still get enough calcium and vitamin D in the diet through lactose-free milk as well as fortified milk alternatives such as soy and almond beverages. Calcium and vitamin D are not added to all milk alternatives, so be sure to read the label to check that the products you are choosing have been "fortified with calcium and vitamin D."

*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.

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

Recommendation

Since you possess 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. 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 1-2 calcium- and vitamin D-fortified lactose-free milk or dairy alternatives such as soy or almond beverages daily.

Limit dairy intake if you experience gastrointestinal symptoms.

Your Results

Gene	Markers
HLA	rs2395182 rs7775228 rs2187668 rs4639334 rs7454108 rs4713586

Risk Variants	Your Variants
Algorithm	GT TT CT GG TT AA

Your Risk

Medium

Gluten

Gluten is a 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 disease represents the most severe 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.* Undiagnosed celiac disease is associated with a number of serious fertility-related complications, in addition to nutrient deficiency and gastrointestinal symptoms. Research has shown that women with unexplained infertility, miscarriages or intrauterine growth restriction are at a significantly higher risk of having celiac disease than the general population.**

*Tonutti E and Bizzaro N. Diagnosis and classification of celiac disease and gluten sensitivity. Autoimmunity Reviews. 2014;13:472-6.
**Tersigni C et al. Celiac disease and reproductive disorders: meta-analysis of epidemiologic associations and potential pathogenic mechanisms. Human Reproduction Update. 2014;20(4):582-593.

HLA

The HLA genes produce a group of proteins called the human leukocyte antigen (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.

*Mark Wolters VM and Wijmenga C. Genetic background of celiac disease and its clinical implications. American Journal of Gastroenterology. 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.

70% of People — *Low Risk*

20% of People — *Medium Risk*

10% of People — *High Risk*

Nutrition Considerations when Following a Gluten-Free Diet

Gluten-free foods include all unprocessed vegetables, fruit, dairy products, meat, fish, poultry, 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.

Sources of Gluten

Major Sources of Gluten	Hidden Sources of Gluten
Bread	Salad dressing
Pasta	Pudding
Cereal	Imitation crab meat
Crackers and chips	Vegan meat substitute
Oats*	Potato chips
Baked goods	French fries
Malt	Soup stock cubes
Soy sauce	Chocolate and candy
Gravy	Processed meat
Barley or wheat based-beer	Canned soup
Vinegars	Instant rice
Wheat - incl rye, spelt and barley	Ice cream

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

Recommendation

You have a medium risk for developing celiac disease; however, this does not mean you have celiac disease. Speak to your healthcare professional if you experience diarrhea, steatorrhea (excessive fat in your stool), 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. Gluten-free foods include all unprocessed vegetables, fruit, dairy products, meat, fish, poultry, nuts, legumes, seeds, fats and oils. Gluten-free grains include rice, quinoa, corn, buckwheat, amaranth and millet.

Medium risk for gluten intolerance.

1in5

People with Risk Variant

Your Results

Gene	Marker
ADORA2A	rs5751876

Risk Variant	Your Variant
TT	CT

Your Risk

Typical

Recommendation

Since you possess the CT or CC variant of 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.

Caffeine

Anxiety

Many commonly consumed foods and beverages, such as coffee, tea, soft drinks and 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. However, caffeine consumption can also have an impact on fertility and risk of pregnancy complications. 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 and restlessness 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 DRD2 polymorphisms and caffeine-induced anxiety. 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.

ADORA2A

The ADORA2A (adenosine A2A receptor) gene encodes one of the main receptors for adenosine. 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 chocolate also contributing to intakes. Research has shown a link between caffeine and fertility, with high coffee consumption being associated with an elevated risk of suboptimal sperm motility, delayed conception, infertility, and poor assisted reproductive therapy outcomes.* Research shows that an individual's caffeine metabolizing capability, and cardiovascular health associated with coffee consumption, depends on a variation in a gene called CYP1A2.**

*Cornelis et al. Coffee, CYP1A2 genotype, and risk of myocardial infarction. Journal of the American Medical 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.
**Minelli A, Bellezza I. Methylxanthines and reproduction. Handb Exp Pharmacol. 2011;200:349-72.
Palatini, P., Benetti, E., Mos, L., Garavelli, G., Mazzer, A., Cozzio, S., Fania, C. and Casiglia, E. (2015). Association of coffee consumption and CYP1A2 polymorphism with risk of impaired fasting glucose in hypertensive patients. European Journal of Epidemiology, 30(3), pp.209-217.

CYP1A2

The CYP1A2 gene produces an enzyme called cytochrome P450 1A2 (CYP1A2), which is the main enzyme responsible for breaking down caffeine in the body. Variations in the CYP1A2 gene affect the rate at which caffeine is broken down. Individuals who possess the AA or GA variant of CYP1A2 break down caffeine more slowly. This may influence the way that caffeine affects reproductive functions and fertility, in comparison to individuals who possess the GG variant of the CYP1A2 gene. 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
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

People with Risk Variant

Your Results

Gene	Marker
CYP1A2	rs2472300

Risk Variant	Your Variant
GA or AA	AA

Your Risk

Elevated

only when caffeine intake is high

Recommendation

Since you possess the AA or GA variant of the CYP1A2 gene, you are considered a slow metabolizer of caffeine. Therefore, excessive caffeine consumption may incur hypertension or prediabetes, which can cause complications during pregnancy. Limit caffeine intake to 100 mg/day. 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 consumption to 100 mg/day.

1in2

People with Risk Variant

Your Results

Gene	Marker
TCF7L2	rs12255372

Risk Variant	Your Variant
GT or TT	GT

Your Risk

Elevated

only when whole grain intake is low

Recommendation

Since you possess the GT or TT variant of the TCF7L2 gene, there is an increased risk of developing type 2 diabetes if your whole grain consumption is low, which may result in reduced fertility. Replacing high glycemic index carbohydrates in the diet with low glycemic index carbohydrates may help to reduce this risk. The food replacement table provides you with some ideas for products that can replace high glycemic index 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.

Whole Grains

Whole grains are a low glycemic index carbohydrate containing more fibre than refined grains. They also contain more essential micronutrients such as folate, magnesium and vitamin E. Whole grain consumption in women undergoing IVF is associated with successful pregnancy outcomes.* Research shows that whole grains may help reduce the risk of several chronic diseases, such as type 2 diabetes. Manifestations of type 2 diabetes, including insulin resistance and hyperglycemia, are associated with reduced fertility. In women, PCOS is closely linked to the development of type 2 diabetes and these conditions often coexist and greatly affect a woman's fertile potential. For men, type 2 diabetes can have endocrine effects, negatively affecting sperm development and maturation, as well as steroid generation.** Research shows that variation in the TCF7L2 gene can affect the risk of developing type 2 diabetes, and some individuals might benefit more from increasing their whole grain consumption.***

*Gaskins A, Chiu Y, Williams P, Keller M, Toth T, Hauser R et al. Maternal whole grain intake and outcomes of in vitro fertilization. Fertility and Sterility. 2016;105(6):1503-1510.e4.
**Jangir R et al. Diabetes Mellitus Induced Impairment of Male Reproductive Functions: A Review. Current Diabetes Reviews. 2014;10(3):147-157.
Livshits A et al. Fertility issues in women with diabetes. Women's Health. 2009;5(6):701-707.
***Cornelis MC et al. TCF7L2, dietary carbohydrate, and risk of type 2 diabetes in US women. American Journal of Clinical Nutrition. 2009;89:1256-62.

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, and may therefore be at risk of reduced fertility. Yet, 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 these foods..
White bread, bagels, pitas	100% whole grain bread, bagels 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 volume. However, 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. Hypertension can have a negative effect on semen quality in men.* In women, hypertension prior to and during pregnancy increases the risk of many serious complications for the developing fetus, as well as the mother herself. 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.**

*Poch E et al. Molecular basis of salt sensitivity in human hypertension: Evaluation of renin-angiotensin-aldosterone system gene polymorphisms. Hypertension. 2001;38:1204-9.
**Eisenberg M et al. Relationship between physical occupational exposures and health on semen quality: data from the Longitudinal Investigation of Fertility and the Environment (LIFE) Study. Fertility and Sterility. 2015;103(5):1271-1277.

ACE

The ACE gene directs 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
Bagel with ham, egg and cheese	1260
Canned soup (1 cup)	1130
Ham (75g)	1040
Pickle (1 medium)	830
Tomato sauce, canned (1/2 cup)	650
Feta cheese (50g)	560
Chips (1 small bag)	390
Cold cereal (1 cup)	350
Bread (1 slice)	230

Source: Canadian Nutrient File and USDA Nutrient Database

7in10

People with Risk Variant

Your Results

Gene	Marker
ACE	rs4343

Risk Variant	Your Variant
GA or AA	AA

Your Risk

Elevated

only when sodium intake is high

Recommendation

Since you possess the AA or GA variant of the ACE gene, there is an increased risk of elevated blood pressure, with its associated fertility complications, when your sodium intake is high. Limiting sodium consumption to the Adequate Intake (AI) level of 1500 mg per day should help to reduce the risk. However, if you frequently sweat heavily during exercise, causing sodium losses, your sodium requirements may be higher. The AI is 1500 mg per day in adults 19-50 years of age, 1300 mg per day in adults 51-70 and 1200 mg per day in adults 71 years of age and older. The AI of 1500 mg per day is equivalent to 3⁄4 teaspoon of salt per day, which includes sodium that is found naturally in foods as well as salt that is added during processing and preparation. Foods rich in sodium include canned soups and canned vegetables, potato chips, processed meats, soy sauce, ketchup and processed cheeses.

Limit sodium intake to the Adequate Intake level.

1in2

People with Risk Variant

Your Results

Gene	Marker
FADS1	rs174547

Risk Variant	Your Variant
CC or CT	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 associated with reduced risk of cardiovascular disease and healthier ooctyes and sperm. 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 and fertility effects. Omega-3 fats are associated with improved fertility because they improve the structural composition and morphology of sperm and oocytes, which may increase fertilization potential. 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.** Maintaining a healthy ratio of omega-3 to omega-6 fatty acids and circulating HDL concentrations are important for the production of healthy embryos and optimizing semen quality.***

*Lu Y et al. Dietary n-3 and n-6 polyunsaturated fatty acid intake interacts with FADS1 genetic variation to affect total and HDL-cholesterol concentrations in the Doetinchem Cohort Study. American Journal of Clinical Nutrition. 2010;92(1):258–65.
Dumont J et al. Dietary linoleic acid interacts with FADS1 genetic variability to modulate HDL-cholesterol and obesityrelated traits. Clinical Nutrition. 2018;37(5):1683-89.
** Hellstrand S et al. Intake levels of dietary long-chain PUFAs modify the association between genetic variation in FADS and LDL-C. Journal of Lipid Research. 2012;53(6):1183-89.
***van Montfoort AP, Plosch T, Hoek A, Tietge UJ. Impact of maternal cholesterol metabolism on ovarian follicle development and fertility. Journal of reproductive immunology. 2014;104 105:32-36. Safarinejad MR, Safarinejad S. The roles of omega-3 and omega-6 fatty acids in idiopathic male infertility. Asian J Androl. 2012;14(4):514-515.

FADS1

The FADS1 gene directs the production of an enzyme called fatty acid desaturase 1. This enzyme 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. Sufficient HDL concentrations in the blood can impact fertile potential in both men and women through supporting oocyte, sperm and embryo integrity.

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
Salmon (75g)*	0.3	0.2
Sardines (75g)*	0.2	0.1
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
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 has benefits for mental health, physical fitness, weight maintenance and the prevention of many chronic diseases. Regular physical activity within recommendations can help maintain healthy hormone levels, insulin sensitivity, and blood lipids, all of which have effects on our reproductive systems. 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 some individuals depending on their genes.* Maintaining healthy HDL concentrations is important for the development of oocytes, sperm and embryos, as it is especially prominent in the follicular fluid.**

*Grarup et al. The -250G>A promoter variant in hepatic lipase associates with elevated fasting serum high-density lipoprotein cholesterol modulated by interaction with physical activity in a study of 16,156 Danish 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.
**Wallace M, Cottell E, Gibney MJ, McAuliffe FM, Wingfield M, Brennan L. An investigation into the relationship between the metabolic profile of follicular fluid, oocyte developmental potential, and implantation outcome. Fertility and sterility. 2012;97(5):1078-1084 e1071-1078.

LIPC

The hepatic lipase gene, also known as LIPC, encodes an enzyme that plays a key role in 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	
Swimming	Race walking, jogging, running
Briskly walking (5 km/hour or faster)	Tennis
Biking	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

Gene	Marker
LIPC	rs1800588

Response Variant	Your Variant
TT or CT	CT

Your Response

Enhanced

when physical activity is high

Recommendation

Since you possess the CT or TT variant of the LIPC gene, you have an enhanced HDL cholesterol-raising response from physical activity. Engage in 150 minutes of moderate intensity exercise per week. This can be met through 30 minutes of moderate 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, and reproductive health. You should also include muscle strengthening activities at least 2 days per week.

Aim for 150 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 minutes/day of moderat cardiovascular activity in bouts of 10 minutes or more, over most 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 150 min/week of cardio and at least 2 days/week of muscle-strengthening activities.

Physical Activity

for Weight Loss

Physical activity has important benefits for mental health, physical fitness, weight maintenance and the prevention of many chronic illnesses. Cardiovascular conditioning exercises include those that elevate your heart rate for a sustained period of time, such as brisk walking, running, swimming and cycling, and improve the function of your heart, lungs and blood vessels. Skeletal muscle conditioning exercises include activities such as weight lifting or certain types of yoga, which improve muscle strength and power and improve bone health. Most forms of physical activity are beneficial; however, different baseline levels of physical activity, depending on variation in the FTO gene, are needed to achieve/maintain a healthy body weight. A healthy body weight promotes reproductive health by helping to maintain adequate concentrations of reproductive hormones, developing sperm with high fertilization potential in men, and encouraging healthy ovulation in women. 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 your metabolic response to physical activity.* 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. Low physical activity accentuates the effect of the FTO rs9939609 polymorphism on body 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

Total energy output, the amount of energy a person burns daily, is the sum of resting metabolic rate (RMR) plus energy burned during physical activity. RMR is the energy burned during essential processes such as digestion, breathing, brain function and maintaining a normal body temperature. RMR can vary substantially between individuals based on differences in muscle mass, weight, age and genetics. In general, consuming less energy and/or expending more energy can help prevent overweight and obesity, which are associated with lower reproductive potential. Indeed, research shows that individuals who experience weight loss improve reproductive prognoses.* However, individuals with a lower RMR may have greater difficulty losing weight than those with a typical RMR. Variation in the UCP1 gene has been linked to a diminished RMR.** It is important to note that appropriate weight gain throughout pregnancy is necessary to support both maternal and infant health. The amount of healthy weight to gain during gestation depends on a mother’s weight prior to pregnancy. Your healthcare provider can help you determine what this amount is, and at what rate weight gain is expected.

*Clark A et al. Weight loss in obese infertile women results in improvement in reproductive outcome for all forms of fertility treatment. Human Reproduction. 1998;13(6):1502-1505.
**Nagai N et al. UCP1 genetic polymorphism (-3826A/G) diminishes resting energy expenditure and 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 metabolic processes 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)
Pizza with pepperoni and cheese (1/2 of 12”)	660
Fish, battered, fried (1 piece)	590
Meat and vegetable pie (1 individual pie)	450
Mixed nuts, roasted (1/2 cup)	410
Carrot muffin (1 medium)	340
Avocado (1 fruit)	320
Cheeseburger (1)	320
Donut, chocolate covered (1)	270
French fries (20-25)	240
Croissant (1)	230

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

2in5

People with Response Variant

Your Results

Gene	Marker
UCP1	rs1800592

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 energy deficit of 10-20% from your current energy needs plus an additional 150 kcal.

1in5

People with Response Variant

Your Results

Gene	Marker
FTO	rs9939609

Response Variant	Your Variant
AA	AA

Your Response

Enhanced

when protein intake is high

Recommendation

Since you have the AA variant of the FTO gene, you have an enhanced 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. Protein is important for hormone synthesis and building and maintaining reproductive tissues. It also keeps you feeling full, which may help you maintain a healthy body weight and improve your reproductive potential. Aim 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 a critical factor affecting fertility, such as hormone synthesis, glycemic control, and body composition. In addition, protein is essential for cell growth and development, and these processes are crucial for embryo development. Protein has also been shown to regulate appetite, allowing you to feel more satisfied with fewer calories. This may help you prevent overweight and obesity, which are associated with lower reproductive potential. 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 FTO gene 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 protein diet.**

*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)
Chicken breast (75g)	25
Extra lean ground beef (75g)	23
Tofu, regular, extra firm (150g)	21
Salmon, baked (75g)	20
Cottage cheese (1/2 cup)	15
Lentils (3/4 cup)	14
Chickpeas (3/4 cup)	9
Skim milk (1 cup)	9
Almonds (1/4 cup)	8
Whole egg (1)	6

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 number of calories as carbohydrates or protein, making it the most energy-dense nutrient. The total amount and types of fats that you consume can affect fertility and body composition. In general, unsaturated fats are more beneficial for the production of sperm and oocytes than saturated or trans fats. In addition, genetic variation affects how individuals who are trying to lose weight respond to the amount of fat that they eat.* This may affect their risk of overweight or obesity, which are associated with lower reproductive potential.

*Grau K et al. TCF7L2 rs7903146-macronutrient interaction in obese individuals' responses to a 10-wk randomized hypoenergetic diet. American Journal of Clinical Nutrition. 2010;91:472-9.
Mattei J et al. TCF7L2 genetic variants modulate the effect of dietary fat intake on changes in body composition during a weight-loss intervention. American Journal of Clinical Nutrition. 2012;96:1129-36.

TCF7L2

The TCF7L2 gene produces a protein called transcription factor-7 like 2. This protein regulates the function of numerous genes involved in metabolism. 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 places you at an increased risk for insulin resistance when your total fat intake is high. Insulin resistance is a risk factor for type 2 diabetes and PCOS, both of which can negatively affect fertility. Consuming a low-to-moderate fat diet can help facilitate weight loss in individuals with the TT variant, which can in turn help with insulin resistance.

Sources of Fat

	Amount (g)
Bacon (75g)	32
Macadamia nuts (1/4 cup)	26
Cheddar cheese (50g)	17
Butter (1 Tbsp)	16
Olive oil (1 Tbsp)	14
Swiss cheese (50g)	14
Pistachios (1/4 cup)	14
Lean beef mince (75g)	11
Goat cheese (50g)	11
Yoghurt, 2-4% M.F. (3/4 cup)	8
Sockeye salmon (75g)	8

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

1in10

People with Response Variant

Your Results

Gene	Marker
TCF7L2	rs7903146

Response Variant	Your Variant
TT	CC

Your Response

Typical

Recommendation

Since you possess the CC or TC variant of the 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 a controlled energy diet.

Consume 20-35% of energy from fat.

1in7

People with Response Variant

Your Results

Gene	Marker
APOA2	rs5082

Response Variant	Your Variant
CC	TC

Your Response

Typical

Recommendation

Since you possess the TT or TC variant of the APOA2 gene, you have no increased risk of obesity, and associated risk of infertility, when following a diet high in saturated fat. However, you should still limit saturated fat intake to less than 10% of total energy intake, as recommended by Health Canada, in order to reduce the general risk of other associated health issues such as cardiovascular disease. Foods rich in saturated fat include coconut and palm oils, fatty meats (lamb, pork and beef), butter, cheese, fried foods and baked goods. Suitable alternatives low in saturated fat include olive and vegetable oils, lean meats, low-fat dairy products, fish, and plant protein sources such as beans, lentils, nuts/seeds or soy-based proteins such as soy beverages and tofu.

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

Saturated Fat

Certain saturated fats, such as those found in red meat and baked goods, are associated with health conditions such as diabetes, cardiovascular disease and obesity. Saturated fat consumption may also negatively affect fertility. In men, higher intakes of saturated fat are associated with lower sperm count and impaired sperm motility.* In women, the ability to produce viable oocytes for fertilization is associated with dietary intake of saturated fat.** Saturated fat intake also may affect one's risk of obesity, which is a known risk factor for infertility. Research shows that the effect of saturated fat on obesity can be influenced by variations in a gene called APOA2.***

*Jensen, TK et al. High Dietary Intake Of Saturated Fat Is Associated With Reduced Semen Quality Among 701 Young Danish Men From The General Population. American Journal of Clinical Nutrition. 2012; 97.2: 411-418.
**Shaaker M et al. Fatty Acid Composition of Human Follicular Fluid Phospholipids and Fertilization Rate in Assisted Reproductive Techniques. Iranian Biomedical Journal. 2012; 16 (3): 162-168.
***Corella D et al. APOA2, dietary fat, and body mass index: replication of a gene- diet interaction in 3 independent populations. Archives of Internal Medicine. 2009;169:1897-906.

APOA2

The APOA2 gene 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, and these different versions of the gene interact with saturated fat in unique ways to influence energy balance and, ultimately, the risk of obesity and reproductive complications. Those people who have the CC variant of the gene are at a higher risk of developing obesity when consuming a diet high in saturated fats, which may in turn disrupt reproductive function, than those possessing the TT or TC variant of the gene.

Sources of Saturated Fat

	Amount (g)
Short ribs (75g)	11
Cheddar cheese (50g)	10
Ice cream, premium (1/2 cup)	11
Butter (1 Tbsp)	8
Salami (75g)	8
Regular ground beef, cooked (75g)	7
Cheeseburger (single patty)	6
Muffin (1 small)	5
French fries (20-25)	5
Homogenized milk (1 cup)	5

Source: Canadian Nutrient File and USDA Nutrient Database

Saturated and Unsaturated Fats

There are two main types of dietary fats: saturated and unsaturated. Saturated fats are primarily found in animal-derived foods such as fatty meats, cheese, butter and other whole milk dairy as well as prepared foods such as pizza, baked goods, and many desserts. A diet high in saturated fat is associated with health conditions such as diabetes and obesity as well as fertility complications. Unsaturated fats, such as those found in olive oil, almonds and grape seed oil, may help to decrease the risk of diabetes and obesity, which are associated with a greater risk of infertility. Current research shows that variation in the FTO gene can impact the response to saturated and unsaturated fat. 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, which is associated with infertility.*

*Phillips CM et al. High dietary saturated fat intake accentuates obesity risk associated with the fat mass and obesity-associated gene in adults. Journal of Nutrition. 2012;142:824-31.

FTO

The FTO gene 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, which is associated with infertility.*

*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	Amount (g)
Macadamia nuts (1/4 cup)	20
Almond butter (2 Tbsp)	12
Olive oil (1 Tbsp)	10
Canola oil (1 Tbsp)	8
Peanut butter (2 Tbsp)	8
Polyunsaturated Fat	**Amount (g)**
Flaxseed oil (1 Tbsp)	10
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

Gene	Marker
FTO	rs9939609

Response Variant	Your Variant
TA or AA	AA

Your Response

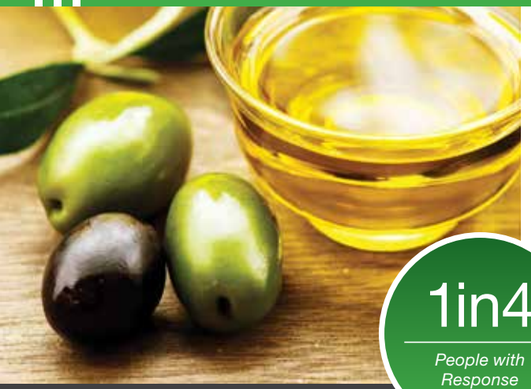
Enhanced

when saturated fat intake is low and polyunsaturated fat intake is high

Recommendation

Since you have the TA or AA variant of 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 which are important for adequate levels of hormones and healthy reproductive tissues.

Limit intake of saturated fat to no more than 10% of energy. Consume at least 5% of energy from polyunsaturated fat.



1in4

People with Response Variant

Your Results

Gene	Marker
PPARγ2	rs1801282

Response Variant	Your Variant
GG or GC	CC

Your Response

Typical

Recommendation

Since you possess the CC variant of the PPARγ2 gene, consuming more monounsaturated fats may not affect your ability to lose weight and lower your body fat. However, because of the important role of fats in reproductive and overall 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

Monounsaturated fats such as olive oil, almonds and avocados have been associated with reduced risk for infertility. Research shows that replacing just 2% of daily energy intake from trans fat with monounsaturated fat was associated with a substantially reduced risk of infertility.* Monounsaturated fats can help reduce “bad” (LDL) cholesterol levels and may also help increase “good” (HDL) cholesterol. Evidence indicates that these fats can help facilitate weight loss and lower body fat composition in some individuals based on their PPARγ2 gene.** Maintaining a healthy body weight contributes to the health of the reproductive system and may improve fertility.

*Chavarro JE et al. Dietary fatty acid intakes and the risk of ovulatory infertility. Am J Clin Nutr. 2007; 85(1): 231-237
**Garaulet M et al. PPARγ Pro12Ala interacts with fat intake for obesity and weight loss in a behavioural treatment based on the Mediterranean diet. Molecular Nutrition and Food Research. 2011;55:1771-9.

PPARγ2

The PPARγ2 gene is involved in the formation of fat cells. Because of its involvement in the development of fatty tissue, PPARγ2 can impact weight management and body composition, and may therefore affect reproductive function. 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 (1/4 cup)	20
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 is largely determined by our taste perception and preferences for certain foods and beverages. The way that we perceive the taste of fatty foods is particularly important because our intake of fats can affect body composition, which can impact reproductive health. Fat is needed to produce sperm, oocytes, and reproductive hormones. It is also required to absorb certain vitamins including vitamins A, D, E, and K, all of which are essential to a healthy reproductive system. Fat 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, Sollai G, Muroni P, Crnjar R, Barbarossa IT. Associations between orosensory perception of oleic acid, the common single nucleotide polymorphisms (rs1761667 and rs1527483) in the CD36 gene, 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

	High in Healthy (Unsaturated) Fat	Amount (g)
Cheddar cheese (50g)		17
Avocado (1/2 fruit)	✓	15
Olive oil (1 Tbsp)	✓	14
Butter (1 Tbsp)		12
Chips (20-25)		12
Hamburger (1)		12
Croissant (1)		12
Salmon (75g)	✓	9
Ice cream (1/2 cup)		8
Homogenized milk (1 cup)		8

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

7in10

People with Response Variant

Your Results

Gene	Marker
CD36	rs1761667

Response Variant	Your Variant
GG or GA	AA

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 than those who are ‘super tasters.’ In comparison, ‘super tasters’ are better able to detect the taste of fats at lower levels. Consuming too much fat, as well as too much saturated and trans fat, can lead to overweight and obesity, which can have negative effects on fertility. 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

People with Risk Variant

Your Results

Gene	Marker
GLUT2	rs5400

Risk Variant	Your Variant
CT or TT	CT

Your Risk

Elevated

Recommendation

Since you possess the CT or TT variant of the GLUT2 gene, you are at an increased risk of over-consuming sugar. This means you may be more likely to enjoy sweet foods and beverages. Be mindful of this craving and aim to keep your intake of added sugar (sugar that is not naturally occurring in food, unlike that found naturally in sources such as intact fruit) below 5-10% of your total daily energy intake. A high intake of added sugar is linked to overweight and obesity, PCOS, and reduced semen quality.

You have a high preference for sugar.

Sugar Preference

Sugar intake is partly determined by our sweet taste preference and cravings for certain foods and beverages. There is considerable variability in individuals' preferences and cravings for sweet foods and beverages. Many factors may impact your preference for sugary foods, including the age when you were first introduced to sweets and psychological associations between consuming these foods and certain life experiences or emotions. In the brain, there are even 'pleasure-generating' signals given off in response to eating or drinking something sweet. Research shows that your intake of sweet foods can also be determined by a genetic variant that regulates blood glucose levels in your body. Excessive sugar consumption may lead to insulin resistance and type 2 diabetes, and it is associated with reduced fertility.*

*Chiu YH. Sugar-sweetened beverage intake in relation to semen quality and reproductive hormone levels in young men. Hum Reprod. 2014 Jul;29(7):1575-84.

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.*

*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.

Sources of High Sugar Foods

	Amount (g)
Iced cappuccino (2 cups)	56
Cola (1 can)	36
Citrus juice, frozen, diluted (1 cup)	32
Caramels (40g)	26
Milk chocolate (50g)	26
Maple syrup (2 Tbsp)	24
Jellybeans (10 beans)	20
Caramel-coated popcorn (1 cup)	20
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 if snacks are healthful and the extra calories are not in excess of those needed to maintain a healthy weight, which is an important factor for reproductive health. Healthy snacks can assist with regulating blood sugar levels and weight control, curbing food cravings and boosting 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. Research suggests that variations in the MC4R gene are associated with the likelihood of eating between meals, driven by the desire to eat more or less frequently depending on your genotype.*

*Stutzmann F et al. Common genetic variation near MC4R is associated with eating behaviour patterns in European populations. Int J Obes. 2009;33:373-378.

MC4R

The MC4R gene codes for the melanocortin 4 receptor, which is found in the hypothalamus 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..
Chips	Whole wheat pita with hummus
Muffin	Whole wheat English muffin with peanut butter
Ice cream with toppings	Low-fat yogurt with fresh berries
Trail mix with added oils or sweets	Fibre-rich cereal with milk/alternative
'Veggie' chips	Fresh vegetables with low-fat dip
Pasta salad	Mixed salad topped with chickpeas
Nachos and cheese dip	Whole wheat crackers with low-fat cheese
Potato chips	Natural popcorn
Pizza slice	Half a turkey sandwich with veggies

2in5

People with Risk Variant

Your Results

Gene	Marker
MC4R	rs17782313

Risk Variant	Your Variant
CC or CT	TT

Your Risk

Typical

Recommendation

Since you possess the TT variant of the MC4R gene, you have a typical risk for eating between meals. To prevent consuming too many calories, 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 wholesome snacks that are not excessive in calories.

Your tendency to eat between meals is typical.

1in3

People with Response Variant

Your Results

Gene	Marker
BDNF	rs6265

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

Your attitude toward exercise and the effect it has on your mood can greatly 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 on one's fertility, including improved body fat levels, blood sugars, blood pressure, and blood lipid profiles. These improvements can influence hormone levels, reproductive tissue function, and ability to conceive. Individuals who engage in regular physical activity have been shown to be more fertile than those who are sedentary.**

*Bryan A et al. A transdisciplinary model integrating genetic, physiological, and psychological correlates of voluntary 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.
**McKinnon C et al. Body mass index, physical activity and fecundability in a North American preconception cohort study. Fertility and Sterility. 2016;106(2):451-459.
Gaskins A et al. Physical activity and television watching in relation to semen quality in young men. British Journal of Sports Medicine. 2013;49(4):265-270.

BDNF

The brain-derived neurotrophic 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 physical activity can improve fertility by regulating blood sugars, improving body composition, and modulating hormone levels in the blood.* Research shows that genetic differences influence the likelihood of engaging in physical activity. The CYP19A1 and LEPR genes have been identified as key contributors to one's probability of participating in physical activity.**

*McKinnon C et al. Body mass index, physical activity and fecundability in a North American preconception cohort study. Fertility and Sterility. 2016;106(2):451-459.
**De Moor MH et al. Genome-wide association study of exercise behavior in Dutch and American adults. Med Sci Sports Exerc. 2009;41:1887-95.

CYP19A1 & LEPR

The CYP19A1 gene helps to make the enzyme aromatase, which is involved in 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

Based on your LEPR and CYP19A1 variants, 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 of the 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 and supporting a healthy body composition. 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

Strengthening activities, as the name implies, are activities that strengthen your 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.* Being physically active has a multitude of benefits on one's fertility, including improved body fat levels, blood sugars, blood pressure, and blood lipid profiles. These improvements can influence hormone levels, reproductive tissue function, and ability to conceive. Individuals who engage in regular physical activity have been shown to be more fertile than those who are sedentary.**

*Ma F et al. The association of sport performance with ACE and ACTN3 genetic polymorphisms: a systematic review and meta-analysis. PLoS One. 2013;8:e54685.
**McKinnon C et al. Body mass index, physical activity and fecundability in a North American preconception cohort study. Fertility and Sterility. 2016;106(2):451-459

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.* Being physically active has a multitude of benefits on one's fertility, including improved body fat levels, blood sugars, blood pressure, and blood lipid profiles. These improvements can influence hormone levels, reproductive tissue function, and ability to conceive. Individuals who engage in regular physical activity have been shown to be more fertile than those who are sedentary.**

*Ahmetov I et al. Genome-wide association study identifies three novel genetic markers associated with elite 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.
**McKinnon C et al. Body mass index, physical activity and fecundability in a North American preconception cohort study. Fertility and Sterility. 2016;106(2):451-459.

NFIA-AS2, ADRB3, NRF2, GSTP1 & PGC1a

NFIA-AS2, ADRB3, NRF2, GSTP1 and PGC1a 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 endurance potential is typical. You may need to increase your training to a greater extent than an individual with a genetic advantage to achieve the same level of cardiovascular fitness. Aim to get at least 150 minutes of moderate-intensity exercise per week. This can be met through 30 minutes of moderate-intensity aerobic exercise five days per week, such as brisk walking or moderate intensity cycling.

Your endurance potential is typical.

7in10

People with Risk Variant

Your Results

Gene	Marker
ACTN3	rs1815739

Risk Variant	Your Variant
TC or TT	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

Delayed onset muscle soreness (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 a key role in 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.**

*Del Coso et al. ACTN3 genotype influences exercise-induced muscle damage during a marathon competition. European Journal of 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. COMT val[sup158]met genotype affects μ-Opioid Neurotransmitter Responses to a Pain 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

The Catechol-O-methyltransferase (COMT) gene is involved in pathways in the body that process 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

People with Response Variant

Your Results

Gene	Marker
COMT	rs4680

Response Variant	Your Variant
GG or GA	GA

Your Response

Enhanced

Implications

Since you possess 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 injury.

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

4in5

People with Risk Variant

Your Results

Gene	Marker
WNT16	rs2707466

Risk Variant	Your Variant
CC or TC	TC

Your Risk

Elevated

Implications

Since you possess the CC or TC variant of the WNT16 gene, you have an elevated risk 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 et al. WNT16 influences bone mineral density, cortical bone thickness, bone strength, and osteoporotic 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

Your Achilles tendon is one of the largest and strongest tendons in 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. Variants within the COL5A1 gene are associated with Achilles tendinopathy in two populations. Brit J Sport Med. 2009;43:357–365.

COL5A1

The COL5A1 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

People with Risk Variant

Your Results

Gene	Marker
COL5A1	rs12722

Risk Variant	Your Variant
CT or TT	CC

Your Risk

Typical

Implications

Since you 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 activities requiring a surge of energy or overextension of this tendon through certain exercises such as 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

The table below includes genetic markers that provide additional insights for health and wellness. These insights come from research studies on genetic variation and its association with 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, rs11144134	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, rs4244372	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, rs1800795	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, rs1051168	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, rs671	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, rs3025058	MMP1 and MMP3 are involved in tissue remodeling	Algorithm	GG DelA	Elevated	You have an elevated risk of having a rotator cuff injury.

International Science Advisory Board

Ahmed El-Sohemy, PhD

Dr. Ahmed El-Sohemy is a Professor and Associate Chair and held a Canada Research Chair in Nutrigenomics at the University of Toronto. He is also the founder of Nutrigenomix Inc., serves as the company's Chief Science Officer and is Chair of the company's International Science Advisory Board. Dr. El-Sohemy obtained his PhD from the University of Toronto and completed a postdoctoral fellowship at Harvard. He has published in the top scientific and medical journals with almost 200 peer reviewed publications and has given more than 300 invited talks around the world. He is currently Editor-in-Chief of the journal Genes & Nutrition, serves on the editorial board of 10 other journals, and has served as an expert reviewer for more than 30 different scientific and medical journals and 12 research granting agencies. He has been a member of international expert advisory panels and scientific advisory boards of several organizations. Dr. El-Sohemy is the recipient of several awards for excellence in research by the American College of Nutrition, the Canadian Society for Nutrition and the American Nutrition Association.

Sara Mahdavi, RD, MSc, PhD

Dr. Sara Mahdavi is a clinical scientist and holds a clinical instructor and research appointment with the Department of Community and Family Medicine at the University of Toronto. Dr. Mahdavi received her doctorate from the Faculty of Medicine at the University of Toronto in the field of gene-environment interactions and cardiometabolic disease. She has been practicing clinical dietetics over the last decade at several hospitals as well as private practices. Dr. Mahdavi has been an invited speaker at medical conferences and for government agencies. She has published over a dozen original scientific articles in top medical journals, has been an invited reviewer for several clinical journals and serves on the editorial board of the Canadian Journal of Kidney Health and Disease. Dr. Mahdavi's clinical research and practice have varied from early insulin sensitivity to kidney disease, rare genetic disorders, and innovative dermatological interventions.

Lynnette R Ferguson, D.Phil. (Oxon.), DSc

Dr. Lynn Ferguson is Program Leader of Nutrigenomics New Zealand. She obtained her D.Phil. from Oxford University working on DNA damage and repair. After her return to New Zealand, she began working as part of the Auckland Cancer Society Research Centre, using mutagenicity testing as a predictor of carcinogenesis. In 2000, she took on a 50% role as Head of a new Discipline of Nutrition at The University of Auckland. She has recently been investigating the interplay between genes and diet in the development of chronic disease, with particular focus on Inflammatory Bowel Disease. As Program Leader of Nutrigenomics New Zealand she is working with a range of others to bring nutrigenomics tools to the New Zealand science scene. She has supervised more than 30 students and has more than 300 peer reviewed publications. Dr. Ferguson serves as one of the managing Editors for Mutation Research: Fundamental and Molecular Mechanisms of Mutation, as well as on the Editorial Boards of several other major journals.

J. Bruce German, PhD

Bruce German is the Director of the Foods for Health Institute at the University of California Davis, and is Professor of Food Science and Technology (http://ffhi.ucdavis.edu/). Dr German received his PhD from Cornell University and joined the faculty at the University of California (Davis) in 1988. In 1997, he was named the first John E. Kinsella Endowed Chair in Food, Nutrition and Health. His research interests in personalized nutrition include the structure and function of dietary lipids, the role of milk components in food and health and the application of metabolic assessment to personalizing diet and health. Dr German has published more than 350 papers and holds a number of patents related to various technologies and applications of bioactive food components. The research articles from his lab rank in the top 5 most cited in the field.

David Jenkins, MD, DSc, PhD

Dr. Jenkins earned his MD and PhD at Oxford University, and is currently a Professor in both the Departments of Medicine and Nutritional Sciences at the University of Toronto. He is also a staff physician in the Division of Endocrinology and Metabolism and the Director of the Clinical Nutrition and Risk Factor Modification Center, St. Michael's Hospital. Dr Jenkins has published over 300 peer reviewed articles and given hundreds of invited talks around the world. He has served on numerous international committees to set guidelines for the treatment of diabetes and most recently on the new joint United States-Canada DRI system (RDAs) of the National Academy of Sciences. His team was the first to define and explore the concept of the glycemic index of foods and demonstrate the breadth of metabolic effects of viscous soluble fibre. He has received many national and International awards in recognition of his contribution to nutrition research. Dr Jenkins currently holds a Canada Research Chair in Nutrition and Metabolism.

Jose Ordovas, PhD

Jose M. Ordovas is Professor of Nutrition and Director of the Nutrigenomics Laboratory at the United States Department of Agriculture, Human Nutrition Research Center on Aging at Tufts University in Boston. After obtaining his PhD from the University of Zaragoza, Spain, he completed postdoctoral work at Harvard, MIT and Tufts University. Dr Ordovas' major research interests focus on the genetic factors predisposing to cardiovascular disease and their interaction with environmental factors. Dr Ordovas has published ~700 articles in peer reviewed journals, and written numerous reviews and edited 5 books on nutrigenomics. He has been an invited speaker at hundreds of International meetings all over the world and is currently a member of the Institute of Medicine's Food and Nutrition Board (National Academies). He serves as Editor for Current Opinion in Lipidology (Genetics Section), and on the Editorial Board of numerous journals. Dr. Ordovas is a Member of Honor of the Spanish Society of Atherosclerosis and has received other awards for his contributions to the field of nutrigenomics.

Ben van Ommen, PhD

Dr. Ben van Ommen is Director of the Nutrigenomics Organization (NuGO) and Principal Scientist at TNO, one of the largest independent research organizations in the area of nutrition world-wide. He is also Director of the TNO systems biology program and leading the activities on nutrigenomics, nutritional systems biology, personalized health and personalized medicine. His research applies systems biology to metabolic health and metabolic disease, focusing on understanding all relevant processes involved in maintaining optimal health and causing specific disease sub-phenotypes, developing new biomarkers and treatment strategies.

Nanci S. Guest, PhD, RD, CSCS

Dr. Nanci Guest is a registered dietitian (sport specialty), certified personal trainer and a certified strength and conditioning specialist, and she has been working in private practice in this field for two decades. She completed her doctoral degree in the area of nutrigenomics and athletic performance at the University of Toronto. She obtained her BSc in agriculture and dietetics, and her MSc in nutritional sciences with a sport focus at the University of British Columbia. Dr. Guest has published her research in top journals, presented at international conferences and has given dozens of invited talks around the world. She also teaches advanced sport nutrition courses at the college level. Dr. Guest is a global consultant to professional and amateur athletes and teams, and she was also involved in creating past athlete nutrition guidelines for the International Olympic Committee. She was the Head Dietitian at both the Vancouver 2010 Olympics and the Toronto 2015 Pan Am games and served as a consultant to a variety of international athletes in preparation for the past four London, Sochi, Rio and PyeongChang Olympics.